

Designing with *Hima*: Integrating Desert Ecosystem Enhancement, Cultural Heritage Conservation and Urban Development in AlUla Region, Saudi Arabia

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Thesis submitted in fulfilment of the requirements for
the degree of

Doctor of Philosophy

under the supervision of

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Certificate of Original Authorship

I, Abdulrahman Saud M Alshami, declare that this thesis is submitted in fulfilment of the requirements for the award of the degree of Doctor of Philosophy in the School of Architecture of the Faculty of Design, Architecture, and Building at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

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Signature:

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The Thesis Formatting Note

This conventional thesis with some creative components and drawings was prepared to fulfil the criteria for Doctor of Philosophy, following the guidelines outlined in “Graduate Research Candidature Management, Thesis Preparation and Submission Procedures 2024 - University of Technology Sydney”. The thesis used the American Psychological Association (APA) 7th edition referencing style. The source of the figures created by the thesis author (Abdulrahman Saud M Alshami) is cited as “the researcher”.

Novelty

First contribution

- Several studies on *hima* have revealed how local traditional ecological knowledge (TEK) protects natural resources and leads to a sustainable way of living with desert ecosystems and mitigating desertification. However, the practicality of the system and a description of how it works in detail are missing, especially in the context of cultural heritage conservation. This thesis addresses this issue by examining how *hima* TEK contributes to desertification mitigation, identifying 18 agricultural, water management and community methods that demonstrate the knowledge of the elders in the AlUla region, northwest of Saudi Arabia, and their heritage of living within desert environments (see Chapter 5).
- This thesis presents the causes of desertification based on the views of the local elders. To understand *hima* TEK's role in mitigating desertification, this research analysed the elders' perspectives on the factors that lead to desertification. Their understanding of desertification is crucial, owing to their long-term habitation in the region and the detailed observations and events they have experienced over time. This initial analysis of the desertification factors helps understand the threats posed to the environment, including cultural heritage and local communities, before studying the traditional strategies that were developed to address these threats and before studying their applicability in modern Saudi Arabia.
- To my knowledge, there has been little research conducted on *hima* TEK in a way that guides design within cultural heritage sites that are under the threat of desertification. The results of this thesis show that *hima* TEK enriches environmental design. The insights from elders and the observations of the region provide preliminary design guides that can

inspire landscape architects, urban designers and decision-makers who see benefits in integrating indigenous ecological practices and knowledge into contemporary urban development in the region.

Second contribution

- The literature on *hima*, to some extent, recognises the tangible cultural heritage that is located within the *hima* protected areas. However, the role of *hima* TEK and its practices in conserving tangible cultural heritage remains unclear and needs further investigation. This thesis finds a link between *hima* TEK and cultural heritage conservation, detailing how local communities have developed their indigenous knowledge and practices to sustain the surroundings, which includes cultural heritage structures (see Chapter 6). This link includes 27 traditional methods within three primary themes: heritage conservation through regeneration, community engagement, and traditional techniques and strategies, illustrating how indigenous practices contribute to safeguarding cultural heritage structures, such as the Nabataean tombs and water infrastructure in AlUla. These are the various traditional ecological practices that form part of the ongoing *hima* TEK and contribute to the preservation of cultural heritage, although the intention behind some of the strategies is not directly aimed at the preservation of cultural heritage structures and sites. These findings not only establish the connection between local TEK and cultural heritage but also enhance our understanding of *hima* sites and their surroundings. The analysis demonstrates how traditional implementations, including water-harvesting techniques and agricultural activities, contribute to the preservation of tombs and other cultural heritage elements. This comprehensive examination underscores the multifaceted holistic role of *hima* in cultural heritage conservation, highlighting its potential for broader application in safeguarding shared heritage.

- The findings inform design guides and directions for landscape architects and urban designers aiming to integrate *hima* TEK into cultural heritage conservation projects. This integration fosters sustainable preservation practices and supports the continuity of indigenous knowledge within contemporary development frameworks.

Third contribution

- Researchers have stated that the involvement of landscape architectural designers and researchers, and their methods, in heritage conservation and urban development projects in the Middle East is limited. Also, there is little connection between methods of landscape architectural design and *hima* TEK methodologies. This research adapts design research in landscape architecture (LA) design/drawing to provide visual data explaining some aspects of *hima* that were found lacking in the literature. Multiple techniques are included to provide a more comprehensive and detailed understanding of the local TEK, such as research for design and research through design, including workshops with landscape architecture (LA) experts, which is considered a part of the design process, to investigate the role of LA design with local TEK research in Saudi Arabia.
- This thesis presents an opportunity regarding the integration of *hima* TEK by LA researchers and practitioners. Through design processes, including analysis, design development and expert discussions (see Chapter 7), this research identified four key qualities associated with the integration of local TEK in urban design projects and master plans. The design process of this research highlights the inherent flexibility within the traditional practices of *hima*, which aligns with the flux of landscape architectural practices. Second, the design process reveals that *hima* can be applied to diverse land types and uses, planning and design projects. Third, this research finds that the design process helps to identify important areas for grazing, community gatherings and water

harvesting, expanding the potential applications of *hima*. Additionally, this thesis finds that design encourages innovation within traditional frameworks, promoting continuity and evolution.

- The design also highlights the challenges and opportunities of integrating *hima* into modern contexts. It plays a vital role in updating a system that originated 2000 years ago to suit contemporary urban settings. Although the focus is on research through design rather than creating design guidelines, the design process generates initial insights that can evolve into comprehensive guidelines and policies that can be used by decision-makers, planners, urban designers and landscape architects.

Publications

Academic Conference Paper (Published)

Alshami, A. A., Bryant, M., & Toland, A. (2023). Wisdom in the dunes: Understanding desertification factors and indigenous ecological knowledge. In L. Uli, L. Isaac & M. Janet (Eds.), *Local cultures—Global spaces: communities, people and place. AMPS Proceedings Series 37.2*, (pp. 179–190). AMPS. <https://amps-research.com/wp-content/uploads/2024/08/Amps-Proceedings-Series-37.2.pdf>

A Q1 Journal Article (Published)

Alshami, A. A., Bryant, M., & Toland, A. (2025). A hima traditional ecological knowledge perspective of the sustainability goals in AlUla’s journey through time masterplan. In S. Hawken, C. Isendahl, K. Strickland & S. Barthel (Eds.), Long-term intergenerational perspectives on urban sustainability transitions [Special issue]. *Urban Studies*.

Papers under preparation

- A paper presenting the role of traditional ecological knowledge (TEK) on cultural heritage conservation (Chapter 6).
- A paper reflecting on the approach of participatory design with local community elders in Saudi Arabia (Part of Chapter 7).
- A comprehensive literature review on the TEK of *hima* (what is the *hima* status today? parts of Chapter 2).

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Abbreviations

BLA	Bachelor of Landscape Architecture
ELC	European Landscape Convention
KSA	Kingdom of Saudi Arabia
LA	Landscape Architecture
OMP	Official Masterplan (sometimes I call it by its official name: Journey Through Time Masterplan (JTTM)) ¹
PRA	Participatory Rural Appraisal
RAD	Research About Design
RCU	Royal Commission for AlUla
RFD	Research for Design
RRA	Rapid Rural Appraisal
RTD	Research Through Design
TEK	Traditional Ecological Knowledge
TK	Traditional Knowledge
UNCCD	United Nations Convention to Combat Desertification
UNESCO	United Nations Educational, Scientific and Cultural Organization
WHS	World Heritage Site

¹ During the course of this research, I discovered that there are five official masterplans within the AlUla County. However, this study specifically focuses on the Journey Through Time Masterplan (JTTM).

Abstract

Desertification now jeopardises more than 20% of the globe's land masses. One of the causes of this is the increasing disconnection between desert ecosystems, human communities and cultures, which were once interconnected by traditional ecological knowledge (TEK) and practices that offered a way of living in desert ecosystems without depleting resources and without environmental degradation. This is especially so in the context of Saudi Arabia. As globalising forces of urbanisation disconnect cultural heritage sites from community and environment, communities are adapting to modern living, while new cities are growing within a cocoon of universal sustainability principles. But this diminishes stewardship of landscape by local communities through their traditional practices of ecological hima. Hence, the broader landscape is being rendered more vulnerable to the forces of desertification.

This research addresses the possibility of concurrently mitigating desertification and fostering community well-being by reconnecting local people with their surroundings, traditions and cultural heritage. This qualitative research uses a case study approach to investigate the AlUla region, Saudi Arabia, one of the most abundant cultural heritage sites within productive desert ecosystems. The researcher employed multiple research methods, such as semi-structured interviews with elders, site visits and observation, research through design, workshops with experts, and a review of existing Arabic and English secondary data and materials. The results generated from a thematic analysis approach show three clear findings. The first is the recognition of detailed strategies relating to how hima TEK contributes to mitigating desertification. The second presents a clear linkage between the hima system and cultural heritage conservation and describes how it can be preserved through local TEK. These two aspects contribute to the third contribution regarding the role of landscape design

and how design can inform, and be informed by, local TEK. This presents opportunities for hima TEK to be integrated into current and future urban master plans and developments associated with ecosystem enhancement and cultural heritage conservation.

Chapter 1: Introduction and Background

1.1 Overview

Traditional ecological knowledge (TEK) encompasses the practices, methods and environmental activities developed and refined over time to formulate a relationship between humans and the natural surroundings. Although TEK has gained significant recognition in various cultures and regions globally, a detailed exploration of it within the context of Arab countries in the Middle East remains limited. In Saudi Arabia, local TEK may appear under-represented or difficult to locate in global research databases such as Google Scholar. However, examining both the Arabic and English literature may provide a better, but general, understanding of the role TEK has played in managing natural resources and preserving cultural heritage in Arab contexts, including Saudi Arabia. This type of research becomes essential in addressing challenges such as the increasing rates of environmental degradation that affect not only the landscape but also cultural heritage and local communities.

The world, today, faces numerous environmental challenges, and climate change exacerbates these issues at every level. One of the most significant of these challenges is desertification, which affects not only ecosystems but also the traditions, values and lifestyles of affected communities. Additionally, many cultural heritage sites in the Middle East, particularly in Saudi Arabia, are threatened by desertification and other natural disasters. This situation requires interventions to protect these valuable sites and address their vulnerabilities. Saudi Arabia is often perceived as a country covered by sand, but it actually contains 11 distinct types of deserts, each with unique ecological systems that support human life (Edgell, 2006). Desertification, as defined by Edgell (2006), is the degradation of arid and semi-arid lands, reducing their productive capacity. This

phenomenon is evident in the decreasing number of oases and farms (Royal Commission for AlUla [RCU], n.d.-c), and the increasing depletion of underground water resources (Yu, 2019). Recent human activities, particularly in the northwest region of the Arabian Peninsula, have exacerbated desertification (Edgell, 2006), which has adversely affected the structures of cultural heritage elements (Alrawaibah, 2017).

The current approach to protecting cultural heritage sites, specifically World Heritage Sites (WHS) in the Arabian Peninsula and other countries, creates another issue for local communities and the surrounding natural environment. The issue is that the locals, their traditions and some aspects of environmental contexts are not considered within the protection approach to the conservation of cultural heritage sites. This creates a disconnection between the locals and the surrounding cultural heritage elements, including the natural environment. These approaches focus on the economic and tourism aspects more than local traditions, affecting local communities and practices. One example is the Official Masterplan (OMP) for the AlUla region, northwest of Saudi Arabia, which aims to transform the region into an international destination for eco-tourism and cultural heritage. Although this urban development approach considers the local community as its core, the local TEK, which has been developed within the natural and cultural heritage of the region for centuries, is missing. It may be missing because there is insufficient research into its value, and how it has been and might be utilised in the region.

This research highlights issues around the impacts of desertification on cultural heritage, natural resources and local communities. It explores the power of indigenous knowledge to enhance the current relationship between the three components and mitigate desertification. It also explores the role of design as informed by local TEK.

The nomadic people of the Arabian Peninsula have for centuries cultivated a unique relationship with their natural desert environment, enabling them to sustainably manage and protect ecosystems, monitor natural resources and their surroundings, and make informed decisions to promote growth and conservation. This system is called *hima*, and its literal meaning in Arabic is ‘protected land’. It is a system where fauna, flora and other natural resources are protected from random harvests, and then managed, monitored and used by local communities.

In Saudi Arabia, *hima* was practised by tribal communities for centuries until the end of the 1960s, when new legislation transferred the management of all free rangelands and natural areas to central government ministries and encouraged nomadic people to settle in villages. This shift negatively affected the natural environment and the traditional interactions between often-nomadic communities and their surroundings. Although the legislation was aimed at managing and supporting communities and providing public services, it disrupted the sustainable, long-term relationship between the locals and the landscape, distancing them from their natural resources. Consequently, management fell to organisational members who often implemented textbook environmental policies that overlooked local inherited practices. This issue is evident across Saudi Arabia (Alrawaibah, 2017) and other Arab Middle Eastern countries (Kilani et al., 2007).

1.2 The nexus of cultural heritage, natural environment and people

Cultural heritage sites and their surroundings are receiving significant attention with regard to their protection and restoration in many countries worldwide. However, conserving cultural heritage often creates tensions between local communities, their natural environments and the heritage sites themselves (Helmer et al., 2020; Verschuuren et al., 2021), particularly in Saudi Arabia (A. Alahmadi, 2021; Alrawaibah, 2017).

The diverse environments of the Arabian Peninsula have shaped people's lifestyles uniquely according to their specific natural contexts. Over centuries of interaction between ancient tribes and their surroundings, elements such as earth buildings, water canals, drought-tolerant farms, climate-sensitive travel-routes and low-intensity farming tools have evolved into cultural heritage assets, representing the history and identity of these places.

The AlUla region in Saudi Arabia (detailed in Chapter 4) is home to thousands of cultural heritage artefacts intricately connected with natural features and assets, including the Hegra Archaeological Site, Saudi Arabia's first WHS (RCU, n.d.-a). This site includes the Nabataean tombs, places of worship and sanctuaries (*hima*), and water-harvesting systems, all carved into sandstone mountains to serve various functions. These spaces were created in an area rich in fertile soil and underground water. The site has been used by many ancient tribes, including the Nabataean, Dadan and Lihyan peoples. Some tombs predate the Nabataeans (Alrawaibah, 2017), indicating earlier occupations.

For over 2000 years, evidence of human–nature interactions, such as reshaped rocks, carved spaces in mountains, water management systems and ancient wells, has been preserved. Current locals continue to live around the site, regenerating agricultural lands and sustainably utilising natural resources harmoniously with ancient remains. There is also evidence that the present-day communities implement traditional techniques that are similar to the Nabataean ones used to regenerate the land and manage and protect its natural resources (Nehmé et al., 2006). These traditional practices are known as *hima* (detailed in Sections 2.2 and 2.4).

Over the past 60 years, the use of traditional practices in the AlUla region has declined, leading to increased separation between locals and their surrounding landscape, noticeable desertification and adverse impacts on cultural heritage, along with changes in local traditions. Current

development initiatives support the region's economy and society through tourism, with projects such as the OMP, aiming to highlight five cultural heritage sites of different ancient civilisations, regenerate oases and offer numerous eco-tourism activities. However, these initiatives place additional pressure on natural resources and further separate the locals from their environment, neglecting local traditions and crucial desertification factors such as flash floods.

Emphasising local resource management techniques highlights AlUla as a site of deep history and a source of environmental, urban and cultural management solutions. The cultural heritage, local community, traditions and surrounding natural environment are interlinked and cannot be conserved separately, a situation that is replicated in many sites across the country. The primary hypothesis is that preserving cultural heritage sites should be based on understanding local traditions, needs and lifestyles within the surrounding ecosystems (A. Alahmadi, 2021; Alrawaibah, 2017; Guan et al., 2021; Verschuuren et al., 2021). The traditional practices of elders and earlier generations in protecting heritage and the natural environment hold significant potential to develop more effective management methods for natural and cultural heritage sites and can be used in conjunction with the current conventional preservation practices.

Cultural heritage and the surrounding ecosystems are profoundly intertwined. Often, the survival of one supports the other. As today's local communities face modern ecological challenges, engaging with landscape in ways that honour and utilise traditional knowledge (TK) is necessary. Cultural heritage offers a critical connection that links us to time-tested ecological practices and guides us towards sustainable interactions with our environment.

1.3 Design

Design, as a noun, has multiple meanings according to the *Macquarie dictionary*, such as ‘the combination of details or features of a picture, building, etc.’, ‘an artistic work’, ‘a plan; a project; a scheme’, ‘intention; purpose’ or ‘an outline, sketch, or plan, as of a work of art’ (Downton, 2003, p. 8). As a verb, it means ‘to plan and fashion a work of art’, ‘to prepare the preliminary sketch or the plans for (a work to be executed)’, ‘to intend for a definite purpose’, ‘to make drawings, preliminary sketches, or plans’ or ‘to plan or fashion artistically or skilfully’ (Downton, 2003, p. 8). The global definition of design (Downton, 2003, p. 9) was stated by Louridas (1999, p. 532) as follows:

Design is a tinkering using materials which the designer cannot freely select, and which have meanings which he cannot freely specify, in order to make a structure fitting the structure of the context. Any activity having these features is a design activity.

Based on these views, this research examines design as a range of activities that involve visual documentation, drawings, presentations, design conversation and iterative discussion workshops to generate new information and knowledge. It is a process of inquiry and knowledge production (Downton, 2003, p. 1). Documenting and drawing cultural heritage, whether intangible (such as local TEK) or tangible (such as water-harvesting techniques), are essential for any site conservation approach to protecting the history and identity of a place. For example, significant documentation efforts have been made at the Hegra WHS over the last two decades (Al Talhi et al., 2014; Nehmé, Abu Wazizeh et al., 2011; Nehmé et al., 2019, 2020, 2021; Nehmé, Villeneuve et al., 2011), such as reports detailing and redrawing heritage elements that are over 2000 years old.

However, local ecological practices have not received the same level of attention, even though some are associated with ancient civilisations such as the Nabataeans. In researching the traditional techniques and practices of *hima*, it was found that there is a lack of visual materials explaining how

design methods might cultivate knowledge to mitigate desertification and contribute to cultural heritage conservation. Although official Saudi authorities have received and proposed multiple landscape architecture (LA) and urban design projects for cultural heritage sites (Alexandra Steed Urban, 2019; Alraddadi et al., 2020; French Agency for AlUla Development [AFALULA], 2021b; RCU, 2020; SaudiProject, 2020), these projects often overlook traditional ecological tools and practices. This oversight may be due to the experts' and decision-makers' lack of knowledge about these traditions. Therefore, this research aimed to address this gap by exploring and visualising the overlooked TK and ecological practices within a cultural heritage site, using a case study approach and two design research methods: research for design (RFD) and research through design (RTD). This may help transmit traditional knowledge to future generations by providing visual materials associated with local TEK.

1.4 Research phases

The thesis follows the traditional thesis approach with some creative and practical components. The research is divided into three phases. The first phase focuses on understanding the context of AlUla and the general relationships among cultural heritage, ecological restoration and the local communities living around cultural heritage sites in Saudi Arabia. I examined the *hima* TEK of local communities to understand its role in mitigating desertification and preserving cultural heritage. Additionally, I investigated urban developmental projects in the region. This stage involved reviewing the literature, reports and project data, conducting site visits and soliciting opinions from Saudi environmental planning experts. Given the approval of the OMP for AlUla, I also studied data from official sources to understand the development approach.

The second phase focused on collecting detailed data on the local TEK, as well as traditional practices and techniques related to cultural heritage conservation and desertification mitigation. I

conducted 11 semi-structured interviews with knowledgeable local experts and elders (respected community members), along with 34 site visits and observations, to investigate three aspects: (1) the interactions and relationships between the locals and the surrounding natural and cultural heritage, (2) the use of traditional knowledge for protecting and managing ecosystems and cultural heritage sites and (3) the design of traditional techniques for desertification mitigation and cultural heritage preservation. At the end of this stage, I identified the potential opportunities for protecting natural and cultural heritage and produced various drawings and preliminary design ideas to visualise different aspects of local TEK that might work in conjunction with the OMP.

The third phase focused on the design process. After reviewing the results of the second phase with three elders, I developed a conceptual master plan based on the data collected in the first and second phases. This master plan, along with the results and drawings, was discussed and critiqued by 10 national experts with design, architecture or planning degrees in three workshops. The findings of this stage highlight the role of design and present key aspects and opportunities for integrating local TEK into current and future regional master plans.

1.5 Knowledge gaps in research

The reliance on Western and European knowledge and experience in Saudi development projects is increasing, with numerous agreements signed between Saudi institutions and Western and European organisations to share their insights on developing cultural heritage sites, agricultural areas, techniques and infrastructure (Saudi Press Agency, 2021a, 2021b). Additionally, multinational agencies are involved in cultural heritage sites and conserved areas in Saudi Arabia (Alrawaibah, 2017). However, local communities and their ecological traditions are often excluded by the official organisations responsible for conservation and urban development (Alrawaibah,

2017). The aim of this research was to find a way to integrate local TEK into current and future projects.

The inclusive perspective of the landscape advocated by the European Landscape Convention (ELC) is inherently reflected in local community traditions, although modern lifestyles have eroded this connection (Makhzoumi, 2016). Despite the decline in *hima* practices in Saudi Arabia over the past 50 years, some communities continue to uphold this tradition (Gari, 2006; Suleiman et al., 2013). Numerous researchers have emphasised the significant potential of TEK for use in sustainability, yet it is at risk of disappearing, highlighting the need for it to be documented, studied and preserved as an intangible cultural heritage. Focusing on TEK can enhance the relationships among local communities and conservation, eco-tourism and urban development projects. This research aimed to fill this gap. And it offers a way of doing so by overlaying LA knowledge, and utilising design skills to not only understand *hima* TEK but also visualise it and to be projective about its applicability. This thesis, therefore, responds to the scarcity of visual materials related to *hima*.

Based on the literature, there has been limited research investigating how local TEK contributes to the protection of cultural heritage sites and their surrounding natural environments in Saudi Arabia, particularly in cases where the cultural heritage site is currently not directly linked to the local tribes or communities. Most studies examining the relationships among local communities, traditions and their surroundings have not engaged with the tradition holders who practise TEK. This knowledge, which is traditionally passed from older generations to new ones, has diminished over the past 50 years (Al-Tabini et al., 2012).

This research uncovers the advantages of TEK for cultural heritage preservation and desertification mitigation. It does so by interviewing elders, Sheikhs (tribal leaders) and local experts (*Ahlul Hal Wal*

Aqd), and by documenting my observations of relevant TEK techniques within the AlUla conserved region and its surroundings.

1.6 Research questions

1. How can the TEK of *hima* enhance living with desert ecosystems within Saudi cultural heritage sites?
2. How can the practices of *hima* TEK contribute to the conservation of cultural heritage sites in urban settings?
3. What is the role of landscape design in a *hima* context, and what are the main design aspects that designers need to consider when aiming to integrate *hima* TEK techniques into urban development projects to mitigate desertification and preserve cultural heritage sites in the country?

1.7 Research aims, objectives and significance

1.7.1 Aims and objectives

This thesis aimed to explore innovative methods for reintroducing the local TEK and practices of some of the Arab local communities within the peninsula into urban projects to mitigate desertification and preserve cultural heritage, while conserving the *hima* TEK as an intangible cultural heritage in Saudi Arabia. Therefore, the thesis objectives are:

- To understand the impact of desertification on ecosystems and cultural heritage from the perspective of local elders.
- To identify detailed traditional methods and strategies for living in desert ecosystems that are under the threat of desertification within the context of Saudi cultural heritage sites.

- To explore the role of local communities and their traditional practices in the preservation of cultural heritage.
- To examine the role of design in uncovering opportunities for integrating *hima* TEK into current and future urban development projects.
- To identify the critical aspects that landscape architects, urban designers, planners and decision-makers must consider when incorporating *hima* TEK into urban projects.

1.7.2 Research significance

The importance of this research can be summarised in five key points:

- Based on the literature review, this is the first study of its kind to examine the traditional practice of *hima* in a local community context within a conserved cultural heritage site in Saudi Arabia.
- Investigating the impacts of heritage site conservation and urban development on the natural environment and local communities is crucial for preserving the local traditions and identity of the landscape and reconnecting people to their surroundings, especially because the country is undergoing significant development to realise the Vision 2030 plan. It is vital to integrate the traditional values of the local community. These values are endorsed by Vision 2030 and align with its objective of ‘strengthening Islamic and national identity’.
- The primary data sources for this research are the local elders, who are diminishing in number, and experts who hold extensive knowledge relating to the surrounding cultural heritage and natural resources. This vulnerable tradition is disappearing, making it essential to reintroduce it by showcasing its conservation capabilities and its role in reconnecting people with their natural and cultural heritage.

- The current management plan in AlUla focuses on international tourism and relies on global experts, experiences and practices. Therefore, it is essential to find a way for *hima* TEK to complement modern development approaches.
- This research adds significant value to regional and local design aspects, fostering relationships among local communities, landscape architects and other related design fields. It produces visual concepts and ideas generated from the *hima* TEK, which contribute to the preservation of the *hima* TEK itself for new generations.

1.8 Thesis chapters

The thesis is structured into eight chapters as follows (see Figure 1-1).

Chapter 1: Provides a research overview, discussing the main topics, defining design, presenting research stages and outlining the research gaps, questions, aims, objectives, significance and thesis structure.

Chapter 2: Examines the state of TEK related to *hima* in Saudi Arabia and other countries, addressing desertification threats, ecosystem enhancement, cultural heritage conservation, *hima* TEK applications, and the role of design, design research and the relevant frameworks.

Chapter 3: Details the research methodology, covering the research design, the researcher's background, the three stages of data collection, data analysis, limitations and challenges, and ethical considerations.

Chapter 4: Focuses on the context of AlUla, describing the natural environment, history, recent development and visions, local TEK, and initial design investigation.

Chapter 5: Addresses the first research question, detailing the elders' perspectives on desertification factors and specifying traditional techniques for mitigating desertification. This chapter and the following one adopt the RFD approach, which frames Chapter 7.

Chapter 6: Discusses the themes that answer the second research question, explaining the traditional technologies that contribute to cultural heritage conservation.

Chapter 7: Explores the role of design and the design process, highlighting the key design aspects that landscape architects and related professionals should consider in such a context and objectives. This chapter responds to the third research question, adopting RTD and building on the previous stages.

Chapter 8: Concludes the thesis, summarising the findings and their implications, and presenting future research directions.

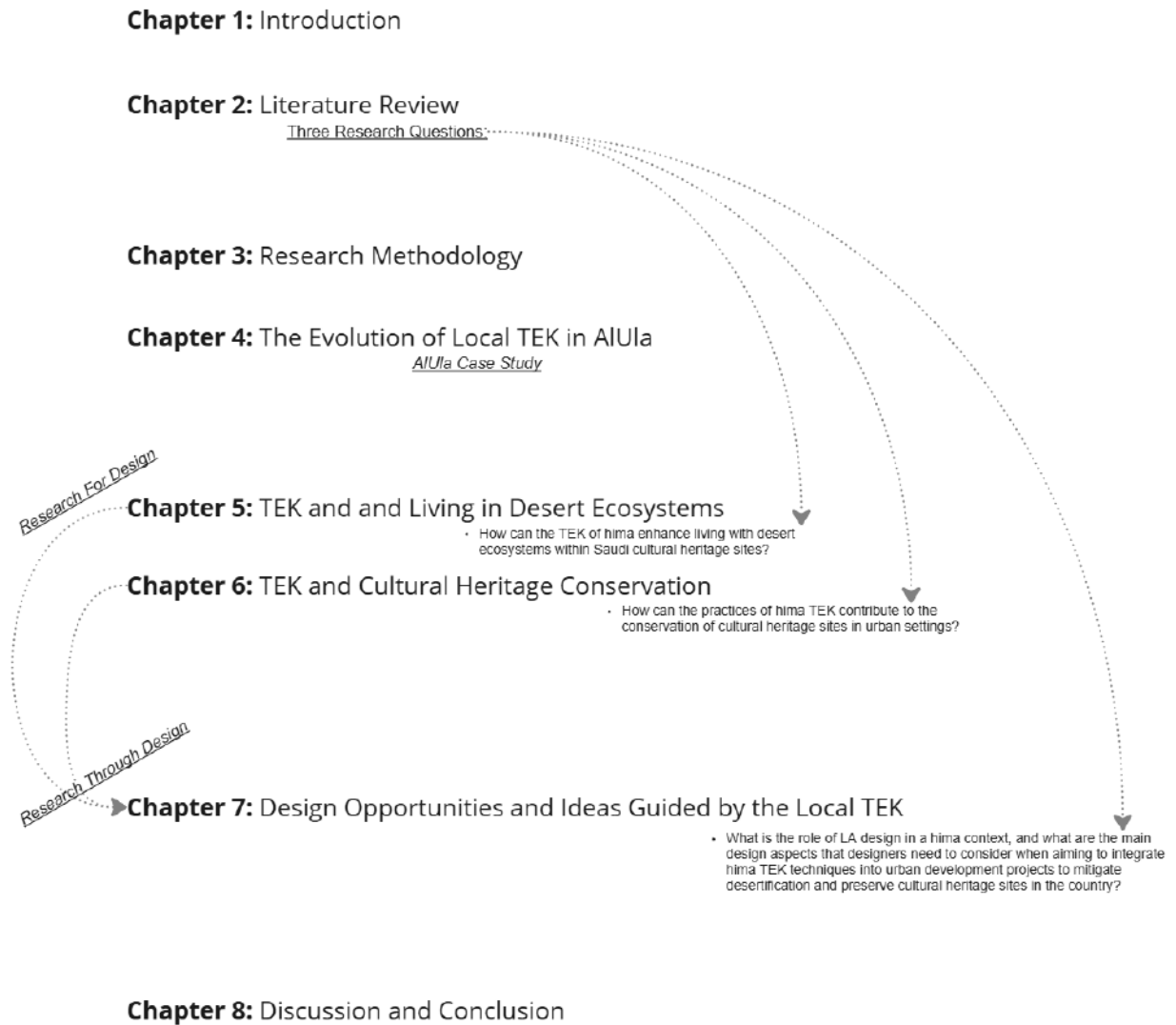


Figure 1-1: This diagram visualises the structure of this thesis (Source: the researcher).

Chapter 2: Literature Review²

2.1 Introduction

This chapter summarises and discusses the existing literature on the role of local TEK and its inherited value in solving environmental issues and contributing to cultural heritage conservation. Additionally, it explores the existing scholarship on the role of LA design in integrating local TEK into urban development projects. This chapter presents and explores the literature on TEK generally, and then focuses on the context of Saudi Arabia, which then leads to an examination of the environmental issues associated with desertification in the region. Subsequently, six *hima* TEK applications are provided to illustrate and exemplify the role of local TEK in solving local environmental issues. Next, I present the literature on cultural heritage conservation and show how local TEK plays a role in this field, even though it is usually perceived as a separate entity from landscape and human society. Finally, I discuss the role of design in the LA profession within this context, along with the approaches and frameworks taken to address such studies and variables.

² Parts of this chapter are accepted for publication in my second paper, see Appendix L.

Indigenous technologies are not lost or forgotten, only hidden by the shadow of progress in the remotest places on earth. While society values and preserves the architectural artefacts of dead cultures, like the four-thousand-year-old Pyramids of Giza, those of the living are displaced, like the six-thousand-year-old floating island technology of the Ma'dan in the southern wetlands of Iraq. (Watson, 2019, p. 17)

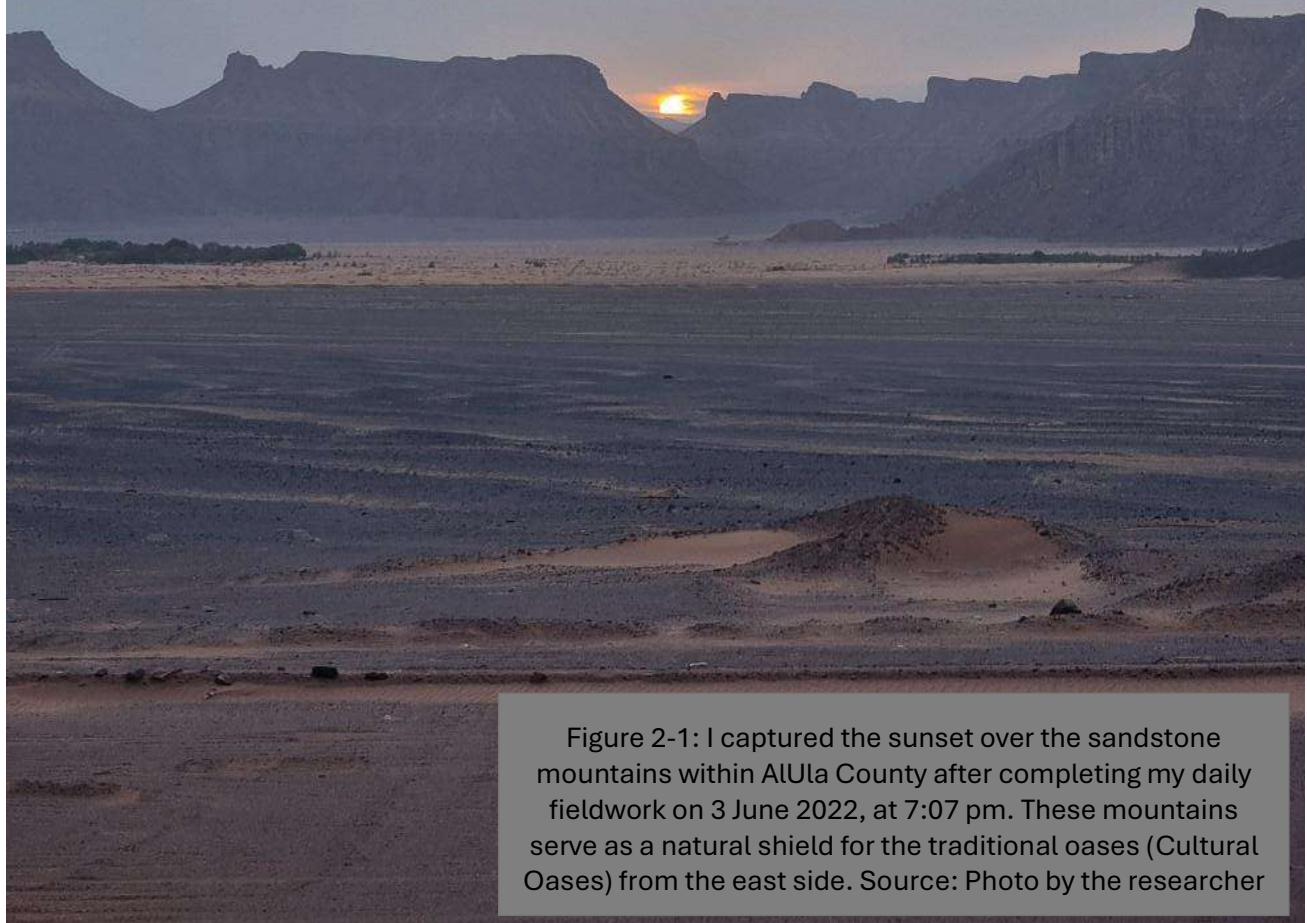


Figure 2-1: I captured the sunset over the sandstone mountains within AlUla County after completing my daily fieldwork on 3 June 2022, at 7:07 pm. These mountains serve as a natural shield for the traditional oases (Cultural Oases) from the east side. Source: Photo by the researcher

2.2 Traditional ecological knowledge in Saudi Arabia

The TEK of local communities in the context of Saudi Arabia may initially seem uncommon to anyone searching for it in databases such as Google Scholar. Therefore, this section explains what was found in the literature. First, it starts by discussing the definition of TEK and TK, highlighting their relevance to environmental management and conservation. It then outlines a historical overview of TEK within the Saudi Arabian communities, including its origins, transmission and cultural significance. Finally, I discuss the role of TEK in shaping sustainable livelihoods, land use practices, and natural resource management strategies.

Berkes (1999) defined TK as ‘a knowledge–practice–belief complex’ (Berkes et al., 2000, p.1252). Bruchac (2014) detailed that TK encompasses the conserved and distinctive understandings of native communities, grounded in cultural experiences, which direct interactions among humans, non-human entities and other elements of specific ecosystems. However, Onyancha (2024) stated that, sometimes, TK can be called indigenous knowledge, aboriginal knowledge or local knowledge. The author added that TK seems to be an updated version of local knowledge and indigenous knowledge, perhaps preferred by researchers (Onyancha, 2024).

On the other hand, Berkes et al. (2000) explicated TEK ‘as a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and their environment’ (p. 1252). Similar to TK, Bruchac (2014) stated that TEK might be called traditional aboriginal knowledge and can be described ‘as practical applied indigenous knowledge of the natural world’, which is a system of awareness offering both ethical guidelines and functional advice, rather than just survival actions. Additionally, there is traditional indigenous knowledge that refers to a complex system of beliefs (religious concepts), knowledge (factual data) and traditions

(practices) aimed at safeguarding, transmitting and contextualising indigenous connections with culture and the environment across generations (Bruchac, 2014). Despite the multiple terms and definitions, TEK can be summarised as a traditional/indigenous system passed down by previous generations, informing ways to care for the surrounding natural environment/entities. Berkes (2012) clarified that TEK originates from accumulated environmental insights developed over time through iterative learning processes, encompassing experimentation and trial and error (Bruchac, 2014).

Recently, there has been an increasing interest in TEK. Berkes et al. (2000) acknowledged the interest taken by scholars across disciplines such as conservation biology, ecological anthropology and ethnobiology, as well as industries such as the pharmaceutical sector, stemming partly from its perceived potential to contribute to various aspects of biodiversity conservation, the preservation of rare species, the management of protected areas and the understanding of ecological processes. They emphasised that several traditional management systems contribute to biodiversity conservation through diverse practices, including cultivating a wide range of varieties and species, managing various landscape patches, and monitoring and adapting to ecosystem changes, leading to positive outcomes for biodiversity (Berkes et al., 2000; Watson, 2019). For example, Watson (2019) illustrated how different forms of TEK, such as the Palayan Rice Terraces in the mountains of the Philippines, Waitiwan Dams in the forests of Brazil, the Qanat Underground Aqueducts in the deserts of Iran, and the Al-Tahla Floating Islands of the Ma'dan in the wetlands of Iraq, include opportunities and capabilities to provide for humans in a biodiverse landscape.

Saudi Arabia and the Arabian Peninsula are no exception. Al-Khatib and Al-Ma'aiya (2020) stated that the TEK of *hima* in the local communities within the Arabian desert ecologies contributed to the current system of nature reserves and protected areas (p. 39). However, TEK and even TK seem to be uncommon terminology in Saudi Arabia, arguably in the Arabian Peninsula, despite the long

existence of traditional practices and systems within the local communities of the Peninsula. According to Knudsen (2004), indigenous knowledge and TEK are notably lacking in the scholarly discourse concerning the Middle East. Knudsen stated that the main reasons for this absence are the insufficiency of focus on indigenous knowledge and TEK, and the marginalisation of the broader field of natural resource management, particularly local-based regulations and practices related to common property resources. Based on my research, I found approximately 17 papers on this topic published between 1985 and 2004. During the period spanning from 2004 to 2024, several published studies examined the local TEK in the Middle East and the Arabian Peninsula. However, the papers are often referred to by alternative terms, such as traditional institution, traditional *hima* system, traditional grazing system, traditional system and local conservation initiatives (Gari, 2006); traditional approaches to conservation, traditional knowledge, indigenous approaches, indigenous/traditional conservation institution and traditional approaches (Kilani et al., 2007); and traditional conservation system, traditional management system, *hima* system, traditional agricultural terraces, traditional water management system, community-based natural resource management and human integrated management approach (see, for example, Abdallah, 2013; Al-Shanqiti, 2013; Gari, 2006; Hassan et al., 2015; Ibrahim et al., 2013; Kilani et al., 2007; Llewellyn, 2013; Llewellyn & Altasat, 2017; Stevens, 2013; Syarifuddin et al., 2020; ten Veen, 2022). Although these terms may be defined differently and in accordance with specific natural characteristics, they are considered a form of the local TEK in the Middle East and the Arabian Peninsula. Based on my observation of the local TEK literature concerning the Arabian Peninsula, translating these terms from Arabic to English could be the reason behind the existence of these various vocabularies representing local TK and TEK.

In the Middle East, specifically the Arabian Peninsula, there is a well-established TEK system called ‘*hima* TEK’ (Marsuki, 2009, p. 216; Stevens, 2013). *Hima* (حمى) in Arabic means a conserved area or

a forbidden area; it is a place where flora, fauna and other natural resources are protected from random harvest and sustainably managed and monitored by local communities (Gari, 2006). Kilani et al. (2007) stated that *hima* TEK is a thriving practice combining landscape preservation with human well-being. Other scholars have highlighted that *hima* is the only practice that has remained constant over time to sustain the natural resources of the Arab region (Gari, 2006; Ibrahim et al., 2013; Syarifuddin et al., 2020). Additionally, Kilani et al. (2007) noted that *hima* TEK is a way of life that passes from generation to generation to help local communities survive in desert ecosystems.

The origins of the system can be traced to the first century BCE. Alhammori (2002) noted that Nabataean leaders enacted measures to protect certain natural resources for their own use and for the temples. This was emphasised by other studies, such as one conducted by Raymond (2008, pp. 27, 51). During the pre-Islamic period in the Arabian Peninsula,³ *hima* was known as a reserved territory with a natural resource controlled by a person or a tribe, forbidding others from benefiting from it (Gari, 2006; Hart, 2017; Ibrahim et al., 2013). It was a tool of oppression (Gari, 2006; Llewellyn & Altasat, 2017). However, approximately 1400 years ago, the *hima* system was modified to be more beneficial and efficient for the welfare of the public by the Prophet Mohammad (PBUH; Kilani et al., 2007; Serhal et al., 2011; Syarifuddin et al., 2020). Serhal et al. (2011) stated that Islam developed and modified this community-centred conservation system with an emphasis on significant values such as fairness, the equitable distribution of benefits, communal welfare and inclusive decision-making processes. *Hima* became known to be a non-profitable reservation area that functions as a fruit, vegetable, fodder and honey production area, and a managed grazing place for a specific time yearly, allowing for sustainable natural growth that benefits people, plants, animals and the whole ecosystem (Gari, 2006).

³ Meaning the period before 610 CE.

According to Llewellyn and Altlasat (2017), the system requires four characteristics or principles to be considered a *hima* (a traditional protected area): (1) the area should be under an official authority to ensure that everyone will follow the rules, (2) the protected area should be operated in the way of God, meaning it should be protected to support public welfare, (3) the *hima* should not prevent local people from obtaining essential needs, and it should not harm them and (4) it should provide a significant number of benefits for society. *Hima* seems to be seen and indirectly classified mostly as a territory and knowledge, and rarely as a practice, and yet, as I mention below, it encompasses lifestyles and land-use activities that affect areas beyond the protected *hima* zones.

Based on the literature, the main function of *hima* is seen to be similar in most studies, but there is inconsistency in terms of its categorisation, since some scholars classified it as having four types, and others categorised it as having five or six (e.g. Al Shaqsi, 2013; Eben Saleh, 1997; Gari, 2006; Kilani et al., 2007; Llewellyn & Altlasat, 2017; Serhal et al., 2011; Zahran & Younes, 1990). I would say that there are five types of *hima* traditional areas based on the literature, although these may sometimes be combined and modified, in accordance with the local needs.

The first type is a reserve where grazing is forbidden. The tribal council of a reserve select individuals (mainly women) to cut wood or harvest grass at specific times to feed their animals at a later date. The council informs designated individuals about where to walk and which parts of the land can be harvested to protect soil fertility from being damaged. The second type of *hima* is a reserve in which grazing is allowed under some conditions, for example, after plants produce their fruits and flowers, for a limited number of specific types of livestock, or for specific seasons or sites within the *hima*. This means that some *hima* are open for the whole year but for a limited number or type of animal. The third type of *hima* is a protected place to support bee communities. Usually, these areas remain closed, except after the flowering period, when grazing is allowed. This is considered the most

successful type because it is profitable for the community (Llewellyn & Altasat, 2017). The fourth type of *hima* conserves woodland and plant species such as *Haloxylon persicum*, acacias, juniper or olives, permitting cutting in certain situations. This type contributes to combating desertification and mitigating sand movements. The fifth type is conserved land for ibexes.

Al-Waleei (1996), and Al-Khatib and Al-Ma'aiya (2020) added another type called reserves supervised for the welfare of a particular tribe, town or village. However, I do not view this as a distinct category, since this concept can be applied to multiple categories. Zahran and Younes (1990), and Serhal et al. (2011) further divided *hima* into three management responsibility categories: section *hima* (managed by up to 10 villages), village *hima* (supervised by a single village) and individual *hima* (privately managed by a few people). Additionally, these *hima* territories may vary in terms of size, ranging from fenced and demarcated areas of 10 hectares to open expanses of over 1000 hectares (Llewellyn & Altasat, 2017; Zahran & Younes, 1990). This variation in the TEK land size can be seen worldwide, such as in India, where the TEK is linked to a single river or a whole watershed, such as in Balie (Watson, 2019, p. 21). This observation is noteworthy because it underscores that *hima* sometimes extends beyond small, demarcated zones, encompassing vast areas connected to multiple villages. Thereby, *hima* informs a communal lifestyle requiring regulated community interaction. However, most of the *hima* sites are small and located next to villages (Llewellyn & Altasat, 2017) or cultivated fields, mostly surrounded by traditional stone walls (Zahran & Younes, 1990). Here, I want to highlight that many studies limit the function of the *hima* TEK as a system of protected grazing land for livestock, but this is not the only function that the system can provide, as stated above.

In addition to the tangible direct benefits to the local community mentioned by Llewellyn and Altasat (2017), Gari (2006) acknowledged that the *hima* system has survived for many centuries owing to

four facts: (1) the high degree of community militarisation that allowed intense punishment for anyone who broke the rules, (2) people moved on foot with their animals between natural areas to find pastures, which allowed other distant pasture areas to grow, (3) animal owners were aware of their responsibility towards natural systems, keeping the *hima* tradition alive and (4) herd sizes were kept small, creating less competition for grazing fields.

Today, the system of *hima* has severely declined. Gari (2006) stated that the practice was stopped in 1954 in Saudi Arabia, owing to an enacted national decree appointing the Ministry of Agriculture and Water to be the owner and thus responsible for rural lands. Kilani et al. (2007) added that, because of the absence of an immediate alternative system to manage natural resources within these lands, the number of *himas* in Saudi Arabia decreased from 3000 to a few isolated ones managed by the local communities, some in cooperation with relevant official organisations. Al-Tabini et al. (2012) compared the contemporary situation regarding the TK of local communities and their surrounding environment with data from 50 years ago in the northern Arabian Peninsula, revealing significant degradation in Bedouin (local communities) lifestyles, rangeland environments, and plant diversity over time. They linked these negative changes to the pause in traditional practices such as *hima* and water harvesting,⁴ and to the artificial borders and official interventions within these areas. Also, Barichievy et al. (2018) noted that the erosion of traditional reserves such as *hima* TEK, alongside the loss of inviolable zones surrounding Makkah and Al-Madinah, resulted in a decline in environmental ethics and the degradation of rangelands and wildlife populations, which later led native species such as the Arabian Oryx, Arabian Gazelle, Sand Gazelle and Nubian Ibex to depend solely on conservation management within the protected area network. To conserve biodiversity,

⁴ Although I see water management and harvesting systems as a part of *hima* TEK, some *hima* experts exclude water management and harvesting systems from *hima* TEK, a perspective I examined in Section 7.3.3.1.

many researchers have highlighted the need to study the role of the local TEK of traditional communities (AbuZinada et al., 2004; Kohsaka & Rogel, 2021; Parween, 2021). For example, AbuZinada et al. (2004) highlighted the importance of the role of *hima* TEK in the local community of the Arabian Peninsula (Gari, 2006) by expressing the following:

With over six thousand years of biocultural diversity in the region it is only to be expected that there is a wealth of indigenous knowledge on how to use natural resources sustainably. Local traditions for the use of resources provide a basis that can be elaborated into programs for linking the conservation of renewable natural resources with sustainable national development. Functioning local himas, agricultural terraces, rainwater-harvesting methods and wildlife populations that are protected by local people all provide initiatives of tremendous value for achieving the objectives of the conservation of biodiversity. (p. 224)

A comprehensive and detailed examination of the local TEK implemented by traditional communities living in the Arabian Peninsula holds promise for fostering enhanced conservation strategies associated with both cultural heritage sites and their surrounding ecosystems, which are under the forces of climate change. Local TEK is a source of inspirational insights that can be integrated with modern techniques to generate new knowledge systems, as noted by Gómez-Baggethun et al. (2013).

2.3 Desertification

TEK is important because it guides local communities to mitigate environmental threats, such as desertification (Gari, 2006). According to Reynolds et al. (2007) and Sen (2013), one of the main issues that the world faces today is desertification, which is related to biodiversity reduction and climate change impacts. The definition of ‘desertification’ varies in the literature. The United Nations Convention to Combat Desertification (United Nations Convention to Combat Desertification

[UNCCD], n.d.) defines desertification as land degradation in arid, semi-arid and dry sub-human areas, resulting from many factors, including climatic variations and human activities (Reynolds et al., 2007). Edgell (2006) framed it as a 'process by which susceptible areas lose their productive capacity, and land degradation occurs in arid, semi-arid, and dry sub-humid areas, mainly as a result of human activities and climatic variations' (p. 86). This aligns with the definition by Amin (2004), in which desertification refers to a productivity reduction and a process of changing a desert into non-productive land, owing to inadequate land management. It is noteworthy, however, that Edgell (2006) clearly distinguished between desert and desertification by presenting desert ecosystems as productive places that can support lives. Therefore, desertification is a process of land degradation that diminishes the capacity of the land to sustain life, affecting wildlife, livestock, crops and human populations (Amin, 2004, p. 22).

According to many studies, desertification threatens one-third of the global lands (Amin, 2004; Peng et al., 2005; Schwartz, 2020; UNCCD, n.d.; Verstraete & Schwartz, 1991). Amin (2004) indicated that each year, the area of land permanently degraded to resemble desert conditions expands by 10 million hectares. One of the countries highly vulnerable to desertification is Saudi Arabia (Alsarhan et al., 2016; Edgell, 2006; Vincent, 2008), and it is expected that desertification will increase (Blilou & Hirt, 2023), particularly on the northwest side of the country. Al-Sheikh (2012) observed that, from 1987 to 2002, approximately 46% of the green cover in the southwest area of Saudi Arabia had been degraded, while others (e.g. Al-Bakri et al., 2016; Shukla et al., 2019) highlighted that 18% of the northwest regions of the Arabian Peninsula and Jordan faced severe desertification.

Generally, the literature has identified many factors leading to desertification, but there are three common factors consistently mentioned (see Amin, 2004; Blilou & Hirt, 2023; Cowie et al., 2007; Edgell, 2006; Goudie, 2018; Massy, 2017; Schwartz, 2020; Vincent, 2008). The first factor is

overgrazing. The second factor is irresponsible decision-making in land use planning, such as hillside farming, which may lead to soil loss, flooding, drought, erosion and persistent gullies. The third factor is the cutting down of trees and vegetation removal. However, the root causes of desertification can vary from place to place and context. Amin (2004), Edgell (2006), and Blilou and Hirt (2023) conducted research on desertification and its causes, particularly focusing on the context of Saudi Arabia. They acknowledged the complexity of this issue and determined several causal factors. The factors identified are evaporative conditions, a small amount of rainfall, drought affecting vegetation and livestock, wind and sand erosion and deposition, the salinisation of agricultural lands, deforestation, the overgrazing of rangeland plants, increased atmospheric dust, a reduction in soil moisture, unsustainable irrigation practices, the overextraction of underground water and urbanisation (Amin, 2004; Edgell, 2006).

According to Sahtouris (2007), 'Biologically, we are a desert-making species.' Other researchers, such as the American permaculturist Neal Spackman, the cofounder and director of the Al-Baydha Project in Saudi Arabia, concluded that flash flood events, deforestation and the forsaking of *hima* TEK are some of the issues that contributed to desertification, based on his experience of living with Al-Baydha's local community and observing the site for months (Al-Baydha, 2020; Schwartz, 2020). Flash flooding can lead to desertification by washing everything out, including vegetation and animals (Subyani, 2011). However, this factor can be seen differently as well. Researchers and practitioners have pointed out that a flash flood is a form of waste that can be managed and harvested to reverse desertification and improve natural qualities (Al-Baydha, 2020; Schwartz, 2020; Zhang et al., 2018). Spackman interestingly emphasised another significant factor, stressing the diminishing of traditionally managed interactions between inhabitants and their surrounding landscape (Schwartz, 2020). This degradation not only compromises landscape integrity but also disrupts the symbiotic relationship between communities and their environments (Schwartz, 2020),

potentially ending in their disconnection. Such disconnection often arises from the loss of the intrinsic environmental qualities that once drew communities to these ecosystems.

Connecting this to the broader global perspective, the Australian agriculturist Charles Massy (2017) pointed out the need to examine the human responses and actions related to climate variations as causing desertification rather than the desertification factors themselves. He stated that it is about changing culture as much as it is about changing land practices. Desertification and natural resource issues, such as a lack of water, negatively affect societies and economies (Filipe & de Mascarenhas, 2011). In doing so, they affect a society's natural and cultural heritage. According to Qu et al. (2014), desertification is one of the main factors that can destroy or change the original environments of natural and cultural heritage sites. Climate change hazards such as erosion, flash floods, natural disasters and landslides have caused significant damage to many United Nations Educational, Scientific and Cultural Organization (UNESCO) cultural heritage sites worldwide (Al-Tokhais & Thapa, 2020; Nguyen & Baker, 2023). Therefore, dealing with desertification today requires an approach that understands community, environment, cultural heritage and their interrelationships. Local communities need to be involved (Blilou & Hirt, 2023), local TEK needs to be significantly prioritised rather than just relying on the scientific knowledge of experts (Davis, 2005), and cultural heritage management needs to be seen as something connected, not as a separate issue. Both practitioners and researchers must embrace a holistic approach (Reynolds et al., 2007), recognising the intrinsic connection between ecological, cultural and social factors, as well as intertwined solutions for supporting livelihoods and managing the ecosystem (Reynolds et al., 2007; Wang et al., 2023).

“Once hybridised and scaled, these indigenous technologies could offer a new path to exponentially shrink the ecological footprint of humankind and mitigate the forecast collapse” (Watson, 2019, p. 18).

In Saudi Arabia, this might entail getting a better understanding of what *hima* TEK is, and what it can do to manage desertification.

2.4 Application of *hima* TEK for ecosystem enhancement in the Middle East and other countries

This section focuses on how the literature presents local TEK and its applications, with an emphasis on the ecological practices related to *hima* rather than viewing it as a territory. I demonstrate this through six *hima* applications or examples. However, before presenting the applications, I will briefly explain some of the characteristics of local TEK that lead to practical ecosystem management, such as regenerating ecosystems, water harvesting, soil conservation and biodiversity enhancement.

Firstly, local TEK as a management system involves physical intervention in the five types of *hima* presented previously: fodder reserve, grazing land, honey production land, woodland reserve and ibex reserve (Gari, 2006; Kilani et al., 2007; Llewellyn & Altasat, 2017). For example, the first, second and third types, which involve entirely or partially restricted grazing to ensure the sustainability and regeneration of ground cover and native plants, are achieved by constructing fences and stone walls to control access to the site, as discussed by Abdallah (2013) and Llewellyn (2013). Zahran and Younes (1990) stated that the difference in vegetation cover and soil quality between fenced *hima* and the surroundings is apparent, indicating the positive functionality and role of these traditional walls and fences (see Figure 2-2).



Figure 2-2: The upper photograph shows a traditional stone wall in the Hima Al-Fawqa (Abdallah, 2013), and the lower photograph illustrates another traditional barrier in the Hima AL-Humayd (Llewellyn, 2013).

Secondly, TEK also involves ecologically-literate community. Gari (2006, p. 219) and Eben Saleh (1998c, p. 179) highlighted the importance of community consensus in protecting and managing surrounding ecosystems and natural resources, rather than institutional or prescribed legislative control. For example, Gari (2006) explained that elders may establish multiple groups of people to be responsible for ecological tasks such as managing rainwater runoff, natural landscapes and agricultural yields. Llewellyn (2013) observed the role of allocated women (or both men and women in some areas) in harvesting natural resources (grass or wood) and materials. Those selected people are aware of the sensitivity of the site and know which materials can be harvested (always by hand, as noted by Llewellyn (2013)).

Another characteristic that can be ascertained from the third type of *hima* (i.e. honey production land) is that the function and usage of the protected lands is determined by locals. Locals may protect a site for a specific purpose, such as honey production, and devise a set of rules to make this reserve work well, such as prohibiting grazing during flowering time. Similarly, the ibex *hima* is another example of biodiversity conservation managed by locals, as exemplified by Llewellyn (2013), who noted as well that the *hima* of Quraysh can potentially work as a key reserve for birds. Hence, despite the main *hima* stereotype of being a pasture reserve, as presented by many researchers, Llewellyn (2013, pp. 216–219) referred to some other functions and purposes that *hima* areas provide, such as a regulated area for harvesting *Haloxylon persicum*, a conditional/natural-based recreation area, an area for managing sand dunes, an environmental restoration area, a natural resources conservation area, a fodder harvesting area, an area for beehives and honey production, a woodland conservation area, a watershed area, a potential eco-tourism area, a possible conservation area for important bird species and as a buffer zone.

Locals would create certain rules to enable the function of their *hima* area to be achieved. Based on this variety, *hima* areas seem to be flexible and can be modified according to the site context and the purpose that locals intend to achieve. For example, the fourth type of traditional reserve (i.e. woodland reserve) demonstrates that local communities may protect a woodland area to mitigate desertification and flash floods. Ground cover and native trees are key elements used for mitigating desertification factors (Shukla et al., 2019, p. 306). They can work as a green belt and cover to prevent the increase in sand movement and its impact. Also, they contribute to the reduction in water evaporation and soil moisture. According to Hooke and Sandercock (2012), native trees, shrubs and ground cover were used to reduce the soil erosion that may occur during natural disasters (see Figure 2-3).

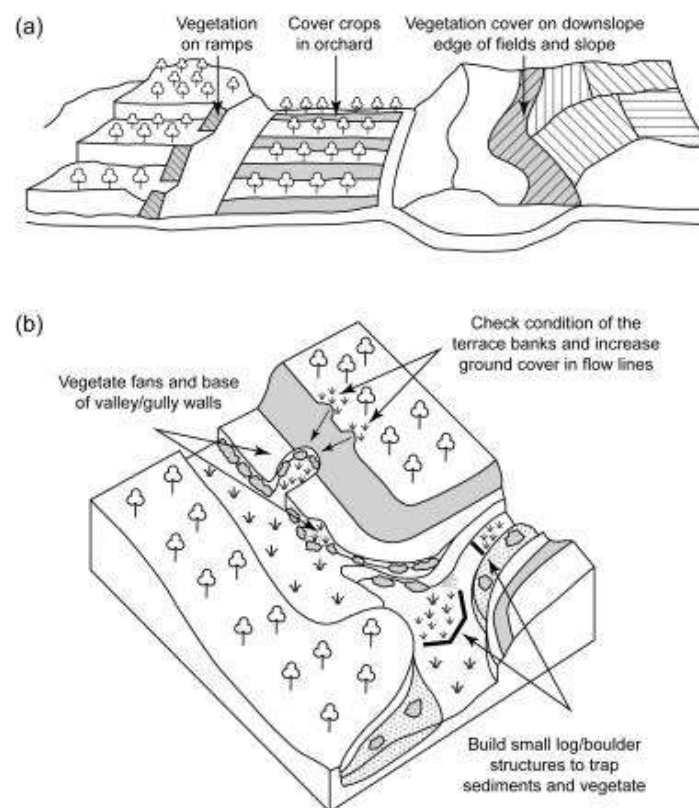


Figure 2-3: Similar to *hima*-based strategies, Hooke and Sandercock (2012) proposed a vegetation strategy to combat desertification in two different spatial contexts.

To further illustrate these management strategies of *hima*, I found six different contexts from multiple countries where indigenous systems such as *hima* TEK were implemented, adapted or proposed. Researchers have already examined these applications from several perspectives, including governance and policy-making. However, I studied them through the lens of LA design. Specifically, I focused on traditional ecological activities, techniques and practices that have played a role in the design and management of natural resources and the surroundings.

The structure of presenting the following examples is based on the spatial context, since I started from Saudi Arabia and concluded with Oman. I present two periods: the Islamic *hima* sites, which are considered fundamental to understanding the system, and the traditional *hima* sites in the Kingdom in Sections 2.4.1.1 and 2.4.1.2. At the end of Section 2.6, I present a table summarising the findings in the literature of *hima* TEK (see Table 2-2).

2.4.1 The context of *hima* TEK in Saudi Arabia

The first context focuses on Saudi Arabia. It explores two distinct periods: the early Islamic *hima*, and later traditional and contemporary *hima* practices, some of which remain to this day. This investigation draws heavily from four Arabic books: *The Nature Reserves in the Kingdom of Saudi Arabia* by Al-Waleei (1996), *the Himas of Medina* by Al-Shanqiti (2013), *the Valleys of the Medina Hima* by Al-Shanqiti (2019) and *the Geography of Nature Reserves* by Al-Khatib and Al-Ma'aiya (2020). It also includes the English literature about Islamic and traditional *hima* to comprehensively understand the diverse traditional environmental practices, activities and techniques that have played a role in conserving natural resources within the region.

2.4.1.1 Islamic *hima* sites

As mentioned earlier, Islam modified the *hima* system more than fourteen centuries ago and transformed it from a tool of oppression to one that serves public welfare. During this era, multiple *hima* sites were established to embody the principles of this reformed system. Although some of these sites are no longer operational, they remain rich in landmarks, cultural significance and the natural heritage features associated with the *hima* concept. Scholars from diverse disciplines have extensively studied and documented these sites. Therefore, a comprehensive understanding of these ancient Islamic *hima* sites and their ecological practices serves as the foundation for contemporary and traditional *hima* practices (Llewellyn & Altlasat, 2017). This section briefly introduces five key sites: the two *haram* boundaries of the two holy cities of Makkah and Medina, as well as three additional *hima* sites—two established by the Prophet Muhammad (PBUH) and one by the second caliph, Umar ibn Al-Khattab.

There is a relationship between the city inhabitants and the natural ecosystems of Makkah and Madinah, which is a lifestyle passed through generations and documented in Islamic literature. The two cities and their local and regional landscapes are protected and considered *hima* but are called *haram*. Marsuki (2009) stated that a *haram* is a TEK form like *hima*. However, some scholars consider it a type of *hima*. The *haram* (حرم) (meaning inviolable sanctuary in Arabic) of Makkah and Medina is a unique type of *hima* that stays implemented forever, unlike other *hima* sites that may be modified or stopped (Al-Shanqiti, 2013; Llewellyn & Altlasat, 2017). It is known in the Islamic literature that the Prophet Mohammed (PBUH)⁵ designated Medina as a *haram*, similar to what Prophet Ibrahim (PBUH) did when he designated Makkah as a *haram*, preventing vegetation removal, woodcutting and wildlife disturbance, including hunting in the areas in and around the city. The Islamic *haram*

⁵ PBUH means 'peace be upon him', and it is always used after the names of the prophets

and *hima* are both constructed based on the Islamic faith, morality and environmental ethics (Llewellyn & Altlasat, 2017). The natural environment of the *haram* of the two cities is protected, although they have a large population and receive millions of pilgrims and visitors each year, which exemplifies the harmony between natural systems and humanity (Llewellyn & Altlasat, 2017). Despite the size and population of these two cities, a diversity of native wildlife can be observed (Llewellyn & Altlasat, 2017). The restriction on harming and killing applies to wildlife and vegetation, exempting domesticated animals and agricultural crops, which are allowed to be slaughtered and harvested (Llewellyn & Altlasat, 2017). Regardless of the type of animals and plants, wastefulness and cruelty are strictly prohibited in all cases (Llewellyn & Altlasat, 2017). Both *haram* cities are full of biodiversity. For example, in the case of Makkah's *haram*, its altitude ranges from 140 to 984 m, with more than 157 plant species and 172 birds, including diverse habitats and ecosystems within its mountains, valleys, deserts and wetlands (see Llewellyn and Altlasat (2017) for more information about the biodiversity of both cities). The *haram* boundary is similar to a *hima* boundary, both are characterised by certain mountains, landmarks and watersheds (see Figure 2-4).

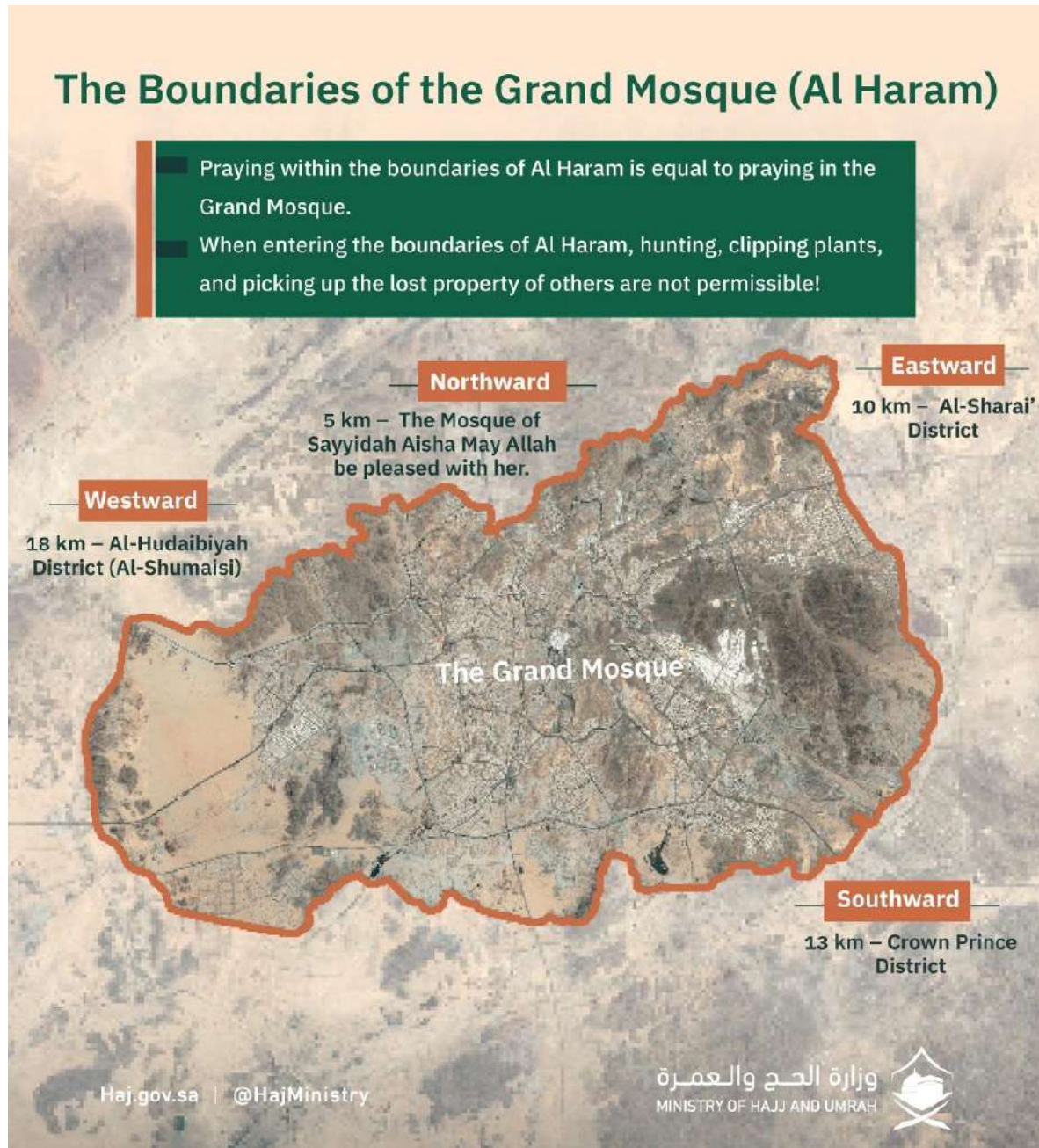


Figure 2-4: This map of the boundaries of Makkah's *haram* is posted by the Ministry of Hajj and Umrah to inform visitors and pilgrims about the environmental ethics inside the boundaries.

Source: Ministry of Hajj and Umrah (2023).

Regarding the other holy city, Medina's *haram* includes some of Makkah's natural characteristics, with many forest and plant communities providing habitats for birds, although the urban fabric has increased significantly over the past three decades. However, Medina has an additional *hima*

surrounding the *haram*, called the Hima of Al-Shajar (see Figure 2-5). This *hima*, as well as the following ones below, are presented based on site visits conducted by Al-Shanqiti (2013), who visited and documented what was mentioned in the Prophetic Biography regarding the three Islamic *himas* (Al-Shajar, Al-Naqi' and Al-Rabadhah).



Figure 2-5: This image shows the *haram* boundaries of Medina (the small, circled area) and Hima Al-Shajar (the larger circled area surrounding Medina's *haram*). Source: Llewellyn and Altasat (2017).

2.4.1.1.1 The Hima of Al-Shajar (حمى الشجر)

As mentioned, this *hima* surrounds the Medina's *haram*, and its animals, such as deer, can be hunted, but its vegetation is protected. The boundaries of this *hima* are 12 miles from the centre of Medina (the Prophet mosque; Al-Khatib & Al-Ma'aiya, 2020, p. 63). According to Llewellyn and

Altasat (2017), and Al-Shanqiti (2013), this *hima* serves as a green belt, crucial for stabilising the soil and shielding Medina from desertification. Hence, preserving trees and soil is imperative to mitigate erosion risks, and actions such as soil removal or waste disposal should be prohibited owing to their potential hazards as seen within the *hima* sites (Al-Shanqiti, 2013, p. 29; Shukla et al., 2019). Within this *hima*, various water wells, ponds and drinking spots are evident, including one valley that contains a *gelt*-like water basin (see Figure 2-11), where water is naturally gathered and harvested (Al-Shanqiti, 2013, pp. 42–45). The basin was located strategically to collect runoff from nearby mountains and valleys. Evidence of forests and water springs further underscores its importance as a vital water source for both locals and travellers. This is demonstrated by the presence of rock art and inscriptions scattered across the area, as pointed out by Al-Shanqiti (2013). He noted that the presence of duplicated inscriptions across multiple valleys suggests that, historically, locals moved or travelled between water sources within the *hima* (Al-Shanqiti, 2013). Within this *hima*, a mountain called Showran hosts water ponds full of fish of remarkable size, some as large as a human arm (Al-Shanqiti, 2013, p. 87). The site, including its historical significance linked to the pre-Islamic period, the Prophetic Biography and Islamic rule, has been described in a number of poems and presented as a once lush forest with abundant water, serving as a local recreational hub (Al-Shanqiti, 2013, pp. 37–39). Despite its religious significance, recent developmental activities have significantly affected the ecosystem and soil integrity within the *hima* and destroyed some of the landmarks, possibly as a result of road expansion (Al-Shanqiti, 2013, p. 35). Another concerning development is the new urban district and food industry establishment within the heart of the Mekhiatt Valley, situated in the *hima*; it is anticipated that the entire area will be adversely affected in the event of heavy rain or flash floods (Al-Shanqiti, 2013, p. 66). The last two statements demonstrate the negative impacts of urban development and the substandard land use management of ecosystem and heritage landmarks (Edgell, 2006).

2.4.1.1.2 The Hima of Al-Naqi' (حمى النقيع)

This *hima* is a 6 km long part of the 26.5 km long valley of Al-Naqi', a small part of Al-Aqeeq Valley (وادي العقيق) (the blessed valley), which crosses Medina from the south to the north and is located 100 km south of Medina (Al-Khatib & Al-Ma'aiya, 2020; Al-Shanqiti, 2013). This valley is called Al-Naqi' because of the number of water basins within it (Al-Shanqiti, 2013, pp. 103–104). The site remains naturally productive, with vast farmlands and expansive grazing areas still visible today (Al-Shanqiti, 2013, p. 111). Additionally, the Hima of Al-Naqi' boasts numerous natural and cultural landmarks, including Al-Quds, a towering mountain reaching 2161 meters in height, situated in the western region of the Kingdom (Al-Khatib & Al-Ma'aiya, 2020, p. 65). Further, this *hima* has been the site of several significant historical events, documented in poetry and recorded in the Prophetic Biography (Al-Khatib & Al-Ma'aiya, 2020). The *hima* encompasses numerous valleys (one of which is the Valley of Shedkh, distinguished for its abundant underground water), seasonal watercourses and water basins, along with approximately 19 rivulets, small villages and mosques (Al-Khatib & Al-Ma'aiya, 2020). Many of the rivulets are settled within mountains and *hurrat* (حرات) (volcanic ranges and lava-landforms), which contribute significantly to water retention, wind breaks and solar radiation reduction, thereby minimising evaporation and extending water longevity (Al-Shanqiti, 2013, p. 154). During the rainy season, some rivulets are transformed into small lakes (Al-Shanqiti, 2013, p. 155).

This *hima* served primarily as pastureland for horses (Al-Khatib & Al-Ma'aiya, 2020; Al-Shanqiti, 2013); however, the livestock of poor families were allowed to benefit from it (Al-Shanqiti, 2013, p. 161). Subsequently, the dimensions of the *hima* were expanded to accommodate the increasing demand for natural resources, thereby extending its benefits to a larger number of animals (see Al-Shanqiti, 2013, pp. 162-165). Finally, Al-Shanqiti (2013) encountered a significant challenge concerning the nomenclature of historical sites within this *hima*. Despite extensive research drawing

from various sources and historians, including consultations with local inhabitants, many mountain names, water sources and valley designations had undergone alterations over time. As a result, certain key sites remained unknown, presenting a challenge to the comprehensive documentation of the area's historical geography.

2.4.1.1.3 The Hima of Al-Rabadhah (حمى الريدة)

Al-Rabadhah, an Islamic *hima* situated 170 km east of Medina's centre, serves as protected grazing land for the State (Al-Shanqiti, 2013, pp. 197-198; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2022b; see Figures 2-6, 2-7 and 2-8). Because of its pristine soil quality, fresh air and diverse ground cover—comprising approximately 50 recorded plant species—the site historically functioned as a main resting station for travellers moving between Iraq and Makkah (Al-Shanqiti, 2013).

According to Al-Shanqiti (2013, p. 194), the geographical richness of Al-Rabadhah is due to its strategic positioning within a broad, flat plain surrounded by numerous mountains and valleys. This topographical arrangement facilitates the inflow of substantial water resources from the nearby valleys and aquifers, sustaining both the *hima* and the local inhabitants. Al-Shanqiti (2013) added that the presence of western mountains significantly mitigated sandstorms, thereby safeguarding soil integrity, vegetation cover and air quality. Adjacent to the *hima* lies an ancient residential area (eventually included within the *hima*) that includes dwellings, mosques, shops, granaries, water reservoirs, human-made ponds and an extensive network of water wells (Al-Shanqiti, 2013, pp. 201–206).

Al-Shanqiti (2013) detailed the complex water management system within the residential area, comprising 200 stone-built water reservoirs situated beneath dwellings, each equipped with an

isolating covering to enhance water reservation. These reservoirs are allocated to every house and feature top entrances to facilitate recharge (Al-Shanqiti, 2013). Water recharge happens through two methods: (1) via rocky water channels collecting rainwater from rooftops into the reservoirs and (2) through manual transfer from nearby public water ponds during drought periods (Al-Shanqiti, 2013, p. 206). Originally, this *hima* was designated for horses and camels, including those belonging to impoverished locals; however, its scope was expanded as the population grew, covering more villages, and additional valleys and pastures (Al-Shanqiti, 2013). Ninety-six years ago, King Abdulaziz revived and expanded the *hima* in response to the increased demand for camels to support pilgrims and the Kingdom's officials, renaming it the *hima* of Medina (Al-Shanqiti, 2013; see Figure 2-6). During a drought that severely affected the Kingdom in 1354⁶ (1935), a traveller described the *hima* as a blessed place with valley forests, abundant rivulets and vibrant vegetation cover, permeating the landscape with an aromatic smell that covered the area (Al-Shanqiti, 2013). Today, the site is still in use as a grazing area for livestock of the local community living around the area, although many parts are now fenced and considered archaeological sites (Llewellyn & Altasat, 2017; see Figure 2-9). Llewellyn and Altasat (2017) suggested that the locals should continue managing the site but participate with official institutions, while the fenced sites could work as a seed bank and be used as benchmarks to measure the difference in biodiversity.

⁶ Hijri lunar calendar



Figure 2-6: This map illustrates the initial *hima* boundary around 634 CE (yellow line), the extended boundary in 799 CE (red line), and the final extension before its decline around 1930 (black line).
Source: the researcher based on Al-Shanqiti (2013).

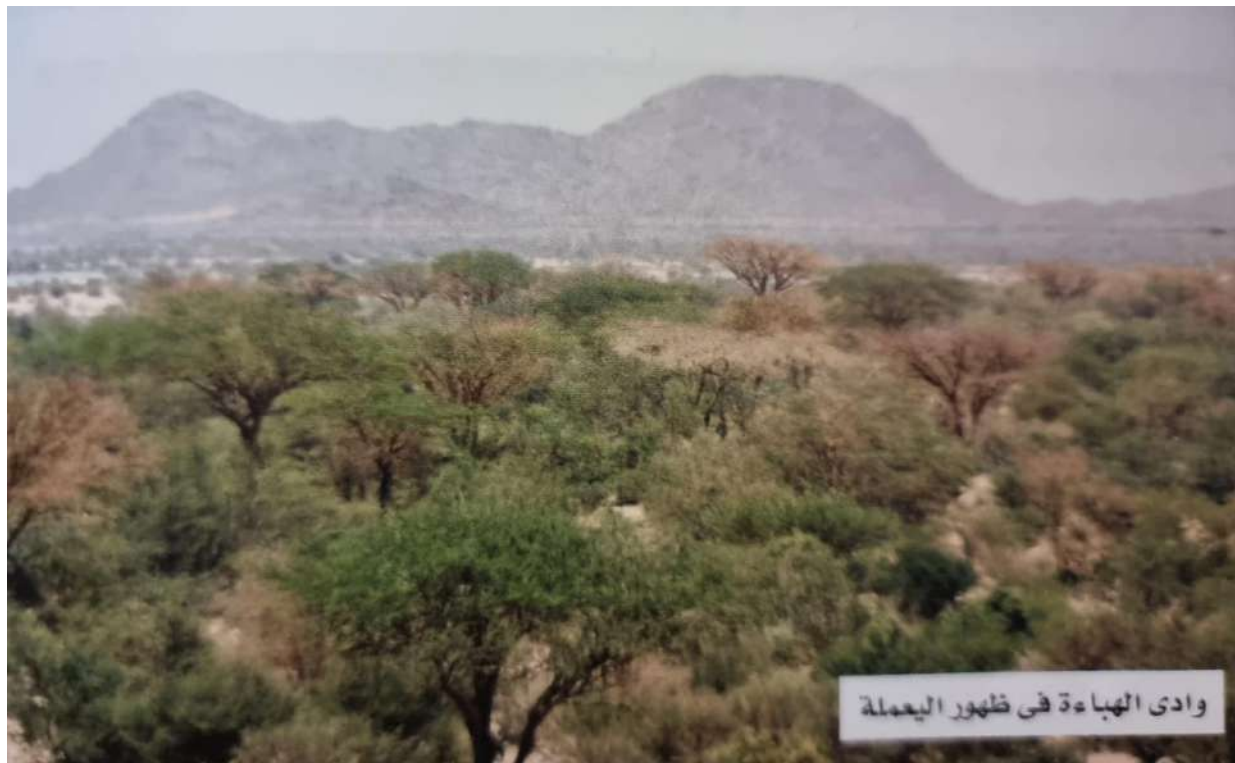


Figure 2-7: One of the valleys of this *hima*. Source: Al-Shanqiti (2013).



Figure 2-8: Satellite image of Al-Rabadhah village (residential area). *Source: Google Maps.*



Figure 2-9: The ancient water ponds. *Source: Al-Shanqiti (2013).*

2.4.1.2 Traditional and contemporary *hima* sites

Both Al-Khatib and Al-Ma'aiya (2020, p. 56), and Al-Waleei (1996, pp. 76–78) describe traditional *hima* areas in Saudi Arabia, presenting similar *hima* classifications connected to specific sites. For example, the first *hima* category, which prohibits grazing entirely, is exemplified in the Hima of Bani Sar, and the second category, allowing conditional grazing, is demonstrated in the Hima of Al-Azahirah (الازاهرة), the Hima of Al-Humayd and some of *hima* sites in Taif. Another category presented by both Al-Khatib and Al-Ma'aiya (2020), and Al-Waleei (1996), which can be included in the previous one, is the allowance of year-round grazing under state management, as exemplified in the Hima of Hail, the Hima of Seje, the Hima of Saysad (سيسد) and the Hima of Al-Khurmah (الخرمة). The third category, designated for beekeeping, is observed in the Hima of Al-Jouf and the Hima of Al-Thamaniah, and the fourth type, defined as a woodland reserve, is exemplified in the Hima of Bani Saad and the Hima of Huraymila' (حريملاء). Interestingly, the authors characterise the beekeeping reserve as a multipurpose *hima*, serving as a recreational space, managed grazing area and, potentially, an agricultural zone if required.

Some of these *hima* sites are presented in more detail; however, I next briefly outline the traditional ecological practices of the locals and any relevant aspects, such as the ecological characteristics of these 10 *hima* sites. It is worth noting that, unlike the *harams*, these *hima* sites continue to be modified. In some respects, they are therefore a cross between Western notions of a National Park, which conserves a landscape, and a farm which is modified to maximise production.

1. The Hima of Huraymila' (Al-Khatib & Al-Ma'aiya, 2020, p. 57): This is a tributary located 80 km northwest of Riyadh, surrounded by many hills. It is dominated by *Acacia* species, as well as 19 other native plant species, and some areas of it are cultivated with date palms. The soil is sandy or gravelly.

Part of this site is a recreational area (national park) managed by the Ministry of Agriculture (Llewellyn & Altlasat, 2017), and the rest of the *hima* is managed traditionally.

2. The Hima of Al-Gadha (Al-Khatib & Al-Ma'aiya, 2020, p. 58): This is a sandy soil area covered by dunes located in the Al-Qassim region. Although the sand layer is deep, the site includes approximately 21 native plant species, including *Haloxylon persicum* (in Arabic: *Gadha*), from which the name of the *hima* site was inspired. Owing to the traditional conservation system, the area is characterised by dense vegetation compared with its surroundings (Al-Waleei, 1996, p. 80). According to Llewellyn and Altlasat (2017, p. 21), this *hima* works as a green belt, and a camping and recreational area for the people of Unayzah town.

3. The Hima of Saysad (Al-Khatib & Al-Ma'aiya, 2020, p. 58): This is a traditional reserve located in a high-altitude area in northeast Taif, 17 km northeast of Taif. Its soil is a mix of sand and clay, sustaining about 42 different plants. Because of its vegetation diversity, the government recently transformed the site into a national park.

However, this transformation may not be the most ideal solution, since the existing community already understands and cares for the environment and its natural resources. Transferring control to a new official institution is likely to alter the quality of the site.

4. The Hima of Buni Sar (Al-Khatib & Al-Ma'aiya, 2020, p. 59): This is a 4.5 km² traditional reserve located in the town of Baljurashi, at an altitude of 2300 m. The soil is mostly volcanic rock fragments. The trees were removed from the semi-flat areas to allow more grass species to grow. However, the trees within hilly areas, foothills and valleys (waterways) were preserved. According to Llewellyn and Altlasat (2017, p. 18), the site is protected to support the local community during times of drought. Hunting and grazing are prohibited, but grass can be harvested (Llewellyn & Altlasat, 2017, p. 18).

5. The Hima of Al-Azahirah (Llewellyn & Altlasat, 2017, p. 17): This is approximately 7 km², located east of the town of Baljurashi in the Al-Bahah region, within the watershed of a tributary of the Ranyah Valley. It is covered by grassy rangeland and tall trees, such as *Olea europaea*, *Pistacia falcata*, *Euclea schimperi* and *Ziziphus spina-christi*, in its lower areas. It has been traditionally allocated as a seasonal grazing area for camels and donkeys. Mostly, local women cut fodder here to feed the animals. Locals worked as a collective for three years to build a wall to protect the site and limit accessibility; however, the wall has made monitoring the site challenging.

6. The Hima of al-Fawqa' (Llewellyn & Altlasat, 2017, p. 17): This is a 1.5 km² area located east of the town of Baljurashi in the Asir region. Within the highland eastern slope of Asir, this site is covered with a woodland forest, such as *Acokanthera schimperi*, *Jasminum grandiflorum*, *Barbeya oleioides* and dense grassland dominated by *Themeda triandra*, *Chrysopogon aucheri* and *Hyparrhenia hirta*. In this *hima*, only a small number of camels are permitted to graze; however, in the past, grazing was completely prohibited, and fodder was harvested by hand (primarily by women), taking turns to cut designated areas during times of drought. This *hima* serves all locals, whether connected to the local tribes or not. Locals have allocated the edge of the *hima* to beehives.

7. The Hima of Al-Humayd (Llewellyn & Altlasat, 2017, p. 18): This area is 5.3 km², located to the west of Hima Al-Azahirah. It is covered with woodland and dense-vegetated rangeland. Seasonally, camels and donkeys are permitted, but sheep are not. Here, fodder is also managed and harvested by women. The *hima* is surrounded by a stone wall and is monitored regularly by locals. Owing to the site conditions, it is recognised as an eco-tourism and recreation site.

8. The Hima of Thumalah (Llewellyn & Altlasat, 2017, p. 18): This is a 7.5 km² area located southeast of At-Ta'if. Its vegetation cover is mostly grassland with many trees. This traditional reserve is used

for beekeeping and grazing for feral donkeys. Its edges are determined by rocks (not surrounded by walls). Many court conflicts have arisen over locals allowing their animals to graze inside.

9. The Hima of Quraysh (Llewellyn & Altasat, 2017, pp. 18–19): This is a 15 km² area located on the west edge of the Taif escarpment, dominated by dense shrubs and grasses, along with some wild olive trees. It is a crucial area for birds. The site used to be a camel pasture; now, all livestock are prohibited except cattle, owing to the multiple benefits related to dairy products and plowing the fields. Part of the *hima* is allocated for honey production. The *hima* is managed by four tribal elders, since the site is one of the largest in the region. The site serves as an eco-tourism site and a nature-based recreation site.

10. The Hima of Jabal Ral (Ral Mountain; Llewellyn & Altasat, 2017, pp. 19–20): This is an area covering 69 km², situated northwest of Saudi Arabia, close to Al-Wajh, and is one of the largest sites in the Kingdom (see Figure 2-10). It features granite exfoliation domes and is dominated by *Moringa peregrina* and *Acacia tortilis* woodland. The site was protected for ibex by the Bili tribe for more than 200 years, preventing any livestock grazing activities. A permanent water spring within the main valley was managed to water livestock; however, in the 1990s, the locals fenced the spring to limit accessibility. The vegetation condition of the site is much better than that of its surroundings, making it a strategic seed bank for rangeland rehabilitation. Although the site is not labelled *hima*, it is managed according to the principles of *hima*.



Figure 2-10: The *hima* of Ral Mountain. Photo: by Mohammed Al-Sharif. Source: CNN (2021).

These ten traditional and five Islamic *hima* sites provide partial insights into the traditional ecological system of *hima*. Authors and researchers who presented these cases examined *hima* as a territory, and less as a practice involving people. However, there remains a lack of detailed information on the specific traditional environmental techniques and strategies employed by the local communities.

Researchers have begun to address this gap by conducting field visits to *hima* sites and documenting their findings. For example, Al-Shanqiti (2019) extensively explored the valleys within the *haram* area of Medina and the Hima of Al-Shajar, thoroughly observing and analysing environmental features alongside cultural heritage elements such as forts, mosques, dams, walls, inscriptions and rock art. In the following text, I outline four pertinent findings from his research, noting that, although some of these practices may not be explicitly categorised under the *hima* system, they are undoubtedly linked to *hima* TEK.

1. Utilising productive areas: Al-Shanqiti (2019, p. 74) observed that the initial stretch of the Al-Aqeeq Valley, renowned for its fertility and abundant water resources, hosts numerous farms

situated more than a day's walk from Medina. Remarkably, despite changes in farming practices and increasing impacts of drier climates, the landscape retains a strikingly similar appearance to its description 1000 years ago.

2. Managing natural water basins: Al-Shanqiti (2019, p. 78) documented the management of natural water basins within one of the Medina valleys, where water is naturally collected and stored throughout the year to sustain local inhabitants, pastoralists and travellers (see Figure 2-11). Historical records indicate past habitation in this area, and its productivity has historically attracted significant events and conflicts. The natural protection provided by the mountains shields the water from direct sunlight and wind, thereby minimising evaporation (Al-Shanqiti, 2019, pp. 84–85). In some areas, water can be drawn to irrigate local farms (Al-Shanqiti, 2019, p. 86).



Figure 2-11: A part of the *Mjz* rivulet (historically known as *Mzj*), where water is collected and preserved naturally between two mountains. Many local communities today call the area in the right image '*gelt*'. Source: Al-Shanqiti (2019, pp. 79–80).

3. Traditional dams and hamlets: Al-Shanqiti (2019, pp. 119–123) documented several traditional dams within the valleys of the Hima of Al-Shajar, with one notable example located in an area known as Al-Jathatha. This particular dam spans 145 m in length and varies from 15 m wide at the bottom to 5 m wide at the top. It is constructed from volcanic stones reinforced with clay. The design

resembles terraces, featuring an aperture or hole at the top, likely used for water management. Additionally, a 3 km long water channel, constructed from local stone and covered from the top, diverts water from the dam to a water pond in a nearby hamlet. The hamlet houses are made with stones and are situated in the higher area of a foothill of a mountain, protected from the risk of floods and providing residents with a vantage point to oversee the valley and water channel, with one structure resembling a watchtower. These houses were built 13 decades ago.

Another example described by Al-Shanqiti (2019, pp. 174–175) is the dam and the Castle of Asim. The castle is a square edifice situated at the higher part of the foothill of a mountain, strategically positioned to avoid flooding and waterways. Owing to the absence of a permanent water source, Asim constructed a dam behind his castle to capture water from the mountain and a small tributary behind the structure. Remarkably, this dam endured for over 13 decades until its recent conversion by the local municipality into a public park (Al-Shanqiti, 2019, p. 184).

Al-Shanqiti (2019, pp. 209–212) introduced a third area, where a huge dam is situated on the eastern side of the Hima of Al-Shajar. This dam, spanning 10 m in length and 3 m in width, was constructed with huge rocks without filling the interstices between the rocks, facilitating water flow through the structure (see Figure 2-12). Further, two smaller dams were subsequently built, with the initial one designed to withstand floods and strong water currents. The two subsequent dams have now been obliterated because of urban expansion in the region.



Figure 2-12: This dam used to be called the Dam of Abdullah ibn Amr ibn Othman. Today, people call it Anter Dam. *Source: Al-Shanqiti (2019, p. 209).*

The fourth instance is the Thi Al-Jdr Dam. Al-Shanqiti (2019, pp. 234–235) elucidated that this dam played a pivotal role in increasing the groundwater levels in the Al-Alia district of Medina. Also, it provided protection to the villages and farms situated near the waterway within the valley. The accumulated water was utilised for irrigation purposes in the city for several decades. It was built and maintained by people with an acute understanding of rain patterns, soil infiltration and the way to harness water. Therefore, it is more than an artefact of a past era; it gives us clues on how humans might engage with the environment.

4. Protective barriers: Al-Shanqiti (2019, pp. 209-212) described the presence of farms, wells, and buildings and structures surrounding the Valley of Al-Aqeeq. He referenced an account detailing three water wells, one of which would routinely become filled with soil and debris after each flood. To mitigate this recurring issue, Ibn Al-Zubayr constructed a strong barrier composed of large rocks to protect the well from such accumulation.

These four strategies at the 15 sites, documented by scholars and not instituted by official institutions, show that the traditional ecological system of *hima* has played a significant role in environmental conservation. Although the management system is unwritten, it is greatly respected within the local communities, making it more effective in conserving the surrounding ecosystems (Zahran & Younes, 1990).

However, the system today is in decline. Llewellyn and Altasat (2017) stated that the notion of *hima* and its associated practices are rapidly diminishing and face the risk of permanent loss since the holders of the knowledge are decreasing in number. This means that it is of the utmost urgency to thoroughly document the system. The reasons behind this threat are as follows: (1) recent socioeconomic transformations, (2) the nationalisation of rural lands, (3) population growth has surged, (4) agricultural practices have become increasingly mechanised and (5) escalating demands for housing, farmland and grazing areas to accommodate expanding livestock herds (Llewellyn & Altasat, 2017, pp. 15–16). Consequently, many of the original objectives for establishing traditional *himas* no longer align with the evolving needs of local societies (Grainger & Ganadelly, 1986; Kilani, 2009, as cited in Llewellyn & Altasat, 2017). Accordingly, the majority of these *himas* have fallen into disuse, with only a handful remaining, and even fewer being actively managed. Because the urban community has lost the need for *hima* areas, they are also losing *hima* practices, which are essential for resilience in this environment.

2.4.2 The context of *hima* TEK in Indonesia

In the case of Indonesia, ten Veen (2022) stated that today's formal conservation approaches are not sufficient to address current forest degradation in the country. Therefore, locals implemented

hima and *harim*⁷ systems in two national parks to protect biological biodiversity and endangered species such as the Javan hawk-eagle, Javan gibbon and clouded leopard (ten Veen, 2022). Mangunjaya and McKay (2012) highlighted the reintroduction of *hima* and *harim* systems, alongside other environmental principles mentioned in the Qur'an, within the local community of the two national parks as regulatory frameworks aimed at strengthening biodiversity conservation efforts. In one instance, a designated 1 ha riverbed area was allocated as a protected zone to be managed by the locals for its upkeep, while also utilising it as an educational hub for biodiversity awareness among students (Mangunjaya & McKay, 2012). Various initiatives were implemented to maintain water resources and the ecosystem, such as regular lake clean-ups and the extensive planting of *Salix tetrasperma* (around 800 seeds and plants) along a 1.5 km coastal stretch to enhance habitat conditions, particularly for culturally significant endangered fish species such as *Mystacoleucus padangensis* (Mangunjaya & McKay, 2012). Strict measures prohibiting illegal logging and forest burning were enforced to mitigate environmental degradation and ensure nature conservation (Mangunjaya & McKay, 2012). The authors pointed out that, although the main principles were derived from the *hima* system, the activities and techniques were proposed during multiple workshops run by the locals based on their traditions and knowledge of conserving natural resources. Owing to the project's positive outcomes for both the environment and the local populace, the government acknowledged the site as a Conservation Village (Mangunjaya & McKay, 2012).

⁷ *Harim* means sacred reserves designated to safeguard water resources and their functions (Mangunjaya & McKay, 2012).

2.4.3 The context of *hima* TEK in Lebanon

In the case of Lebanon, owing to the decline of the *hima* system over the past 60 years, the Society for the Protection of Nature in Lebanon has led a revival of the *hima* approach in the country to conserve important bird areas in partnership with local organisations (Serhal et al., 2011). They have empowered local communities and established small groups of youth protectors called ‘*Homat Al-Hima*’⁸ to maintain the ecosystems in the *hima* areas and stop illegal hunting activities (ten Veen, 2022). The project is aimed at reducing poverty by providing locals with direct benefits from the protection (Serhal et al., 2011). Nine steps form a road map used to revive the *hima* approach in Lebanon, and some of these steps develop the concept of *hima* by addressing many different aspects. One of these aspects involves understanding other traditional ecological practices, such as the *Aflaj* water management systems in Oman (this system includes *hima* characteristics, as mentioned by Al Shaqsi (2013)), *Harim*⁹ zones of water bodies, *Awqaf* agricultural terraces, *Hujrah* systems in Yemen and traditional grazing systems (Kilani et al., 2007; Serhal et al., 2011). The main objective of this revival effort is to integrate the traditional values of the locals with the *hima* system, incorporating recent developments in preservation knowledge, including site identification, stakeholder analysis, and the linkage between livelihoods and natural resources, to foster sustainable development (Serhal et al., 2011). Recently, the Society for the Protection of Nature in Lebanon has initiated eco-tourism activities, encompassing hiking excursions and bird-watching locations, alongside traditional activities such as seed-gathering zones, grazing pastures and apiaries, to enhance the economic welfare of the community, thereby fulfilling the third pillar of sustainability, complementing the dimensions within the *hima* framework that have already been addressed (Kilani et al., 2007). The outcomes of this revival, including the involvement of the locals

⁸ This means ‘*hima* youth nature guardians’, as Veen (2022) explained.

⁹ *Harim* is a form of *hima*, associated with water resources.

and their livelihood, shows a strong commitment from the locals to protect the ecosystem, water and plants, fostering an increased trust between locals and the associated organisation (Kilani et al., 2007).

2.4.4 The context of *hima* TEK in Tanzania

In the case of the Misali and Pemba Islands, in Zanzibar, Tanzania, Misali Island was recognised as the first marine *hima* in history (Kilani et al., 2007). Since the country includes one of the main hotspots of biodiversity in the world and contains a diverse array of native plants, mammals, reptiles and birds, 35 of which are facing threats to their survival (ten Veen, 2022), a *hima* REDD+¹⁰ project was proposed to achieve three goals (Terra Global Capital, n.d.). The first goal is the promotion of biodiversity preservation by safeguarding the existing forests and supporting the natural regeneration of wooded areas to enhance wildlife habitats and marine environments. The second is to address climate change by reducing the carbon emissions that result from deforestation. The third goal is to enhance community well-being, particularly for women, by assisting them in adopting sustainable land use practices (Terra Global Capital, n.d.). The project activities include developing community knowledge and the capacity to manage the site, protecting the forest through redrawing the boundaries between key areas, reducing the need for firewood by finding alternatives, regenerating mangrove forests and maintaining equitable benefit distribution (Terra Global Capital, n.d.). The replanting, restoration and protection of mangrove forests is a key aspect of this project, owing to the enormous benefits the forest offers to humans, ecosystems and the climate (Terra Global Capital, n.d.).

¹⁰ This is an acronym for ‘reducing emissions from deforestation and forest degradation in developing countries’, and the ‘+’ stands for the added sustainable forest-associated activities aimed at protecting the climate (United Nations Framework Convention on Climate Change, n.d.).

2.4.5 The context of *hima* TEK in Iraq

In the case of Iraq, an initiative called ‘Hima Mesopotamia’ was proposed to protect the eco-cultural heritage sites in the country (Stevens, 2013; ten Veen, 2022). Although the TEK of the local community in Iraq is not referred to as *hima*, it is highly relevant to the *hima* system (Stevens, 2013). According to Stevens (2013), water scarcity, the unequal distribution of water resources and desertification represent significant risks to both the biodiversity and cultural heritage of the Tigris–Euphrates river basin in Iraq. These factors, including modern dams in neighbouring countries, have led to decreased annual flows, causing water scarcity and the degradation of water quality across the basin, leading to a rise in salinity levels, a decline in fish populations and low-quality grazing areas for water buffalo (Stevens, 2013). During the period from 2003 to 2005, and after regional conflicts and the collapse of some of the modern water dams, local communities managed to return to their homes and initiate the regeneration of certain components of their surrounding natural ecosystems, including the restoration of some fish populations and indigenous plant species (Stevens, 2013). According to Stevens (2007), the traditional ecological practices observed among the marsh local communities involved various techniques, such as the controlled burning of mature vegetation to encourage regrowth and establish micro-habitats, as well as managing multiple species of plant resources, including water buffalo fodder, fish and waterfowl (Stevens, 2013). They also implemented strategies such as rotational resource usage, selective harvesting based on seasonal factors, regulating the harvesting of fish and managing landscape patchiness (Stevens, 2013). Finally, the author concluded that the *hima* system holds promise as a solution for community engagement and traditional knowledge in maintaining water sources, promoting biodiversity, enhancing human well-being and strengthening the economy in the region.

2.4.6 The context of *hima* TEK in Oman

The last example is in Oman, where rural communities rely on a traditional water management system known as the *Aflaj* system, as described by Al Shaqsi (2013). However, this system faces various threats resulting from socioeconomic challenges, climate change impacts and hydro-physical factors, including shifts in lifestyle patterns, urbanisation, modernisation, declining adherence to traditional practices, population migration and drought (Al Shaqsi, 2013). *Aflaj*, derived from Arabic, translates to ‘small rivers’, referring to the constructed water channels found throughout Oman, either underground or on the surface (Al Shaqsi, 2013). Traditionally, water allocation from *Aflaj* follows a hierarchical order: prioritising drinking water, followed by allocations for mosques, forts, domestic needs (such as public baths, clothing and dish washing areas) and agricultural purposes (for permanent crops such as date palms, then seasonal crops; Al Shaqsi, 2013). In case of drought, water will be cut from the seasonal vegetation areas (Dutton, 1995; J. C. Wilkinson, 1977, as cited in Al Shaqsi, 2013). Both the *Aflaj* and *hima* systems share similarities, since both are forms of community-based natural resource management guided by good governance and environmental, ethical and institutional principles (Al Shaqsi, 2013). Notably, aspects of the *hima* concept can be observed within the *Aflaj* system, as illustrated in Figure 2-13. Finally, Al Shaqsi (2013) suggested that applying a *hima* community-based natural resource management system could offer effective solutions for water management challenges and reinforce the *Aflaj* system in rural Oman.

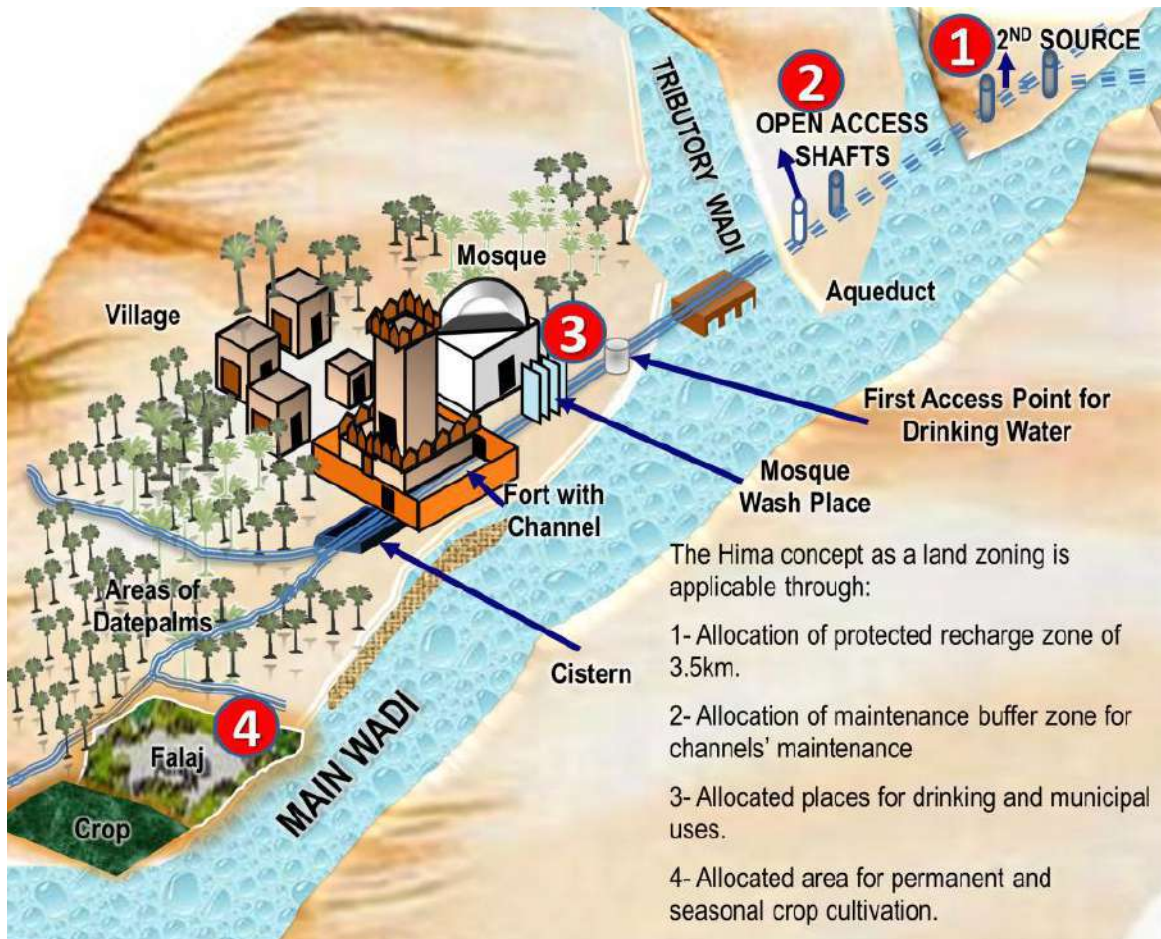


Figure 2-13: This diagram shows four land zonings of the *hima* system that are applied in the *Aflaj* system. The author discussed *hima* as a place-based system with zones of land use. Each zone includes ecological practices that involve local communities. Source: Al Shaqsi (2013).

2.5 Cultural heritage preservation in Saudi Arabia

In this section, I discuss the two types of cultural heritage, the importance of preserving them, and present the current situation regarding conservation approaches and the related issues nationally and internationally. Heritage is associated with, and sometimes rooted in, the natural environment, and it can be classified as natural and cultural. UNESCO (1972) defined cultural heritage as monuments, buildings and sites with outstanding universal value (i.e. architectural works, sculptures, inscriptions, works of man, works that present nature and man, or homogeneous buildings with their landscape). The Saudi Ministry of Culture (2021) defined it as 'the legacy of

places and objects, as well as of intangible practices, representations, expressions, knowledge, and skills, which are deemed to be symbolic of the cultural identity(ies) of a given country or community, among others' (p. 6). Regarding natural heritage, it was defined by UNESCO (1972) as natural features, geological and physiographical formations, and natural sites or areas with an outstanding universal value in terms of conservation, science or natural beauty. Natural heritage in Saudi Arabia is considered an interlinked element of cultural heritage. The Saudi Ministry of Culture (2021) emphasised that, in Saudi Arabia, the majority of protected natural heritage areas contain notable cultural characteristics, such as sacred sites, ancient water management structures, rock art, tombs and hunting traps, and these cultural values are often deeply intertwined with the surrounding environment. In contrast, numerous cultural sites also possess significance in terms of natural heritage, including distinctive geological formations, biodiversity and natural aesthetic features (Ministry of Culture, 2021). Both cultural and natural heritage features are parts of human identity, tradition, and culture. Conserving these features contributes to protecting human values and history. According to UNESCO (2009a), cultural heritage conservation means 'the measures taken to extend the life of cultural heritage while strengthening transmission of its significant heritage messages and values' (p. 86). Qu et al. (2014) added that heritage elements must be protected within similar environments where these heritage features were created.

In addition to its core cultural heritage values rooted in historical and societal contexts, the significance of a place extends to other dimensions, such as tourism. Internationally, cultural heritage conservation has received considerable attention recently from researchers and relevant institutions (e.g. A. Alahmadi et al., 2022; Allan et al., 2019; AlSayyad, 2013; Al-Tokhais & Thapa, 2020; Hirszenberger et al., 2019; Nguyen & Baker, 2023; Paulino et al., 2023; UNESCO, 2022a, 2022d, 2023a, 2023b; Valverde-Roda et al., 2023), enhancing the conservation practices from different aspects. However, these studies have also highlighted several human, climatic and environmental

factors that pose a risk to cultural heritage sites, such as irresponsible tourism approaches, urbanisation, industrial development, natural disasters and environmental degradation.

In 2016, the Kingdom of Saudi Arabia initiated a national strategy, aiming at economic diversification and shifting towards a post-oil economy, with tourism recognised as a key sector (Saudi Vision 2030, 2016b). Despite the Kingdom's profound historical narrative centred mainly on religious pilgrimage to the sacred cities of Makkah and Medina, Al-Tokhais and Thapa (2020) stated that tourism has only recently become a priority, owing to its relatively undiscovered relationship with historical and cultural heritage. According to the General Authority for Statistics (GASTAT, 2023), pilgrimage statistics rose notably to 25 million visitors in 2022, underscoring the growing interest in religious tourism. With the Kingdom positioned as an unknown destination, Saudi Vision 2030 (n.d.) states that it is important to harness the diverse aspects of tourism, including religious, cultural and natural attractions. The vision strategy acknowledges UNESCO WHSs as key elements, seeking to increase the number of inscribed sites from 5 to 14 by 2030 (Saudi Vision 2030, n.d.), which indicates the significance of cultural heritage conservation and the eco-tourism approach in the Kingdom's transformation strategy.

Saudi Arabia boasts seven cultural UNESCO WHSs to date, each with its own unique significance: (1) Hegra Archaeological Site (2008), (2) At-Turaif District in ad-Dir'iyah (2010), (3) Historic Jeddah, the Gate to Makkah (2014), (4) Rock Art in the Hail Region (2015), (5) Al-Ahsa Oasis, an Evolving Cultural Landscape (2018), (6) *Himā* Cultural Area (2021) and (7) The Cultural Landscape of Al-Faw Archaeological Area (2024) (UNESCO, n.d.-a). There are also two other natural heritage sites recognised by UNESCO: (1) the natural heritage site of Uruq Bani Ma'arid (2023; UNESCO, n.d.-a) and (2) Harrat Uwayrid Biosphere Reserve (2022; UNESCO, 2022c). In terms of the Saudi intangible cultural heritage list recognised by UNESCO, there are 13 elements, such as Majlis, a cultural and

social space; Al-Qatt Al-Asiri, female traditional interior wall decoration in Asir; the traditional weaving of Al Sadu; date palm knowledge, skills, traditions and practices; knowledge and practices related to cultivating Khawlani coffee beans; and the Alheda'a, oral traditions of calling camel flocks (UNESCO, n.d.-b; see Table 2-1). Notably, no *hima* practices are considered cultural heritage, but this may be because they are not well documented.

Table 2-1: There are 22 Saudi heritage elements recognised by UNESCO, and *hima* system is not one of them.

Saudi Natural Heritage (2)	Saudi World Heritage Site (7)	Intangible cultural heritage (13)
Harrat Uwayrid Biosphere Reserve (2022)	Hegra Archaeological Site (al-Hijr / Madā'in Šāliḥ) (2008)	(1) Arabic coffee, a symbol of generosity, (2) Majlis, a cultural and social space and (3) Alardah Alnajdiyah, dance, drumming and poetry. (2015)
Uruq Bani Ma'arid (2023)	At-Turaif District in ad-Dir'iyah (2010)	(1) Almezmar, drumming and dancing with sticks. (2016)
	Historic Jeddah, the Gate to Makkah (2014)	(1) Al-Qatt Al-Asiri, female traditional interior wall decoration in Asir. (2017)
	Rock Art in the Hail Region of Saudi Arabia (2015)	(1) Traditional weaving of Al Sadu. (2020)
	Al-Ahsa Oasis, an Evolving Cultural Landscape (2018)	(1) Falconry, a living human heritage, and (2) Arabic calligraphy: knowledge, skills and practices. (2021)
	Ḥimā Cultural Area (2021) ¹¹	(1) Alheda'a, oral traditions of calling camel flocks, (2) Knowledge and practices related to cultivating Khawlani coffee beans, and (3) Date

¹¹ Although this site is called *hima* and may be associated with a traditional *hima* territory, it is primarily recognized for its extensive rock art, with no representation of *hima* TEK or the local communities inhabiting the area.

Saudi Natural Heritage (2)	Saudi World Heritage Site (7)	Intangible cultural heritage (13)
		palm, knowledge, skills, traditions and practices. (2022)
	The Cultural Landscape of Al-Faw Archaeological Area (2024)	(1) Harees dish: know-how, skills and practices, and (2) arts, skills and practices associated with engraving on metals (gold, silver and copper). (2023)

Source: UNESCO (n.d.-a, n.d.-b, 2022c).

In addition to the UNESCO list, the Kingdom includes approximately 354 other historical locations with natural and cultural heritage values (Saudi Vision 2030, n.d.). These sites have been subject to extensive research by both national and international scholars, especially the Hegra Archaeological Site, uncovering ancient values and contributing to conservation endeavours (e.g. Alhaiti et al., 2015; Al Talhi et al., 2014; Durand & Gerber, 2022; Nehmé, 2010; Nehmé et al., 2006, 2009, 2015, 2016, 2018, 2019, 2020, 2021, 2022; Nehmé, Abu Wazizeh et al., 2011; Nehmé, Villeneuve et al., 2011; Wenning, 1996; Zhongming et al., 2018). What is missing from these studies is an examination of the role of the local community and their indigenous practices in relation to the conservation and current condition of cultural heritage structures and their surrounding ecologies. This is a critical aspect, since eco-tourism and economic aspects have become the main drivers of these sites, not only to conserve cultural heritage, but also to support the local communities.

Studies by Alrawaibah (2017), Aliraqi (2017), Yu (2019) and A. Alahmadi (2021), have explored this complex relationship between cultural heritage, local community and management of the surrounding landscapes within Saudi cultural heritage sites. Alrawaibah's study was conducted within multiple Saudi heritage sites, and the others focused on the heritage of AlUla County, given that the region is one of the most abundant sites of cultural and natural heritage in the Kingdom, with a long history of human habitation within the region.

In the first study, Alrawaibah (2017) extensively studied the relationship between local communities and three cultural heritage sites in the Kingdom. Her research revealed that the traditions and activities of the local communities within the preserved cultural heritage sites are not documented in any official UNESCO or Saudi Commission for Tourism and Antiquities records. Also, the Saudi Commission for Tourism and Antiquities' protection strategy did not request any support from the surrounding locals and even restricted their interaction with the site. Alrawaibah (2017) pointed out that local communities, and their traditions and knowledge around conserved cultural heritage sites, must be involved when developing and conserving such sites. In terms of desertification causes, the researcher highlighted the impact of flash floods on heritage structures in AlUla, for example, by the removal and damage of some heritage elements and structures.

Therefore, Alrawaibah (2017) aimed to reconnect the local community to its surrounding heritage by informing individuals of the value of heritage resources so that they could responsibly protect them for future generations. Hence, Alrawaibah (2017) examined the contribution of museums to the preservation of Saudi heritage assets, aiming to enhance awareness and engagement within the Saudi community and actively involve locals in the development process. However, although Alrawaibah (2017) conducted the study within three cultural heritage sites in the north and northwest regions of Saudi Arabia, most of her research participants were from the central area, potentially not accurately representing the local communities residing near heritage sites. Additionally, most of the 237 participants were younger individuals who may have lacked an awareness of traditional customs and the historical connection between locals and their surrounding environments and values. Among the 237 participants, only one person was over 65 years old, and 11.1% were aged between 45 and 64. This age distribution highlights the need to give greater attention to the voices of elders, as they often carry intergenerational knowledge and experience that are particularly valuable to such research contexts.

Alrawaibah's (2017) research led me to search for more studies investigating the relationship between cultural heritage and the surrounding local communities. I found two such studies: Aliraqi (2017) from a cultural landscape perspective and A. Alahmadi (2021) from a tourism development perspective.

In reference to local communities and their attachment to the cultural heritage sites, Aliraqi (2017) examined the relationship between AlUla's local community and the cultural landscape, which is considered a combination of natural and cultural heritage, natural qualities and human interactions with nature. Aliraqi (2017) emphasised the importance of cultural heritage and its connection to local communities, where landscapes cannot be protected without maintaining the life patterns of the local communities, since their way of life is considered the producer of the cultural landscape. Aliraqi (2017) identified a lack of knowledge among the locals (25 university students, 32 government clerks, 6 schoolteachers and 12 university staff members) about the surrounding cultural heritage and ecosystems. For example, no one mentioned that there was an attractive intangible cultural heritage within the AlUla region. Further, some participants did not refer to the WHS as an attractive place. Finally, Aliraqi (2017) suggested that the community should be empowered in new developments instead of merely being engaged, and that AlUla needs more attention and recognition from official institutions and the local community. This study led me to consider the type of questions to pose to the locals that may encourage them to talk about their surrounding cultural heritage, and whether they are attracted to it or not. The notion of a lack of awareness of the locals who live around the tangible historic artefacts was questionable to me, leading me to consider interviewing the elders who have long experience with the surrounding landscape and history.

In reference to tourism within such contexts, it can serve as a double-edged sword in the realm of local traditions, cultural heritage conservation and urban development (AlSayyad, 2001).

A. Alahmadi (2021) investigated the repercussions of tourism within cultural heritage sites for local communities, pointing out that, although tourism has the potential to contribute positively to cultural heritage preservation, it also poses risks, particularly in eroding local traditions and knowledge, and connections to the environment, unless the involvement of locals is actively addressed. Although many studies have aimed to preserve cultural heritage as tangible artefacts for public display, the benefits and outcomes of tourism often fail to cater to all segments of society (Imon, 2017). The impact of tourism on cultural heritage can manifest in various ways, as demonstrated by the research (A. Alahmadi, 2021; Holzner, 2011; Newby, 2013; Robinson, 1999).

A. Alahmadi (2021) highlighted the economic benefits resulting from the classification of Hegra as a UNESCO WHS, particularly in terms of job creation and increased visitor numbers, since this may lead to higher demand for local products. However, he mentioned the concerns of some locals, mainly employed in economic sectors, that there is a potential loss of culture and traditions caused by tourism. He stated that the region's rural setting, which is differentiated by a tribal structure and strong traditional family values, may face disruptions as a result of tourism influences. A. Alahmadi (2021) suggested that incorporating local traditions into tourism strategies within heritage sites could preserve the unique cultural heritage of the area, making the site distinct from other WHSs, and offering visitors an authentic experience. Prideaux (2003) emphasised that authenticity in heritage tourism is fundamental in such approaches.

Al-Tokhais and Thapa (2020) observed that, in general, local communities residing in or near WHSs in Saudi Arabia have been marginalised in terms of their role in enhancing the value of heritage sites and are not actively engaged in heritage preservation and planning efforts. In reviewing the management plan of the Hegra WHS, I found that the local community was given limited involvement in terms of economic and tourism aspects, and the traditional techniques and knowledge were not mentioned at all (Kingdom of Saudi Arabia, 2007b). This form of neglect has been identified and

discussed worldwide by researchers such as Allan et al. (2019), Melubo and Lovelock (2019), and Qu et al. (2014). Their studies investigated the relationship between cultural heritage, nature and local communities in different locations around the world.

Melubo and Lovelock (2019) studied the relationship between the Maasai indigenous community and the WHS Ngorongoro Conservation Area in Tanzania. Through interviews with traditional leaders and local Maasai, discussing the impacts of the WHS conservation, most participants mentioned the burden caused by the WHS status and the associated tourism approach. The disadvantages included limited and restricted access to site resources, weakening livelihoods, weak participation in making decisions, the unfair sharing of benefits, the threat of being moved and negative attitudes towards the protection approach (Melubo & Lovelock, 2019). The researchers concluded that sharing benefits and decision-making is essential for the locals to achieve successful conservation. The impact of tourism on local traditions, as indicated by the participants, may not be noticed if a researcher does not interview the elders and leaders of the community. Their comments and insights are important for fully understanding the issues between the cultural heritage conservation approach and local communities.

Allan et al. (2019) investigated the relationship between WHS conservation and indigenous cultures facing economic and environmental issues that hinder them from thriving on Ovalau Island in Fiji. The authors stated that conservation sometimes delivers contradictory outcomes instead of complementary ones (Allan et al., 2019). They emphasised that a culture needs to adapt itself to economic and environmental issues to thrive. A research methodology that involved visiting sites, observing interactions and talking with locals was used to discover the relationship and produce a solution to help the community thrive. The authors found that a landscape can act as an adaptation ground that brings together conserved heritage elements and the local community (Allan et al.,

2019). The authors concluded by providing small design proposals and new urban plans that may contribute to sustaining and supporting the locals, their economy, the environment and cultural heritage, while building a healthy relationship between the locals and the conserved heritage site. It is worth mentioning that the situations in AlUla and Ovalau Island have many issues in common, since both are heritage sites associated with nature, and their local communities are under threat from numerous factors, including the modern conservation system.

Although these researchers produced valuable contributions to understanding the relationship between cultural heritage conservation, local communities and the surrounding natural environment, they provided few insights into how the knowledge and traditions of local communities can conserve cultural heritage and natural environments, and reverse desertification simultaneously. Hirszenberger et al. (2019) categorised the challenges identified among official institutions managing cultural heritage conservation projects into several groups and causes. These include a shortage of expertise in traditional methods and materials, limited access to the scientific literature and specialised publications for conservation professionals, misunderstandings arising from diverse interpretations of terminology across professional disciplines, decreased efficiency in communication, the absence of feedback mechanisms, a reluctance to engage in open and constructive criticism within consortia, and limited knowledge sharing.

As explained by Genet and Kebede (2022), both UNESCO (2009b) and ICOMOS¹² (2017) emphasise the importance of incorporating the perspectives and preferences of the local community when undertaking conservation initiatives and tourism activities at WHSs by taking into account the traditional narratives that highlight the historical significance, symbolism and purpose of the heritage site, thereby ensuring an authentic experience for tourists. Therefore, it may be better for

¹² ICOMOS stands for International Council on Monuments and Sites

this research to focus on the possibilities that can be generated from the traditional practices and knowledge of local communities in managing their surrounding natural and cultural heritage features, given that this is one of the three common methods used to conserve cultural heritage sites, as highlighted by Nguyen and Baker (2023).

In relation to the surrounding ecosystems of cultural heritage sites, many of the conserved heritage sites in Saudi Arabia are under the threat of natural risks (Alrawaibah, 2017) and desertification (Edgell, 2006). In the case of AlUla, researchers have pointed out that AlUla and its heritage are affected by flash floods (Alrawaibah, 2017), along with the natural water cycle and the rapid reduction in underground water, estimating water depletion within two decades (Yu, 2019). Although there are many efforts to recharge aquifers in Saudi Arabia, such as implementing techniques to harvest water (Parimalarenganayaki, 2020), new developments and the unsustainable use of underground water are still risking the water cycle in some areas. Based on site observations and visits in AlUla, including discussions with farmers, Yu (2019) stated that the underground water level had been 10 m deep; however, it is now approximately 75 m deep, decreasing 3 m every year. The misuse of underground water led to degraded farms and the formation of an unhealthy relationship with nature, which forced people to leave the area or change the use of their farm to a recreational area (Yu, 2019). This is similar to the circumstances in Al-Baydha in Saudi Arabia, where the local community were affected by desertification, which altered their traditional life and forced them to find another way to earn an income to survive within their environment (Schwartz, 2020). To conserve the heritage of AlUla, as well as its characteristics and human–land relationship, Yu (2019) suggested that people must consider three points: (1) they must perceive the oasis and the watershed as one integral system and maintain an equiponderant water cycle, (2) water cycle restoration should be the main objective in the region and (3) people must consider the role of

landscape architects, given that they are skilled in exploring sustainable approaches to the ecological restoration of watersheds.

However, ecological restoration approaches need to be carefully studied. Qu et al. (2014) investigated the role that 60 years of afforestation played in protecting natural and cultural heritage sites in Dunhuang, China. The study's results showed that desertification was stopped, and the ecosystem recovered. However, this ecological restoration negatively affected the quality of the heritage elements. The increasing levels of moisture and the rising numbers of insects, birds and rodents, apart from the decreasing underground water level, led to some of the murals and sculptures inside the heritage site being endangered, and reduced the native vegetation and its variety outside the area, but within the surrounding natural environments (Qu et al., 2014). The authors suggested that any new changes must be implemented carefully to avoid destroying the conditions that had preserved the heritage for centuries (Qu et al., 2014). Although there are positive environmental achievements, cultural heritage features are susceptible and need careful decision-making processes. Therefore, suggesting large-scale ecological restoration can sometimes be inappropriate in cultural heritage sites. However, local TEK that was first developed around such contexts may carry valuable insights to guide developmental projects (Eben Saleh, 1997, 1998b, 1998c, 2004; ten Veen, 2022, p. 218; Yun & Yi, 2023).

2.6 Traditional (ecological) knowledge for cultural heritage conservation

As highlighted earlier, a profound connection between the natural environment and cultural heritage exists. My contention, based on the observation of the literature, is that the TEK or TK of local communities in the Middle East has played a role, either directly or indirectly, in conserving cultural heritage.

Although local inhabitants implement their ecological knowledge and practices to manage their surrounding natural resources (e.g. allocating a number of individuals to tasks such as managing natural landscapes, implementing stone barriers and reporting any negative activities to the leaders (Eben Saleh, 1998b)), these traditional ecological practices might also contribute to the conservation of cultural heritage structures within their surroundings and *hima* territories. This proposition arises from various studies on TEK, wherein researchers have noted that *hima* areas often encompass cultural heritage elements, whether directly linked to the locals or not. Two studies are outlined below to explain this correlation.

The first study was presented by Al-Utaibi (2005), concerning the Dariyah (ضريبة) archaeological site (Gari, 2006). This site has been perceived as having different purposes, for example, as a town, as *hima*, and then as a main pilgrimage station between Basrah and Makkah (Al-Utaibi, 2006, 2007, 2010). The site includes 'water structures' such as water wells, ponds, channels and dams, owing to its location as a pilgrimage station and its several water resources (Al-Utaibi, 2006). However, Gari (2006) highlighted an important point revealed by the archaeological investigations, which is that the town was inhabited until the early tenth century, contrasting with Al-Samhudi's statement of a continued inhabitation until the sixteenth century. This suggests that the area became recognised by the local community (nomads) in later centuries (from the eleventh to the sixteenth century) primarily as grazing land (*hima*) rather than a transit town for pilgrimages, as it was previously perceived (Gari, 2006, p. 218). Additionally, Al-Utaibi (2006, p. 158) stated that certain ancient water wells remain active and continue to be utilised and maintained by local communities today. Based on this statement and the understanding of *hima* activities and techniques, the study indicated that the *hima* TEK had a role that might have contributed to the conservation of the ancient structures, not only by recognising the site as a protected area, but also by managing it and interacting with it. Further, Al-Utaibi (2006) characterised the Dariyah Dam as a flood protection measure. He noted that

the dam's design suggests that its primary purpose is not only water retention and groundwater infiltration, but also safeguarding the adjacent areas from flooding, since it allows water to continue downstream while capturing a portion of it (see Figure 2-14).¹³



Figure 2-14: Dariyah Dam, which was implemented to reduce the risk of flooding. *Source: Al-Utaibi (2006, p. 187).*

The second observation, as noted by Al-Shanqiti (2019), concerns the Dam of Abdullah ibn Amr ibn Othman, constructed to regulate the water flow from the Ranuna Valley (وادي الرانونا). Although the researcher did not explicitly state that the dam protected structures downstream, it is possible to argue that the dam played a role in safeguarding valuable heritage sites situated along the

¹³ This example is included in this section rather than in Section 2.4 because of its connection to the protection of urban areas rather than the ecosystem itself.

watercourse route of the Ranuna. Al-Shanqiti (2019) highlighted several significant sites within the Ranuna Valley, including rock art (inscriptions), pre-Islamic souqs (traditional shopping areas), residential areas, mosques and wells.

These examples, along with previous examples provided, underscore the intertwining relationship between cultural heritage structures and *hima* TEK, whether in the form of protected areas or through various practices and techniques. However, the inquiry into how *hima* TEK directly contributes to the conservation of cultural heritage remains appropriate, given the limited information on its operational mechanisms. The presence of cultural heritage as structures and sites within *hima* territories is highlighted in the *hima* literature (e.g. Al-Shanqiti, 2013, 2019; Al-Utaibi, 2006; Gari, 2006; Kilani et al., 2007; Llewellyn & Altasat, 2017). However, the linkage is still unclear (see Table 2-2).

Table 2-2: A summary of the main references concerning the role of local TEK in local ecosystems and cultural heritage in the Arabian Peninsula. Among these references, I highlighted the studies conducted by researchers from urban design, landscape architecture and planning professions, and other similar fields. Source: Created by the researcher.

No.	Title (author, date)	Study location	Study aims and summary	Study method	Ecology and TEK practices What is still missing in this regard?	Cultural heritage	My notes and observations What is still missing in the study?
						Was tangible cultural heritage mentioned, and how, and what was missing?	
1	The Hema system of range reserves in the Arabian Peninsula (Draz, 1985)	Arabian Peninsula	This paper aims to reintroduce the <i>hima</i> system as a means for range land improvement and stopping vegetation removal.	–	–	–	This paper provides an overview of <i>hima</i> in the Arabian Peninsula with a focus on the role of the local community and the impact of new official legislation on the local TEK.
2	Hema system: traditional conservation of plant life in Saudi Arabia (Zahran & Younes, 1990)	Saudi Arabia 1-Hima of Bani Sar, 2-Hima of Thamala and 3-Hima of Sakhayet)	This paper aims to understand the positive impact of the <i>hima</i> system on soil and plant life. Land protection Grazing management. It is more about grazing and tree cutting controls, and social unit control.	Aerial photographs and monoclimatic maps analyses. Mapping <i>hima</i> territory (line of drainage, ridges, fields, buildings pre- 1956, stone walls and small private <i>himas</i>) Fieldwork (soil analyses and vegetation, and ground cover study)	The system contributed to the conservation of plant life and soil quality. By managing the type of livestock that can graze, where and when, the study shows the difference in plants and soil quality between areas inside and outside of the <i>hima</i> . Deep soil with long root systems may contribute to storing water and reducing surface runoff. <i>Hima</i> is located next to agricultural lands, includes catchment areas, and can be surrounded by stone walls	<i>Hima</i> TEK was mentioned as a form of intangible cultural heritage and a pre-Islamic system.	The study did not say much about the <i>hima</i> TEK, its techniques, and how it works. A few details and techniques were mentioned based on the site observation and visits of the authors.

No.	Title (author, date)	Study location	Study aims and summary	Study method	Ecology and TEK practices	Cultural heritage	My notes and observations
					What is still missing in this regard?	Was tangible cultural heritage mentioned, and how, and what was missing?	What is still missing in the study?
					Grazing terraces are located on the waterways. The grazing management strategy had a positive impact on vegetation cover. However, when the grazing was stopped, undesirable vegetation increased.		
3	Hima: A traditional Bedouin land use system in contemporary Syria and Jordan (J. A. Shoup, 1990)	Syria and Jordan	This PhD thesis attempts to examine a land use system (al- hima) as it is applied by governments in their Bedouin policies. It compares the two Hima-based programs in Syria and Jordan and the success of the Syrian program.	Ethnographic research, which includes interviews, field work, literature and document review	This study focused on pasture lands and traditional grazing management.	–	The study compared the <i>hima</i> revitalisation projects in Syria and Jordan and the role of the local community and official organisations in the success of these initiatives.
4	Middle Eastern sheep pastoralism and the Hima system (J. Shoup, 1990)	Syria	'The chapter discusses the important changes that have occurred among the Syrian Bedu as	Literature and official document review	Based on the abstract, this chapter presents <i>hima</i> TEK and its practices generally.	–	It appears that this paper is a summary of the research conducted in the previous reference.

No.	Title (author, date)	Study location	Study aims and summary	Study method	Ecology and TEK practices What is still missing in this regard?	Cultural heritage	My notes and observations
						Was tangible cultural heritage mentioned, and how, and what was missing?	What is still missing in the study?
			a result of the implementation of revived hima.'				
5	Nature Reserves in The Kingdom of Saudi Arabia (Al-Waleei, 1996)	Saudi Arabia	This governmental book by the Saudi Wildlife Authority (now it is called the National Centre for Wildlife) aims to provide a comprehensive view of the nature reserves in the Kingdom. One of the chapters presents <i>hima</i> of Makkah and Medina (haram) and some traditional <i>hima</i> sites.	Based on my understanding, it is a combination of literature review and official documents	In a generic way, the book talked about environmental issues such as desertification and how both ancient systems, such as <i>hima</i> and haram and modern approaches, such as national parks and protected areas, contribute to ecosystem enhancement.	–	Detailed information about <i>hima</i> TEK is limited.
6	Al-Alkhalaf vernacular landscape: the planning and management of land in an insular context, Asir region, southwestern Saudi Arabia (Eben Saleh, 1996)	Saudi Arabia Asir region	'This study examines the vernacular landscape of Al- Alkhalaf, an agricultural community located in the Asir	Literature review Interview with elders personal experience and site visit	'The vernacular landscape is viewed in the context of the interaction between the built environment, agricultural and natural landscapes and the inhabitants.'	The author looked at the TEK as a key part of the cultural landscape.	'The study discusses the interaction of ecological, economic, and social- structural factors during a particular historical period and shows their role in shaping human life and the vernacular

No.	Title (author, date)	Study location	Study aims and summary	Study method	Ecology and TEK practices What is still missing in this regard?	Cultural heritage Was tangible cultural heritage mentioned, and how, and what was missing?	My notes and observations What is still missing in the study?
7	Toward a Sustainable Land Management of Vernacular Landscape in the Highlands of South-western Saudi Arabia: Indigenous and Statutory Experiences (Eben Saleh, 1997)	Saudi Arabia Asir region	region of southwestern Saudi Arabia.’ Moreover, ‘this paper provides the reader with historical, cultural and ethnographic perspectives on the planning and management of land in Al-Alkhalaf’. - traditional architecture - traditional water management - traditional agricultural terraces - traditional planning and landscape management. This paper investigates the negative impact of development towards the environment and aims to develop a model where	‘A survey of several government agencies with landscape management responsibilities, a field survey of diverse settlements	This study shows how the natural environment and ecosystems influence locals to settle more than others. The paper illustrates the flexibility of <i>hima</i> and why some types disappeared, and some types still exist.	Tangible cultural heritage can be included within the ‘vernacular landscape’, which consists of the integration of three distinct parts: the	landscape.’ However, the study lacks a detailed aspect of the local TEK and how its traditional environmental techniques work, although interesting information with some details related to the local community was explained.

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8	Planning for conservation: the management of vernacular landscape in Asir region, southwestern Saudi Arabia (Eben Saleh, 1998c)	Saudi Arabia Asir region	locals and officials can work together to manage the landscape and urban development. 'In this article, I [the author of the paper] propose that the current government approach to land management can be modified to return legal title to indigenous residents for the co-management of forests and local resources with pertinent	and the wilderness of the southwestern highlands, and extensive interviews with local people who had responsibilities for management of the vernacular landscape during the pre-State and early transitional eras' Field investigation and trips focusing on the traditional and contemporary aspects of management in the landscape. (A map of more than 40 <i>hima</i> territories was provided) Recording the economic, social, cultural, urban and planning history of the landscape using	<i>Hima</i> contribute to the preservation of wildlife species. – Set of traditional ecological regulations. – The creation of social groups, one for water harvesting, a second for landscape management, a third for agricultural benefits, etc. The research stated that 'The local tribal culture interacted with the ecology at three levels. The first involved the environmental policies of the tribe and its ability to influence regional patterns of settlement and resource exploitation. The second concerned the various philosophies advocated by village groups through local settlement and agricultural practices. The third level was that of the individual. Individuals served as agents	built form of a settlement, agriculture and natural ecology surrounding the locals. Tangible cultural heritage, such as historical buildings and ancient forests, were considered part of cultural landscape (built, agricultural and natural environment) that is managed by the local TEK. 'The deplorable condition of forests, historic buildings,	scientific knowledge and practice with traditional expertise through a participatory approach between locals and officials. Although it provided local traditional knowledge in terms of governing the region, and in terms of the social roles. It lacks information about traditional physical techniques that contribute to harvesting water and managing the landscape. The paper proposed 'a new stewardship program' that 'could combine scientific knowledge and practice with traditional expertise. This paper is similar to the previous one. It presents an exemplary aspect of local TEK but lacks detailed elements of the practice and the techniques. The balance is the key factor to achieve good

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9	Land use and planning of vernacular landscape in the highlands of the southwest of Saudi Arabia (Eben Saleh, 1998b)	Saudi Arabia Asir Region	governmental agencies.'	an anthropological approach	of change or stability through development of new agricultural areas or the preservation of existing landscape values, but their actions were dictated by the operation of a tightly controlled system of cultural and political structures.'	and other features has become a symbol of decline in the Asir vernacular landscape.'	results. The local TEK is a good example of that.
				Photographic documentation for physical evidence, Interviews with land managers (both traditional and contemporary)	Traditional terraces and water-harvesting techniques. It provided an overview of <i>hima</i> TEK in general.	The study includes tangible cultural heritage as part of the regional cultural landscape.	However, this paper lacks enough details on the water system and terraces management.
10	Alternative land management approaches in the	Saudi Arabia Asir Region	This study aims to provide a framework for officials and traditional elders to plan the indigenous land together.	–			'The paper's findings suggest that not only do indigenous peoples need to be provided with some degree of control over their territories and resources, but there needs to be a new type of partnership between indigenous peoples, scientists, and national government organizations that allow for the integration of the two knowledge systems to develop innovative resource management strategies and land- conservation plans.'
			It aims to propose an alternative to the practised	Literature review Personal experience and site visits	'The forest conservation rules established by the indigenous inhabitants of the	-	This is a key study, given that it provides a new module to integrate local

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11-16	highlands of southwestern Saudi Arabia (Eben Saleh, 1998a)		system of land management and planning. The alternative is that which recognises indigenous people as potential stewards of the vernacular landscape, and it may play a leading role in the conservation and management of the highlands of the southwestern region of Saudi Arabia.		area contributed to the good environmental quality of the vernacular landscape. For example, in almost every settlement in the highlands of the southwestern region of Saudi Arabia, local village councils established rules which were effective in organizing relations between man and productive lands (Eben Saleh, 1997). The local rules were traditionally established after consultation with community members to conserve and protect the landscape elements such as forests, agricultural and pasture lands (Eben Saleh, 1996). The rules instituted prohibitions against uncontrolled cutting of trees in tribal lands and prohibited the erection of dams and embankments that might prevent the free flow of water to the agricultural lands.'		communities into the official land management and urban development.
	(Eben Saleh, 1999a, 1999b, 2000a, 2000b, 2001, 2002)	Saudi Arabia Asir Region	Another six papers from the same region looking at the <i>hima</i> TEK of the local community and highlighting the indigenous value within the system, and exploring new ways to integrate the <i>hima</i> TEK in new urban developments in the region. All of these papers provide general views and some detailed aspects of the <i>hima</i> TEK. The titles of the papers are as follows: – Uniqueness in Globalization: Physical Development of Traditional Settlements in Southwestern Saudi Arabia				

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						Was tangible cultural heritage mentioned, and how, and what was missing?	
			– Development versus deterioration of traditional settlements of Southwest Saudi Arabia: Government policies and possible courses of action – The architectural form and landscape as a harmonic entity in the vernacular settlements of Southwestern Saudi Arabia – Value assessment of the cultural landscape in Alckas settlement, Southwestern Saudi Arabia – Environmental cognition in the vernacular landscape: assessing the aesthetic quality of Al-Alkhalaf village, Southwestern Saudi Arabia – A transformation in the vernacular landscape of the highlands of southwestern Saudi Arabia.				
17	Nabataean Kingdom: A study in the social and economic conditions (Alhammori, 2002)	Arabian Peninsula	This book talks about the life of the Nabataean people.	–	This book provided some information about the ecological practices of the Nabataean people in Hegra.		The Nabataean implementations are considered tangible cultural heritage in the Arabian Peninsula today.
18	Learning from tradition: the planning of residential neighborhoods in a changing world (Eben Saleh, 2004)	Saudi Arabia Asir Region	This paper analyses the community values of residential neighbourhoods in the southwestern region of Saudi Arabia as an approach to a new theory in urbanism by discussing the three stages of practised urbanism.	Southern traditional settlements planning concept as a case study	This study analyses the design of traditional settlements of <i>hima</i> local community from different perspectives, such as environmental, economic, social and political angles. It illustrates the traditional concepts that contribute to ecosystem enhancement, cultural heritage conservation and urban fabric protection.		The study concludes that 'New Vernacularism' as a planning concept looks at the community development in Al-Horaidhah in the light of Shariah, the Islamic Law and Customary norms by emphasising the importance of the involvement of local residents in the planning process and gives suggestions on how this might best be achieved and later implemented into new communities.' This study provided a detailed aspect of some

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							traditional techniques that contribute to the protection of houses. It provides recommendations for planners on how to engage with local communities and work together to reach better outcomes.
19	Is there indigenous knowledge in the Middle East? Towards a reassessment of knowledges in management of common pool resources (Knudsen, 2004)	Turkey and the Middle East	This paper questions how and why IK/TEK has achieved prominence in some socio-geographical locations and not in others, such as the Middle East.	Literature review and ethnographic research But it highlights fieldwork and participatory methods as key instruments for TEK research	–	–	This paper discussed in detail the factors that affect TEK research in the region. Although the researcher mentioned issues around the term IK or TEK in the region and the low number of published papers in the ME before 2004, I found many papers presenting local TEK but under different terminologies. I feel and tend to argue that the terminology issue could be a translation issue from Arabic to English.

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20	Dariyah Site: Archaeological Field Study (Al-Utaibi, 2005)	Saudi Arabia Dariyah Site	A PhD thesis.	–	–	–	This study was referenced many times, but I could not find a copy of this study except for the quotes and summaries within other papers.
21	Dariyah: Lights on its history and archaeology (Al-Utaibi, 2006)	Saudi Arabia Dariyah Site	An overview paper presenting the history of the site and the historical structures it includes.	Literature review	The paper introduced different water-harvesting techniques in the site, and it indicates that some of these implementations are still used until today, although the <i>hima</i> as a territory was cancelled around 785 AD	The site includes archaeological structures.	This paper focused more on the historical activities and techniques of <i>hima</i> rather than the practices of local communities today. However, it indicates that the site is used today by the local community around it.
22	A history of the <i>hima</i> conservation system Gari (2006)	Middle East	A review paper about <i>hima</i> TEK and the system in general.	Literature review	It provides a general view of the ecological practices of <i>hima</i> .	The paper indicates the system is a form of intangible cultural heritage. It indicates that some <i>Hima</i> protected areas include historical structures.	Key reference. This paper covers the history of <i>hima</i> from the pre-Islamic period till today. Also, it presents this type of TEK in different countries in the Middle East. However, it lacks details.
23	Al-Hima: A way of life Kilani et al. (2007)	Middle East and Indonesia	A review paper about <i>hima</i> TEK and the system in general.	Literature review	–	–	This paper is very similar to Gari's paper, with more focus on the TEK in the Saudi context.
24	The <i>hima</i> of Dariyah during the early Islamic era	Saudi Arabia Dariyah Site	A review paper about <i>hima</i> system in general.	Literature review	It indicates the different animals allowed to graze in the site.		This paper is a review of the historical texts describing the site.

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						Was tangible cultural heritage mentioned, and how, and what was missing?	
	(Al-Utaibi, 2007)						
25	Botanic gardens in the Arabian Peninsula (Al Farhan et al., 2008)	Arabian Peninsula	–	–	–	–	This paper connects the <i>hima</i> TEK to the conservation plan speeches in the Arabian Peninsula. However, it did not say much. It was just one general paragraph.
26	Cultic Niches in the Nabataean Landscape: A study in the orientation, Façade ornamentation, Sanctuary organization, and function of Nabataean Cultic Niches (Raymond, 2008)	Middle East	It presents the Nabataean sanctuary (haram) (a type of <i>hima</i>) around 100 BCE.	–	Water-harvesting techniques.	–	This source draws a connection between the <i>hima</i> TEK and the Nabataean kingdom and their practices that were implemented on the northwest side of the Arabian Peninsula.
27	Diversity Conservation of Rangeland and Forest Plant Species in Saudi Arabia (Assaeed, 2009)	Saudi Arabia	'This paper briefly describes natural plant species diversity, introduces plant conservation practices in Saudi Arabian rangelands and forests, and evaluates the	Literature review	It explains how the traditional protection of some plant species leads to sand stabilisation and fodder production.	–	The paper lacks details.

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28	The practice of Islamic environmental ethics: a case study of Ḥarīm and Ḥimā (Marsuki, 2009)	–	successes and failures of these practices to conserve biodiversity at the plant species level.’ One of the practices studied in this paper is the <i>hima</i> TEK. This PhD research investigates <i>hima</i> and haram as a form of TEK. It looks at it from a religious perspective and as a form of ‘ritual services.’	Literature review	–	–	This thesis presents <i>hima</i> and haram from an Islamic perspective, which is considered the basis for understanding the fundamentals of <i>hima</i> TEK. However, it did not explain the current and traditional practices of local communities.
29	Integrating Islamic Models of Sustainability in Urban Spatial Planning and Management (Barau, 2010)	Kano - Nigeria	‘This paper examines the Islamic instruments of spatial planning and management which are enshrined in the concepts of <i>harim</i> , <i>hima</i> and <i>finā</i> .’	‘The research couples analysis of images, interviews, field assessments and literature review.’	This paper extracted environmental concepts and strategies from <i>hima</i> and haram TEK and used them as an urban design and planning guide. Traditional concepts and strategies are such as urban green zone development, wetlands conservation, urban gardening by the poor, land degradation control, carrying	Tangible cultural heritage can be considered one of the key elements of the urban fabric of Kano.	‘The paper argues that Islamic instruments (<i>hima</i> and haram) are more easily appreciated and implemented by all inhabitants of the Muslim cities right from the grassroots to power towers.’ It is interesting how the research extracted these interesting concepts

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						Was tangible cultural heritage mentioned, and how, and what was missing?	
					capacity regulation, pollution control, and protection of local common resources, etc.		from the <i>hima</i> system and considered them as simple urban design guidelines for Islamic cities where people are more likely to accept the values suggested.
30	Place-Making in National Parks: Ways that Australians of Arabic and Vietnamese background perceive and use the parklands along the Georges River, NSW (Byrne et al., 2010)	Sydney	This document summarises <i>hima</i> TEK in the Middle East.	–	It presents a new developed ecological purpose with <i>hima</i> TEK, such as protecting land for bird species.	–	This document summarises the history of <i>hima</i> translated from a different place.
31	The Hima: an ancient conservation system from the Arabian Peninsula for the future (Serhal et al., 2011)	Arabian Peninsula	This paper provides an overview of <i>hima</i> TEK in different countries.	Literature review	-	-	The outcome of this paper is that ‘the revival of the Hima approach might offer opportunities for sustainable development, since it tackles conservation and poverty alleviation issues simultaneously’.
32	Livestock, medicinal plants and rangeland viability in Jordan’s Badia: Through the lens of traditional and local knowledge (Al-Tabini et al., 2012)	Jordan	‘This study investigates the traditional and local knowledge of Bedouin (Badu) communities in the Badia region of	Questionnaire survey Interviews with the old generation Focused group	Traditional water-harvesting techniques Traditional grazing Plant conservation and use for human health	–	‘The findings indicate that the rangeland environment has become severely degraded, herd sizes have decreased, plant species are in danger,

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			the Hashemite Kingdom of Jordan with regard to livestock production, medicinal plant use and rangeland management, and examines how such knowledge has changed over time.'				and traditional Bedouin lifestyles have changed radically, owing to unrelenting pressure on the land, water scarcity, manufactured livestock feed, government intervention, artificial borders, and the abandonment of natural water harvesting and hima practices.'
							It provides some ground- based evidence of the impact of local TEK on the natural environment and the local community.
33	Remaking the places of belonging: Arabic immigrants and the urban environment along Sydney's Georges river (Goodall, 2012)	Sydney	This paper reports on a study which has compared the environmental knowledge and practices which (Arabic) immigrants bring from their homelands with their experiences in their new homes.'	Study review Interview	This paper lists a number of positive impacts of TEK of the Arab Australians towards nature and national parks.	–	TEK can be adapted to new places, reinforcing its flexibility

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34	Waters of Belonging: Al-miyahu Tajma'unah: Arabic Australians and the Georges River Parklands (Goodall et al., 2012)	Sydney		Qualitative interview			This study shows the <i>hima</i> TEK of Arab Australians and their impact on natural systems and parks.
35	Reviving an Islamic approach for environmental conservation in Indonesia (Mangunjaya & McKay, 2012)	Indonesia	It talks about <i>hima</i> and <i>harim</i> TEK.	–	Applying the concept of <i>hima</i> and <i>harim</i> in a local river to enhance the ecosystem of the site and manage the interaction of the local community with it.	–	–
36	Principles of the Human Integrated Management Approach (HIMA): Towards Sustainable Development (Saleh et al., 2012)	–	–	–	Collecting rainwater runoff monitoring, grazing and farming.	<i>Hima</i> TEK is considered a cultural heritage.	It focuses on <i>hima</i> TEK as a governing framework.
37-41	International Workshop: Towards an Implementation Strategy for the Human Integrated Management Approach Governance System (Suleiman et al., 2013)	Global	'Our aim in this workshop is to understand the Human Integrated Management System (HIMA) in greater detail and reach to a consensus in selecting the best practices we can apply for the sustainable management of	This conference proceeding presents 17 papers. I found that 5 papers are key to understanding local TEK in the Arabian Peninsula and contain detailed aspects and methodological frameworks to study the local TEK. The titles of these papers are as follows: – The Presence of HIMA Concepts in Aflaj System in the Sultanate of Oman (Al Shaqsi, 2013) – HIMA as a Model for Sustainable Development: Conceptual Framework (Al-Jayyousi, 2013) – A Process to Establish Traditional HIMAs as Community Conserved Areas: Essential Skills Required (Abdallah, 2013) – Requirements for Successful Revival of the HIMA (Llewellyn, 2013) – HIMA Mesopotamia: Community-Generated Conservation in the Tigris Euphrates Watershed (Stevens, 2013).			

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42	Hima as 'Living Sanctuaries': An Approach to Wetlands Conservation from the Perspective of Shari'a Law (Ibrahim et al., 2013)	–	our shared natural resources that suit our surrounding environmental conditions.' To highlight aspects of the protected areas as seen from the perspective of Islamic laws; and how it then turns the protected areas into living sanctuaries	Exploratory and library-based research	–	–	This paper presented <i>hima</i> TEK from an Islamic perspective. But it lacks the ecological practice of current local communities.
43	The himas of Medina (Ahma' al-Madinah al-Munawwarah: Hima ash-Shajar, Hima an-Naqi', Hima ar-Rabadhah) (Al-Shanqiti, 2013)	Saudi Arabia	To document the historical sites of three Islamic ancient <i>hima</i> .	Site visits and observation based on the literature	Many <i>hima</i> techniques and activities associated with ecosystem enhancement were mentioned.	–	This is a key reference.
44	The role of protected areas in supplying ten critical ecosystem services in drylands: a review (Dudley et al., 2014)	Global	It aims to provide a detailed review of local TEK examples from dryland regions of the world, along with a typology of ecosystem	Literature review	The ecological practices associated with <i>hima</i> TEK were presented in general.	Valuable sites were included as part of the local TEK systems.	<i>Hima</i> TEK was presented in general.

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			services maintained.				
45	Is Rural Heritage Relevant in an Urbanising Mashreq? Exploring the Discourse of Landscape Heritage in Lebanon (Makhzoumi, 2014)	Lebanon	To inquire whether the study of rural landscapes is of relevance to heritage studies in the region, whether the discourse of rural culture can contribute to the evolving construction of place and identity and whether the concept of landscape is of significance to the patrimonialisation practices of designers and planners.	Literature review. Landscape design approach (landscape master plan) qualitative research methods, such as in- depth semi- structured interviews.	Empowering the traditional and agricultural, and rural communities. Restoring forest lands.	Tangible and intangible cultural heritage are acknowledged in the minds of communities of <i>hima</i> TEK.	This paper shows the opportunities and contributions that landscape architects and researchers can provide in such contexts.
46	Islam and corporate environmentalism: the case of Shariah- compliant public listed firms in Malaysia (Mohd Nasir, 2014)	Malaysia		Interviews	–	–	This PhD thesis provides general <i>hima</i> knowledge based on an Islamic perspective. it lacks details on the current ecological practices of local communities.

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						Was tangible cultural heritage mentioned, and how, and what was missing?	
47	An economic valuation of a large-scale rangeland restoration project through the Hima system in Jordan (Myint & Westerberg, 2014)	Jordan	To present an ex- ante cost-benefit analysis of a rangeland restoration through the <i>hima</i> TEK within a river basin.	GIS	–	–	Benefits of large-scale rangeland restoration from the <i>hima</i> system were found to outweigh the management and implementation costs at a discount rate of 8 per cent.
48	Homing in on the range: enabling investments for sustainable land management (Davies et al., 2015)	–	To understand the capability of the traditional sustainable management of the <i>hima</i> grazing lands.	–	Grazing land management.	–	The paper concludes that adapting <i>hima</i> TEK, including science-based approaches, may lead to better sustainable outcomes. This paper focuses on benefits and investments. It lacks details on detailed ecological practices.
49	Hima as a model for neighbourhood open space planning (Hassan et al., 2015)	Malaysia	'The aims of this paper are to highlight the concept and characteristics of the <i>hima</i> in spatial planning and management and how it can be allocated in neighbourhood areas.'	Exploratory study: Literature review	Recognise the prescribed boundaries, or ' <i>hudud</i> ,' pasture where trees and grazing lands were protected managing natural areas, such as woodlands, grasslands and wetlands, and protecting them against floods.		It is inspiring how the authors explored and analysed <i>the hima</i> TEK to be reintroduced within urban open spaces and national parks. It shows some direction on how we, as landscape architects, can identify areas that can be new <i>hima</i> areas.
50	The Haraman and the Hima: Inviolable	Saudi Arabia	To present an overview of <i>hima</i> and haram,	Literature and document review	Many ecological practices were mentioned in general.	Many cultural heritage structures are located within	The paper lacks detailed ecological practices of <i>hima</i> TEK.

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51	Sanctuaries and Protected Areas in Islam (Llewellyn & Altlasat, 2017, p. 21), Valleys of the Medina Hima (Awdiat hima al- Madinah al- Munawwarah) (Al-Shanqiti, 2019)	Saudi Arabia	including traditional <i>hima</i> TEK. To document, observe and study the valleys of <i>hima</i> of Medina.	Site visit and observation Talks with locals Literature review Photographing	Many <i>hima</i> TEK techniques were described and documented. They are mostly associated with water management.	the boundaries of the <i>hima</i> sites mentioned in the paper many historical structures were associated with <i>hima</i> TEK.	This is a key reference. A missing aspect within this great book is the ecological aspect within the <i>hima</i> sites and the found techniques.
52	the Geography of Nature Reserves (Al-Khatib & Al-Ma'aiya, 2020)	Saudi Arabia	This book presents nature reserves in Saudi Arabia, and it starts with a brief introduction about <i>hima</i> TEK.	–	–	–	The provided <i>hima</i> TEK information on pages 35 and 36 is general.
53	The Reindeer Chronicles: And Other Inspiring Stories of Working with Nature to Heal the Earth (Schwartz, 2020)	Global	A section of this book talked about <i>hima</i> TEK of a local community that faces the threat of desertification	Inspirational stories			I included this book because it talks about the Al-Baydha ecological restoration project in Makkah with the traditional community that used to practice <i>hima</i> TEK.
54	Reflecting Al-Hima on 'Kinship Mindfulness' Within The Ammatoan's Indigenous Kinship System for The Nature Sustainability Through Life Simplicity (Syarifuddin et al., 2020)	–	linking <i>hima</i> TEK with Ammatoans' 'kinship mindfulness' to understand how simple life systems maintain the environment	Comparative study	–	–	The information about <i>hima</i> TEK was general.

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55	Environmental Stewardship: Perspectives from the Islamic Teachings (Chaudhry, 2022)	–	To understand how Islamic teachings (<i>hima</i> TEK) encourage environmental stewardship	Desktop research	Water conservation Land, soil, and air conservation Biodiversity conservation	-	This study did not look at just <i>hima</i> TEK, but it included other Islamic values associated with natural systems as well.
56	Territories of Life in West and Central Asia and the Caucasus: Diversity, present status, and threats. (Samakov & Foggin, 2022)	Lebanon	An overview of <i>hima</i> TEK.	–	–	–	The provided <i>hima</i> TEK information on pages 35 and 36 are general.
57	Hima as a Protected Area–Opportunities and Challenges in the 21st Century (ten Veen, 2022)	Global	To summarise <i>hima</i> TEK and present its opportunities and challenges	Literature review case study	–	–	The provided <i>hima</i> TEK information are general.
58	Biocultural conservation systems in the Mediterranean region: the role of values, rules, and knowledge (Plieninger et al., 2023)	Mediterranean region	to understand how the four types of TEK, including <i>hima</i> , are shaped.	Literature review	The management of use and access to vegetated lands - agricultural terraces – rainwater-harvesting methods.	–	The presented information about <i>hima</i> was not deep, although it presented interesting values, rules and knowledge within <i>hima</i> TEK.
59	Hima as a Reversing Instrument to Bring Communities Back to the Land (Yun & Yi, 2023)	Saudi Arabia	Proposes <i>hima</i> TEK for urban waterways to reverse desertification and support ecology.	–	Traditional water management Community engagement.	It considers <i>hima</i> an intangible cultural heritage; besides, it is being introduced around cultural heritage sites.	<i>Hima</i> TEK is used as a source of inspiration for urban development to mitigate desertification causes.

No.	Title (author, date)	Study location	Study aims and summary	Study method	Ecology and TEK practices What is still missing in this regard?	Cultural heritage Was tangible cultural heritage mentioned, and how, and what was missing?	My notes and observations What is still missing in the study?
Summary	Some of the main points extracted from the previous studies: 1- There are some terms connected with <i>hima</i>, such as <i>haram</i> and <i>harim</i>. All refer to protection and prohibition. In general, <i>hima</i> refers to a traditional conservation system protecting natural resources, while <i>haram</i> denotes a sacred or prohibited area, and <i>harim</i> historically refers to the private quarters of a household, and sometimes is connected to water resources as <i>hima</i> and <i>haram</i>. 2- <i>Hima</i> is primarily connected to landscape management, where cultural heritage structures and elements can be included. 3- The function of <i>hima</i> may closely align with the concept of nature reserves and farms, as it balances the conservation of natural resources with meeting human needs. 4- <i>Hima</i> is associated with grazing, water management, agriculture, and overall landscape management. 5- The details of how <i>hima</i> functions are limited, and its contribution to cultural heritage remains unclear. 6- The voices of elders are missing, and local community involvement is limited. 7- <i>Hima</i> appears flexible, as it can be applied in different contexts and cultures. 8- Traditional Ecological Knowledge (TEK) of <i>hima</i> presents various opportunities. 9- <i>Hima</i> system can be revived with some modifications. 10- A more focused on <i>hima</i> daily practice of locals is needed.						

2.7 Landscape architecture design, profession and the local TEK

The concept of landscape is inherently inclusive. The ELC defines landscape as ‘an area, as perceived by people, whose character is the result of action and interaction of natural and/or human factors’ (Council of Europe, 2000). Makhzoumi (2016) noted that this definition is ‘expansive’ because it broadens the traditional focus on ‘outstanding landscapes’ (p. 462) to include ordinary landscapes—involving natural and cultivated, rural, urban and peri-urban areas. In essence, it acknowledges the interconnectedness of landscapes that together shape a region’s character (Makhzoumi, 2016, p. 462). Conversely, LA is defined as ‘a profession and academic discipline that employs principles of art and the physical and social sciences to the processes of environmental planning, design and conservation, which serve to ensure the long-lasting improvement, sustainability and harmony of natural and cultural systems or landscape parts thereof, as well as the design of outdoor spaces with consideration of their aesthetic, functional and ecological aspects’ (Evert, 2010, p. 509). Makhzoumi (2016) stated two key facts: one is that the inclusive meaning of landscape, which includes ecosystems, cultural heritage and humans, is inherited in the inhabitants’ tradition and culture in the Arab Middle East, and owing to the mis-introduction of the word ‘landscape’ in the region at the beginning of the twentieth century, the current developmental projects create a gap between people and their inclusive meaning of landscape (pp. 462–463). Second, the involvement of LA researchers and designers in the region is limited owing to the reliance on Western companies to lead these projects (see Tables 2-2 and 2-3). This issue may continue to contribute to diminishing the traditional values of the local communities and increasing the gap as long as the voice of foreign experts is prioritised. This highlights the importance of landscape architects being involved in such projects and topics with the local community.

As a landscape architect exploring traditional ecological techniques and practices that contribute to desertification mitigation and cultural heritage conservation, I recognise the crucial role of LA design and drawings as ‘an important object of knowledge and research’ (Nijhuis & Bobbink, 2012, p. 242) to visualise aspects of the *hima* TEK and enhance understanding of this system. A review of the relevant literature reveals a significant lack of visual materials on *hima* TEK. Although some photos, maps, and a few sketches and drawings exist, most of the information found in studies, such as those by Zahran and Younes (1990), Eben Saleh (1997, 1998c, 1998b, 2002, 2004), Kilani et al. (2007), Llewellyn (2013), Abdallah (2013), Al Shaqsi (2013), Al-Shanqiti (2013), Llewellyn and Altlasat (2017), Al-Shanqiti (2019), and Yun and Yi (2023), provide general descriptions with little detailed insights into the functionality of local TEK and its practices (see Table 2-2).

In contrast, some studies, such as that conducted by Kent (2016), offered detailed visual materials, including sections, sketches and photos, from an environmental restoration project with traditional local communities (former *hima* practitioners, as noted by Schwartz (2020)) in the Makkah region of Saudi Arabia.¹⁴ Although these ideas are rooted in permaculture, they provide detailed information on the design and functionality of techniques. For example, Kent (2016) illustrated the function of windbreakers in mitigating causes of desertification, such as sandstorms, the design and hierarchical pattern of farms and plant types, and the design and operation of dams, along with photos of existing implementations (see Figure 2-15 for visual references).

Internationally, there have been a number of contributions by LA researchers exploring local TEK and its role in ecosystems and cultural heritage. One of these is a book authored by Watson (2019), which presents and illustrates the value and significance of the TEK of local communities through both visual and written narratives. The book explored 18 case studies of different types of local TEK

¹⁴ For more information about the project, see Schwartz (2020).

systems within 4 ecosystems in 12 countries. Watson interviewed individuals who know these traditional ecological systems, and she then visually illustrated some of the traditional ecological techniques as a source of inspiration. Sheppard-Simms (2020, p. 79) reviewed the book and noted that some of the traditional ecological techniques provided in the book are superior to modern technologies, given that TEK can be productive and promote long-term sustainable and adaptable approaches/solutions. However, Sheppard-Simms (2020) also highlighted ‘the long histories of misinterpretation and appropriation that have characterised Western interactions with Indigenous peoples’ (p. 79), indicating the importance of deepening the way researchers interact with and interpret the practices of traditional communities and their TEK.

In terms of LA design, both drawings and visual representations are essential tools in LA research because they function as instruments used for understanding, analysing, recording, and expressing ideas and relationships (Nijhuis & Bobbink, 2012, p. 242). This process includes three key stages: (1) analysing and examining precedents, designs and situations to establish an information foundation for making design decisions, (2) generating designs to develop and test the main ideas, and (3) engaging in public communication and delivering presentations (Nijhuis & Bobbink, 2012, p. 242). This point influenced my interest in research strategies and the relationship between research and design in LA, leading me to explore how design can serve as a research tool (Bruns et al., 2016; Deming & Swaffield, 2011; Lenzholzer et al., 2013; Nijhuis & Bobbink, 2012; Nijhuis & de Vries, 2019; Prochner & Godin, 2022; Van den Brink et al., 2017). Two design research approaches emerged: RTD and case study methodologies. RTD is a type of research that utilises design as a research strategy to identify, map and explore possible concepts and ideas (Nijhuis & de Vries, 2019, p. 90). In contrast, a descriptive case study, as defined by Yin (2009), is a practical investigation into current phenomena within a real-life setting, especially when the boundaries between the selected context and research are unclear (Deming & Swaffield, 2011, p. 80). The data collection tools used in the case study approach, such as interviews and site observations, are evident in multiple *hima* studies. However, incorporating the RTD approach may help to identify opportunities to reintroduce local TEK and techniques into regional urban master plans of Saudi cities. Given the lack of involvement by landscape architects in cultural heritage development projects in the Middle East (Makhzoumi, 2016, p. 463; see Table 2-3), part of the aim of this thesis was to establish a path in which landscape architects and researchers could contribute to cultural heritage conservation through the RTD approach.

Table 2-3: A list of the papers produced by researchers in landscape architecture in Saudi Arabia regarding cultural heritage sites, design and local TEK to some extent. *Source:* Created by the researcher.

Author date	Title	Location	Notes
Wael Hussein 2016	The Reflection of Environmental and Social Aspects on The Design and Formation of Outdoor Circulation Elements in Heritage Towns	AlUla	This study explored the social and ecological aspects in AlUla Old Town.
Abdelmohsen Farahat 2023	Urban Heritage as Generator of Future Innovation	Many sites	This study looked at the future of heritage sites from a theoretical point of view
Amer Habibullah Nawaf Al Hajaj 2023	Assessing Mobility Infrastructure for Wheelchair Users in Heritage Sites: The Case Study of Historic Jeddah	Three walkways in the Jeddah Old Town	This study developed a disability mobility infrastructure assessment checklist comprising 14 indicators to assess three major walking routes in Historic Jeddah
Abdullah Ghazal Amer Habibullah 2023	A Methodology Proposal For Studying and Evaluating Vegetation Cover in Heritage Areas in Arid Regions	Four heritage sites	This study explores impact assessment criteria for vegetation cover with cultural heritage sites to reach the optimal design decision

2.8 Theories, frameworks and concepts for applying local TEK

Based on the literature review, two approaches were identified: a deductive (theory-driven/top-down) approach and an inductive (data-driven/bottom-up) approach (Deming & Swaffield, 2011, p.

7; Moser & Korstjens, 2018). Although a deductive approach is employed to test and develop an explanation of a theory, inductive research ‘is the generation of descriptions and explanations of relationships in the world through strategies of inquiry grounded in the world of experience and empirical evidence’ (Deming & Swaffield, 2011, p. 7). On examining various relevant frameworks and theories, several potential frameworks emerged, including the holistic landscape approach (Makhzoumi, 2016) influenced by the ELC, the cultural landscape approach (Brown, 2007) and the social-ecological system framework (McGinnis & Ostrom, 2014; Ostrom, 2009). Although these frameworks offer comprehensive insights and structured methodologies, they also present certain limitations. Specifically, their predefined structures may limit and direct research perspectives, which could potentially restrict the scope of the research, forcing researchers to keep to predetermined pathways and potentially overlook emergent themes during the data collection and analysis stages. Additionally, these frameworks include aspects that may not be related to the research questions. More significantly, TEK is primarily transmitted orally across generations, and it may defy attempts to be structured but will offer emergent possibilities.

Owing to these considerations, I chose to adopt a data-driven approach for this research. This methodology allows for greater flexibility and responsiveness to the collected data, enabling the identification and exploration of themes and issues as they naturally emerge. This approach is particularly suited to the nature of this research and its questions, which aimed to uncover and understand the detailed dimensions of the TEK related to the *hima* system. This data-driven approach was informed by a substantial body of literature, approximately 59 papers, specifically related to *hima* TEK. This extensive review ensures that the research is grounded in existing knowledge while remaining open to new insights and directions that may arise from the data. By prioritising an inductive approach, this research aims to maintain a balance between being informed by existing literature and frameworks and being driven by the collected data. This approach not only

enables an understanding of the *hima* system, based on selected specifics, but it also facilitates the potential discovery of novel insights and contributions to the field.

Regarding data collection tools, most papers rely on the literature, official document reviews, site visits and observations, and the personal experience of the researchers themselves. Aishah Abdallah (2013, pp. 115–116) outlined two suitable approaches introduced by Freudenberger (1999) for data collection in the context of the *hima* system: (1) participatory rural appraisal (PRA) and (2) rapid rural appraisal (RRA), including stakeholder analysis. PRA requires two months to a year, while RRA can be conducted within a few weeks. Both approaches require a trained team with diverse skills to effectively manage data collection tasks, making them unsuitable for this PhD research. However, Abdallah (2013) identified several ‘information-gathering methods’ that could be employed independently, and that align with my capabilities. These methods include semi-structured interviews, site visits and observations, workshops with experts, feedback sessions, historical recalls, and participatory mapping and diagramming. These techniques can help in gathering rich, high-quality data and reinforce the importance of triangulation to minimise bias from the researcher or informants (Abdallah, 2013, p. 116).

2.9 Conclusion

This chapter presented and discussed the local TEK found in Saudi Arabia, examined the threat of desertification and environmental degradation, and outlined how local TEK contributes to providing solutions to environmental threats through six examples from around the world. Cultural heritage conservation and the role of TEK in such a context were then discussed. Subsequently, the role of LA and the relevant research frameworks associated with the research topics were also explored.

There are five points that summarise the main gaps I found in the literature. First, *hima* TEK holds much promise and potential worldwide, but it must be understood in more detail, especially in the context of Saudi Arabia. Although more than 59 papers on the regional TEK of *hima* have been published, there is still a lack of understanding of the details regarding the practicality of the ancient systems and how they work. According to the literature, *hima* can be categorised into three types: *hima* territories, *hima* knowledge and *hima* practices. *Hima*, as territory and as knowledge, have been studied by many researchers. However, *hima* as a practice needs further exploration. It is rooted and included in the daily lifestyle of the local community and requires an engagement with the local people and their surroundings. This is a crucial aspect, not only because the system itself is a form of intangible cultural heritage, but also because of the increasing regional desertification in the northwest part of the country, where local communities have built their TEK to mitigate the risk posed to their surroundings, including cultural heritage sites and structures. Therefore, the first research question is: ‘How can the local TEK of *hima* enhance living with desert ecosystems within Saudi cultural heritage sites?’

Second, the risk of desertification is increasing and affecting the environmental productivity of the desert, local communities and their cultural heritage sites. Official organisations have acted in various ways to conserve cultural heritage and mitigate desertification, for example, through tourism. However, this creates another issue since it ignores the local communities’ ecological traditions, which increases the gap between people and their surroundings, landscape and cultural heritage. Based on the literature, there is a potential role for local TEK to contribute to the conservation of cultural heritage, and this linkage has not been sufficiently addressed to date. Therefore, the second research question is: ‘How can the TEK practices of *hima* contribute to the conservation of cultural heritage sites in urban settings?’ Through this question, I hope to draw a

clear connection between both by explaining in detail the ways that *hima* TEK contributes to cultural heritage conservation.

Third, there are limited voices from elders, leaders and experts in local communities found in the literature. At the same time, other stakeholders, such as students, teachers, designers, officials and tourism employees, can be heard in such studies. It would be critical, valuable and insightful to hear from the elders and local experts in the community to learn how desertification mitigation and cultural heritage conservation can be addressed traditionally and simultaneously.

Fourth, based on the literature, several sites could have been selected for this research. However, AlUla County, which includes many cultural and natural heritage sites, such as Hegra and Harrat Uwayrid, is the most suitable site, given that it is undergoing a major urban transformation as a vital part of the realisation of Saudi Vision 2030. The site is part of the Medina region, which includes many *hima* sites. However, the site will be presented in a separate chapter to assist in explaining the many key aspects of its context.

Fifth, for the following reasons—there has been a lack of contribution from LA researchers and professionals to this type of research, the landscape as a perspective is inherent in the local TEK, there is a lack of visual materials regarding local TEK and there is significant urban development occurring now in the country of Saudi Arabia—there is an opportunity for this research to fill a gap by adopting design research methods exploring the integration of local TEK into urban development projects. Therefore, the third research question is: ‘What is the role of landscape design in this context, and what are the main design aspects that designers need to consider when aiming to integrate *hima* TEK techniques in urban development projects to mitigate desertification and preserve cultural heritage sites in the country? Finally, at the end of this research, I hope to provide

a better understanding of how local TEK and its practices can mitigate desertification and conserve cultural heritage, and explain how LA design can contribute to understanding *hima* TEK.

Chapter 3: Research Methodology

3.1 Introduction

This chapter outlines the research methodological framework employed to achieve the research aims and answer the research questions. It includes a discussion of the research design, the researcher's background, the various sources utilised during data collection and the data analysis approach. Additionally, this chapter addresses the ethical considerations and the reliability of the qualitative methods used (see Figure 3-1). Based on the LA design discussion in the previous chapter, this chapter contributes to the methodological aspect by developing a methodological framework for researchers from LA and other relevant design fields who are interested in integrating local TEK into modern urban development projects.

This thesis aimed to explore the *hima* TEK of the AlUla local community in Saudi Arabia and the relationship between the locals' traditions in the surrounding ecosystem and tangible cultural heritage sites to mitigate desertification, conserve cultural heritage and foster community well-being by reconnecting people to their surroundings and traditions. I chose the AlUla region, Saudi Arabia, for the case study because of the richness of its landscape-based history and cultural heritage artefacts, its unique desert ecology and its long-term traditional management system, all of which offer important contributions to knowledge about sustainable living, and yet may be threatened by modernisation. The research also aimed to document and discuss the different traditional techniques and practices through design to enhance their implementation in the current and future urban development and landscape management projects within natural systems and heritage conservation areas in the Arabian Peninsula. The main questions guiding this research are:

1. How can the TEK of *hima* enhance living with desert ecosystems within Saudi cultural heritage sites?
2. How can the practices of the TEK of *hima* contribute to the conservation of cultural heritage sites in urban settings?
3. What is the role of landscape design in a *hima* context, and what are the main design aspects that designers need to consider when aiming to integrate *hima* TEK techniques in urban development projects to mitigate desertification and preserve cultural heritage sites in the country?

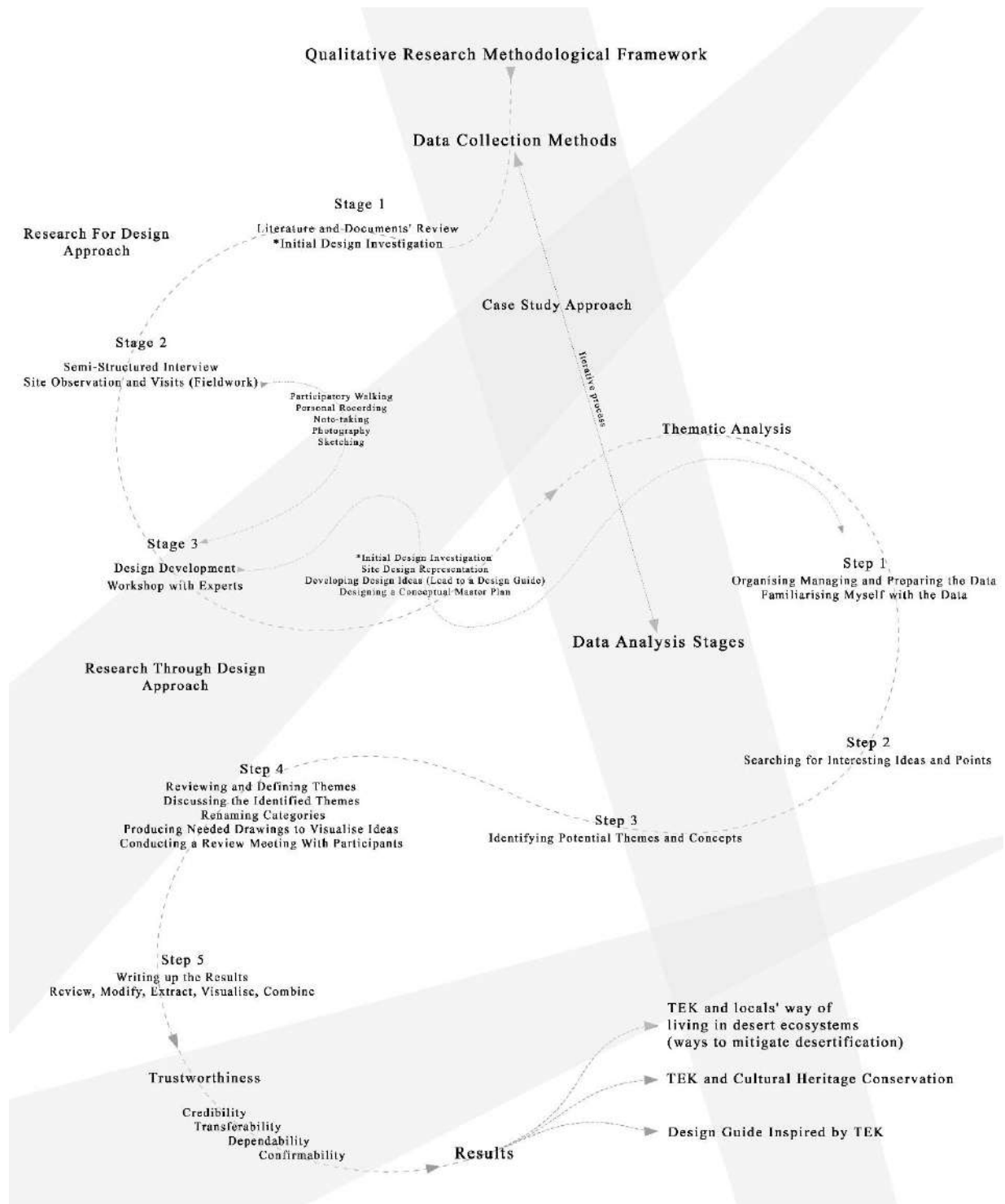


Figure 3-1: This diagram presents the research methodological framework. The data collection approach has three stages, and the data analysis approach was conducted in five stages. The last part is the result, which is divided into three chapters (5, 6 and 7). *Source:* Diagram by the researcher.

3.2 Research design

This qualitative research investigates the local TEK in the context of AlUla using a case-study approach as well as a design research approach to achieve the research aims and objectives, and to answer the research questions. Qualitative research is advised when a researcher investigates topics related to people's experiences, meanings and perspectives in relation to something that cannot be counted or measured (Hammarberg et al., 2016).

A case study approach, according to Hafiz (2008) and Johansson (2007), is a method that 'facilitates exploration of a phenomenon within its context using a variety of data sources' (p. 544). According to Yin (2009), the reasons that encourage a case study approach are (1) when the research question starts with 'how', (2) when the edges between the context and the phenomenon are unclear, (3) when there is a need to consider multiple issues relevant to the phenomenon and (4) when the involved individuals' behaviour cannot be manipulated. A descriptive case study is utilised to illustrate an involvement or phenomenon, and the context in which it appeared (Yin, 2003). The case study approach is one of the descriptive strategies categorised in LA research, owing to its capability to be adopted and framed for graduate researchers in the field (Deming & Swaffield, 2011, p. 50). The case study approach includes different data-gathering tools, such as semi-structured interviews, in which researchers can explore people's views regarding specific topics and collect data about their experiences, knowledge and values (D. Gray, 2014). According to Moser and Korstjens (2018, p. 11), the estimated number of interviews for these types of qualitative research methods that explore people's experiences and knowledge is fewer than 10 participants. However, the researcher must decide whether the received data are rich enough or require more interviews (Moser & Korstjens, 2018).

Since design is involved in this research, I adapted the design-research approach (Lenzholzer et al., 2013) and combined it with the case study approach to answer the research questions. Design is a way of mining new knowledge (Downton, 2003). Downton categorised design research into three types: research for design (RFD), research about design (RAD) and research through design (RTD) (Downton, 2003). This research employed the first and third types. RTD is an essential method that involves designing as a part of the research process, given that it can generate knowledge when dealing with issues associated with designing (Lenzholzer & Brown, 2016) and landscape (Nijhuis & de Vries, 2019).

One of the benefits of using this methodology is that the information gathered, understood and analysed through the research process can also be explored through design methodologies (Downton, 2003) when the intended outcome is to advocate for a shift in the design approaches themselves (in this instance, the existing approach being taken to the master planning, heritage and environmental planning, and design implementation of the AlUla project). This approach allows for the exploration of new factors that may change decisions, knowledge and expectations (Downton, 2003; Nijhuis & de Vries, 2019).

RFD, as defined by Downton (2003), refers to the ‘research that is carried out during the overall design process to support designing in whatever way the designers regard as useful, and this includes research intended to provide information and data that is necessary to successfully conclude the undertaking in question’ (p. 17).

The research findings in Chapters 5 and 6, regarding the first and second research questions, exemplify RFD. These chapters provide insights from elders on local TEK and its role in living in the desert while mitigating desertification and conserving cultural heritage, along with associated

ecological values, techniques and practices. In this context, research serves as the knowledge producer that could inform design guides.

Conversely, Chapter 7 addresses the third research question and exemplifies RTD. In this chapter, design ideas and drawings generated from the findings in Chapters 5 and 6 serve as the primary data to be integrated into the design process. This integration will work as a tool to encourage experts to critique and refine the design process and results, or specific design aspects, illustrating the iterative nature of RTD. The RTD is thus a methodology for integrating TEK with modernisation.

3.3 Researcher's background (positionality)

Positionality is vital to the qualitative research process, and it is essential to be considered and illustrated when conducting research (Holmes, 2020). Positionality refers to the pre-existing experience of a researcher, and his/her knowledge and philosophical standpoint (Sikes, 2004). As highlighted by Holmes (2020) and Wellington et al. (2005), the selected research approach will be influenced by factors such as the researcher's interest, expertise, predilections and background. Therefore, it is essential to highlight and justify some key points regarding my positionality and relationship with the local communities and their TEK in the region.

I am a Saudi landscape architect who grew up in one of the Islamic *hima* (haram) territory, the holy city of Makkah, where my father consistently taught me during my childhood how to care for the environment and avoid any harmful actions towards it, such as cutting plants and hunting animals, given that they are entirely prohibited. I have been practising these traditional ecological values since my childhood within the *haram* border.

During my Bachelor of Landscape Architecture (BLA) programme, I have worked with the local communities, especially elders and community leaders within the Medina region (where AlUla is

located), and understand their traditional practices in managing natural resources, such as water springs and oases, and protecting their cultural heritage sites. Some of the projects during the BLA aimed to develop traditional sites while preserving the local identity, ensuring ecological productivity and reviving sites sustainably to generate healthy national eco-tourism sites in the Medina region.

After finishing my BLA, I moved to Medina City. I worked for two years in one of the development authorities responsible for key urban development projects in the region of Medina, including AlUla (this was before the establishment of the Royal Commission for AlUla (RCU)). I had the opportunity to participate as a landscape architect in the ecological restoration and development project of the Al-Aqeeq Valley, one of the main valleys of the *himas* of Medina. Also, I had the opportunity to work with many local communities in the region, which helped me understand the local TEK and the impact of urban development that may cause tensions between the locals and the surrounding ecologies and cultural heritage. I am in a rare position in that I am trusted by the local community to understand the traditions and formulate the research in a way that respects and preserves these traditions. I am fully aware of the local culture, traditions and values.

In my Master of Landscape Architecture project thesis, I studied the relationship between people, cultural heritage and the surrounding ecosystems in Hegra's WHS in AlUla, Saudi Arabia, to create healthy, sustainable interaction through landscape design and management to ensure natural continuity, community well-being and heritage conservation. The MLA enabled me to develop a position to contribute valuable insights to support local communities and their environments affected by current heritage conservation practices tied to tourism development. I understand the documentation required to visit key sites in AlUla for data collection, and I have experience interacting respectfully with community leaders and elders.

Finally, the experiences I had and witnessed motivated me to direct the focus of my PhD study to exploring local TEK and its interlocked relationship with cultural heritage, natural landscapes and community well-being in Saudi Arabia.

3.4 Data collection

In this section, I explain and discuss the data collection procedure. The data collection process is divided into three stages. The first stage is associated with secondary sources such as the published literature, official documents and reports. The second stage relates to primary data collected from interviews, site observations and visits (fieldwork). The third stage entails design research (design development and the workshop with experts).

3.4.1 The first data collection stage

This stage, which corresponds to the first stage of the PhD, has two parts: the literature and document review (Llewellyn, 2013, p. 206) and the initial design investigation. In the first part, I collected data from secondary sources such as official documents and reports from governmental and private organisations involved in cultural heritage conservation, protected areas and urban development, for example, the Royal Commission for AlUla, the Heritage Commission, the Ministry of Tourism, the General Authority for Statistics and the French Agency for AlUla Development, including the published literature available in the Saudi National Library and global scholarly databases. I aimed to review the relevant documents, understand the local TEK along with the issues that have been studied and documented, and determine whether the traditional ecological practices of the local people are considered within the new urban developments in AlUla. My intention was to understand the situation regarding efforts to enhance the relationship between the local people, cultural heritage sites and the surrounding environments within protected cultural heritage sites in

AlUla by reviewing the AlUla Master Plan (OMP), as well as the relevant reports and legislation, initiatives and landscape design proposals.

In the second part, I developed a design process based on my understanding of the literature. In this process, I visualised, proposed and integrated traditional ecological practices and techniques into a natural context in AlUla, since there is a lack of visual materials regarding *hima* TEK. By the end of this stage, I gained an understanding of the situation in AlUla in terms of its local TEK, urban development, cultural heritage conservation, ecological protection and community involvement. I found that there was a lack of documented traditional ecological practices and a lack of engagement with *hima* TEK in urban development and conservation projects in the region. I produced landscape designs, drawings and sketches that illustrate potential, healthy interactions between the local people and their surroundings through the TEK and practices of the local communities. I recognised that these drawings were my interpretation of *hima*, and not necessarily knowledge that the community shared. But translating the found information into visual materials and LA drawings contributed to the development of the second and third data collection stages.

3.4.2 The second data collection stage

In this stage, I utilised two data collection methods: semi-structured interviews and site observations and visits. According to Abdallah (2013), semi-structured interviews and site observations are two information-gathering methods that researchers should utilise when studying *hima* and local traditional practices. This stage was undertaken between May and June 2022.¹⁵ My aim was to answer the first and second research questions in this stage. This stage resulted in two sets of themes that answer the research questions, as well as many drawings associated with

¹⁵ I received my UTS ethical approval on 17 May 2022, see Appendix A.

desertification issues, cultural heritage conservation, new urban development and the local TEK. The RFD approach was employed for this stage.

3.4.2.1 Semi-Structured Interview

This section explains why I chose to conduct interviews and presents information regarding the structure of the interviews, the development of the interview questions, the number of elders who participated, the selection criteria, the period spent with the elders and how I contacted them.

Through interviews, researchers can discover individuals' views regarding particular topics and gather data about their knowledge, values and experiences (D. Gray, 2014). By conducting semi-structured interviews, researchers have the flexibility to add questions when needed, and participants can expand their responses to clarify their points (D. Gray, 2014). Therefore, I performed semi-structured interviews with community elders, such as tribal leaders and local experts, who were considered the knowledge holders. I began the interview process with general open-ended questions concerning the relationship of the local people with the surrounding natural resources and cultural heritage. This is because the first few minutes of an interview should be utilised to make participants feel comfortable and prepared, as Moser and Korstjens (2018) explained. After the general questions, I started asking questions about two topics: (1) desertification issues and how they combat them and (2) the tangible cultural heritage and how they protect it. I provided two scenarios based on my earlier drawings and analysis to motivate and encourage the participants to explain how their ecological knowledge and practices mitigate desertification and conserve cultural heritage. Scenario-based interviews are significant for three reasons: (1) they encourage participants to speak (Jaidin, 2018), (2) they promote comparable data in a significant way within a study, and (3) they elicit responses about experiences in working practices and problem-solving that the research

participants commonly use (Beighton, 2021). The last part of the interview involved questions about some detailed points regarding the design of traditional techniques.

Therefore, the interview structure ranged from general enquiries to specific issues to detailed questions (see Appendix E). At the end of each interview, I asked the participants to suggest a site or place where I could see and observe some of the traditional techniques and practices discussed, or that related to our conversation. I checked whether they were interested in participatory walking. However, if I felt that this question should not be asked, or that the participant may have had some difficulties joining me in participatory walking, I would not ask. For example, Participant 1 informed me that he would be busy after the interview, so I decided not to ask him. Interestingly, some participants suggested participatory walking without being asked. For example, Participants 4 and 6 asked me to walk with them through their oases to see some of the implementations and issues we had discussed.

The development of the interview questions went through several stages. The first stage, carried out by me, involved reviewing and developing the interview questions to cover the main aspects of the research questions and aims. The second stage was conducted in cooperation with my supervisory panel by discussing the questions. The third stage was translating the interview questions into Arabic. I reviewed the Arabic version of the questions with six qualitative experts, including my Saudi-based supervisor, to determine whether the translated interview questions were accurate and precise. In this stage, I found that some questions needed to be simplified to make it easier for the elders to understand. For example, the question ‘How would you describe the relationship between the locals and the surrounding natural and cultural heritage elements?’ was too long in Arabic, so I divided it into two shorter questions: ‘How would you describe the relationship between the local community and the surrounding natural environment?’ and ‘How would you describe the

relationship between the local community and the surrounding cultural heritage?’ The last stage of development was conducting a pilot study to check whether the questions were clear to the elders or needed to be improved. I found that some scientific terms, such as desertification, were not always clear; therefore, I decided to ask the same question in various ways to make it clear to the participants. The interview questions were much more developed at the end of these stages (see Appendix E).

Based on the estimation and recommendation¹⁶ of Moser and Korstjens (2018, p. 11), I interviewed 11 local elders and experts within the community. I had four reasons for choosing community leaders and experts to be the research participants. First, these people are the *Ahlul Hal Wal Aqd* (أهل الحل والعقد), which means people of knowledge, wisdom and justice in Islamic traditions. According to Al-Gilani (2005), *Ahlul Hal Wal Aqd* are ‘the members of the community’s decision-making council, to whom the community refers to resolve problematic issues’ (p. 48). Since the community selects and respects them, I determined that they were the best people to be interviewed. The second reason is that ecological knowledge and practices are rarely seen in today’s context owing to lifestyle changes, and younger generations are not as involved in these traditions as the elders. Third, the local community elders are the holders of knowledge and history, and disregarding their participation and opinion may contribute to the loss of ecological knowledge forever, as Parween (2021) hinted. The last reason is that elders’ voices have been missing from many studies conducted in Saudi Arabia. Therefore, I decided to listen to this respected generation. I designed the participants’ selection criteria to choose the most relevant participants. The selection criteria for the local interviewees were as follows:

¹⁶ See Section 3.2.

1. Participants should have engaged in *hima* practices or possess local TEK, live close to a *hima* territory or use a *hima* resource. This point excludes people who have local TEK but do not practice or experience it.
2. Participants should be local Saudis who are aware of the local traditions. This point excludes people who are not aware of the traditions and customs of the local community.
3. Participants should be elders, tribal leaders or local experts. This point excludes the younger generation, who do not have as much experience as the elders.
4. Participants should have a long relationship with the WHS and the cultural heritage features. This point excludes people who are unaware of the tensions and challenges that have existed between the local community and the surrounding natural and cultural heritage in the past and the present.

I planned to spend approximately an hour on each interview. However, some interviews took longer because some elders wanted to talk and provide more details about desertification and cultural heritage conservation issues. Since they had agreed to participate in the research, I felt that I should give them the time they needed to explain and talk about TEK and the issues they wanted to highlight. One of the local traditions is that if an older person is talking, younger ones should listen to them until they finish. Therefore, I gave them the time they wanted. The total time spent with the elders was approximately 19 hours and 27 minutes (the shortest was 50 minutes with Participant 4, and the longest was 3 hours and 17 minutes with Participant 6; see Table 3-1).

In terms of how I contacted the participants, I implemented the snowball sampling method to reach the elders. According to Noy (2008), the snowball sampling approach is a method that assists researchers in achieving new relevant informants based on the recommendations of some participants. Given that I was in contact with some of the local people from AlUla, I asked them to

connect me to the elders and local experts in the community, and I provided them with my research abstract and selection criteria. The locals suggested Participant 1, Participant 2 and Participant 11. However, when I interviewed Participant 1, he connected me to Participant 2 and others. The main point I would like to highlight is that there were specific names that were suggested many times by locals and other participants in every interview. I found that most of the participants were community representatives at different official or government events, which indicates that I contacted the appropriate people for this research.

To conclude, the elders with a long relationship with the region's natural and cultural heritage elements provided me with meaningful insights into how the local TEK works, along with design guides relating to how the traditional techniques and practices contribute to mitigating desertification, protecting cultural heritage sites and reconnecting people to their surroundings.

Table 3-1: This table presents information regarding the interview.

Number	Interview period H:M	Meeting place	Interviewee location and social position	Conducted participatory walking	Suggested sites	Expertise
Participant 1	1:14	A farm	A local elder from the AlUla Old Town	No	AlUla Old Town Cultural Oases Southern AlUla	Water Management
Participant 2	1:40	A farm	A local elder from the AlUla Old Town	Yes	Dadan AlUla Old Town Cultural Oases	Traditional equipment and techniques History
Participant 3	1:20	A farm	A local elder from the AlUla Old Town	No, but showed me tools and techniques	Hegra AlUla Old Town Cultural Oases	Traditional equipment and techniques

Number	Interview period H:M	Meeting place	Interviewee location and social position	Conducted participatory walking	Suggested sites	Expertise
						Water management
Participant 4	0:50	A farm	A local expert from Shalal	Yes	Shalal - Therbah	Water and oasis management
Participant 5	1:35	A farm	A local expert from Shalal	No	Shalal - Hegra	Hunting History
Participant 6	3:17	A farm	A local expert from the AlUla Old Town	Yes	AlUla Old Town Cultural Oases	Water and oasis management Cultural heritage conservation
Participant 7	1:02	A farm	A local elder from Hegra	Yes	Mogayra - Hegra	Water and oasis management
Participant 8	1:05	A farm	A local expert from the AlUla Old Town	Yes	Cultural Oases	Water and oasis management
Participant 9	2:34	A farm	A local Expert from the AlUla Old Town	No	Mogayra AlUla Old Town Cultural Oases	Water management History
Participant 10	3:00	A farm	A local elder from the AlUla Old Town	No	AlUla Old Town Ikmaah - Hegra Harrat Uwayrid	Cultural heritage conservation History
Participant 11	1:50	A house	A local elder from the AlUla Old Town	No	Hegra AlUla Old Town Cultural Oases	Oasis management Cultural heritage conservation

3.4.2.2 Site Observation and Visits (Fieldwork)

This section presents an explanation of why I employed this approach, how I selected the sites, the method used during the observations, and the duration and frequency of the visits. Site observation is an essential data collection method used for investigating water issues in urban areas (Backhaus et al., 2016), as well as *hima* practices and TEK (Abdallah, 2013; Llewellyn, 2013). According to Backhaus et al. (2016), the term ‘observation’ means ‘looking at phenomena connected to a problem by whatever means necessary: looking with one’s eyes, asking questions, using mechanical measurement devices, and so on’ (p. 288).

My objectives in conducting site observations were to gain more information and knowledge regarding the TEK of the local community in a real-life context. I wanted to see and observe the techniques, practices, issues and activities associated with desertification mitigation and cultural heritage conservation and understand how these features work in a natural context. I sought to document these local ecological traditions and considered how they could be reimplemented in new urban development projects.

As mentioned in the previous section, the elders proposed several sites around AlUla. These sites can be divided into three types. The first is a traditional private oasis or a site owned by the participant. After the interviews, some participants invited me to walk through their oases to discuss issues or points mentioned during the interview. The second type is sites managed by official organisations and open to everyone as public open spaces or tourism sites, such as the AlUla Old Town, the Cultural Oases and the WHS in Hegra. The third type is the natural or cultural heritage sites that are not managed and developed yet, but can be easily accessed, such as the widespread rock art sites inside neighbourhoods and the ancient farms outside the WHS. The selection criteria I designed included three points:

1. The sites should be open to everyone unless they are sites to which the participants invite me.
2. The sites should have proper and safe access. (This point excluded all dangerous sites that may have had potential risks.)
3. The sites should be associated with desertification and cultural heritage conservation issues. (This point excluded the sites that were irrelevant to my research or those that would not add value.)

Based on these criteria, I visited 24 sites, excluding all the sites mentioned by participants that were unsafe, needed permission to access, were irrelevant to my research aims and objectives, or were very far away from the OMP boundaries (see Figure 3-2).

During the site observations, I engaged in participatory walking and personal recording, including using the methods suggested by Backhaus et al. (2016), such as note taking, photographing and sketching. During the participatory walking, most of the participants would take me to areas in the sites that were related to the points mentioned in the interview. I might ask the participants some questions to remind them of our discussion points. While walking, I might take photos, write notes, or sketch or draw LA sections describing a traditional technique. I may make a quick personal recording if I cannot write or sketch. In terms of the site observations conducted alone, I searched for answers and solutions to my research questions, interview questions and the highlighted issues. For example, when I experienced some sandstorms hitting oases in Hegra, I observed the role of windbreakers, such as olive plants, in protecting the oases. At the same time, I observed a person cutting fruit from the olive trees, which explained the multifunctionality of these elements for the environment and the people. Having different tools to document and collect data was very helpful in cases where something prevented me from taking a photo or making a sketch. I captured moments

where elders drew some traditional concepts and techniques to explain how these techniques work (see Figures 5-13 and 5-41).

In terms of duration and frequency, I conducted 34 visits, since some sites needed to be visited two or three times because of the area size or the richness of the place (see Table 3-2). I spent 30 to 60 minutes at each site searching for implementations associated with desertification mitigation or cultural heritage conservation. Most of the visits were conducted during the morning or afternoon. Although sunset occurs around 7:00 pm, I avoided conducting site observations after 5:30 pm since the sites became dark owing to the mountains shadowing the area.

At the end of this stage, I made many drawings (LA sections) that represented what I had observed, including what the elders had described.

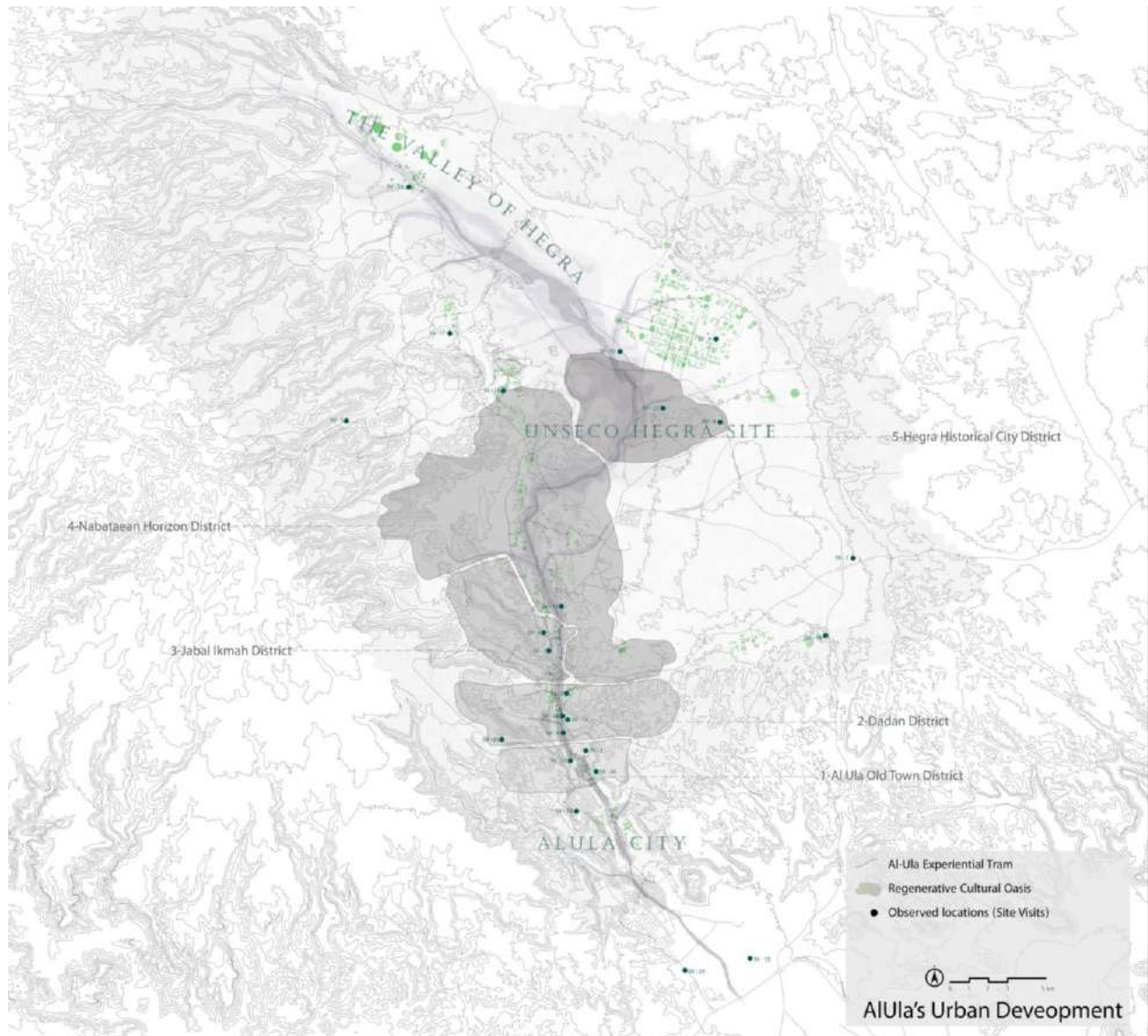


Figure 3-2: This map shows the 24 sites I visited in the region of AlUla. It also shows the zones that will be developed according to the OMP. *Source:* Map created by the researcher.

Table 3-2: This table presents data related to the site observation and visits.

Site symbol	Site type	The name of the area	Comment	Method	Number of visits
SV 1	Public	Northern AlUla city	An oasis that combines traditional and modern techniques	Photograph Personal recording Note taking	1
SV 2	Public	AlUla city	An oasis that combines traditional and modern techniques	Photograph Personal recording Note taking	1
SV 3	Private	Shalal area	Shalal Water Spring and the associated traditional oases	Photograph Personal recording Note taking	3
SV 4	Public	Ikma area	Ikma Mountain – Rock art	Photograph Personal recording	1
SV 5	Public	Dadan area	Dadan Heritage City	Photograph Personal recording	1
SV6	Public	Cultural Oases	Cultural Oases	Photograph Personal recording Note taking Sketching	5
SV 7	Public	Hegra area	A local planting nursery	Photograph Personal recording	1
SV 8	Natural site	Hegra area	Walking around Hegra	Photograph Personal recording	1
SV 9	Private	Hegra area	A traditional farm	Photograph Personal recording Sketching	2
SV 10	Natural site	Hegra area	Hegra Ancient Farms	Sketching Photograph	1
SV 11	Public	Shalal area	Shalal resort	Photograph Personal recording	1
SV 12	Private	AlUla city	A traditional farm	Photograph Sketching	1
SV 13	Private	Shalal area	A traditional farm	Note taking Photograph	1
SV 14	Private	Cultural Oases	A traditional farm that contains local cultural heritage elements	Personal recording Note taking	1
SV 15	Natural site	Southern AlUla city	Degraded oases and the southern desert Then I went to Mogayra to see the degraded oases and the long irrigation pipes.	Photograph	1
SV 16	Private + Natural site	Hegra	A traditional farm	Photograph Personal recording	1

Site symbol	Site type	The name of the area	Comment	Method	Number of visits
SV 17	Public	AlUla Old Town	AlUla Old Town + Tathe'el water spring	Photograph Personal recording Sketching	3
SV 18	Private	Cultural Oases	A traditional farm	Photograph Personal recording	1
SV 19	Public	AlUla city	Cultural heritage and traditional agricultural equipment	Photograph Personal recording Note taking	1
SV 20	Public	AlUla city	preserved documents Rock art	Photograph Note taking	2
SV 21	Public	Harrat Uwayrid	Harrat Uwayrid Nature Reserve	Photograph Personal recording	1
SV 22	Public	Hegra WHS	UNESCO site The Nabataean water management system	Photograph Personal recording	1
SV 23	Public	Southern AlUla city	The new urban area	Photograph	1
SV 24	Public	Therbah	Therbah town and oases	Note taking	1

3.4.3 The third data collection stage

This stage is associated with the RTD approach. I employed two methods for this stage: design development and a workshop with experts. These two methods relied on the previous stage and its results. There were two aims for this stage. First, it aimed to produce developed drawings, including a conceptual master plan, inspired by the *hima* TEK, and to visualise some aspects of the TEK associated with desertification mitigation and cultural heritage conservation. The second aim was to develop a design guide that illustrates the crucial elements needed for designing an open space or a site based on the local TEK in a natural or cultural heritage environment; that is, a method to integrate the knowledge of elders with new urban developments.

3.4.3.1 Design Development

This section presents the process implemented to develop design ideas that were generated based on the TEK of the elders. The steps performed include the initial design investigation, site design representation, design development ideas and designing a conceptual master plan. The last three

steps used an iterative approach that allowed me to continuously learn, adapt and improve the design process, as well as conduct recurrent discussion meetings with my supervisors at the end of each cycle. The discussion meetings were important to review, critique and develop the design outcomes. Another factor that inspired me to repeat the cycle was the emergence of new issues or aspects that I had not initially considered.

The first step was the initial design investigation. This was conducted in the first data collection stage. The goal of this step was to understand the context of the sites and to visualise some critical aspects identified in the secondary data (the published literature and official reports), such as traditional water-harvesting techniques, traditional human–nature interactions, and natural and cultural heritage conservation. During this step, I tested different drawing techniques and found that black and white line sections and plans of the landscape best represented the *hima* TEK and the relevant information. Additionally, I investigated the relationship between three factors—human, ecology and cultural heritage—to identify potential opportunities for reintroducing TEK (see Section 4.6). This step prepared me for the subsequent phases.

In the site design representation phase, I drew some of the visited sites to explain the traditional ecological techniques, actions or social activities observed or described during the second data collection stage (interviews, site observation and visits) (e.g. see Figures 5-5, 5-26, 5-33 and 6-12). I created drawings that presented the themes and categories identified in the data to visualise the traditional concepts involved with combating desertification and cultural heritage issues (e.g. see Figures 5-1, 5-44, 6-2, 6-16, 7-1). Most of the drawings produced presented the existing condition. I developed these drawings to include the past and future conditions or contexts of the sites to understand the long-term changes (e.g. see Figures 6-5, 7-6, and 7-9). The drawings of past conditions were illustrated based on historical satellite images, elders' stories and site observations

of the heritage areas. Conversely, the drawings of future conditions were created based on the new master plan and its associated 3D-rendered perspectives published by the RCU (RCU, n.d.-b). After reviewing the outcomes of the previous stages, I found that there was an essential step needed to show the integration between the new urban master plan (OMP) and traditional ecological techniques. Therefore, I redrew the drawings of future conditions, integrating traditional implementations and techniques (e.g. see Figures 7-6, 7-7 and 7-10). In this step, I aimed to address desertification issues using traditional ideas and techniques, in addition to realising the ideas of the OMP. This step would not have been achieved without the comprehensive understanding gained from the previous steps (see Figure 3-3).

The last phase was to design a conceptual master plan inspired by the *hima* TEK (see Figure 7-3). The aim of this step was to investigate how designers may design sites based on *hima* TEK to solve environmental issues, conserve cultural heritage features and allow for sustainable human interactions with the sites (see Appendix G). After developing the master plan, I conducted the next step, the workshop with experts, to critique, review, discuss and evaluate the conceptual master plan and the whole design development approach.

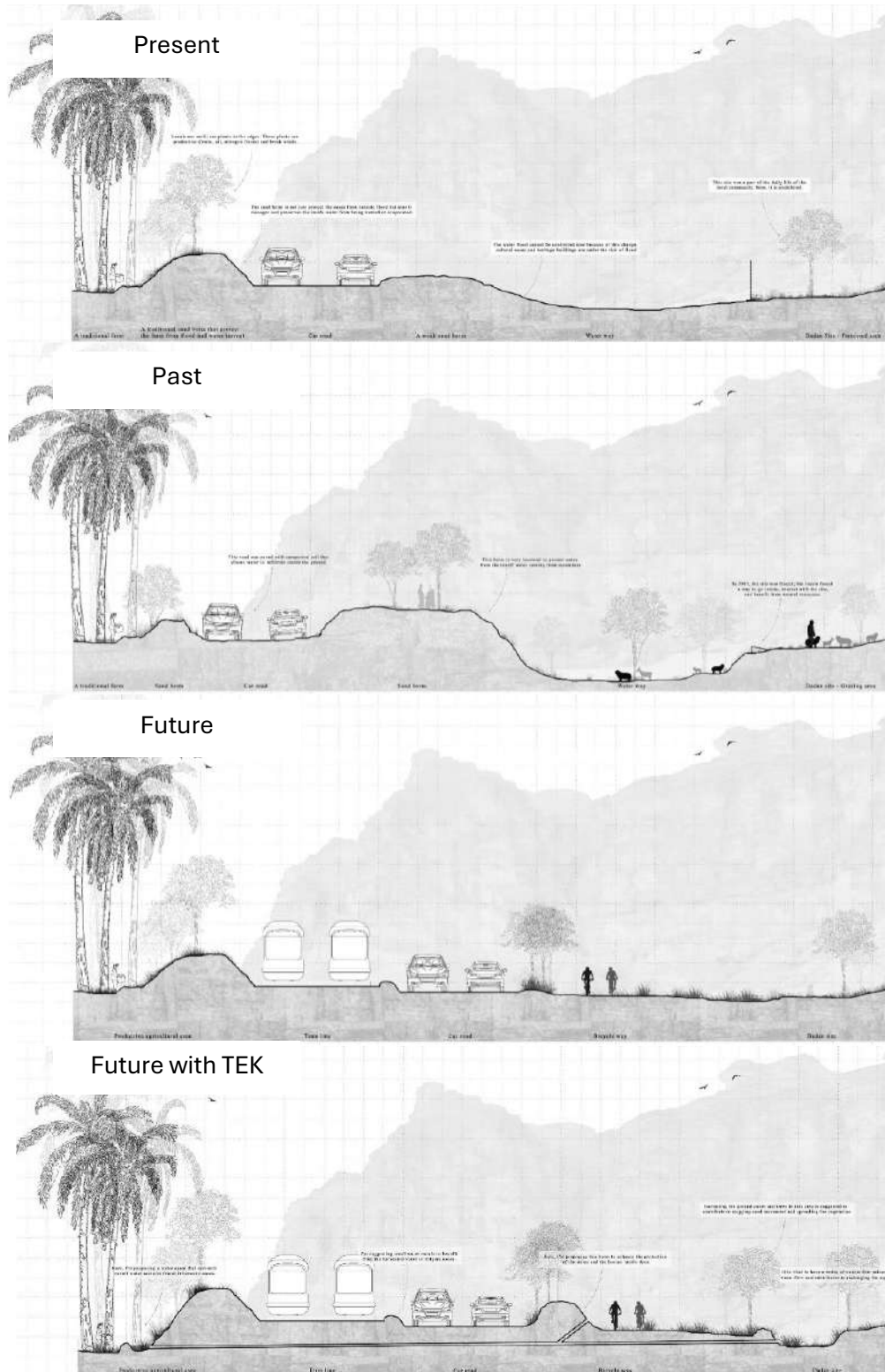


Figure 3-3: These sections illustrate the four steps for one of the observed sites, displaying the site context in different periods. *Source:* Drawing by the researcher.

Before conducting the workshops with experts, I wanted to ensure that the results would accurately present the local TEK and the terminologies used, since meanings are sometimes lost in the translation from Arabic to English. Therefore, I conducted a review meeting with three elders: two had been interviewed previously, and the third was a community leader who had not been able to meet me during the second data collection stage (see Appendix H). These elders reviewed the results (the identified themes and categories), and I provided them with a result review form to facilitate this process (see Appendix F). They reviewed, commented, questioned and modified the themes and categories where necessary.

3.4.3.2 Workshop with Experts

Although the design discussion meetings with my supervisors were helpful, I proposed conducting workshops with Saudi LA experts with local TEK backgrounds so that they could critique and evaluate the design development approach, the initial results and the subsequently inspired conceptual master plan. This approach was critical as it allowed for outcome development and validation and removed any bias or shortcomings from my side.

I developed selection criteria for the national experts and professionals suitable for this research. The selection criteria were as follows:¹⁷

1. Experts should be aware of the local ecological traditions, including *hima*. (This point excluded experts focusing on other issues in the field.)
2. Experts should be older Arab individuals (preferably older than 50 years of age) who have experienced the environmental changes associated with the reduction in local ecological practices in Saudi Arabia. (This point excluded experts who were less aware of the local

¹⁷ Some of the experts from the first workshop did not meet the first and second selection criteria. However, I chose to include them because of their significant involvement in ongoing developments in AlUla.

traditions of the Arab people and those not old enough to have experienced how these traditions had changed.)

3. Experts should be aware of the WHS issues related to local communities and environments.
(This point excluded experts who might have been aware of the traditions but not engaged in the issues associated with cultural heritage conservation and the local community.)
4. Experts should be from the design field, such as LA, urban design or environmental planning.
(Since there were design aspects, I required someone with a design background to critique and evaluate the research outcomes.)
5. Experts should not be from the local community of AlUla. (Since I had met people from the local community and together reviewed the results, I wanted someone with a different perspective to examine the research, since this might have highlighted points and aspects that the elders and I had missed.)

I conducted three workshops (instead of one)¹⁸ at different places and times with three Saudi national experts. The three experts suggested inviting someone who was compatible with the selection criteria from within their circle. Therefore, there were 10 experts in total (see Table 3-3).

Table 3-3: This table presents the ten experts who participated in the workshops.

Name	Workshop	Gender	Expertise	Involvement	Note
Expert AA	First	Female	Urban design	AlUla regional development	The first workshop was mostly about the OMP
Expert AB	First	Male	Urban Planning	AlUla regional development	

¹⁸ The issues behind this change are explained in the 3.6 Limitations and Challenges section.

Name	Workshop	Gender	Expertise	Involvement	Note
Expert AC	First	Female	Sustainability Sustainable urban design	AlUla regional development	
Expert AD	First	Male	Architecture and standards	AlUla regional development	-
Expert BA	Second	Male	<i>Hima</i> and landscape planning expert	National conservation and development	Worked with local communities in their <i>hima</i> sites for more than 40 years A member of one of the local communities who practised <i>hima</i> in the southern regions of the Kingdom
Expert BB	Second	Male	Landscape architecture and urban and environmental studies	National conservation and development	
Expert BC	Second	Male	Landscape architecture and planning	National conservation and development	-
Expert BD	Second	Male	Landscape architecture and planning	National conservation and development	-
Expert CA	Third	Male	Landscape architecture professor and a <i>hima</i> expert	National conservation and development	Worked with local communities in their <i>hima</i> sites for more than 40 years
Expert CB	Third	Male	TEK and a landscape architecture lecturer	National development	-

Regarding the workshop operation, I developed a PowerPoint presentation to present the research aims, gap, questions, methodology, results, design development and the conceptual master plan. Additionally, I developed four discussion questions encouraging the experts to critique the design

approach and the conceptual master plan, as well as providing me with general feedback about the research approach (see Appendix E). I reviewed the content and the materials required for the workshop with my supervisors, and then conducted a pilot study with my Saudi-based supervisor to identify aspects that needed to be modified or improved. I found parts that needed to be adjusted; for example, regarding the content, I reduced the number of design development examples from six to two because there was a lot of associated information that may have distracted the experts. I found that presenting two sites would be enough to explain the process. In the pilot study, I found that I had focused on cultural heritage issues more than desertification. Presenting the research took a long time, which I thought might affect the experts' concentration, so I minimised some topics in the presentation. I decided to focus on the points that need to be discussed by the experts.

During the workshops, I began by distributing consent forms and information sheets to the experts, allowing for a few minutes to address any questions. I then presented the research topics for the first 30 minutes. Following this, I facilitated a discussion among the experts and myself, encouraging feedback and insights about the research. I placed an A2 sheet displaying the conceptual master plan and some detailed sections on the table for the experts to examine and discuss. I asked four specific questions regarding the conceptual master plan, its associated design guides and the design development (see Appendix E). These questions elicited critical feedback on issues, weaknesses and missing aspects, leading to significant improvements in the design approach and design guides. The duration of the discussion was approximately an hour. After each workshop, I reported the main points to my supervisors. Additionally, the feedback from the three workshops was compared and analysed to identify the key topics and processes essential for reintroducing *hima* TEK into the design of such sites. These key topics represent new knowledge generated through the design process, which could not have been discovered solely through discussions about local TEK with the elders.

3.5 Data analysis

This section presents the data analysis procedure. Qualitative data analysis involves organising and preparing data (transcribed recordings or photographs) for analysis, including minimising data into themes and codes, and presenting it in figures and discussions (Creswell, 2007; Creswell & Poth, 2018). Therefore, in this section, I present the different stages of the data analysis approach.

According to Moser and Korstjens (2018), analysing data from studies exploring people's experiences regarding a phenomenon aims to represent and interpret the meaning of the experience by determining the essential themes and subthemes. One of the flexible and practical tools used for analysing qualitative data is the thematic analysis approach (Braun & Clarke, 2006). Identifying common patterns within different data sources allows a researcher to provide a detailed explanation that captures the essence of a 'lived' experience (Moser & Korstjens, 2018). Therefore, I adapted the thematic analysis approach to identify the themes and subthemes that answered the research questions. There are six useful stages for analysing data thematically: knowing, understanding and being aware of the collected information; establishing initial codes; exploring themes; re-evaluating themes; defining and naming themes; and writing the results (Braun & Clarke, 2006, 2012).

To analyse the data, I adapted the stages described by Braun and Clarke (2006), including other steps that I believed were necessary owing to the nature of this research. The first stage focused on organising, managing and preparing the data. I created different folders on my secured computer, and each folder contained a different type of collected data source, such as interviews, workshops, site observation and design development. To ensure effective organisation, I allocated a separate folder for each site visit, enabling a systematic arrangement of relevant materials. All the photos, comments, sketches and personal recordings taken during visits were uploaded into the site visit folder.

I created an individual folder for each interview within the designated 'interview' folder. These interview folders contain both the transcribed text and the recorded audio files, facilitating easy access to the collected data and ensuring comprehensive documentation. I prepared the data by transcribing all recordings into text and de-identifying any personal or sensitive information mentioned in the interviews and workshops. Further, I read and reread the transcribed texts and reviewed and re-reviewed the site observation data to familiarise myself with the data. During this step, I wrote down any thoughts or ideas related to the research questions that came to mind. For a few weeks, I trained myself to use NVivo software to facilitate the data analysis process. According to D. E. Gray (2021), NVivo is an application that assists researchers with managing the codes and themes of qualitative data.

In the second stage, I searched for interesting patterns relevant to the main topics of the research. By the end of the first round, I had 99 categories (meaning codes or points). I decided to conduct a second round to ensure that I had covered everything, and as a result, I had six new categories added. Although I started this step with the transcribed interviews, the photographs, notes and sketches from site visits also generated some categories, such as the category outlined in Section 5.3.1.2 (Implementing barriers).

In the third stage, I created potential themes relevant to the research by grouping categories that had something in common. However, I faced an issue in that I could not visualise the potential themes and thus engage with them, although NVivo does provide visual diagrams that present themes, subthemes and categories (codes). Therefore, I decided to work on a Miro board, a platform that allows researchers and designers to interact with the different data types uploaded. Using the Miro board in thematic analyses is similar to conducting manual thematic analyses, but with advanced features. This platform allowed me to see all of my data, including themes, subthemes and

categories simultaneously, with the flexibility to change and move things around easily. I then moved the NVivo-generated themes and categories to Miro, and reviewed those categories two times, trying to find answers to my research questions. By the end of this stage, I had 2 themes, 5 subthemes and 29 categories relating to the first research question, and 3 themes, 7 subthemes and 27 categories that answered the second research question.

The fourth stage involved reviewing and defining the themes. I reviewed and discussed the identified themes with my supervisory panel to develop the connections between the themes, subthemes and categories, and their relation to the research questions. The feedback I obtained from the elders during the review meeting was constructive in terms of whether the themes and categories represented the TEK of the locals. I received some comments regarding the identified categories, which were addressed later during the last stage of the data analysis (see Appendix F, an example from the review meeting). Additionally, I renamed and defined each category, subtheme and theme to ensure that there was a clear hierarchy between them. Further, I made additional drawings to visualise some of the categories, ensuring a clear explanation of the traditional techniques (e.g. see Figure 5-33).

Writing up the results was the fifth stage. This stage allowed me to review, modify and extract different types of data to tell the story behind the local TEK related to desertification mitigation and cultural heritage conservation. Even in this stage, I found that some categories could be combined with others. For example, I combined the 'Storing Water' category with the 'Water-Harvesting Techniques' category to become the 'Implementing water-harvesting techniques' category (Section 5.3.2.4) because both illustrate the role of harvesting and storing water traditionally in mitigating desertification. In this stage, I decided to write the results in three separate chapters, each explaining the themes and categories associated with a research question. I decided to combine the

findings and the discussion sections, since I believe that it is much clearer to discuss the interpretation of a finding directly after presenting it. The analysis of the workshop data followed the same five steps presented above.

3.6 Limitations and challenges

There are three primary challenges and two limitations associated with the data collection. The first challenge relates to the interviews with the elders, which were difficult to organise owing to the COVID-19 pandemic. Although all restrictions were lifted in Saudi Arabia in March 2022 (Saudi Press Agency, 2022), some elders still refused to participate in face-to-face interviews, preferring to answer questions via phone calls. As a result, I conducted in-person interviews with locals who were willing to participate, because it was essential to observe their expressions and body language when discussing *hima* TEK. The second challenge involved organising the workshops. Initially, I planned to gather three national experts in one location for a single workshop. However, coordinating their schedules was impossible, so I modified my approach to conducting three separate workshops in different cities with a total of ten experts, including the three. This change required me to submit an amended ethics application to increase the number of participants from three to ten (see the approval in Appendix J). The third challenge related to time management, since most of the workshops and interviews extended beyond the initially planned duration. This occurred, for example, because the experts frequently wished to comment on points in my research before I had finished my presentation.

The first limitation was the lack of sources and information available online or in print. Despite visiting every library and bookstore in AlUla city, I was unable to find sufficient written information about the area. Additionally, many high-quality, expensive books published by official organisations were available, but these were designed primarily for tourism purposes and lacked the reliability

required for academic research. As a result of this, I decided that Chapter 4 would focus on the context of AlUla and include conclusions about what I had found in the literature and other secondary sources.

The second limitation concerned the voices of local female elders. Although they were acknowledged as playing a critical role in *hima* TEK, cultural and traditional barriers made it difficult for me to organise interviews with them. Consequently, although I was able to cover some aspects of their contributions, interviewing them was challenging because of these restrictions and required me to train a female research assistant to conduct these interviews. However, owing to the conditions at that time, I decided to acknowledge these limitations and moved forward to carry out the research.

3.7 Ethical considerations

‘Ethics’ can be defined as moral rules that direct an individual’s behaviour (Blumberg et al., 2014). Since this research involves humans (the elders of the local community in AlUla), it was vital to determine guidelines in which the participants were protected from any potential risks. Therefore, this research was undertaken in compliance with the Australian Code for the Responsible Conduct of Research and the National Statement on Ethical Conduct in Human Research. Ethics approval was granted from the University of Technology Sydney on 17 May 2022 (see Appendix A). Since the research was conducted inside the Kingdom of Saudi Arabia, permission was granted by King Saud University to conduct this research in 2022 (see Appendix B). All sources of data used in this research were considered low risk.

According to D. Gray (2014), there are four ethical aspects to consider when conducting research: (1) preserving privacy, (2) informed consent, (3) avoiding deception, and (4) ensuring

trustworthiness. In terms of preserving the privacy of the participants, I took actions to ensure that their privacy was protected. I received informed consent from the participants prior to the interviews. The participants were informed that they had the right to withdraw their responses at any time or decline to answer any question. In addition, I did not ask for any personal information, and I de-identified all names and sensitive information from the transcribed interviews. I received their consent to publish parts of this research in the future. Regarding the privacy of the research data, I saved all the data on my secured computer and in the OneDrive cloud (using the University of Technology Sydney's OneDrive system) to protect the data.

As D. Gray (2014) highlighted, it is essential to make the participants aware of the main goal of the research, its main questions and objectives, the required time for conducting an interview, and the expected results and contribution of the research. Therefore, I prepared a Consent Form (see Appendix D) and a Participant Information Sheet with two copies (in English and in Arabic) containing all the essential information and provided them to the participants (see Appendix C). Since the participants are the elders of the community, I allocated the first 10 to 15 minutes of the interviews to explain the research in simple words and allow the participants to read the documents and ask any questions regarding the research. I informed them about the expected period needed for the interview, and I emphasised their anonymity. I explained to them that they could refuse to participate and withdraw the data they offered at any time, and I informed them that there would not be any consequences for withdrawing.

In terms of avoiding risks, D. Gray (2014) described different types of risks, such as psychological, physical and emotional. In my research approach, I aimed to minimise any actions that may have led to potential risk. First, I emphasised to the participants the time needed for the interview so that they could prepare themselves. Second, I mentioned the three aspects of the research that I

intended to ask them about because I wanted them to be aware of the research and hoped to remove any worries or burdens from their minds. Since the research focuses on *hima* TEK and the elders' experience with natural systems and cultural heritage, it was expected that conversations during the interview might be disrupted by the mention of moments and stories irrelevant to the research. In these cases, I tried kindly to redirect the conversation back to the research questions. Regarding the interview location, I aimed to meet the participants in a comfortable and safe place, such as a library or a university meeting room, to conduct the interview. Most participants suggested meeting at their oases or farms, given that these locations were more comfortable for them and included guest areas where we could conduct the interview. One participant suggested meeting at his house.

Regarding the site visits and observations, I tried to be very careful when conducting participatory walking visits with the elders by visiting places that are allowed and prepared to be visited, whether by the locals themselves or by official organisations in the region. When visiting a site alone, I was cautious, especially when walking through oases and cultural heritage sites, and avoided any place that might not be safe. Before the visits, I informed official guards or the local inhabitants that I wanted to visit the site for research purposes. I was very explicit in explaining that I would be writing notes, producing drawings or taking photographs at the site, so that they would be aware of my presence and advise me on what was permitted on the site.

According to D. Gray (2014), 'deception' refers to misleading information when presenting research. I informed my interviewees in advance that the interview would be recorded, unless they refused or withheld their consent. I provided them with the Participant Information Sheet that presented information about the research and the researcher (see Appendix C). In addition, I provided them with my Saudi and Australian contact addresses so that they could reach me whenever they wanted to verify something or ask about anything related to the research.

The last point is to ensure trustworthiness. Similar to validity and reliability in quantitative studies, trustworthiness is used in qualitative studies, meaning the actions employed in research to ensure that the results are trusted (Korstjens & Moser, 2018; Lincoln & Guba, 1985, p. 290). I used the four factors described by Lincoln and Guba (1985) to ensure the trustworthiness of the research: credibility, transferability, dependability and confirmability. Some of these are aligned with those highlighted by landscape architects Lenzholzer et al. (2013).

In terms of credibility, I used the triangulation method (Abdallah, 2013, p. 116) to collect the primary data from different types of sources, such as semi-structured interviews, design development, workshops with experts and site observations, and compared them. I discussed my research approach and the results with my supervisors, who provided me with valuable feedback that helped improve the research approach and consolidate the arguments. In terms of transferability, I provided detailed descriptions of the study area's setting, including its cultural, environmental and social contexts. Further, I described and justified the selection criteria for the participants and experts, including the site selection method. Regarding dependability, I devised a detailed, transparent research process with visual diagrams so that future researchers can replicate the approach within a different context. Specifically, I explained the different stages of collecting and analysing the data. In terms of confirmability, I documented different types of data, such as transcribed recordings and photographs from site visits, and then presented some of them as supporting evidence when making an argument. I conducted a review meeting with the three elders to check the results and ensure that the identified themes and categories accurately represented their TEK. Further, I invited an external supervisor, who is a Saudi LA professor and a Saudi ICOMOS member, to join the supervisory panel. I obtained valuable feedback and guidance that helped me strengthen the research outcomes. I conducted workshops with national experts to critique the research approach, its design aspect and the potential contributions to the field.

3.8 Conclusion

In this chapter, I presented the research approach used to achieve the research aims and objectives and answer the research questions. I discussed the research design, the researcher's positionality, the data collection procedure (including site design development), the data analysis approach and the ethical aspects of the research, including trustworthiness. The data collection approaches and stages, and data analysis phases were explained in depth to direct future LA and other design field researchers interested in local TEK or those aiming to integrate TEK into urban development projects and regional master plans.

The following chapters present the context of AlUla and the results associated with the research questions.

Chapter 4: The Evolution of Local TEK in AlUla¹⁹

This chapter is centred on the context of AlUla. It presents the evolution of the local TEK based not only on the literature, but also on an understanding gained from the available secondary sources, such as Google Maps, official documents and websites, official posts and media available on the social media platforms of the official institutions. In this chapter, I endeavour to find answers to my research questions using the secondary data available online.

Before explaining the evolution of the local TEK within AlUla County, this chapter provides an overview of AlUla as a research site, its natural environment and its long history up to its recent development. The chapter then presents the TEK of the locals and the ancient peoples who lived within this environmental context. Finally, an initial design investigation exercise is described. I attempt to translate the available secondary data about the local TEK and integrate it into urban development projects to solve environmental and cultural heritage conservation issues.²⁰

4.1 Overview

AlUla is one of the counties of the Madinah region in Saudi Arabia, covering 22,561 km² and located northwest of the Kingdom, 300 km from the holy city of Madinah (see Figure 4-1). AlUla, as a county, is inhabited by 64,300 people (AFALULA, 2019), spread across 16 central towns (GASTAT, 2004), such as the cities of AlUla and Hegra,²¹ and approximately 300 villages. The population is expected to increase to 130,000 by 2035 (AFALULA, 2021a). Hegra, which is located 30 km north of AlUla, includes the Hegra Archaeological Site, the first WHS in Saudi Arabia, which features approximately

¹⁹ Parts of this chapter are accepted for publication in my second paper, see Appendix L.

²⁰ Based on the available secondary data, I conducted this exercise to examine and understand the local TEK. This step was essential because the COVID-19 pandemic, which imposed significant lockdowns and restricted social interaction, meant that I had limited access to primary sources.

²¹ Some references refer to Hegra as *al-Hijr* or *Madā'in Šālih*.

111 Nabataean tombs carved inside sandstone mountains and an ancient water-harvesting system (UNESCO, 2008). Besides the WHS, there are multiple key heritage sites within the county, such as Dadan City (UNESCO, 2008, pp. 10-11), Jabal Ikamah, AlUla Old Town (RCU, 2021b) and the Harrat Uwayrid Biosphere Reserve (UNESCO, 2022c).

The Hegra Valley, including its numerous palm oases within the county, is located on the historic Incense Route, a notable trade route connecting the south of the Arabian Peninsula to the northern world (Alrawaibah, 2017, p. 220; Qureshi et al., 2024; Rohmer et al., 2022). The valley is the primary natural feature linking the city to the surrounding villages within this mountainous desert environment. Owing to its rich underground water, fertile soil, oases and unique mountains, AlUla was home to many Arabian kingdoms and tribes, who enriched the region with their traditional ecological practices and cultures. Beyond its historical significance, AlUla plays a crucial role in agricultural production in the Kingdom today, containing two million date palms that yield 90,000 tonnes of dates annually (Saudi Press Agency, 2021c). Additionally, AlUla is a major tourist attraction in the Kingdom and is pivotal to achieving the goals of Saudi Vision 2030, given that 80% of it will be categorised as natural reserve areas by 2035 (AFALULA, 2021a; Saudi Vision 2030, 2016a).

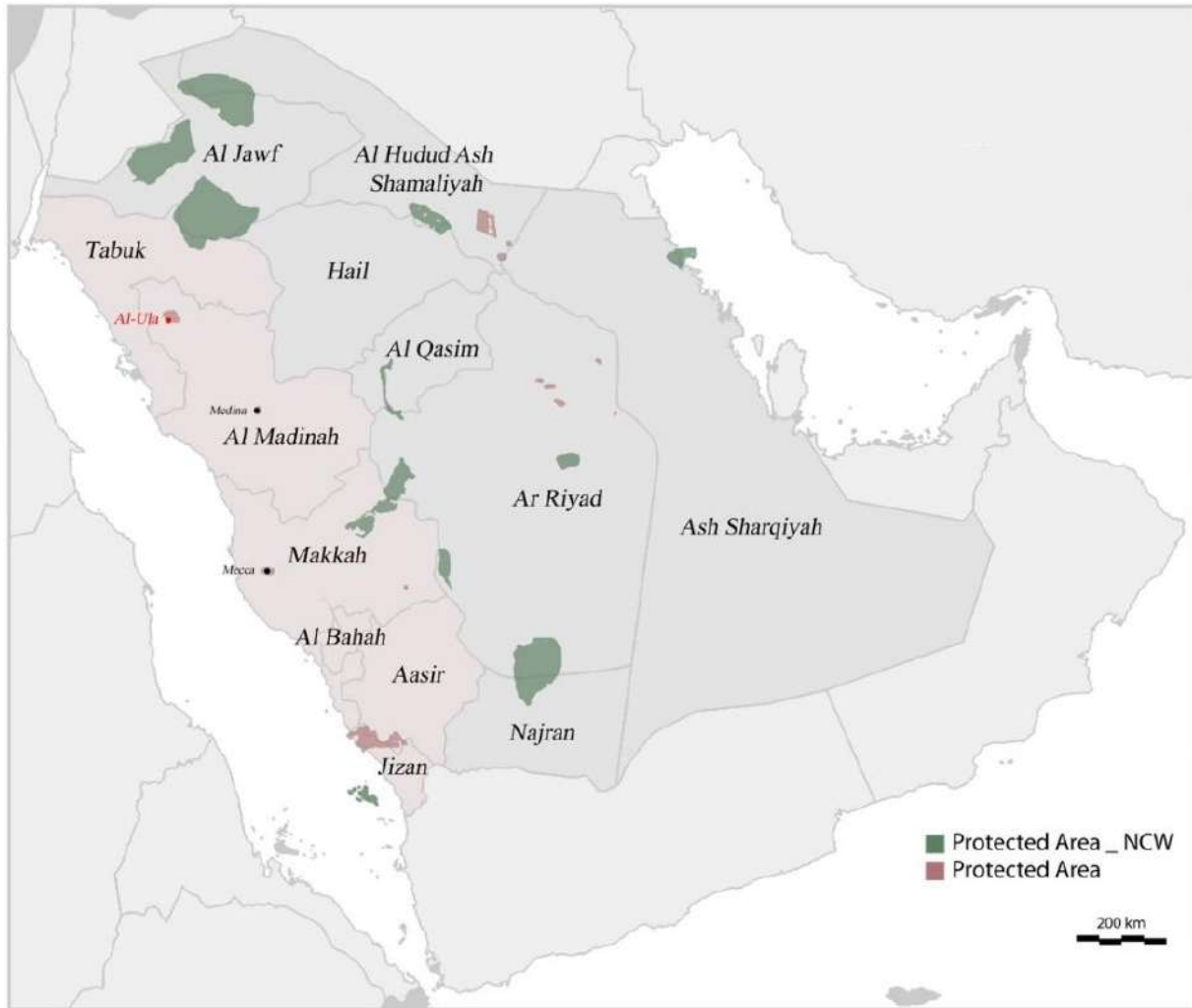


Figure 4-1: Saudi Administrative Map showing the 13 regions of the Kingdom and AlUla County. The map also shows the natural reserve areas managed by the National Center for Wildlife (NCW) and other institutions. *Source:* Map created by the researcher based on NCW website.

4.2 The natural environment of the site

A summary of the Arabian Peninsula's environment is essential to understanding the context. Throughout the Quaternary Period, the Arabian Peninsula experienced significant environmental changes, shaping its diverse natural features. The west side had igneous activity resulting in mountains, and sandstone layers to the east, which were uplifted. River valleys formed. Lakes and basins were established during the humid period of the Holocene, from 8000 to 4000 BCE, which

also saw early humans occupying the Peninsula (Hoyland, 2002; Parker, 2009; Preusser, 2009). According to Groucutt (2020), volcanism and earthquakes positively affected the western part of the Arabian Peninsula by providing fertile volcanic soils and water availability. These conditions, such as the porosity of the sandstone geology soils leading to vast underground water tables, attracted early human groups migrating from Africa to settle in the northwest of the region. This wet period ended with a shift to a dry climate, affecting the central and northern parts of the Peninsula by drying up ancient lakes and rivers (Groucutt, 2020), creating deserts such as the Rub' al-Khali (Empty Quarter), Al-Dahna and Al-Nafud (Hoyland, 2002; Parker, 2009).

The western area was less affected owing to its natural characteristics (Groucutt, 2020). This region experienced increased rainfall and humidity, attributed to the close proximity of the African monsoon system (Groucutt, 2020). These climatic alterations led to diverse environmental features and complex cultures. King and Bailey (2006) noted that topographic complexity and tectonic changes caused by volcanism formed volcanic landscapes, creating suitable environments for hominins on the western side of Arabia. These conditions influenced ancient Arabian tribes to develop various water conservation systems. According to T. J. Wilkinson (2012), during the Late Holocene period, major agricultural and irrigation developments in Near Eastern civilisations adapted to the arid conditions (see Figure 4-2). The harsh environment prompted the creation of sustainable living practices. Local communities developed methods to access underground water, effectively transforming it into a usable underground river.



Figure 4-2: The green line in the middle of the valley is the traditional oases, recently rebranded as *Cultural Oases*, along with the orchards of AlUla. The soils of the oases allow underground water flows to feed the aquifer. *Source*: the researcher.

AlUla is a part of this region of the Peninsula. Much evidence showing the interactions and influences between landscape and people has been preserved until now. Within the unique sandstone mountains, some of which were covered by sand for long periods, and includes carved caves and tombs, water-harvesting techniques and even ancient texts that tell the story of ancient tribes. AlUla and its natural and cultural heritage elements are surrounded by igneous and metamorphic mountains (Arabian Shield) from the west and sandstone mountains from the east. The characteristics of this region encouraged many ancient civilisations and kingdoms, such as the Nabataean, Dadan and Lihyan, to settle and thrive.

In terms of the weather, AlUla's summer is long, dry and clear, and the average temperature is approximately 34 °C. Winter is short and cooler, and the average temperature is lower than 23 °C. The average annual rainfall in AlUla is 42 mm (F. Alahmadi, 2017), and the wind direction is mainly from the north (WeatherSpark, n.d.). In terms of vegetation, the AlUla region has numerous desert plant species with different characteristics. The RCU and a French agency studied AlUla's vegetation

and found 58 native plants, representing 20% of the region's plants (AFALULA, 2020). A year later, 249 native plants were identified.²² These plants were classified into seven types according to their landscaping potentials, such as shading plants, ground cover plants and climbing plants (AFALULA, 2020). This study was unique owing to the observation focus, which targeted cultivable plants with visual and aesthetic features rather than rare plants (AFALULA, 2020). However, it appears that the local TEK was not part of the framework of this two-year study.

The county's vegetation and ecosystems attract various bird species. In addition to the native vegetation, the rock formations and mountains in AlUla provide appropriate nesting habitats for many birds (Boland et al., 2020b, p. 133). The authors of *The Birds of Saudi Arabia* identified and documented four groups of birds that interact with the local ecosystems of AlUla and their surroundings: resident species, spring-summer breeding migrants, winter or erratic visitors, and passage migrants (Boland et al., 2020a). Among 401 native and migratory species (260 around AlUla), 11 introduced exotic species (2 around AlUla), and 87 vagrant species (13 around AlUla), approximately 275 birds interact with AlUla's ecosystems. This includes 60 breeding residents, 5 breeding migrants, 77 winter or erratic visitors, and 118 passage migrants (Boland et al., 2020a; see Figure 4-3). This information highlights the significant role that AlUla's ecosystems play. However, these natural qualities are threatened by desertification, as presented in Section 2.3 (Desertification). To understand more about how people found a way to live in this environment and mitigate desertification, an overview of human history is essential to understand the situation.

²² This information is taken from the RCU's Open Data Library.

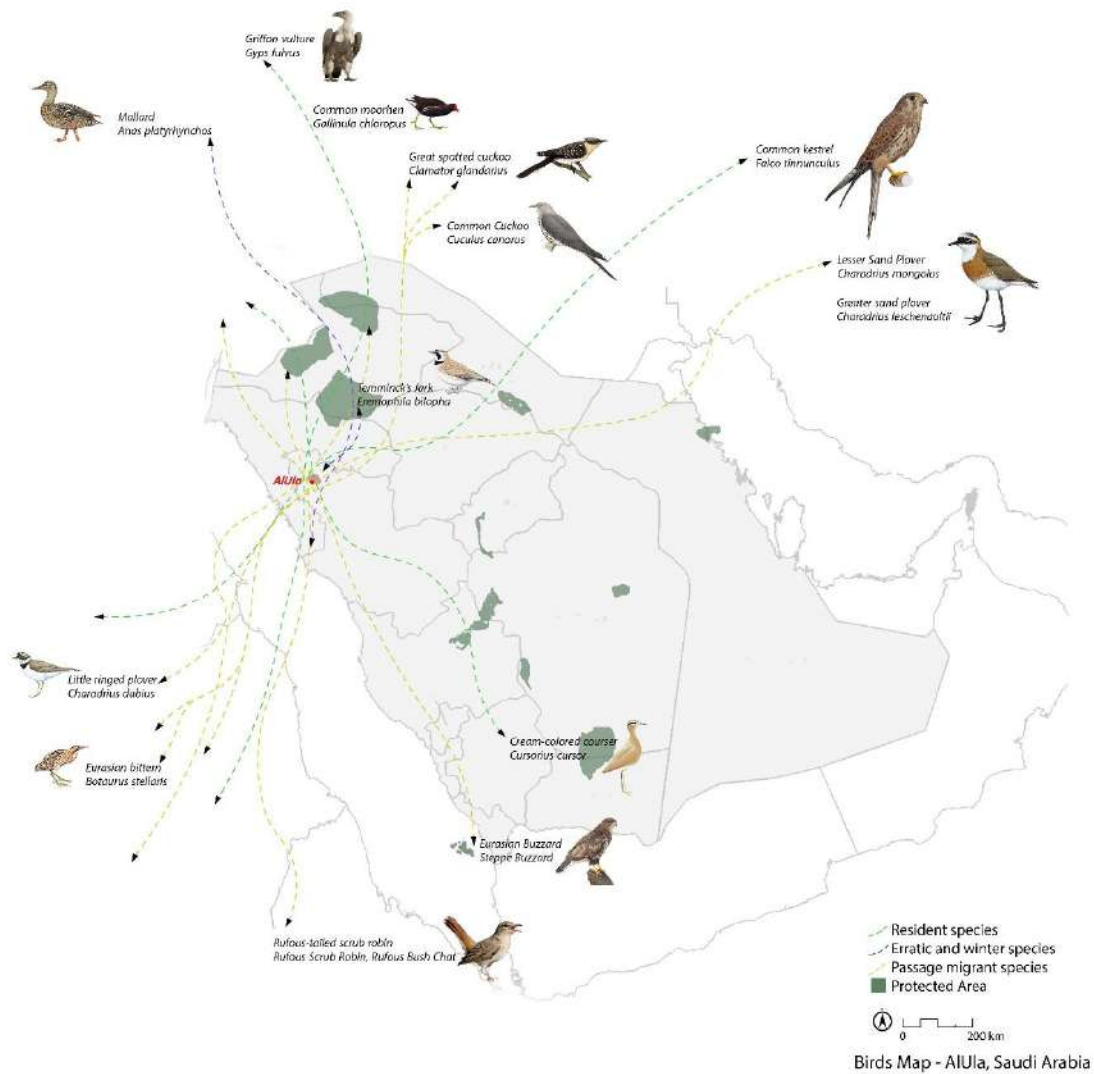


Figure 4-3: Map showing some of the birds interacting with AIUla County's ecosystems and other protected areas. *Source:* Boland et al. (2020a), drawing by the researcher.

4.3 History and timeline

AIUla's history is complex, and there are still many exploration projects being undertaken, making it challenging to fully understand the diverse cultures and interactions between its ancient kingdoms and the local environment (Rohmer et al., 2022). However, in this section, I highlight the timeline of the key events that are relevant to the local TEK. According to the RCU (n.d.-d) and the World Tourism Organization (2020), AIUla has been a hub of human activity and civilisations for over 200,000 years

(see Figure 4-4). The numerous stone structures dating back to the Bronze Age (approximately 5200–1200 BCE) indicate a high level of cooperation among prehistoric communities in the area (RCU, n.d.-d; Rohmer et al., 2022). In the first millennium BCE, AlUla experienced the establishment of the Dadan and Lihyan Kingdoms (Pavan, 2023; RCU, n.d.-a). In the early fifth century BCE, the Dadan Kingdom was established in the valley by the Dadan tribe, renaming the area the Dadan Kingdom, which included Dadan City and its oases, now part of the modern city of AlUla. In the late fifth century BCE, the Lihyan Kingdom was established, expanding to cover most of the northwest Arabian Peninsula and controlling the Incense Route (Yousif, 2020). Experts suggest that the Lihyan may have been an extension of the Dadan Kingdom, although there are significant differences between the discovered historical features of the Dadan and Lihyan tribes (Pavan, 2023; Yousif, 2020). Some researchers, such as Nasif (1981, p. 119), suggest that the Lihyan tribes were the ones who established qanat systems in the region to manage water and irrigate oases.

By the late second century BCE, the Lihyan Kingdom was weakened, allowing the Nabataean tribes to migrate from Petra to Hegra and colonise the area in the first century BCE, influenced by the increasing power of the Roman Empire (Alhammori, 2002). Between the first century BCE and the first century CE, Hegra thrived as the Nabataean Kingdom's southern capital city, known for its developed agriculture, architecture and hydraulic engineering (RCU, n.d.-a). The Nabataean settlement within the Hegra Valley contains more than 130 Nabataean water wells and a sophisticated water management system that harvests rainwater and runoff, redirecting the flow efficiently. It contains *hima/haram* areas (sanctuary areas; Raymond, 2008), where the water-harvesting system is implemented. The Nabataeans were influenced by many cultures, as is evident in the architectural features of tomb facades that show similarities to Egyptian, Phoenician, Assyrian and Hellenistic styles (UNESCO, 2008).

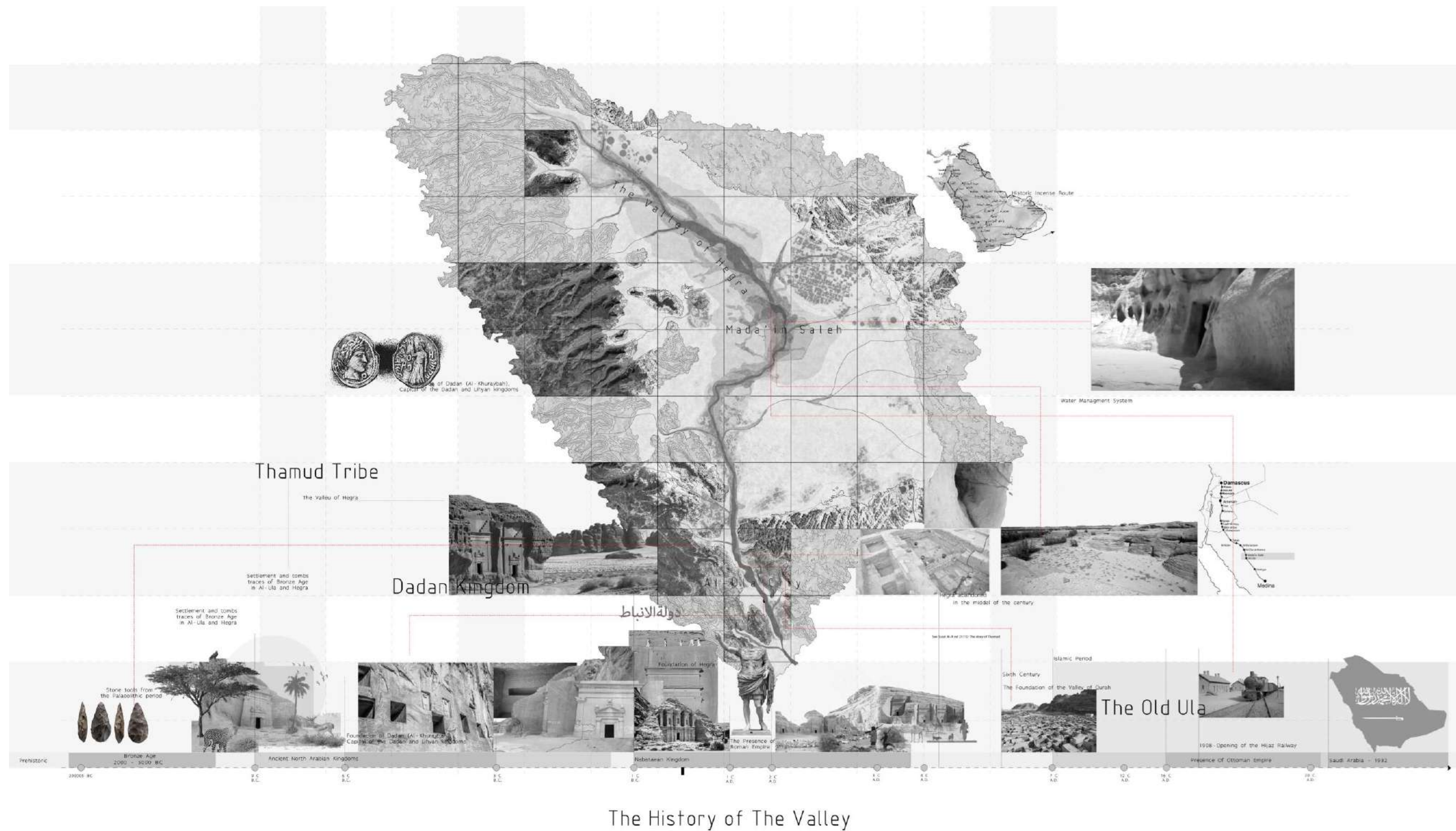


Figure 4-4: This collage shows the timeline of the history of AlUla County. *Source:* The researcher.

One of the key events occurred during the seventh century CE when the Prophet Muhammad (PBUH) traversed the region on his travels to Tabuk and established new guidelines for interacting with the site (Hegra Valley). It is known from the Islamic literature that the Thamud tribe lived in the Hegra Valley, and they were described in the Qur'an as people who carved houses out of mountains (Anwar, 2020). The Quran also mentions that the Prophet Saleh (PBUH) was sent to the Thamud people with a divine message, which they ignored, leading to their punishment, caused by their arrogance. Around 630 CE, the Prophet Muhammad (PBUH) declared that drinking or using the area's water is prohibited and advised people to pass through the area quickly. Owing to this new guideline, the locals and many Islamic scholars consider human interaction with the area (specifically, the Nabataean tombs and wells) as a sensitive matter (see Kingdom of Saudi Arabia (2007a, p. 68). However, this prohibition is for religious purposes.²³ The earliest mention of the Thamud is found in the Assyrian records of Sargon II (722–705 BCE), indicating conflicts between the Thamud tribes and the Assyrian nation (Achrati, 2008). From the seventh century to the twelfth century, AlUla town again became one of the main stations on the incense trade routes (RCU, n.d.-a). From the thirteenth to the twentieth centuries, the Ottoman Empire governed the area. One of the key events was the Hejaz Railway project that connected Damascus to Medina to facilitate the pilgrimages to the two holy cities.

In 1932, the Kingdom of Saudi Arabia was founded, uniting the Arabian tribes under King Abdulaziz. Approximately 22 years later, the management of *hima* territories was officially declared to be managed by the Ministry of Agriculture rather than the local communities (Llewellyn & Altasat, 2017, p. 15). In 2008, Hegra, covering 1621 hectares of AlUla, was designated as Saudi Arabia's first WHS

²³ I considered whether to include this aspect as part of the local TEK. However, based on the *hima* literature, this prohibition is not related to the local TEK because it is not based on ecological reasons but religious ones. Even in the *hima* studies that examined *hima* TEK from an Islamic perspective, they did not include this aspect as part of *hima* TEK.

owing to its outstanding universal value as a cultural heritage site that showcases the long history of interaction between ancient civilisations and the arid mountain desert environment (UNESCO, 2008).

In 2016, the Saudi government announced Saudi Vision 2030, a strategic plan aimed at diversifying the nation's economic income, improving the quality of life and achieving development goals. A key project within this vision is the AlUla development project, which has three primary objectives: (1) to transform AlUla into a living museum and an international destination for culture, eco-tourism and heritage, with a focus on the local community and sustainability; (2) to place AlUla's community at the heart of its transformation; and (3) to ensure sustainable practices for preservation, conservation, water management, and the reintroduction of fauna and flora (Saudi Vision 2030, 2016a).

4.4 Development and Vision 2030

The Saudi Vision 2030 is a strategic 15-year plan that includes the AlUla development project, a significant USD \$15 billion development project to be carried out by the RCU in partnership with the France-based Agency for AlUla Development (AFALULA, 2019). The RCU announced many initiatives and four master plans to sustainably build the county's infrastructure, advance the economy, improve the quality of life, and preserve the natural landscapes and archaeological sites of the county (RCU, n.d.-f). The four master plans are (1) MP1: The Journey Through Time Masterplan (JTTM), (2) MP2: The Path to Prosperity Masterplan, (3) MP3: The Sharaan Nature Reserve and (4) The Khaybar Heritage Village (RCU, n.d.-f). All of these master plans contribute to the realisation of Vision 2030 since they directly support the three pillars of the national Vision: (1) An Ambitious Nation, (2) A Thriving Economy and (3) A Vibrant Society (RCU, n.d.-e). According to the RCU, these master plans

and initiatives aim to designate 80% of the county's land as natural reserves, which will undergo vegetation restoration and animal species reintroduction (RCU, 2021b).



According to the first master plan (JTTM/OMP), the RCU aims to develop five main districts: (1) AlUla Old Town, (2) Dadan District, (3) Jabal Ikmaah District, (4) Nabataean Horizon District and (5) Hegra

Historical City, featuring its monumental rock-carved tombs that form part of the UNESCO WHS (see Figures 4-6 and 4-7). According to one of the project representatives and urban designers, Khaled Azzam, owing to the degraded and lifeless agricultural lands that were embedded within AlUla and served as a connection and an extension between AlUla and its environment, the project team aims to explore ways to regenerate the Cultural Oases through cultural and tourism activities, including agricultural activities (RCU, n.d.-c). The rendered perspectives of the five proposed districts show extensive environmental restoration, luxury hotels and resorts, open-air museums, and cultural and eco-tourism sites, including many new structures (see Figure 4-7).

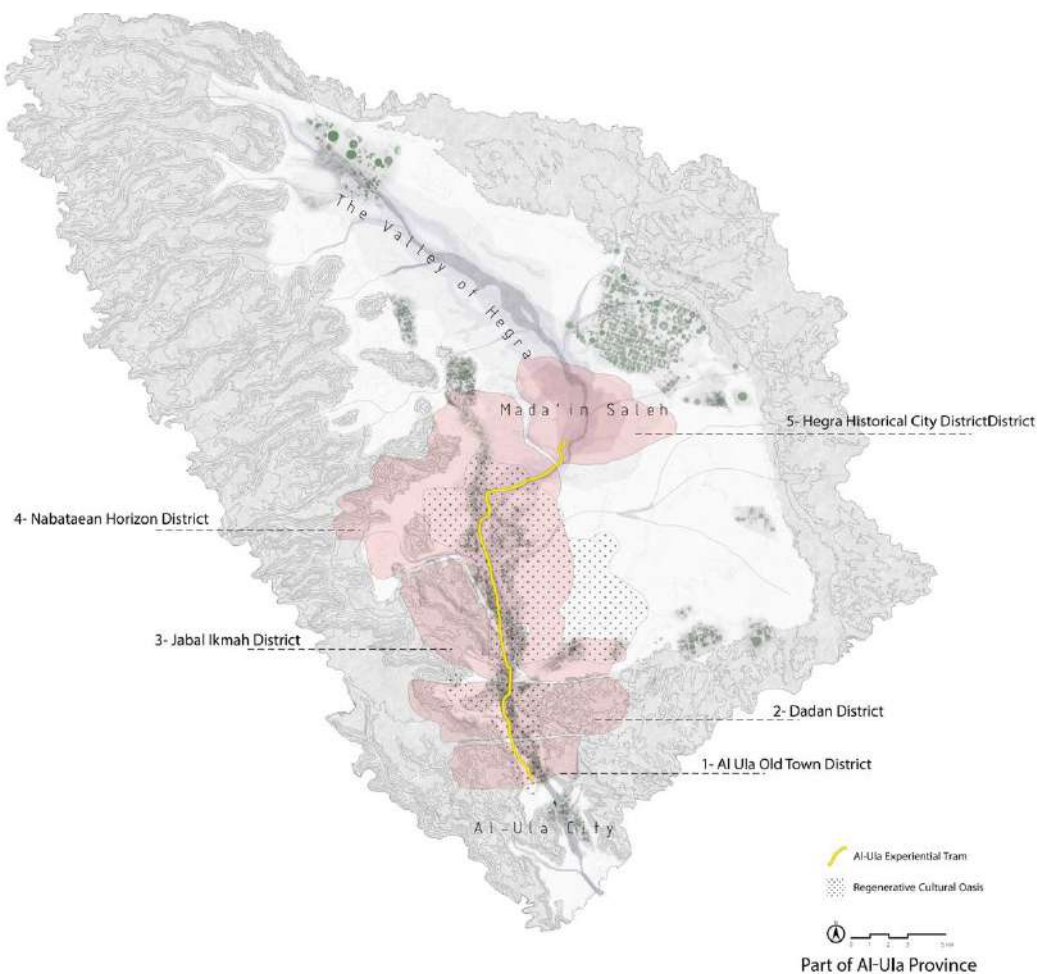


Figure 4-6: Recent development map (the Journey Through Time Masterplan for AlUla). *Source:* The researcher.

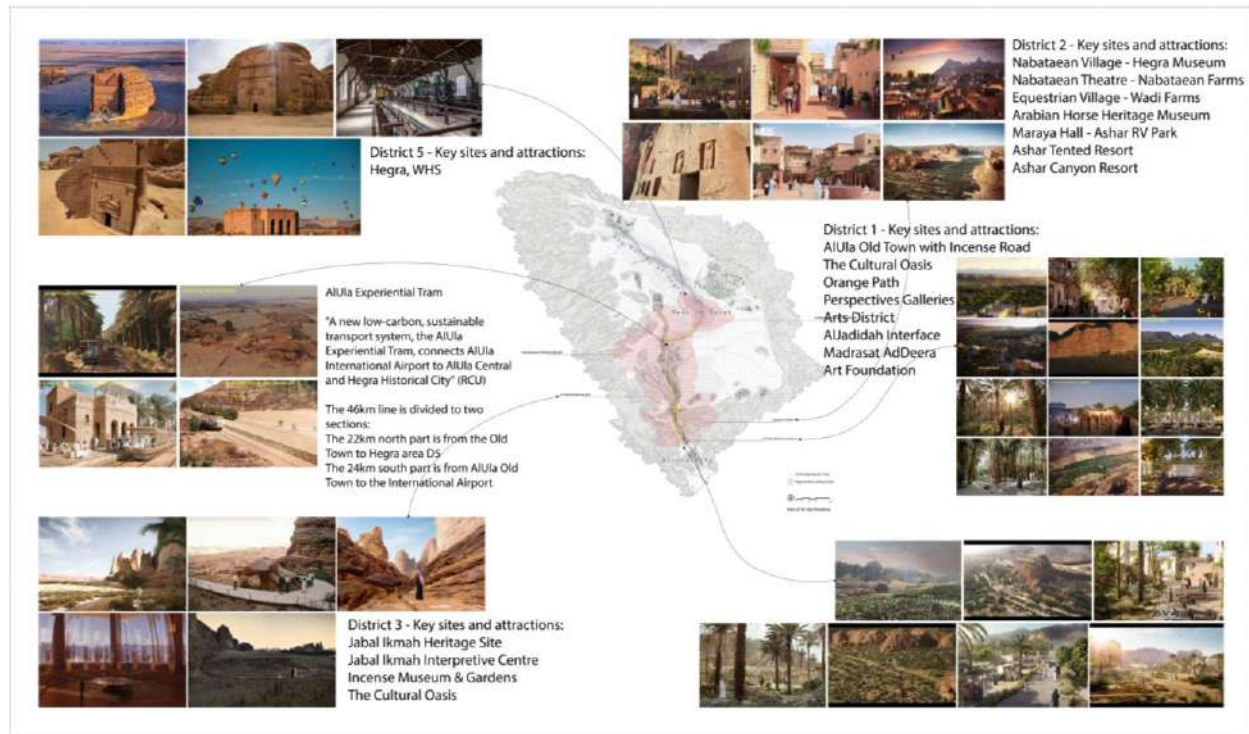


Figure 4-7: These photos are the rendered perspectives of the districts, tram project and Cultural Oases, which shed light on the future of the region. *Source:* Diagram by the researcher and photos by RCU.

However, such an approach may involve negative impacts. Many studies have documented the effects of tourism on the traditions and values of local communities (A. Alahmadi, 2021; Imon, 2017). For example, approaches associated with tourism may lead to increasing water consumption as a result of the proposed new construction, infrastructure and the growing population in the region, which may exacerbate the pressure on natural resources, such as underground water, already threatened by desertification and overextraction. According to Toumi et al. (2015), underground water is the primary source of water for both human and agricultural use in AlUla. Local reports have indicated that underground water levels decrease by 3 m annually, which highlights a critical environmental concern in the region (Yu, 2019). The visual renderings indicate that much of the degraded land within the Cultural Oases will be regenerated, as shown in Figure 4-7. This regeneration will likely increase water consumption. Based on the RCU open data and official

reports, AlUla's agricultural production in 2022 produced 201,859 tonnes from 35 types of vegetables, fruits, fodder and cereals, which collectively consumed 385 million m³ of regional groundwater (RCU, 2023a).²⁴ Date palm production alone amounted to 136,890 tonnes, an increase from the previous year's 90,000 tonnes (RCU, 2023a; Saudi Press Agency, 2021c), which indicates a greater water consumption driven by expanded and restored agricultural areas.

In terms of the inhabitants, the existing community of AlUla is central to this transformation (Saudi Vision 2030, 2016a). The RCU (n.d.-c) announced 12 sustainable development principles to guide its urban transformation, and one of these is the need to empower AlUla's local community (see Table 4-1). This principle can be seen through a number of initiatives, such as the creation of 38,000 jobs and the creation of scholarships for AlUla's youth to study overseas, preparing them to lead and contribute to the regional development (RCU, n.d.-c).

Table 4-1: These 12 principles are the framework governing the development of AlUla.

No.	Sustainable principles	No.	Sustainable principles
1	Safeguard the natural and cultural landscape	7	Revitalise, restore and regenerate the built environment
2	Celebrate heritage, culture, and arts as a global destination	8	Enable the local community
3	Sustain ecosystems and wildlife	9	Incorporate imaginative infrastructure
4	Maintain balanced agriculture	10	Integrate invisible security
5	Develop light touch tourism	11	Design safe and healthy environments within the circular economy
6	Ensure subtle connectivity and accessibility	12	Embed resilience

Source: RCU (n.d.-c).

²⁴ This information is taken from the RCU's Open Data Library.

However, the master plan and promotional documents for the project seem to largely overlook the longstanding local TEK developed by local communities, as can be observed in the official case studies of the RCU (2023b). The current scheme favours globalised approaches to sustainable urbanism and heritage conservation developed by international design experts (RCU, 2021b), rather than deeply engaging with local ecological practices tailored to the region's specific desert ecosystem (see Figure 4-10). Although some researchers and archaeologists have stated that these traditional ecological practices and techniques demonstrate continuity in socio-ecological adaptations from the Nabataean period until the present day (Alhammori, 2002; Nehmé, 2013, p. 88; Nehmé et al., 2006, p. 69), they are absent from the master plans. Connecting this issue to that presented in Section 2.5 (Cultural heritage preservation in Saudi Arabia), a question may be asked: would the local TEK be acknowledged and recognised as one of the Kingdom's intangible cultural heritage in the coming future, since there is an increasing interest and acknowledgement of cultural heritage elements and practices?²⁵ Although it is still possible that the system may be acknowledged nationally and internationally, it appears that local TEK is not going to be integrated into the urban development of AlUla unless the official organisations acknowledge it. Some of the RCU experts clearly stated that the lifestyle of the local community and their TEK are 'not viable' anymore, claiming that this way of life has adverse impacts, such as desertification and overgrazing (RCU, 2021a - 49:07). Based on my understanding of the *hima* literature and other case studies, such statements need to be carefully studied. After listening to this workshop of RCU, I asked myself many questions: does the lifestyle of the local people lead to desertification and how? Who are the local community in this context? Is overgrazing a result of this lifestyle, and how? Can we overlook the

²⁵ I was asked this key question by one of the assessors in my PhD Stage 3 assessment.

traditional lifestyle of the local community simply because of these factors? Many questions need to be answered before deciding to overlook the local TEK.

In terms of the demographic information of the local community, there are three main tribes in the region: Anazah, Juhainah and Baliyy (Nasif, 1981, pp. 109–112, 1995, p. 56), and more than 35 clans living around the Valley of Hegra, which includes several villages (see Figures 4-8 and 4-9). A comparison between the official statistics reports from 2004, 2010, and 2017 reveals an unstable increase and change in population within some villages (GASTAT, 2004, 2010, 2017).

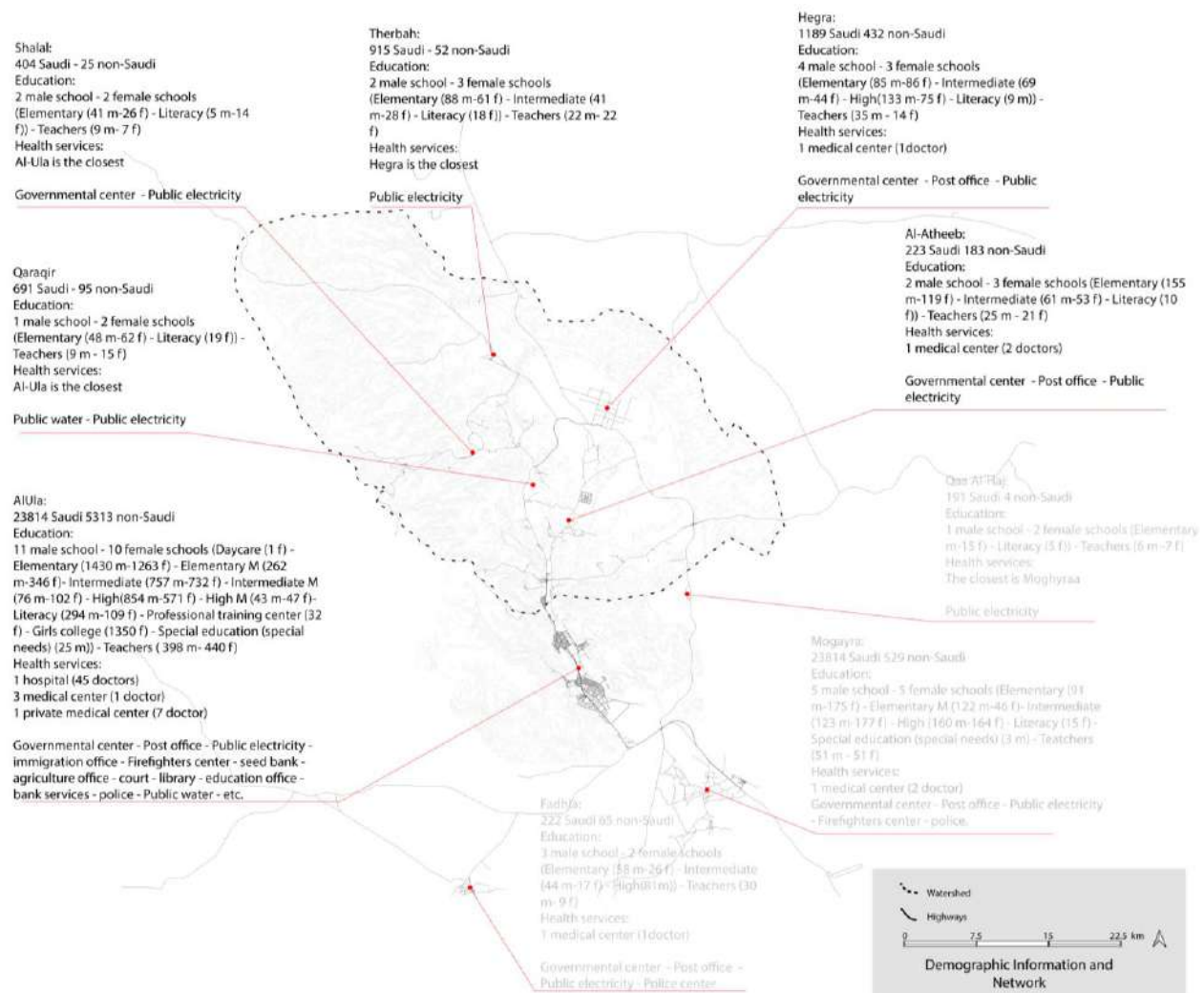


Figure 4-8: Demographic information and network map. Source: The researcher.

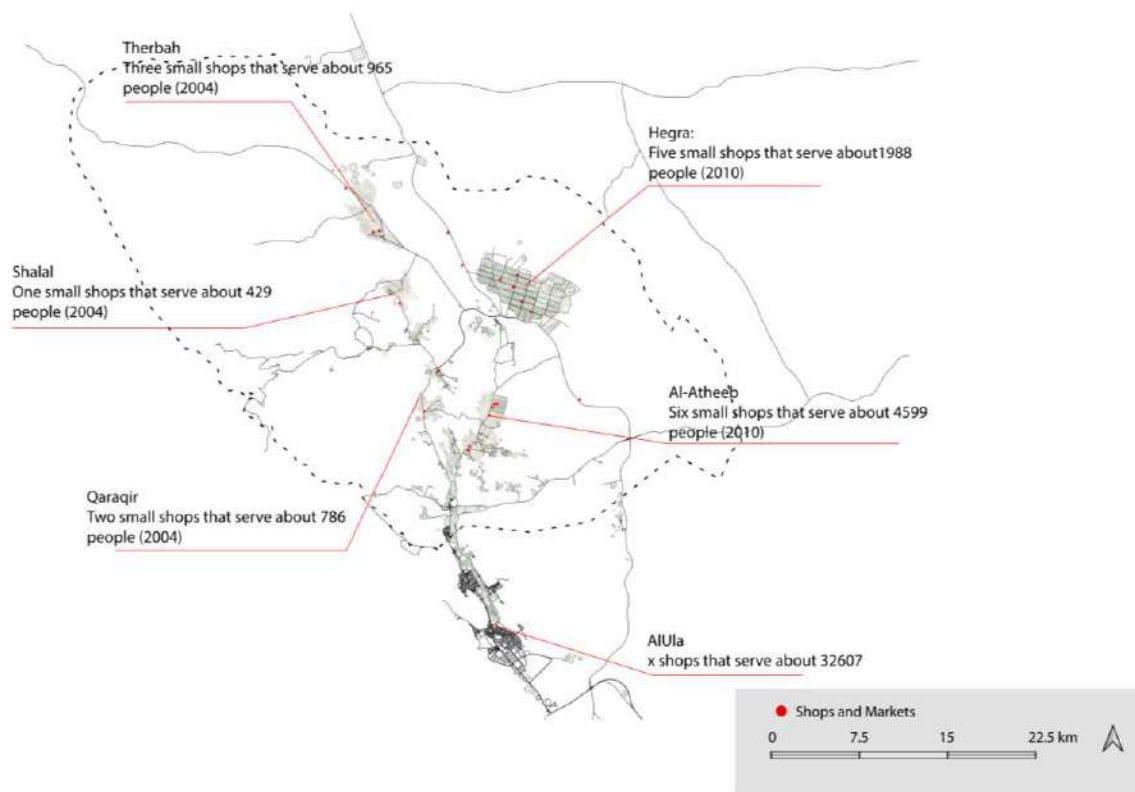


Figure 4-9: Trade map showing the number of shops in each town. The data is derived from a 2021 map survey conducted by the researcher. *Source:* The researcher.

4.5 The persistence of ancient TEK in the local traditions (*hima*, agriculture and water management)

This section presents the information on local TEK found in the secondary data sources. It briefly explains *hima* TEK, the traditional agricultural practices and the traditional water management practices of the local community and the previous peoples who inhabited the county.

The Nabataean era spanned from 100 BCE to 100 CE, and many scholars have drawn attention to the connection between the Nabataean Kingdom and *hima* in terms of ecological practices and territory. Alpass (2013) highlighted the consistent association among Nabataean idols, tombs and sacred inviolable areas (p. 139). He underscored the frequent mentions of the concept of '*mḥrmt*' within Nabataean contexts, interpreting it as denoting a sanctuary or reserved place, which aligns

with the notion of *haram*, one of the types of *hima*. Additionally, Alhammori (2002) acknowledged the significance of land ownership in Nabataean society, but lamented the lack of detailed information on its workings (pp. 77–78). He speculated that Nabataean land ownership practices may resemble those of other ancient Arab tribes, such as the people of Yemen during the same period, who safeguarded two types of lands (as *hima* territories): those owned by the kings and tribal leaders, and those owned by the temples. Both Alpass (2013) and Alhammori (2002) associated sacred and worship sites with *hima* areas, including natural resources. In the case of AlUla, Jebel Ithlib in Hegra stands out as a Nabataean natural sacred area that includes a *haram/hima* zone, as noted by Wenning (1996, p. 206) and cited by Alpass (2013, p. 139). The site features numerous idols, water basins for ablution and water canals for harvesting rainwater from the mountains, all carved into the rock (see Figure 4-10; Alhammori, 2002; Nehmé, 2010; Nehmé et al., 2006, 2009). Alhammori (2002) described Nabataean *hima* as a nature reserve that could be cultivated and then utilised to support temples, termed temple *hima* (p. 78). Further, he characterised the early Nabataeans, prior to settling in Hegra, as nomads who safeguarded certain sites for pastures (Alhammori, 2002, p. 77).

Researchers have stated that the Nabataeans experienced two distinct phases: initially as nomadic herders and later as settled agriculturalists (Alhammori, 2002; Alrawaibah, 2017, p. 142). According to Alhammori (2002), the early Nabataeans focused on grazing and agriculture while avoiding permanent structures. Over time, they developed foothill areas and transformed deserts into productive lands using native plants. To manage scarce water resources, the Nabataeans employed techniques such as building terraces to slow water flow, stabilising soil with non-edible or toxic

trees,²⁶ and constructing small stone hills, known as *Talelat Al-Enab*, to manage erosion, redirect water and gather dew drops (Alhammori, 2002).

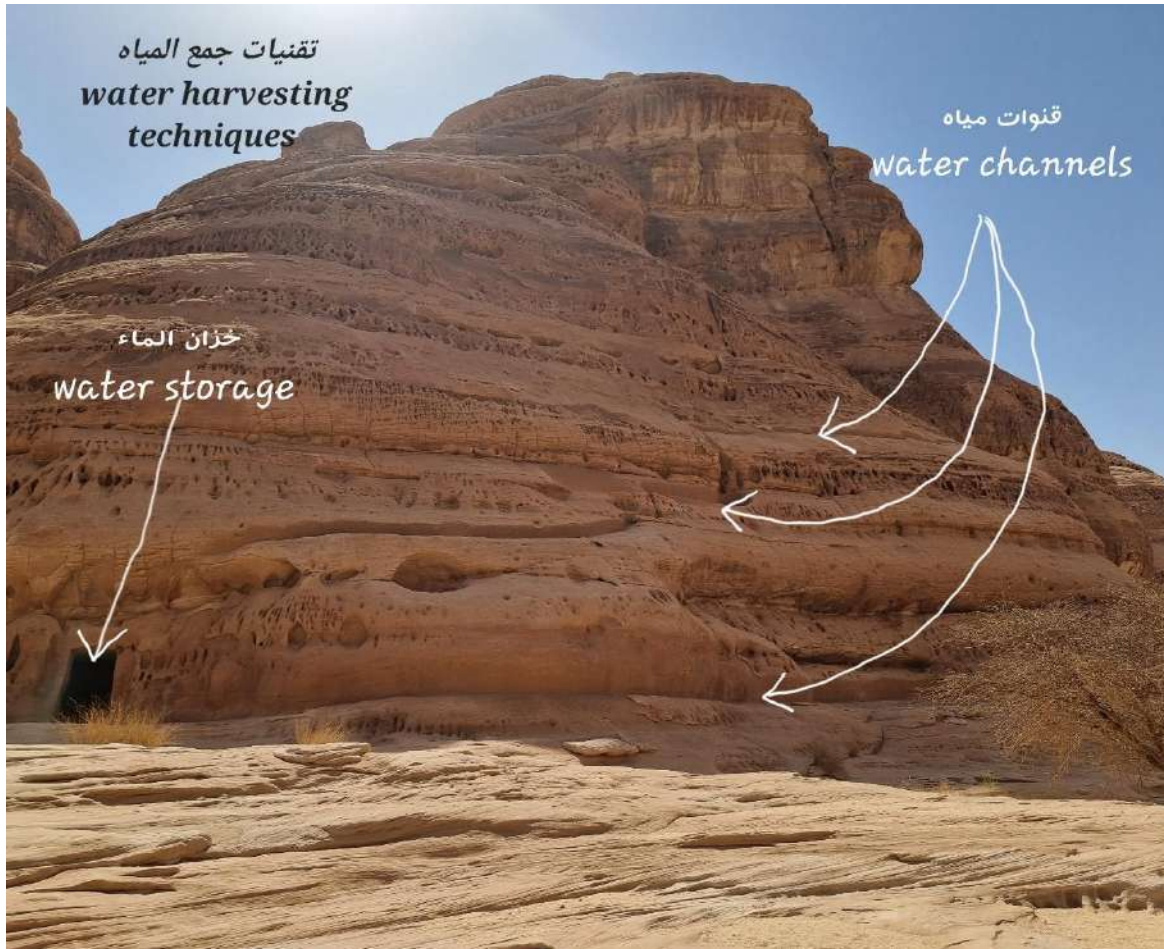


Figure 4-10: These techniques are located within the Nabataean sanctuary in Ithlib mountain.

Source: The researcher.

Although the abovementioned practices are ancient, research conducted by Nehmé et al. (2006, p. 69) and Nehmé, Villeneuve et al. (2011, pp. 261–262) provide evidence that the site and its water-harvesting system and techniques, such as the Nabataean water wells, were utilised more recently

²⁶ They might have used this type of plant because most grazing animals tend to avoid it.

(between 1960 and 1970).²⁷ Studies carried out by Al-Shanqiti (2013, 2019) generally highlighted traditional ecological activities, such as traditional pasture land management, agriculture and water management practised by current local communities within the region of Medinah.

Although it is common knowledge that most of the Arabian tribes have their own *hima* system and territory, I could not find any study that explored the *hima* system of the local communities living within AlUla County. However, there are a few studies, such as those conducted by Nasif (1981, 1995), which studied and explored the contemporary aspects of the local TEK of a number of local communities within the county, such as those living in the AlUla Old Town, the Shalal and the Therbah villages. However, most of the local TEK presented by Nasif is associated with spring water management and qanat systems, along with some information about traditional agricultural practices. Nasif (1981) observed that the qanat systems and the existence of water springs encouraged the Bedouin communities to settle down in these villages and generate agricultural areas, perhaps instead of consistently travelling for food and pasture (p. 187). He then presented and highlighted some aspects of local TEK and related activities, such as the role of traditional maintenance and cleaning, spring restoration, water distribution and customary water law (see Nasif (1981) for more details).

Additionally, Nasif (1995) examined the social and cultural aspects of the local people (p. 113). He noted that the life of the locals, until recently, was focused on agriculture and underground water extraction, when the whole country thrived and became united. After presenting the names and locations of the oases and more than 40 water springs in AlUla, he explained the process of palm date production and other yields, presenting agricultural food types and the different uses of these

²⁷ Although these studies provided some information about the local TEK, their main focus was on the Nabataean period

products, and describing how they can be stored and harvested, and then used for trading with the northern Bedouin communities. Additionally, Nasif (1995) discussed the summer-winter journey of the local people of AlUla Old Town, stating that they used to travel from their town to the oases in summer, while the men went back to the town every morning to maintain their houses. However, seasonal travelling from one place to another was one of the traditional practices of Arabian local communities. One study conducted by Nasif (1981) presented local TEK regarding the qanat system of a number of local communities within the county, such as Hegra, Shalal, Tharbah, Yanbu, Medina and Khaibar, and another by Nasif (1995) focused on the community of AlUla Old Town. It appears that *hima* TEK is more practised by the local communities outside of AlUla Old Town. The northern Bedouin communities in these two studies received less attention.

The following is some of the key local TEK information presented by Nasif (1981). Regarding AlUla Old Town, Nasif explained that the palm and tamarisk trees are significant materials for use in the construction of houses and the urban fabric. Additionally, he stated that the local people used palm trunks as water tunnels inside the urban fabric to manage and utilise flood water for irrigation. Regarding the Hegra village, Nasif's research highlighted that the local community in Hegra did not adopt the qanat system but utilised the Nabataean water wells and agricultural fields. Nasif stated that the existence of water encouraged the local people to settle in Hegra and other villages such as Shalal and Tharbah, and it motivated them to generate agricultural fields. Unfortunately, I could not find any information about the water drainage channels and systems that are located underneath the houses of AlUla Old Town, where water was harvested and redirected to the agricultural fields. I did not find detailed information about the traditional ecological techniques implemented by local communities within AlUla County.

Regarding the Nabataeans, Nehmé et al. (2006) observed that they developed a sophisticated water management system that enabled them to expand their territory and transport water over long distances to their farms. According to Alhammori (2002), their wells were notable for their precision, despite the absence of modern engineering tools, machinery and knowledge. Constructed primarily in limestone areas to prevent leakage and ensure long-term water preservation, these wells have remained safe and functional for thousands of years (Alhammori, 2002). Typically, about 4 m deep, Nabataean wells varied in shape, including square, triangular or pear-shaped longitudinal sections. The well tops were small and covered with stones to reduce evaporation and conceal them from potential enemies.

The Nabataeans utilised two types of water channels, as explained by Alhammori (2002). The first was a water canal implemented to harvest rainwater from the mountains and hills, and redirect it to terraces, agricultural fields, or storage areas and dams. The second type was a water canal used to collect drinking water from springs, which required more complex construction to navigate the hills, dams and topographical challenges. Alhammori (2002) added that these canals were often hidden and carved into rocks to protect and preserve the water. For water storage, the Nabataeans carved sandstone rocks to create ponds with rational dimensions, enhancing them with additional rocks when necessary. Some ponds were designated for grazing animals, and many storage facilities were connected to water canals that collected rainwater from the mountains.

Within the region of AlUla, many of the described features, such as water wells, water storage and water canals, can be seen, and most are considered cultural heritage nowadays (Nehmé et al., 2006). It appears that current local communities within the county (specifically the local people of Hegra) continue to employ some of these traditional water management techniques (Nehmé et al., 2006). Water-harvesting methods, such as dams, sand berms and water canals, are visible in various

areas within and outside farms. Although nomadic people historically implemented these techniques within their *hima* territories, current local communities use them for agricultural fields.²⁸ Even within the WHS, traditional ecological practices and techniques are evident (Nehmé, Villeneuve et al., 2011) and apparent, with some sand berms and dams likely serving to manage water flow and protect valuable heritage elements, as seen in the northern tombs within the site (p. 262; see Figure 4-11).

Regarding agriculture, the Nabataeans adapted agricultural practices (Nehmé et al., 2006) from other Arabian tribes, where they utilised simple tools, such as rocks, timber and axes, as well as more advanced tools involving animals for ploughing and soil refinement (Alhammori, 2002). Key tools included *Al-Malqa*²⁹ for refining the soil, *Al-Mjzz*³⁰ for levelling fields and *Al-Manjb*³¹ for ensuring quality sowing. Harvesting tools, such as sickles, were used to gather crops, which were then processed using tools that extracted and crushed plant stems (Alhammori, 2002). Their agricultural products included wheat, barley, sesame oil, grapes, pomegranates, berries, balsam trees (for medical purposes), olives and date palms.

Many of these traditional practices persist among contemporary tribes in the AlUla region (see Nehmé, Villeneuve et al., 2011, pp. 261–262). Local farmers continue to cultivate date palms, grapes, pomegranates and lemons (Sky News Arabia, 2020). Additionally, AlUla locals produce high-quality honey (The Pure Village for Oil Press, 2019). Despite advances in the medical sector, some medicinal plants such as *Moringa peregrina* are still grown for their antibiotic properties, and for producing cooking and medicinal oil (The Pure Village for Oil Press, 2019). This plant also serves as

²⁸ This was before the locals of Hegra moved from the Nabatean area to the northern part of Hegra.

²⁹ A wild temper pulled by animals to refine the soil.

³⁰ A wooden tool with teeth pulled by animals to carry soil and refill lower areas to make the ground flat and straight.

³¹ A wooden tool that looks like a comb but without teeth.

a windbreaker, assisting in the conservation of agricultural lands. Although modern techniques and tools are prevalent, it is anticipated that some elders may still prefer traditional agricultural methods.

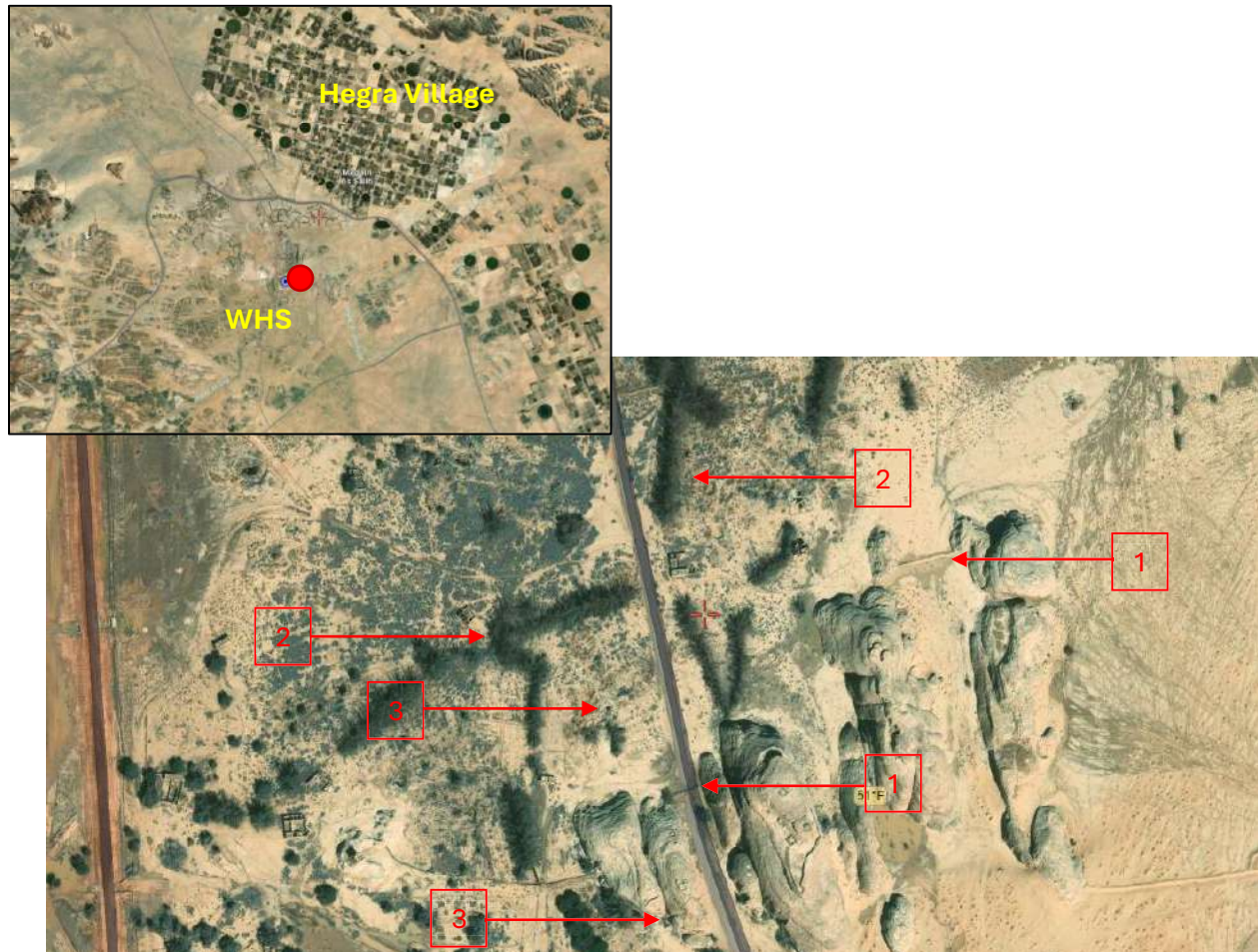


Figure 4-11: By reviewing satellite views of Hegra and its surroundings (including reports in Nehmé, Villeneuve et al. (2011), Kingdom of Saudi Arabia (2007b, pp. 58–64) and Nehmé et al. (2006)), some traditional ecological techniques can be observed, such as (1) traditional sand berms, (2) windbreakers/barriers, and (3) water-harvesting techniques and a water well near the tombs of Hegra. Source: Satellite view in Apple Maps, modified by the researcher.

4.6 Initial design investigation

After exploring the context of AlUla, the local TEK was described in this chapter, and in association with the desertification and heritage conservation issues discussed in Chapter 2, and owing to the

confidentiality associated with the official projects (Filippi & Mazzetto, 2024, p. 4) and the missing literature regarding the sustainable transformation of AlUla (Pavan, 2023), I decided to conduct a design investigation exercise. I chose the Hegra area, specifically the northern part of the WHS, given that this area connects the WHS and Hegra village (see Figures 4-12, 4-13 and 4-14). This area is critical because it is where flash floods enter the WHS. Therefore, it is a place where the cultural heritage and natural environment are affected by desertification factors. Through this investigation, I aimed to explore ways to address the environmental challenges and heritage conservation issues by mapping them and identifying potential solutions through LA design. These solutions and implementations should contribute to the mitigation of desertification issues and the conservation of cultural heritage. My goal was to investigate ways to integrate the local TEK and practices derived from the literature. I wanted to have a clearer vision regarding integrating design ideas and processes into research within the context of the OMP in the fifth district of Hegra. In addition, I wanted to experiment with different drawing styles. In this section, I presented the relationship among the local people, ecology and cultural heritage within the Hegra site and outlined the potential opportunities discovered through this exercise.

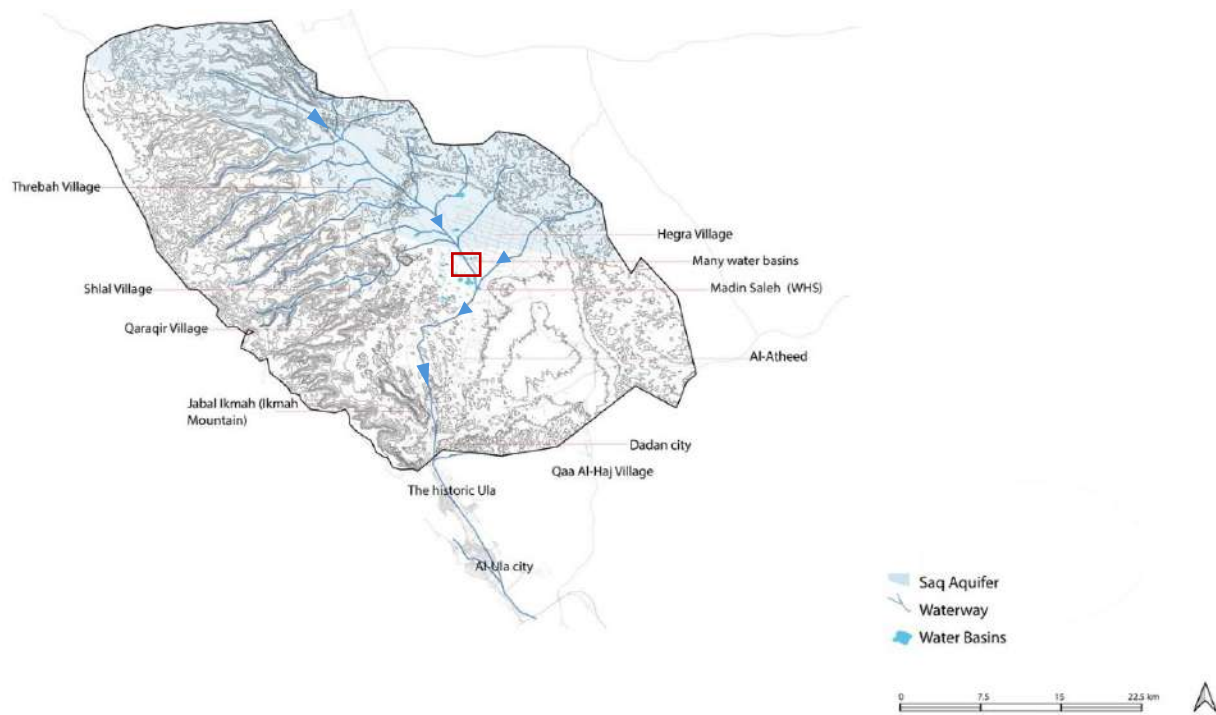


Figure 4-12: Map of the main seasonal waterways and water basins. The square shape indicates the selected site for this exercise. *Source:* The researcher.

4.6.1 The site's natural factors

As previously discussed in the literature and context sections (e.g. Sections 2.5 and 4.2), AlUla was once abundant with underground water, flora and fauna. However, it now faces significant challenges, including high evaporation rates, increased extraction of underground water, a lack of rainfall and new infrastructure development, all of which affect the ecosystem, local community and cultural heritage. I began by exploring and identifying waterways and basins using aerial photos taken during the rainy season to address these issues (see Figures 4-13, 4-14 and 4-16). To understand the changes and differences, I then compared this data with Geographic Information System information, such as contour lines, waterways, basins and vegetated areas. According to the agriculturist and permaculture design expert Geoff Lawton (2020), tracking the signs of water on the surface reveals environmental problems. Following this method, I identified large areas where water

is naturally collected but evaporates quickly owing to wind erosion and direct sunlight exposure (see Figure 4-13). Seasonal water streams support some ancient farms, native vegetation and agricultural lands. However, certain vegetated areas are deprived of water because of obstacles such as dunes, farm waste, streets and expanded agricultural lands.

This site has a clear relationship with waterways, basins and vegetation. Some vegetation groups have survived for years, probably owing to their proximity to a seasonal stream. However, one ancient farm within this area has been negatively affected for three possible reasons: (1) the distance from the farm to the waterway, (2) the farm's elevation relative to the seasonal water stream, or (3) dunes blocking water flow. When the water basin is full, particularly during intense rainfall, it can irrigate the ancient farm and the surrounding vegetation groups.

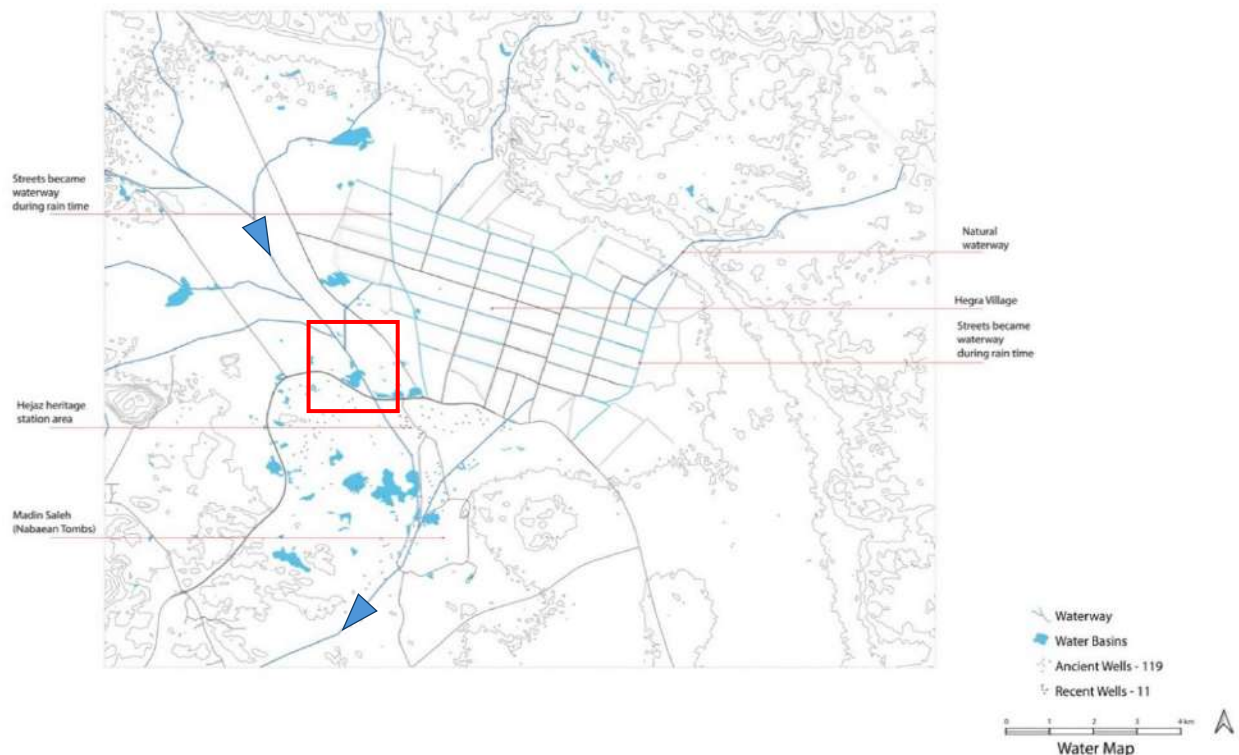


Figure 4-13: Map of the main seasonal waterways and water basins focused on the area of Hegra. The red square is the selected site. The blue arrows indicate the direction of the water flow. *Source:* The researcher.

In terms of plants, I could not identify the names of the plants in this area; however, I have considerable information about the native plants of the region. AlUla's native vegetation possesses characteristics that deal with a variety of issues, such as soil salinity, poor soil, hard surfaces, high evaporation, low nitrogen and flash flooding. Many plants can be considered multifunctional owing to their various products and benefits for nature, heritage and humanity. In conclusion, the main issue I found was that there are many environmental problems, and these problems can be mitigated and solved by implementing traditional techniques that reduce evaporation, harvest water, and enhance protection. As a landscape architect, I can suggest some elements and propose a planting design that includes some water-harvesting techniques to enhance the ecosystem, but the goal is to discover how the local people, along with their knowledge and traditions, would solve this issue and how local TEK can be integrated.

4.6.2 The site's natural environment and heritage

The selected site (the area located in the north side of the WHS) encompasses three main types of cultural heritage elements: (1) ancient farms, potentially established by previous generations of current tribes or even older; (2) 131 Nabataean wells and 111 tombs, constructed by Nabataean tribes over 2100 years ago; and (3) the Hejaz Railway and Hejaz Station, built during the Ottoman Empire 116 years ago (see Figures 4-14 and 4-16). The ancient farms within the conserved WHS are severely degraded, with vegetation (probably windbreakers) surrounding the farms being the primary remaining element. These surviving trees function as windbreaking trees, protecting the interiors of the farms. The west side of the ancient farm area is covered by many native plants, indicating good water access, while the east side has poor ground cover (see Figure 4-14). This imbalance might be due to the Hejaz Railway or the new road inside the conserved area. Evidence supporting this claim includes the approximately 50 ancient wells located on both sides of the farms, suggesting equal

water availability (Nehmé et al., 2006, p. 58). These wells, made from locally sourced sandstone, were 10 m deep, indicating a historically accessible water table that is now probably deeper than 75 m (Yu, 2019, p. 9).

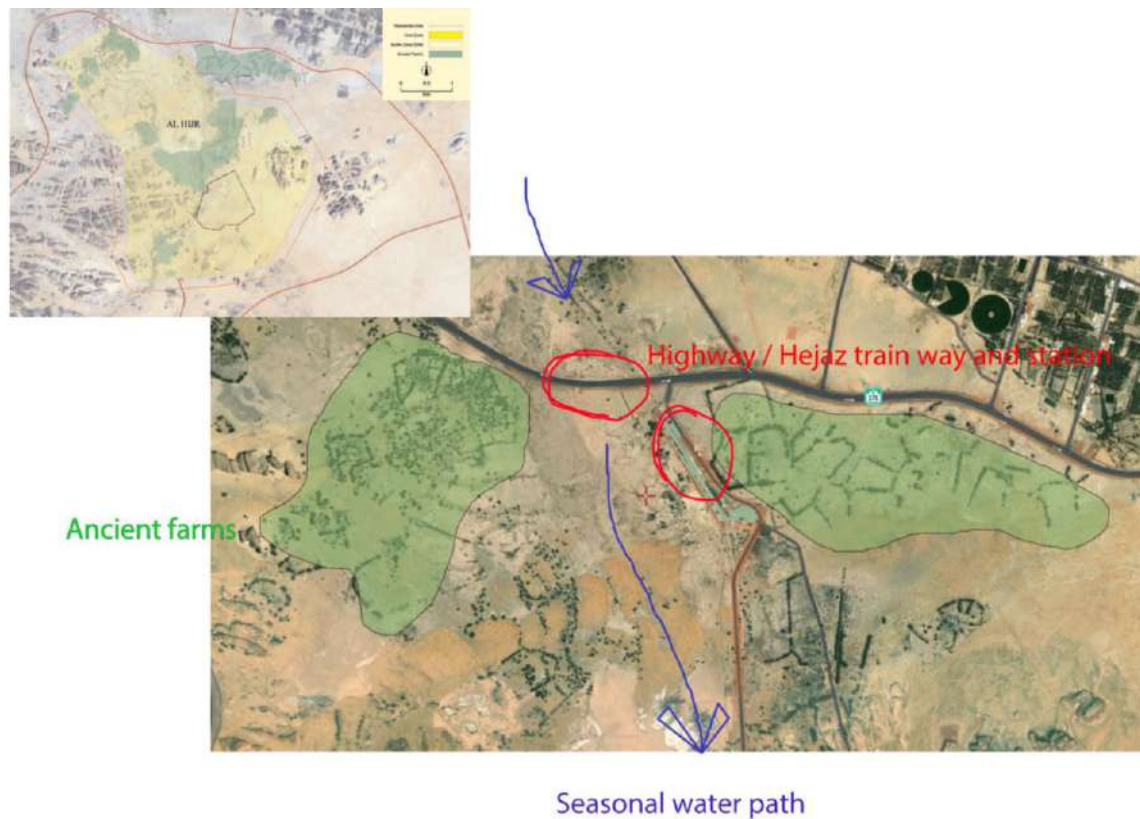


Figure 4-14: Map of the main seasonal waterway that passes the ancient farms. The road disturbs the natural drainage of water in the area. *Source:* The researcher.

The west side might receive more water than the right side, but it also has more saline soil areas, likely because of the rapid evaporation and low soil absorption (see the soil map in Figure 5-13; Nehmé et al., 2006, p. 58). Conversely, the east side is more affected by desert sands. The Nabataean tombs are distributed in various locations, some surrounded by oases and others by sand. Certain natural and cultural heritage elements, such as sandstone hills and tombs, create microclimates and shaded areas that may encourage native plant growth. Other areas are exposed to direct sunlight.

This conserved site may offer opportunities for traditional activities, such as managed, rotated grazing practices and fodder harvesting. Additionally, traditional techniques such as small dams and swales can harvest water, enhance vegetation and create microclimates. Some reports have indicated that desertification factors, such as flash floods, displaced historical elements, such as pottery fragments, stone cisterns, columns and coins (Alrawaibah, 2017). Therefore, traditional techniques here could contribute to protecting these cultural heritage features from being moved or lost. Another example involves the Hejaz Railway, where some parts of the railway line seem to have been affected by flash floods. Implementing traditional modifications could yield excellent results in terms of protecting this heritage element.



Source: Kingdom of Saudi Arabia (2007a).



Source: Peterson (2018).

Figure 4-15: Pictures of the cultural heritage features and native vegetation.

4.6.3 The site's natural environment and the local community

Based on my observations of aerial images and a review of the relevant literature, there are signs that local communities in the region continue to follow the traditional land use patterns that can be found in the literature on the Nabataeans and other ancient Arab communities interacting with natural systems. Villages, urban areas and farms are strategically located in foothill areas to benefit from mountain runoff and to avoid flash flooding of the valley. Even the expansion of Hegra village has adhered to this pattern. It appears that the local farmers utilise seasonal waterways from the mountains, in that the design of some streets may function as waterways during the rainy season (see Figure 4-10). Some streets also appear to act as swales or barriers to protect oases and manage runoff. Traditional *oqoom* (عقوم) (sand berms) and terraces located between urban areas and the mountains were probably constructed by locals to slow the water flow, enhancing aquifer recharge. Traditional techniques and practices are expected to be implemented even inside the oases.

Notably, this area is capable of producing pastures for local animals, which is a key activity of the *hima* system that is still required. However, abolishing the *hima* system has created multiple issues in terms of natural resource management, leading to more degraded lands. Owing to the sensitivity of the WHS, grazing activities within the region have become more restricted.

The *hima* system facilitated a beneficial interrelationship between humans and nature, with mutual advantages. Without this system, locals are less able to care for, monitor or benefit from their environment through activities such as grazing. Many critical areas within the region require modifications to preserve water and enhance productivity by planting appropriate native plants. In terms of agriculture, there are significant similarities between the crops grown today and those grown during the Nabataean period. The local people cultivate date palms, wheat, barley, grapes, pomegranates and various fruits, relying on wells and underground water for irrigation. Although

water-harvesting techniques to recharge aquifers are essential for local communities to thrive, it is crucial to comprehensively consider other local TEK-related aspects as well.

4.6.4 The site's local community and heritage

The site's designation as a tourism attraction with universal heritage value has exacerbated the disconnect between locals and their surrounding nature and heritage (UNESCO, 2008). Based on my understanding, the Nabataean people and the current locals do not share a lineage, which explains the lack of direct connection between the Nabataean tombs and the present inhabitants. However, noted similarities exist in the traditional knowledge and techniques of both groups for managing and conserving the surrounding natural resources and heritage.

Ancient farms near some of the tombs might have been owned by the ancestors or elders of current tribes, based on the link drawn by Nehmé et al. (2006, pp. 69–70). The site remained uninhabited for five centuries until the nineteenth century, when tribes from Tayma revitalised Hegra's agriculture and wells, adversely affecting cultural heritage elements (UNESCO, 2008). However, this relationship warrants further investigation through observation and interviews to understand how it can be enhanced in a manner that respects local traditions.

According to the site's management plan document published by UNESCO, the local communities' reactions and suggestions regarding tourism, development and site management systems should be integrated and included 'as far as possible' (Kingdom of Saudi Arabia, 2007b, p. 17). For example, the management plan document suggests that the metal fence surrounding the WHS can be replaced with minor landscape interventions and symbolic barriers based on discussions with the local community (Kingdom of Saudi Arabia, 2007b, p. 19). However, recent studies have confirmed a lack of integration of the local community in this regard (A. Alahmadi, 2021; Alrawaibah, 2017).

4.6.5 Potentials and opportunities

After conducting some investigations, this section presents conceptual and initial design ideas inspired by traditional practices as understood from the literature. I integrated the traditional ecological techniques into the site context to illustrate the opportunities for conserving and restoring cultural heritage and the surrounding environment, and reconnecting the local communities with their surroundings. I began by analysing a small site with a water basin, heritage features and human facilities (see Figure 4-16), then expanded the scope to include the entire village of Hegra, Nabataean tombs, Nabataean wells and ancient farms (see Figure 4-25). The seasonal water stream in the area passes through a narrow section before widening and gathering in an area on the north side of the highway (see Figures 4-16, 4-17 and 4-18). Some water continues south, while some stagnates and evaporates within the WHS. Before the narrow section on the north side of WHS, part of the Hejaz Railway collapsed, likely because of flash flooding, and an ancient farm was affected by sand movement.

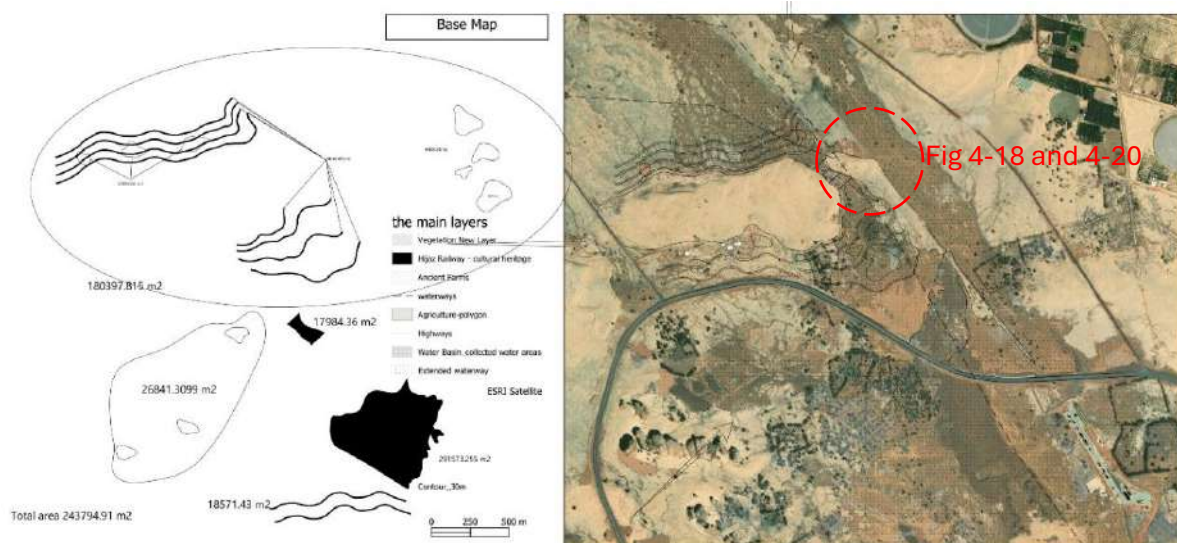


Figure 4-16: An analysis of the selected site where water is naturally collected on the north side of the WHS, southwest of the village of Hegra. The red circle indicates the narrow area. *Source:* The researcher.

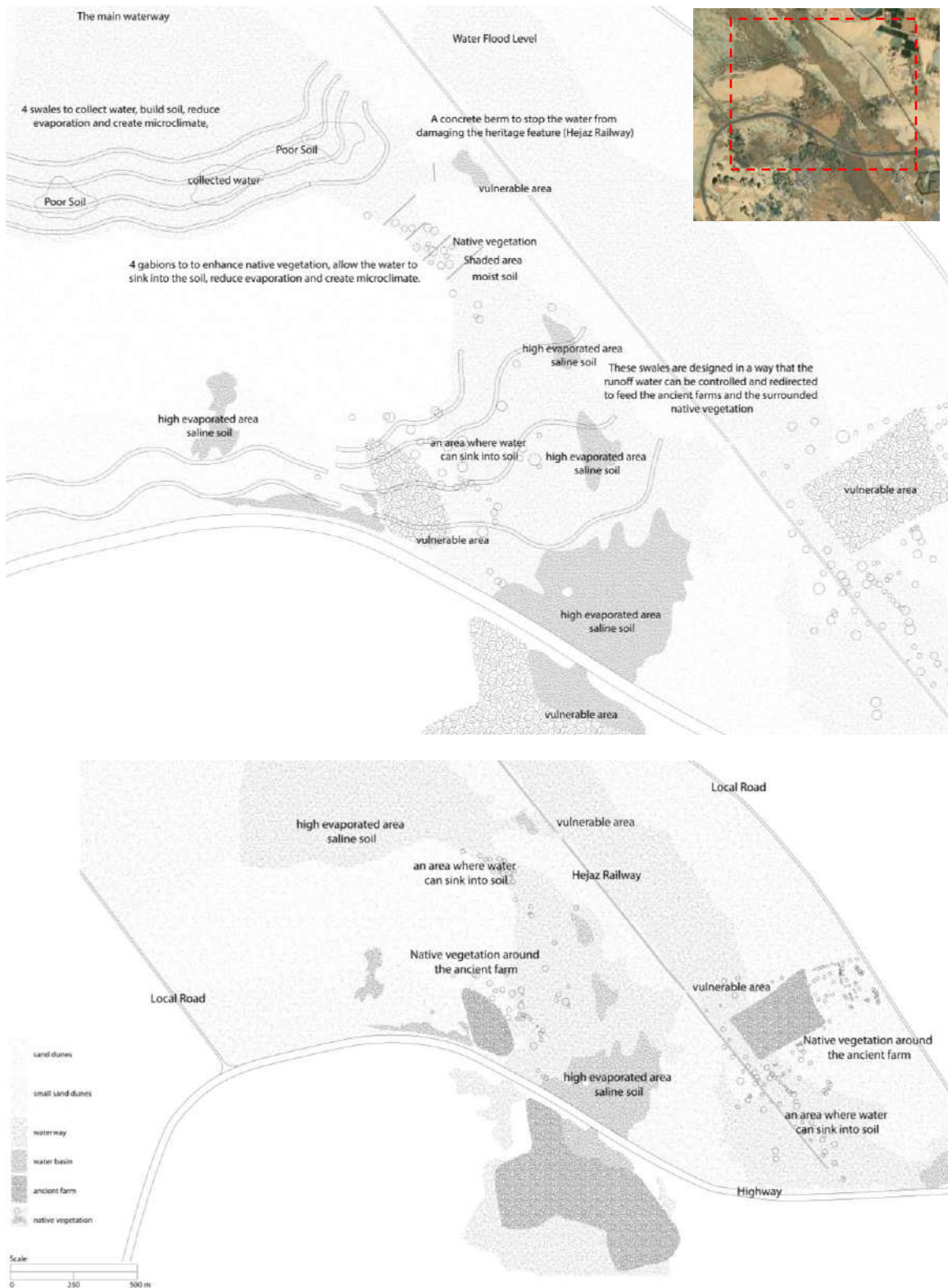


Figure 4-17: These two maps highlight the main heritage elements and natural issues. A conceptual design is proposed to include traditional techniques to enhance the protection of the heritage and the oases. *Source:* The researcher.

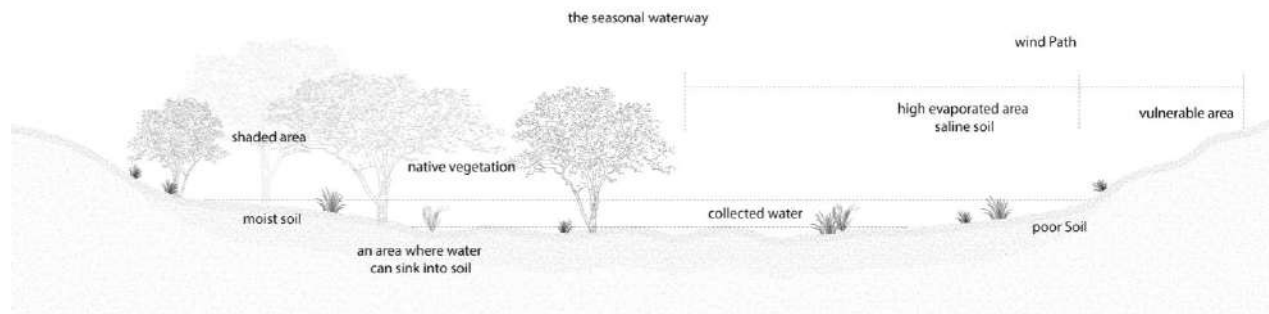


Figure 4-18: The narrow area contains a group of native vegetation plants and a seasonal water stream that passes through it to the WHS (south). *Source:* The researcher.

To address these issues, I propose a series of water-harvesting techniques. First is the implementation of swales as the initial line of defence to reduce flood speed, protect the Hejaz Railway, minimise evaporation and rejuvenate the area with windbreakers and nitrogen-fixing trees to create an oasis, an essential element of the site's identity (see Figure 4-17). Second, a small berm near the railway is suggested to prevent damage from flash floods (see Figure 4-19). Additionally, enhancing the green cover in this area is crucial for improving the valley's environmental condition and supporting the local community by providing grazing areas to support their livestock. Third, the narrow area, which has good soil and some vegetation, can benefit from gabions placed between the trees to improve the microclimate and increase water absorption, using native plants with long root systems suitable for these objectives (see Figures 4-16, 4-17 and 4-20). Fourth, the sandy area between the narrow section and the water basin, adjacent to an ancient farm, offers an opportunity to use a swale to redirect the water flow to the farm, enhancing its condition (see Figures 4-17, 4-21, and 4-23). This intervention is likely to contribute to increasing the green cover between the narrow area and the ancient farm, creating a green space for locals to enjoy while revitalising the farm. Finally, to address the issue of high evaporation within small water basins, I propose planting native vegetation to reduce wind impact, increase shaded areas and green cover, and allow water to sink and enrich the aquifer (see Figures 4-16, 4-22 and 4-24).

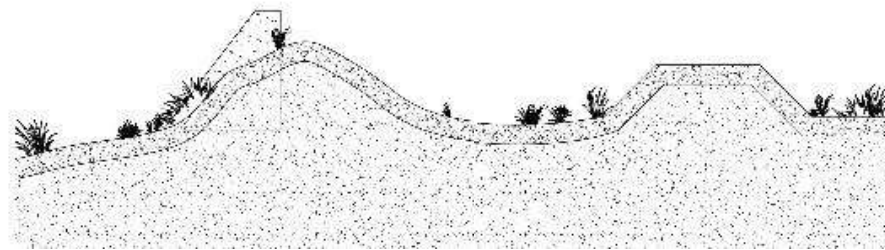


Figure 4-19: I propose the installation of a sand berm within a vulnerable part of the Hejaz Railway where water flooding has damaged it. The berm may contribute to enhancing the protection of this cultural heritage element in the future. *Source:* The researcher.

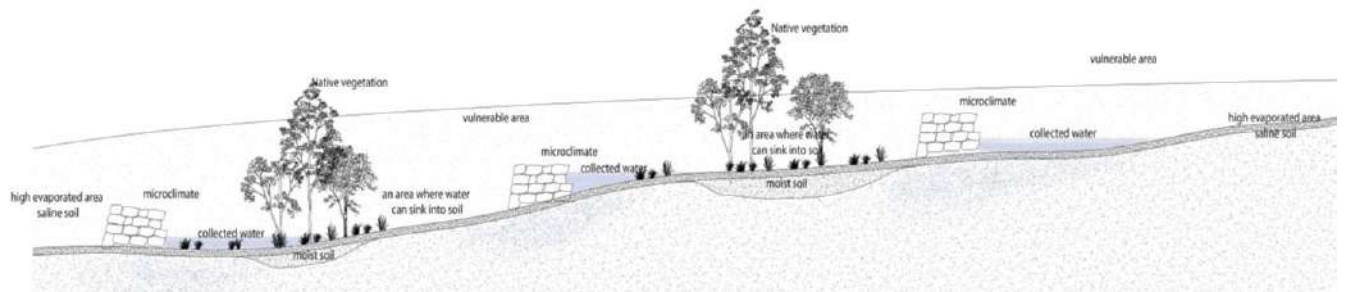


Figure 4-20: I suggest three gabions be inserted within the narrow area to enhance the soil and native vegetation condition, slow down the water flow, enhance the microclimate, allow the ground to absorb water and reduce evaporation. *Source:* The researcher.



Figure 4-21: I propose the installation of three swales to collect water and redirect it to the ancient farms, increasing ground cover and vegetation, and benefiting from the runoff water. *Source:* The researcher.



Figure 4-22: Within the water basins, replanted areas are essential to improve the quality of the site. *Source:* The researcher.

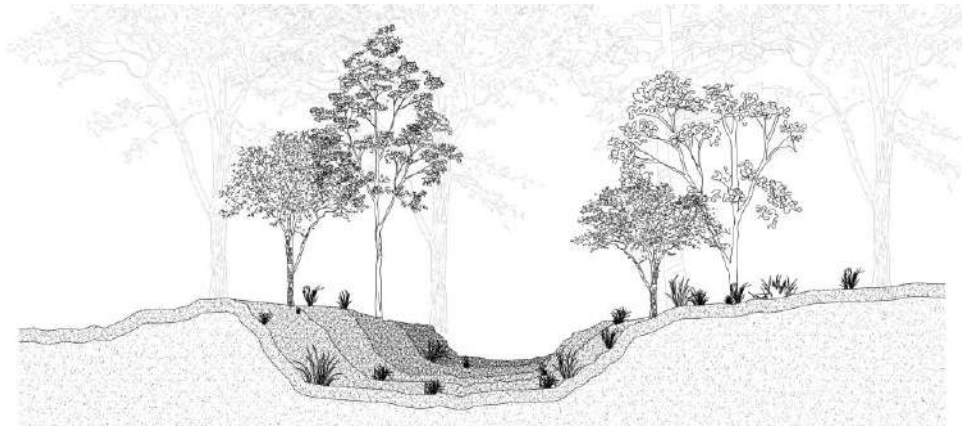


Figure 4-23: The function of this swale is to collect water and redirect it to different areas where water is needed. *Source:* The researcher.

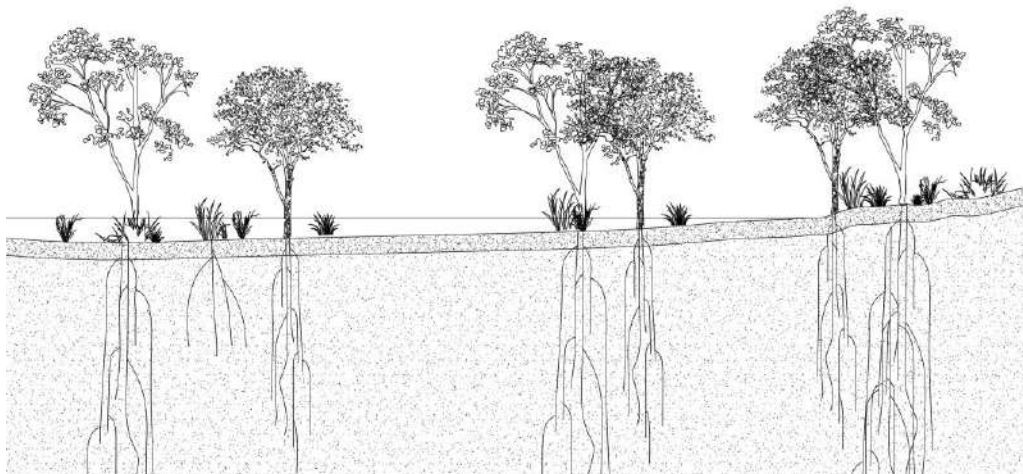


Figure 4-24: Some native trees, such as tamarisk, have a deep root system that can reach underground water easily, enhancing the ground absorbance of water and improving the soil. *Source:* The researcher.

Extending the study area was fundamental for building comprehensive connections between the local people and their heritage. Thus, I included the entire village and part of the WHS to identify new potential opportunities (see Figure 4-25). Interacting with Nabataean tombs and wells is sensitive from an Islamic perspective, which the locals respect. This sensitivity could have been the reason for the relocation of the local people from the WHS to its northeast. However, they historically used the area for grazing and monitoring their natural surroundings, as previously explained.

After analysing the natural factors—topography, hydrology, flora and fauna—of the area between the village and the WHS, I developed a conceptual plan and ideas to illustrate the site’s potential, enhance the natural environment and provide meaningful spaces for the local people (see Figures 4-25 and 4-26). There are several ancient farms in this area, and I suggest regenerating those close to the village and far from Nabataean elements, since some might have been operated by the elders recently, and to address the sensitivity of the place within the community (see Figures 4-25 and 4-27). There are also small, vegetated basins in the area; hence, I propose enhancing the ground cover of these basins to provide pastures for domestic and wild animals (see Figures 4-27 and 4-28).

Regarding the heritage–nature relationship, some water streams harm tombs and prevent the irrigation of ancient farms. I propose installing swales to redirect water to the farms and reduce pressure on the tombs (see Figure 4-25). For accessibility, locals need private access, and the best entry is on the east side of the northern main gate. The method of replacing the fence with more traditional ideas, such as *oqoom*, was discussed with the elders during the main data collection stage. The north side of the village was also studied. Based on aerial images, it can be seen that water flow can damage the first line of farms and their facilities on the northeast side. I propose installing swales to reduce water speed and the regeneration of the oasis with native plants, emulating Nabataean practices (see Figure 4-25).

By examining these ecological solutions inspired by the TEK found in the literature, I could see the potential for the TEK of *hima* and the associated practices and techniques to contribute to the conservation of cultural heritage and the enhancement of local ecosystems, reconnecting locals to their surroundings (see Figure 4-30). However, it became apparent that there was a need to visit the site and its surroundings and meet and consult with the traditional elders who understand the history of the area and are aware of the *hima* TEK to find appropriate solutions based on their indigenous

knowledge and practice. These design ideas needed to be discussed with national LA experts who have design backgrounds and are aware of the local TEK.



Figure 4-25: In this map, I analysed the extension of the site to understand the connection between Hegra village and the WHS. *Source:* The researcher.



Figure 4-26: The imaginary section shows the predicted future of the site after water-harvesting techniques have been implemented. It also shows how the swales with the trees can create green and natural zones that can be used as an open space for locals and visitors to interact with nature in the future. *Source:* The researcher.

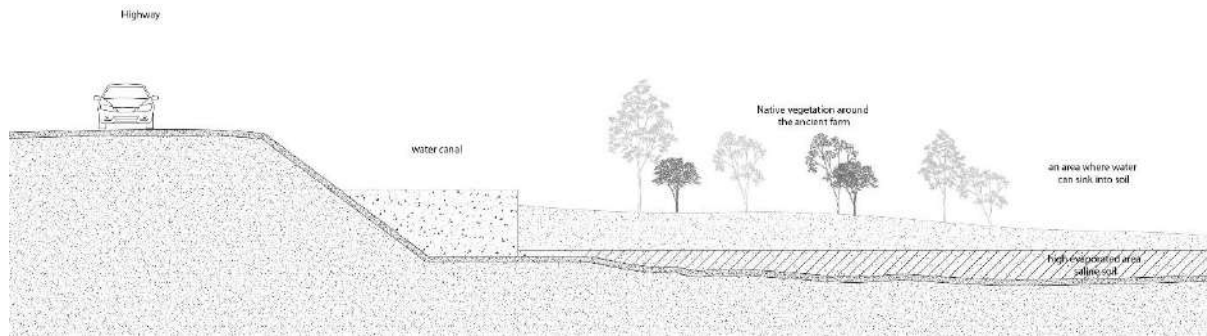


Figure 4-27: The highway is one of the most significant factors affecting the environment and ancient farms since it disturbs the water movement and water distribution. *Source:* The researcher.

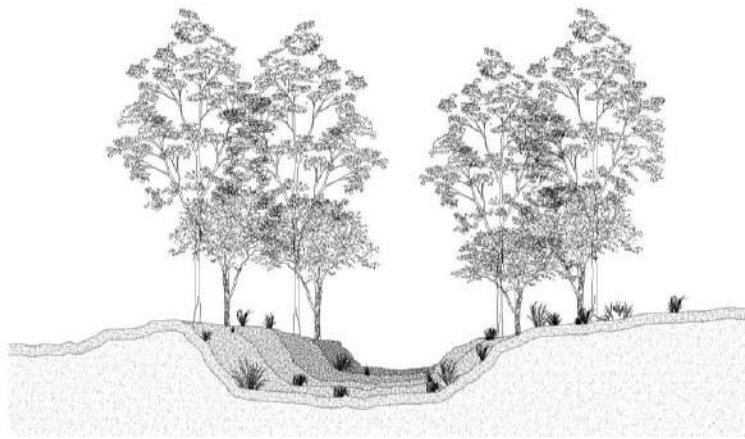


Figure 4-28: Within this swale, the function of the trees is to break the wind, reduce evaporation by shading the area and slow down the water flow. *Source:* The researcher.

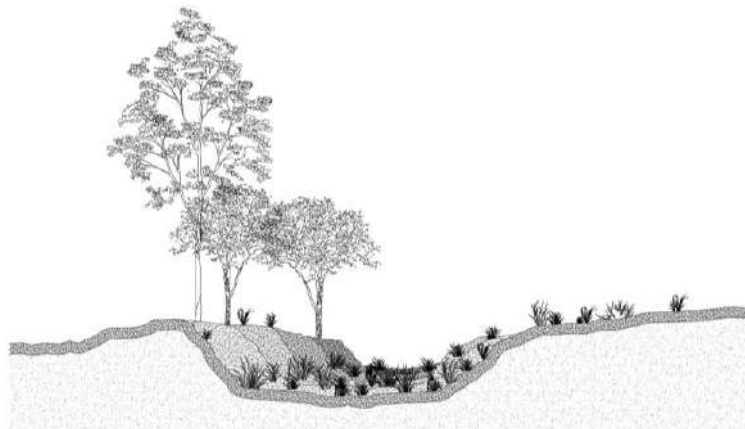


Figure 4-29: Within this swale, the function of the trees is to provide shade to the smaller and newer plants, as well as fix the soil and create a microclimate. *Source:* The researcher.

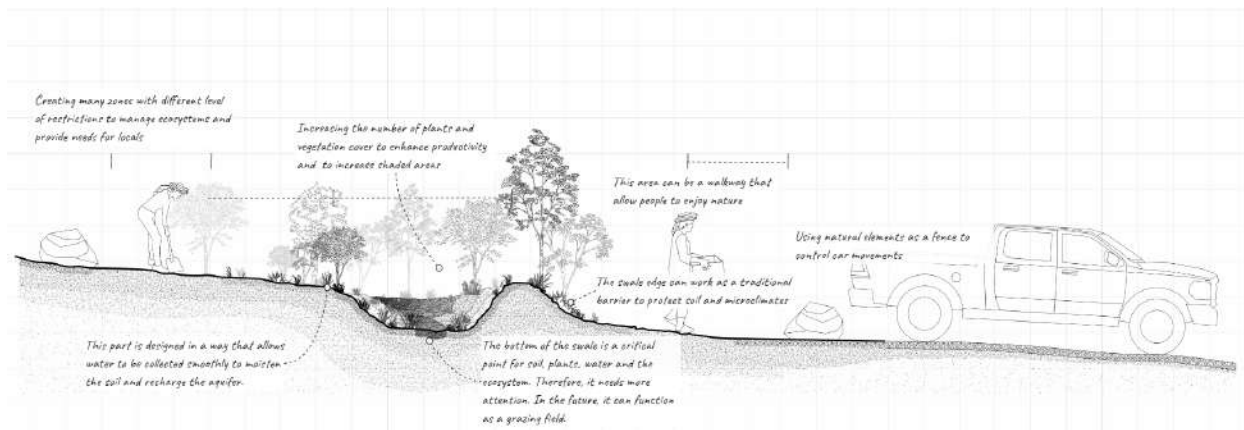


Figure 4-30: The indigenous knowledge related to caring for nature will be better preserved if we allow locals to manage their surroundings and provide them with the support they need. *Source:* The researcher.

4.7 Conclusion

This chapter described AlUla County and its natural environment, historical context, development and the local TEK, such as traditional agricultural practices and water management systems. Subsequently, I conducted a design investigation to identify the potential opportunities and challenges. This empirical investigation provided valuable insights but also raised several questions.

This design exercise highlights four key points. First, the OMP appears to focus on tourism and global approaches more than traditional methods. Official institutions seem to consider the local communities in terms of providing them with jobs and new opportunities, which is an important aspect; however, seeing them as a source of knowledge is another aspect they need to consider as well. Second, it appears that the seasonal river, which damaged the Nabataean structures, was not modified appropriately, and there is an opportunity to improve it through the use of *hima* TEK. Third, the absence of local TEK demands the proposal of various traditional ecological techniques to complement the OMP. These techniques should aim to mitigate the risk of flash flooding, enhance ground cover and improve the microclimate, potentially contributing to ecosystem restoration and

cultural heritage conservation. Fourth, this exercise allows for a better understanding of the local TEK system and the historical relationship between the locals and their surroundings.

However, studying such critical sites requires more than desktop research. Through this pragmatic investigation, I began to uncover the possibilities for enhancing the relationships among cultural heritage, the surrounding ecosystem and the local community, as well as mitigating desertification. Although this experiment highlighted opportunities for conserving heritage, regenerating oases and reconnecting locals to their environment, it also raised many questions. A clearer vision regarding integrating *hima* TEK through design research to answer the three research questions is needed.

Nevertheless, I remain curious about how locals, especially elders, perceive environmental issues such as desertification and land degradation. How can the TEK of *hima* enhance living with desert ecosystems within Saudi cultural heritage sites? How can the practices of *hima* TEK contribute to the conservation of cultural heritage sites in urban settings? What is the role of landscape design in the *hima* context, and what are the main design aspects that designers need to consider when aiming to integrate *hima* TEK techniques into urban development projects to mitigate desertification and preserve cultural heritage sites in the country? Chapters 5, 6 and 7 present the main findings and answer the research questions using the previously proposed methodological approaches.

Chapter 5 presents the local TEK regarding desertification and traditional living with the desert ecosystem, Chapter 6 presents the linkage between TEK and cultural heritage conservation, and Chapter 7 focuses on the design aspect. Although the local TEK does not consider ecosystems and cultural heritage as separate entities but considers them as one (the surroundings), I have separated these two chapters to clearly illustrate how the *hima* TEK contributes to desertification mitigation and cultural heritage conservation, owing to the level of intentionality behind the traditional

ecological methods and actions, and to present this indigenous system clearly. This interconnection and overlap are explored more within these two chapters.

Chapter 5: Traditional Ecological Knowledge and Living in Desert Ecosystems³²

5.1 Introduction

This chapter presents the results generated from the primary data collection (Stage 2) relating to the first research question on how the local TEK can enhance living with desert ecosystems within a conserved Saudi Arabian cultural heritage site. This investigation was carried out in the context of desertification mitigation within AlUla County, Saudi Arabia. After analysing the data from semi-structured interviews with elders, as well as site visits and observations, I found two main themes to be presented and discussed: (1) elders' views on the causes of desertification, and (2) traditional strategies to mitigate desertification and enhance living with desert ecosystems. Although the second theme directly addresses the research question, the first provides valuable context by revealing elders' perspectives on desertification. Despite the second theme being the focus during my interviews and site visits, the first theme was raised by the local elders many times, indicating the importance of this aspect.

Initially, this chapter focuses on the *hima* TEK related to desertification mitigation and how elders applied their indigenous knowledge to manage such issues. However, the findings also reveal the elders' way of being in desert ecosystems more broadly. This illustrates not only their methods for mitigating desertification threats but also their adaptive way of living and thriving in these challenging environments, which is a significant aspect of the TEK of the local community. It is important to note that these results are not presented as a universal solution for global issues such as desertification, but rather as an indigenous system that can serve as a source of inspiration within specific contexts.

³² This chapter was published in the conference proceedings of the 'Local Cultures—Global Spaces: Communities, People and Place', see page ix and Appendix K.

Also, since it is indigenous, there are some concepts and categories that may overlap with other categories. Within the first theme, two subtopics emerged, and within the second theme, three subtopics were identified, each containing five to six categories (see Table 5-1).

Table 5-1: This table summarises the results regarding the first research question.³³

Chapter's main topics (This is the classification I made to present the results)	Subthemes (These are the groups I made to present the elders' knowledge and opinions)	Categories (These are the ideas, methods and issues mentioned by the elders)
Elders' Views on the Causes of Desertification	Human factors	Using new technologies to facilitate vegetation removal and easy access to natural resources Abandoning a place and ceasing to interact with it Forsaking the practices of <i>hima</i> TEK Following unsustainable water irrigation practices Adopting substandard land use planning
	Non-human factors	Sandstorms Sandy soil conditions Flash flooding Decreasing water springs Harmful insects and birds Oases decline
Traditional Actions for Living with Desert Ecosystems	Mitigating desertification through traditional agricultural activities	Cleaning and maintaining oases Implementing barriers Ethical respect for the natural environment Planting native plants Managing the soil Recycling farm waste Eradicating insect and bird pests
	Mitigating desertification through traditional water management activities	Maintaining waterways Managing the extraction of water Modifying irrigation systems Implementing water-harvesting techniques Creating hammams
	Mitigating desertification through community activities	Establishing a community association Conducting regular inspections of key resource areas Limiting accessibility Storing palm dates traditionally Being self-sufficient

³³ I have published the results in the table in the AMPS Proceedings Series 37.2

5.2 Elders' views on the causes of desertification

This topic refers to the 11 factors contributing to the causes of desertification as raised by elders. These factors were also observed during site visits. As shown in Table 5-1, I divided them into two groups: (1) human factors and (2) non-human factors. Human factors refer to people's actions that contribute to the desertification process. Non-human factors refer to natural events or climate change factors. I did not label them 'natural factors' because of the direct or indirect impact and influence of humans within these factors.

5.2.1 Human factors

There are five human factors identified as leading to desertification: first, using new technologies to facilitate vegetation removal and easy access to natural resources; second, abandoning a place and ceasing to interact with it; third, forsaking the practice of *hima* TEK; fourth, following unsustainable water irrigation practices; and fifth, adopting substandard land use planning.

5.2.1.1 Using new technologies to facilitate vegetation removal and easy access to natural resources

The use of new technologies in the AlUla region has significantly contributed to the process of desertification in the surrounding natural environment. All 11 elders discussed the positive and negative impacts of new technologies on natural systems, and most agreed that using new technologies has assisted in vegetation removal and in reaching the natural resources easily. Regarding vegetation removal, locals might cut dry branches for firewood as a construction material to maintain their houses and oases, or to make essential tools. Participant 2 explained:

In the past, the situation was different; people would search for dry branches and cut them in very small quantities. However, due to modern techniques, entire trees have been removed. In the past, only dry parts of trees were cut, and only if necessary, would a branch or two be taken, leaving the tree standing.

This statement means that, in the past, people were careful when cutting trees. However, now, they cut more than needed or cut for unessential purposes, and the new modern machines have facilitated this action, contributing to environmental degradation. Though, there is government legislation prohibiting tree cutting in the country, as outlined by the Ministry of Environment, Water and Agriculture, enforcement and awareness remain critical challenges. Another statement by Participant 9 noted that the overharvesting of wood is a critical issue, and they suffer now because of it, especially in rural areas. During my visits to the rural areas in Hegra, I found many signs of trees being cut by modern machines (see Figure 5-1). For example, in the SV-10 Site, the whole tree was cut down by an electric saw and then harvested. My interpretation of this site is that people may have cut the entire tree to dry it all first. Then, they may come later to take more dry branches. In the background of the same photo, many trees had been cut down, and nothing was left behind. It is worth mentioning that this site is one of the ancient farms close to the UNESCO WHS, where security and surveillance/monitoring have recently increased. Therefore, the people who cut the tree may not return to take the remaining branches. This topic has been widely referred to in many studies as deforestation or logging (e.g. Edgell, 2006).



Figure 5-1: This photo shows the impact of excessive logging/deforestation close to the UNESCO Hegra site. *Source:* Photo by the researcher.

The second issue that led to desertification is the improved access to the surrounding natural resources, such as water and fodder, via modern technologies. In the past, locals used to spend days travelling between places to find essential needs such as food, fodder and water. However, modern technologies, such as trucks, enable people to access natural resources more easily, leading to more rapid desertification of the environment, given that they can carry their livestock to many grazing places to consume fodder, which does not allow for the natural recovery and regrowth of these ecosystems (Schwartz, 2020, p. 42). Participant 7 stated:

We used to feed our sheep and camels from our *himas* [protected areas]. However, we used to look for the springs [the grazing areas that grow after the rainy season]. We used to go to Hail [a city 500 km away from their village] and Medina [the second holy city, 300 km away], especially in times of drought. Today, people go further.

He observed that people are more capable of going further to find fodder since they can carry their animals and reach distant places within a few hours. During my site observation and visits, especially around the SV-16 Site, I saw shepherds with huge trucks that can carry multiple sheep and some camels (see Figure 5-4).



Figure 5-2: This photo shows the rough ground of some of the natural areas and oases close to Shalal village, where Participant 5 lives, revealing the difficulties that locals have to endure to reach the mountain areas to hunt. *Source:* Photo by the researcher.

In another example, Participant 5 indicated:

Hunting areas and places where we can find rabbits and gazelles are located in the open areas that are close to mountains. Usually, people would struggle to reach these areas. A man may walk for days to reach hunting regions.

He mentioned this fact to illustrate how cars enable people to reach hunting areas more easily (see Figures 5-2 and 5-3).

In terms of underground water, Participant 5 stated:

Regarding groundwater, people use simple machines and limit them to specific times of the day, usually six hours. Consequently, there wasn't a significant water extraction. However, with recent advancements, machines now operate 24 hours a day, reaching depths of up to 70 meters, compared to the previous 9–12 meters.

This is another example where modern techniques facilitate groundwater extraction and deepen its levels, which affects the area's ecology in general. To summarise this impact, water extraction was difficult and required time and effort, which created a balance between use and natural recharge. This balance allowed locals to restore and maintain the water springs (Nasif, 1981, p. 142). However, modern machinery has made extraction effortless, which has led to overuse, agricultural expansion and land acquisitions by outsiders. This has significantly depleted groundwater levels, negatively affecting oases and water springs, and creating a reliance on modern techniques.



Figure 5-3: A large truck used by shepherds to carry animals and take them to grazing areas can be seen in the background of the photo. *Source:* Photo by the researcher.

These actions, such as using trucks to carry animals to different natural areas, may contribute to the rapid reduction in natural resources such as fodder and may prevent plants from growing efficiently. This point is similar to that noted by Neal Spackman regarding the *AlBaydha* region in Saudi Arabia, where people from outside the region brought hundreds of their animals via trucks to graze in *AlBaydha* grazing areas and consume all the natural resources (fodder and water; Schwartz, 2020, p. 42). Edgell (2006) highlighted these types of causes as human causes contributing to desertification in the Saudi Arabian context (pp. 83–84). Although they have already been mentioned, this presentation of the causes provides a more detailed view from the local elders themselves.

5.2.1.2 Abandoning a place and ceasing to interact with it

The second factor emphasises the crucial relationship between inhabitants and their surrounding natural environments. Regular interaction with natural oases and areas fosters a positive relationship between the local environment and its users, prompting them to care for, manage and protect these spaces. Abandoning these sites leads to desertification. Participant 9 remarked:

One of the primary tasks for protecting the farm from desertification is ensuring consistent oversight by the owner. I am against occasional visits; instead, the owner should be present for the majority of the time. The adage, which says [**a natural feature (meaning farm/domestic animals or oases and plants) that its owner doesn't manage will die even if there is a water stream next to it** (In Arabic: **حلال ما يواليه صاحبه يموت لو الربيع حاذاه**)], underscores the need for the owner's constant presence. They must be intimately familiar with the farm's condition, address any issues promptly, and make decisions, such as replacing water-intensive trees with more efficient alternatives, based on firsthand observation. Additionally, continuous monitoring ensures that production aligns with the family's needs for vegetables and fruits.

Additionally, Participant 11 mentioned that one of the reasons behind the degradation of the Cultural Oases and the AlUla Old Town was the migration of people to new urban areas. This abandonment has led to the deterioration in date palms, fruit trees and old houses (see Figure 5-4). However, Participant 10 clarified a critical factor behind this migration: the concept of need. He observed:

The most essential factor is need or necessity. As long as I need a specific thing, I will preserve it no matter what. Anything associated with me will be maintained. Whenever I find a cheaper, less effort-intensive, and more productive alternative, I will choose it ... The people of AlUla Old Town and the Cultural Oases left the places for several reasons, including the need for services such as electricity and water, bigger houses, new services that cannot be implemented in the Old Town, and the fact that people's lifestyle has changed, and the need for entertainment has increased.



Figure 5-4: These two photos show degraded oases that had been abandoned for many years. In the background, there is another one that has been managed and maintained by some of the locals. *Source:* Photo by the researcher.

Abandoning areas rich in natural features or resources, such as water springs or oases, negatively affects the quality of these features. Over time, the site's productivity diminishes without the necessary attention, leading to the collapse of water springs and oases being affected by sandstorms. Although locals have traditional techniques to protect and maintain these environments (discussed further in the next theme), the cessation of interaction with these natural elements results in desertification. Edgell (2006) highlighted the role of construction and the expansion of urban centres, which increasingly encroach on desert ecosystems (p. 84). This urban expansion prompts locals to relocate to access better infrastructure and services, a move that contributes to the desertification process, as noted by the elders.

5.2.1.3 Forsaking the practice and techniques of *hima* TEK

The third factor contributing to desertification is the abandonment of ecological traditions by some of the local people. When traditional techniques are no longer practised, the productivity of natural resources diminishes.

During my site visits, I observed several indicators supporting this point. For example, at the SV-3 Shalal Site, 42 individuals collaboratively managed the Shalal water spring to irrigate their oases 108 years ago. They divided tasks among themselves to maintain the water and the oases. This maintenance involved traditional techniques and tasks, such as using windbreaker trees, *washea* (وشيع) (a fence made of palm leaves), rocky dams and *oqoom* (sand berms) to protect plants and houses within the oases. However, these techniques require a collective effort. Owing to recent lifestyle changes, only a few locals continue to implement these traditional practices. Consequently, at the VS-3 Site, many parts of the sand berms that protected the oases have collapsed as a result of a lack of attention and maintenance. During this site visit, I found only one person maintaining the oases and the water stream from the spring. Despite visiting at different times and days, I encountered the same individual managing the entire area.

Without collective maintenance, the sand berms protecting the oases from flash floods were in poor condition, allowing water to infiltrate the oases. The section of the oases adjacent to the waterway was degraded (see Figure 5-4, the right-side photo, and Figure 5-5). Participant 2 emphasised that *oqoom* are essential where there are potential risks to plants or houses, and are necessary to prevent floods. However, Participant 1 said that these techniques must be performed collectively and on a regular basis. Unfortunately, new generations are not interested in *hima* TEK owing to lifestyle changes. He noted that their lives depended on local TEK, which guided them in food production and protecting their natural resources. Participants 4 and 5 highlighted that the locals responsible for these oases moved from the uphill area to down the valley, closer to public services, gradually ceasing to engage in their ecological traditions. As a result, the ecosystem's productivity, including the water springs and the oases, has been negatively affected and subsequently desertified. Neal Spackman identified the abandonment of the TEK of *hima* by locals as a significant

factor contributing to the desertification of ecosystems in Makkah, Saudi Arabia (Al-Baydha, 2020; Schwartz, 2020).



Figure 5-5: This is the VS-3 Shalal Site. The area surrounded by a red dotted line contains the degraded oases. The brown dotted lines represent the sand berms that prevent flash floods from damaging the oases and the water spring. The yellow-circled areas contain the unmaintained berms that require attention. Source: Map from Google Maps, modified by the researcher.

5.2.1.4 Following unsustainable water irrigation practices

Unmanaged water extraction and the excessive use of groundwater for daily use and irrigation contribute to decreasing water levels and drying aquifers. Consequently, ground cover and biodiversity have diminished, a form of desertification since biological productivity is affected.

All the elders acknowledged the water issue and noted the significant changes in groundwater levels between the past and present. Participant 5 commented that water is excessively extracted to irrigate palm trees and plants for commercial purposes rather than for daily needs, which is considered by locals a form of overuse. Participants 1, 6 and 9 highlighted that digging numerous artesian wells in the region reduced and eventually dried up nearly all water springs, leaving only 3 to 4 of the original 80 to 82. Participants 3, 4 and 6 noted that, when underground water levels decrease, modifications are needed to manage irrigation, and reduce waste and evaporation. However, they observed that these modifications are not considered within many sites, which has exacerbated water depletion. Participant 5 noted that an area called Mogayra has entirely dried up, and this problem forced the community to rent wells 20 km away to irrigate their farms at an annual cost of approximately 50k Saudi Riyals (21k Australian Dollars). I observed these long pipes on my first day in AlUla and questioned their purpose until it was clarified by Participant 5 (see Figures 5-6 and 5-7).

Another observed issue with modern drip irrigation is salt accumulation in the soil. During site visits to the Cultural Oases, I found areas where the soil was laden with salt drawn up by irrigation. This issue adversely affects various plants that the locals depend on, highlighting the detrimental impact of unsustainable water irrigation practices on ecosystem productivity. During site visits, I observed traditional irrigation practices, noting both efficient and wasteful methods. Some practices, such as using narrow water canals and targeted irrigation around trees and palms, were water-efficient. Although traditional practices have historically been adapted to ensure sustainability, some of these observed practices can now be considered unsustainable owing to a lack of necessary modifications.³⁴ For example, I observed traditional flood irrigation practices in which a large basin

³⁴ It is important to highlight that one of the benefits of the data-driven approach is that it allows us to discover both positive and negative aspects associated with the topic or issue that is being researched.

is irrigated to support a single palm tree (see Figure 5-8). This approach results in significant water wastage, since a single tree does not require such an excessive amount of water.

In the past, this system was sustainable owing to the presence of a traditional management structure that carefully regulated irrigation practices, including the timing, water quantities and distribution network—not only for this site, but also for the surrounding oases. Back then, each basin would have supported a variety of trees and shrubs, with the entire basin being irrigated only once or twice a week, relying on a natural water spring that fed multiple oases on a weekly basis.

However, over time, several changes have disrupted this balance. The water spring has ceased to flow, the local family has left the site, and a water well, along with modern extraction machines, has been introduced. These changes have altered the needs of the site and its vegetation without implementing suitable adjustments to the irrigation practices. Currently, the oasis extracts large amounts of water to irrigate several basins that contain only a few palm trees, which may no longer be essential to the family's livelihood.

To address this issue, significant modifications are required to better manage water usage while preserving the site's traditional identity and ecological significance. However, modifying the practice does not necessarily mean replacing it entirely, for example, with a modern drip irrigation system. Instead, a balanced and thoughtful approach can be achieved by consulting with local elders to explore viable options that optimise water management while respecting and maintaining traditional ecological practices and identity.

This issue is underscored by Yu (2019) and Edgell (2006). Yu (2019) emphasised that the depletion of water resources could have led to the decline of ancient civilisations, and they stressed that

understanding the water cycle and watershed of the region should be a primary focus in any site that experiences development and modification (p. 9).



Figure 5-6: Water pipes are extended for 20 km for irrigation purposes, given that the water is depleted in Mogayra. *Source:* Photo by the researcher.



Figure 5-7: The degraded oases of the Mogayra village in AlUla resulting from the depletion of the underground water. *Source:* Photo by the researcher.



Figure 5-8: Left—An example of well-managed traditional waterways and small basins around palm trees. Right—An example of an unsustainable traditional practice with large water basins irrigating only one or two trees per basin. *Source:* Photo by the researcher.

5.2.1.5 Adopting substandard land use planning

Allocating areas for industrial activities near oases can significantly reduce their productivity. This issue of unsustainable land use planning was highlighted by elders during the first review meeting and corroborated by participants in the semi-structured interviews.

In rural areas, urban planning often receives inadequate attention, leading to environmental issues that affect the productivity of ecosystems and their natural features. For example, placing a factory next to an oasis can disrupt the natural balance of the oasis. Participants 6 and 12 recounted their experiences with a concrete factory located near their oases. Smoke from the factory adversely affected the ecosystem, affecting plants, air quality and farm animals, which in turn reduced the productivity of their oases. Additionally, during my site visits, I observed construction waste around

Hegra and places under development in AlUla multiple times, disturbing the site ecology and view. Another example is the extension of some roads for cars within oases, damaging plants, soil and natural waterways. These examples underscore the importance of integrating sustainable land use planning to mitigate desertification and protect natural resources. This issue can also be found in the study by Edgell (2006), where cities, oil industries and new roads were cited as causes of desertification within desert ecosystems in Saudi Arabia (p. 84).

5.2.2 Non-human factors

In this subtopic, I identified six factors leading to desertification: sandstorms, sandy soil conditions, flash floods, decreased water springs, harmful insects and birds, and the decrease in oases.

5.2.2.1 Sandstorms

Sandy winds and sandstorms are significant non-human factors that negatively affect both ecosystems and cultural heritage artefacts. These winds can damage small plants and micro-ecosystems, cover natural and agricultural ground cover, reduce productivity and degrade sites.

Elders highlighted this issue, noting that northern winds carrying sand dust cover their farms. Participant 1 mentioned that these winds are prevalent in the Hegra area and northern regions of AlUla, while the Old Town and agricultural oases (Cultural Oases) are less affected owing to the tall mountains to the west and east (see Figures 5-9, 5-10 and 5-11). Participant 2 confirmed that sandstorms are uncommon in the Cultural Oases but frequent in Hegra and other northern villages. During site visits, I observed several degraded oases, now mostly covered by sand, which were once inhabited by locals.

In the VS-10 Site in Hegra, I noted that the surface level inside the oasis was lower than outside, indicating that trees prevented sand from covering parts of the oasis (see Figure 5-9). However, some

traditional irrigation elements were still buried by sand. The elders suggested visiting *AlDewan* (الديوان), a Nabataean hall within the sanctuary area in the UNESCO WHS in Hegra, to observe the impact of sand dust collected naturally inside the hall. This hall, located near oases that the elders frequented, is partially covered by sand, with visible marks on the wall from this event (see Figure 5-10). The impact of sand movement and sandstorms extends beyond oases, significantly affecting tangible cultural heritage as well.



Figure 5-9: Left: This photo illustrates the role of windbreaks in an ancient oasis, effectively stopping the encroachment of sand. Right: This photo shows sand covering the water canals and highlights the flatness of the site. Typically, water ponds are situated at higher elevations within oases to facilitate the downward flow of water for irrigation. *Source:* Photos by the researcher.

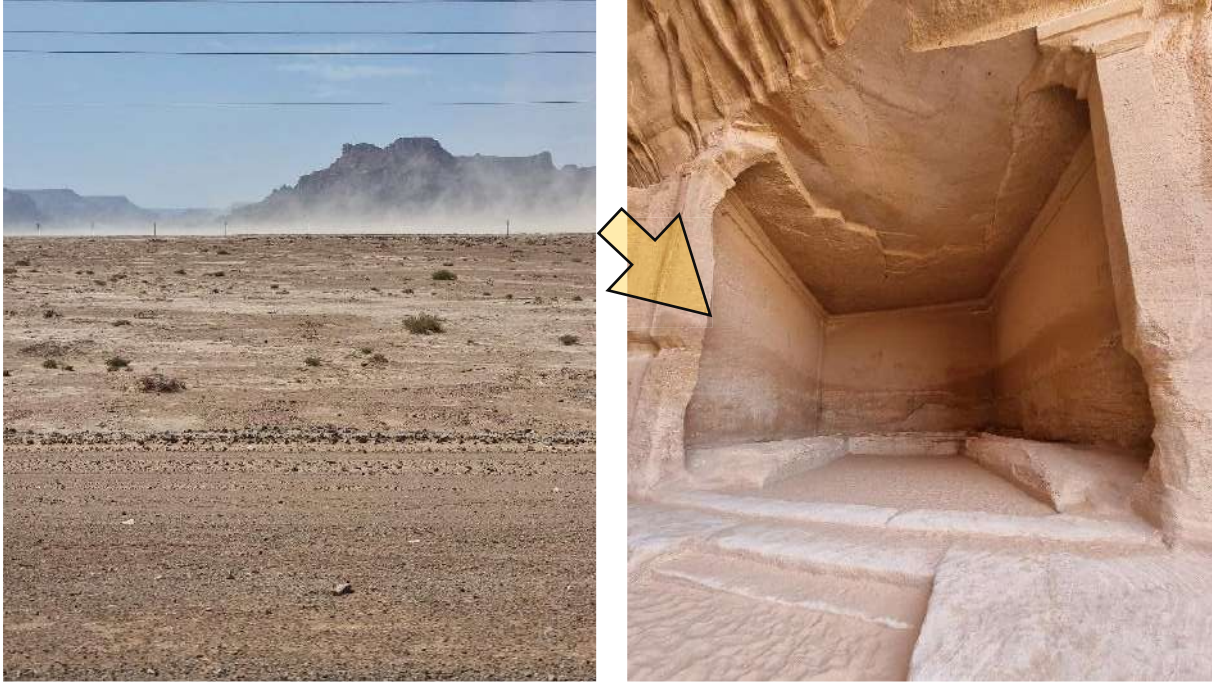


Figure 5-10: The left photo shows a sandstorm captured during one of my site visits. The right photo shows the surface line of the sand cover inside *Aldewan*. Source: Photos by the researcher.



Figure 5-11: Left: The photo shows the oases on Hegra and the northern areas of the AlUla region. Right: The photo shows the Cultural Oases and how the two series of mountains from the east and the west protect them by reducing the impact of sandstorms. Source: Photos by the researcher.

5.2.2.2 Sandy soil conditions

One characteristic of sandy soil is its inability to retain water, causing rainwater to either quickly sink into the ground or evaporate owing to the region's high temperatures. The elders identified this as a contributing factor to desertification. Participant 9 explained:

There is some wasted water that evaporates quickly, preventing plants from benefiting. On my farm, I mixed sand with clay to allow plants to absorb water from the soil. Some lands, including my father's, are entirely sandy. My father refused to plant until the soil was mixed with clay, enabling less frequent irrigation once a week instead of daily. Mixed soil retains water better, which was one of his key practices.

This statement shows that a soil that can hold moisture is a key factor in mitigating desertification. Participant 1 added that vegetation in sandy soil is fragile, a common issue in the Hegra and northern areas. Observations and interviews with elders from Hegra confirmed that, although sandy lands are dominant in the north, there are also areas with mixed clay soils (see Figure 5-12).

During the second review meeting, Participant 11 noted: 'The issue is not just with sandy soil; clay soil can also pose problems. For instance, pure clay soil prevents water from penetrating to plant roots.' Therefore, both pure sandy and pure clay soils can lead to degradation unless properly modified. According to the soil map of the WHS, the entire site is not completely sandy; many areas are covered with clay soil (see Figure 5-13).



Figure 5-12: These are some examples of locals mixing soil with clay around plants in Hegra village.
Source: Photos by the researcher.

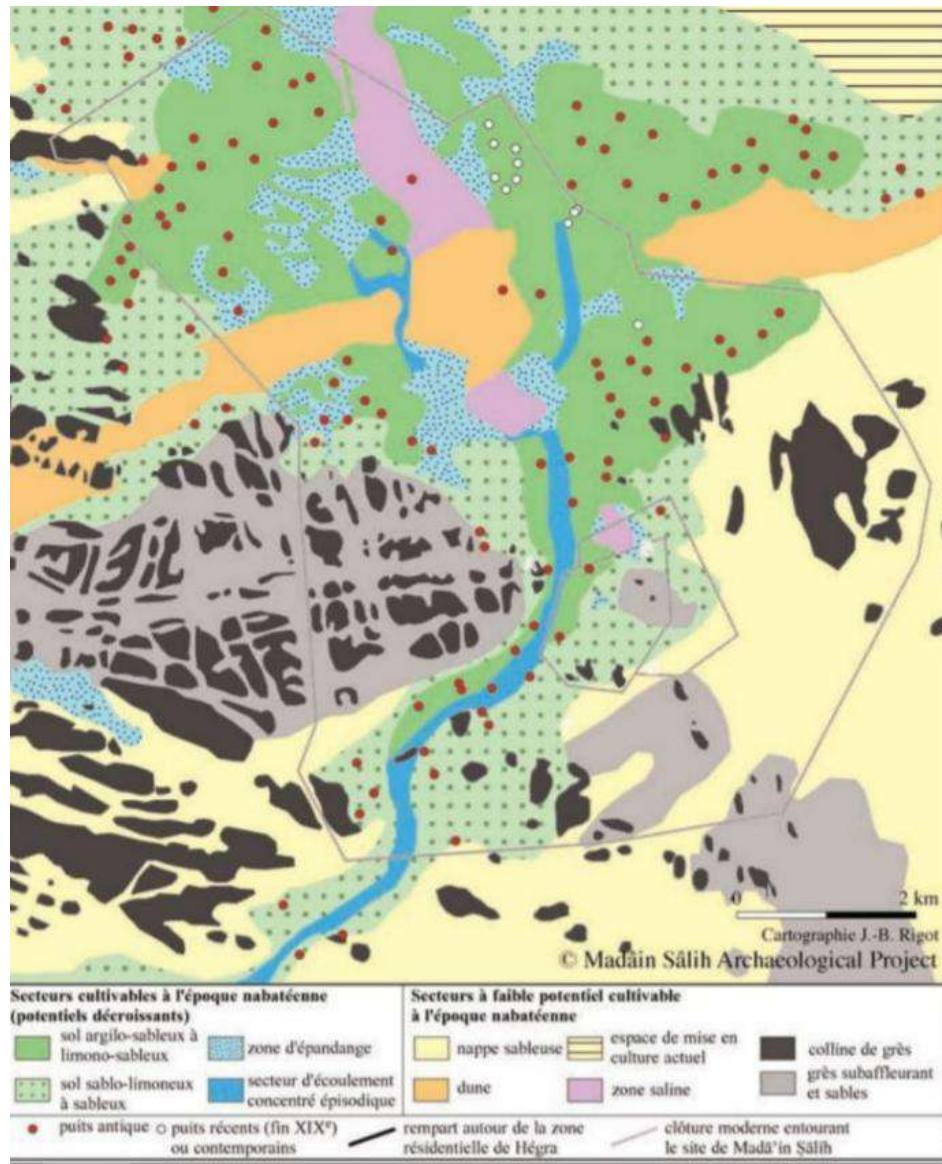


Figure 5-13: This soil map illustrates the various soil types within the WHS of Hegra. It indicates that areas adjacent to the seasonal water streams and basins contain different types of clay soil. However, as the distance from these waterways and basins increases, the soil composition becomes progressively sandier. *Source: Kingdom of Saudi Arabia (2007a).*

5.2.2.3 Flash flooding

The third factor that leads to land degradation is flash flooding. Flash flooding is rapid and localised flooding that appears within a short period and after intense rainfall (Ledraa & Al-Ghamdi, 2020).

Flash floods have the power to negatively affect natural qualities such as ground cover and native vegetation, oases, animals and even tangible cultural heritage.

For example, Participant 5 experienced extreme flash flooding in 1986, noting:

In 1406 Hijri (1986), a flash flood came from the valley of Al-Jazl, where locals used to grow palm trees and benefit from the seasonal water of the valley. However, the scary flash flood came and took everything, even some individuals and belongings. People ran to the top of the mountains. Since then (38 years ago), they stopped growing permanent cultivation inside the valley.

They developed their practice and TEK based on what they experienced. Participant 6 confirmed the flash flood event by saying:

The strongest flood we experienced was in the year 1406 Hijri [Islamic Date] during the time of King Fahd. It was a very powerful rainstorm that lasted for seven days. It washed away structures and even cars and trucks, carrying them to the valleys ... Farms were destroyed, and irrigation systems collapsed ... Some people lost their lives, and there are stories of people climbing trees or walls and staying there for days.

Also, he mentioned another flash flood that occurred in 1970: 'I remember my father telling me that there was a very strong flood in 1390 Hijri [Islamic Date] that caused significant damage. Approximately 16 years separated these two floods. This major flood is well-known among the people of AlUla.'

During site visits and observations, Participant 8 showed me the damage that a recent flash flood had caused, such as an area where its surface had been lifted up by the carried soil that came with the flash flood. He also pointed out a collapsed part of a house inside the oasis. He said: 'The flood entered the oasis and changed a few things, then left us' (see Figure 5-14). I revisited the site later in 2023 and observed ongoing roadwork and road expansion activities, which included the removal of

many traditional barriers that previously protected the oases. This development, which is part of the OMP, could potentially increase the area's vulnerability to flash floods (see Figures 5-14 and 5-15).

The impact of flash floods was pointed out by Neal Spackman in the Al-Baydha project in Saudi Arabia (Schwartz, 2020). He stated that flash floods might remove many trees on their way, and even infrastructure, such as roads, might be damaged (Al-Baydha, 2020). Flash floods lead to degraded lands and ecosystems, damaging key environmental factors and disturbing the relationship between locals and their natural environment.



Figure 5-14: This is the *Al-Sa'ah* Walkway (now called the Dadan Heritage Trail), where the flash flood came, damaged oases and removed structures. The top photo was taken during a site visit in 2022. The bottom photo was taken in 2023. All the traditional techniques, such as waterways and *oqoom* and *washea*, were removed owing to the construction of a new road for cars. Source: Photos by the researcher.

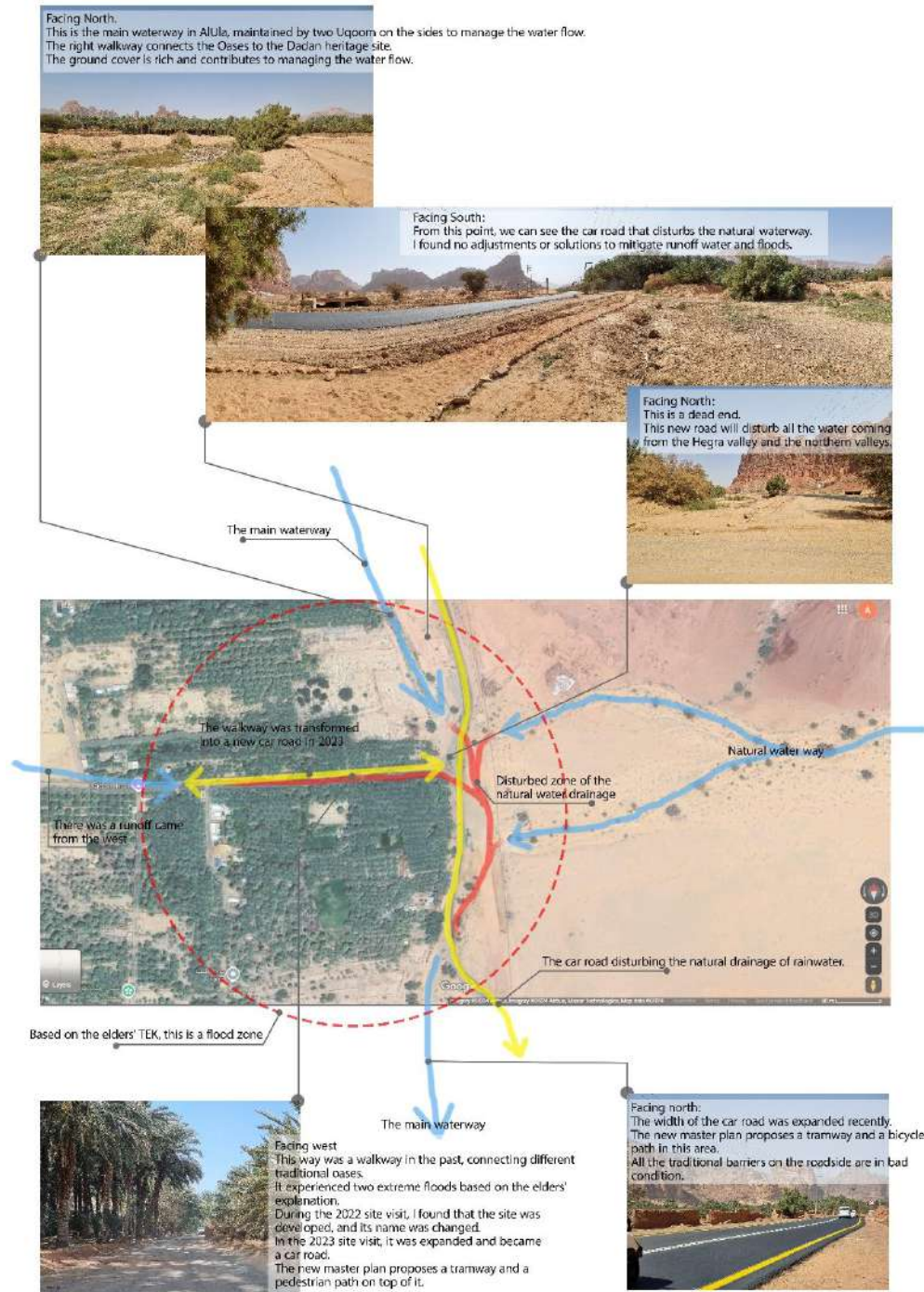


Figure 5-15: Based on the site analyses, the new master plan seems to overlook the flash flood issue. *Source:* Diagram by the researcher.

5.2.2.4 Decreasing water springs

Another factor that has led to desertification is the decreased number of water springs in the region of AlUla. Water springs were the key factor behind the habitation by locals and previous nations.

Since water was abundant, the inhabitants focused on agriculture to cultivate the land, and lived and thrived within this arid desert ecosystem. When asking Participants 1 and 4 about the factors causing desertification, they both started by saying that ‘all the water springs were dried and gone’. Participant 9 said that this issue is related to the increasing number of artesian wells. When locals dug more wells, the number of water springs decreased until they were gone—the last ones were the spring of *Dhaba’a* (ضبيعا) and the spring of *Salah* (صلاح) in 1405 Hijri (1984). He added that, when the water levels and the number of springs decreased, people neglected the traditional irrigation system and the oases and replaced them with more wells and unsustainable irrigation practices (see Figure 5-16).



Figure 5-16: The degraded traditional/Cultural Oases that used to rely on approximately 80 water springs in the past. *Source:* Photos by the researcher.

Although I categorised this issue as a non-human factor, elders draw a connection between this and another human factor, highlighting the complexity that the region faces. The elders highlighted that this issue could be related to the lack of maintenance of the water springs. They reported that irregular maintenance often leads to reduced or stopped water flow owing to natural and unnatural obstructions within the channels. A common issue mentioned by Participants 1 and 2 was the collapse of soil inside water canals (see Figure 5-17). Participant 1 noted: 'We may stay for two to three weeks without water, and this period of time may impact our plants.' Participant 4 added that water canals frequently accumulate debris that impedes water flow. Participant 11 remarked: 'I am one of the people who go inside the canals to remove things that disturb the water. One day, I removed a wooden stick that stopped one of the springs after a heavy rain and flood.' Additionally, Participant 6 pointed out that tree and palm roots growing inside water canals can reduce water flow.

During site visits to the Shalal Spring, I observed algae, rocks and plants inside the spring, particularly in the open parts of the canal. Without proper maintenance, these canals will inevitably suffer (see Figure 5-17).



Figure 5-17: Top: The open part of the Shalal Spring. Many obstacles that may affect the water flow can be seen. *Source:* Photo by the researcher. Bottom: This photo shows the most famous water spring in AlUla, Ain Tadeul (Tadeul Water Spring), highlighting the soil collapse at its exit. *Source:* Photo and modification by the researcher.

5.2.2.5 Harmful insects and birds

Farms and oases attract different types of insects and birds. These species play an essential role in sustaining an ecosystem. However, there are some species that affect the productivity of natural spaces, which may lead to desertification.

For example, Participant 9 stated that the smell of dates attracts the red palm weevil (*Rhynchophorus ferrugineus*). Also, Participant 3 noted that there are two species that affect their orchards, locusts and birds, since both come in high numbers and eat plants and fruits. Participant 1 said that the locals love locusts and love to eat them, but they do not like locusts when they attack their farms. In addition, he stated that one year, locusts ate all the clover fields in the area. Participant 8 highlighted that the impact of locusts and the red palm weevils is temporary and light, and does not affect people. However, Participant 7 stated that the red palm weevil is one of the insects that severely affects palms, stating: 'For two years, I did not benefit from palm dates due to this insect.' Owing to the differences between the contexts of the two sites, the impact of the species differs. Since these species influence the productivity of natural sites, the elders consider it one of the desertification factors.

5.2.2.6 Oases decline

The reduction in the number of oases in the region is a significant factor contributing to desertification, as noted by the elders. When oases diminish, there is an increase in unshaded areas, which leads to higher evaporation rates, along with the migration of birds and other essential animals. Participant 10 remarked: 'Part of the traditional/Cultural Oases has disappeared; farms are dead, and date palms and trees are either dead or nearly so.' He emphasised the need to regenerate oases to combat desertification.

This decline has been observed in several areas around the region, including AlUla Old Town, Shalal, Hegra and Mogayra. Although the reduction in oases is a standalone factor, it is interconnected with other factors previously discussed, exacerbating the desertification process. The literature supports this observation, indicating that reduced ground cover contributes to increased sandstorms and flash floods (Al-Shanqiti, 2013; Edgell, 2006; Gari, 2006).

In the following section, I explore the traditional methods of combating desertification, providing detailed information about the traditional activities and techniques that address each contributing factor.

5.3 Traditional actions for living with desert ecosystems

After explaining the first theme and the issues regarding desertification that the elders experienced or observed in AlUla, this section describes how to enhance living with desert ecosystems while dealing with desertification factors and issues traditionally. Three subtopics are identified to mitigate desertification: mitigation through traditional agricultural, mitigation through water management and mitigation via community.

5.3.1 Mitigating desertification through traditional agricultural activities

Under this subtopic, seven categories are associated with agriculture and address desertification factors. The seven categories are cleaning and maintaining oases, implementing barriers, ethical respect for the natural environment, planting native plants, managing the soil, recycling farm waste, and eradicating insect and bird pests. It is important to mention that, since these topics are part of a traditional system, some categories may be connected to two or more subtopics, indicating the complexity of the local TEK (see Table 5-1 and Figure 5-44).

5.3.1.1 Cleaning and maintaining oases

To protect an oasis from desertification, cleaning and maintaining the area and its plants are essential. ‘Cleaning’ here means removing waste, such as dead leaves, expired fruits and dead branches. ‘Maintaining’ in this case means undertaking essential activities to ensure that plants thrive and produce.

Maintaining and cleaning were mentioned many times by the elders. For example, Participant 9 stated:

Maintaining and cleaning palm trees is crucial for their health and productivity. We would climb palm trees about ten times a year to perform various tasks: pollinating the trees (Toubeer), covering the fruit branches (Al-Qenow), adjusting these branches as they became heavier, removing the covers and adjusting the branches again, harvesting the fruit, cutting old branches and removing any remaining dates stuck on the branches. Nowadays, this maintenance has been reduced to twice a year, focusing only on seeding and fruit harvesting. This reduction in maintenance has led to an increase in insects and plant diseases due to the leftover fruit that attracts pests.

He also added that cleaning is fundamental to protecting oases, and people need to learn when to cut and when to clean.

During a site visit with one of the participants, I saw two groups of cleaned palm trees; one was in good condition and the second was not (see Figure 5-18). When asked about them, the participant said that the branches of the first group were maintained and cleaned regularly, while the second one was not. When branches are not cut and maintained appropriately, the plants will be at risk of insects and diseases. Participant 8 emphasised the importance of cleaning and maintaining palm trees to protect oases from degradation. He noted that allowing farm animals such as chickens, sheep and ducks to roam freely within the oases provides multiple benefits, since they consume

insects, fallen fruit and grass. This not only helps keep the farm clean, but also promotes the health of the animals, contributing to a self-sufficient farming system (see Section 5.3.3.5). Participant 8 also mentioned that maintaining and cleaning farms traditionally required a collective effort from the family, as highlighted by Participant 1. Today, many people need to hire workers to perform these tasks. Overall, regular cleaning and maintenance are crucial for protecting oases from desertification.



Figure 5-18: Left: This photo shows well-maintained palm trees with neatly trimmed leaves. Right: This photo illustrates a poorly maintained palm tree with randomly cut leaves, resulting in fruit being trapped between the remnants of old branches, attracting more insects. *Source:* Photos by the researcher.

5.3.1.2 Implementing barriers

This section explores various traditional fences and barriers that elders implement to protect oases from desertification factors. The following discussion presents the importance of implementing barriers, detailing their characteristics and functions.

Constructing barriers and fences is necessary for the ecosystem. Participant 11 stated: ‘Fences are important and play an essential role as they protect oases and plants from winds and sandstorms.’ Additionally, Participant 8 noted: ‘Protection is the main factor behind our decisions. For example, the Wall of Al-Saba’a³⁵ was built to protect the city from outside attacks, floods, and sandstorms.’ He meant that they may decide to build a wall around a place to enhance the protection of the place. However, Participant 1 added, ‘Fences should be high to break winds and prevent outside attacks.’ These statements underscore the significance of traditional fences or barriers, which serve multiple purposes, including preventing outside attacks, flash floods and sandstorms.

Various types of barriers were observed and mentioned by the elders. For example, using plants such as Athel trees (*Tamarix*) as fences to break winds and stop sand movement is common in the region (see Figure 5-19). The Athel tree lines in ancient farms within the UNESCO WHS in Hegra protect the oases and orchards from sandstorms, a common regional phenomenon. Although this site was abandoned by the local community approximately 40 years ago, its ground cover remains maintained by these green fences. Additionally, a combination of trees protects an oasis from sandy winds and flash floods. Another observed function of these barriers is to provide privacy, since the trees are strategically planted to prevent visibility into the oases.

³⁵ The wall is located on the north side of AlUla Old Town.

Participant 1 explained, ‘Plants and fences can protect us from northern winds that carry sand dust. One of these plants is the Athel tree [*Tamarix*], which can work as a windbreaker. The good thing about Athel is that it can grow on sandy soil.’ Unlike other plants, Athel does not require the soil to be mixed with clay, contrary to what is detailed in Section 5.3.1.5. Participant 4 added, ‘We used fences to surround oases. If you use Athel trees, you will not need much water. Irrigating it once every two months is enough. Athel does not have many benefits or fruit, but it can stop the movement of dunes. However, an alternative is olive trees. They produce fruit and oil that benefit locals and protect oases from dust and winds. Recently, locals have been replacing Athel trees with olive trees [*Olea europaea*] due to their dense, large leaves.’ This reflects the community’s interest in plant species that provide additional benefits, such as fruit and oil. Participant 6 observed:

In this valley, some trees are 100 years old and work as windbreakers. One of them is the Athel tree, which has many benefits. It can be used as a windbreaker, for medical purposes, and to stop desertification. It is always green, provides shade, and we use it to make doors, ceilings, walls, and barriers.

Participant 9 elaborated:

These windbreakers are very helpful and are used on the edges of the farm. They should not be used inside the farm as they harm other plants. I’m using the Alban tree [*Moringa peregrina*], which is more beneficial for me. It does not need water except at the beginning. It is productive, always green, provides shade, and stops sand and wind.

Thus, like olive trees, the elder mentioned the Alban tree (*Moringa peregrina*) as a windbreaker, which has additional benefits appropriate to his needs.

Another type of fence, called *washea*, was described by Participant 1: ‘We made *washea*, which is made from the fronds of palm trees, and it works as a protection element for oases, stopping sand from entering farms.’ He added: ‘Windbreaks can be made of *washea* or can be a wall [made of clay

and bricks]. Sometimes, we built them between the neighbours [oases]. Their height can reach 3 meters, but it depends on the context of the site and what surrounds it.’ The *washea* includes wooden columns (1.5 m apart), 20 to 30 palm tree leaves between every two columns, and three metal ropes that link the leaves together and are linked to the columns for support (see Figure 5-21). Participant 9 added, ‘We use *washea* to enhance the cultural identity of the oases and to shade sitting areas.’

During site visits, various types of fences and their functions were observed. Locals used plants, *washea*, *oqoom* (sand berms), clay walls, brick walls and sometimes a combination of two or three techniques to reduce evaporation and perform the previously mentioned functions (see Figures 5-22 to 5-27).

These types of barriers can be added to the ones presented in the literature, such as stone walls (Abdallah, 2013, pp. 124-125; Llewellyn, 2013, p. 214; Llewellyn & Altasat, 2017, p. 14) and wire fences (Abdallah, 2013, p. 125). These studies presented how the traditional barriers contributed to the protection of vegetation, water and other natural resources.



Figure 5-19: Athel trees used as a natural fence to protect the natural ecosystem and cultural heritage elements inside the WHS in Hegra. *Source:* Photo by the researcher.



Figure 5-20: This is another traditional barrier that protects a young farm in the Alatheeb (العذيب) area between Hegra and the Cultural Oases. *Source:* Photo by the researcher.



Figure 5-21: This is the *washea*. All the bases of the leaves should be embedded in the ground. *Source:* Photo by the researcher.



Figure 5-22: The left photo shows a wall made of rocks. The right photo shows a wall made of clay bricks and shows how water can still access the oasis. *Source:* Photos by the researcher.



Figure 5-23: Elders noted that these walls allow the water to go into the farm gently by having small gaps between the rocks. This type is common in the Shalal area next to the volcanic mountains. *Source:* Photos by the researcher.



Figure 5-24: Another technique is called *oqoom* (sand berms). These are usually located next to seasonal waterways, and they vary in height and width. I observed this technique within the Cultural Oases (the right-side photo) and in the Hegra area (the left-side photo). *Source*: Photos by the researcher.



Figure 5-25: It is sometimes necessary to combine two to three techniques to enhance the protection of a site. In the left photo, locals combine the metal fence with *oqoom* and plant a fence to protect the oases from the flash flood. In the right photo, they combine *washea* with *oqoom* (sand berms) to support the *washea*. *Source*: Photos by the researcher and published in Alshami et al (2025).

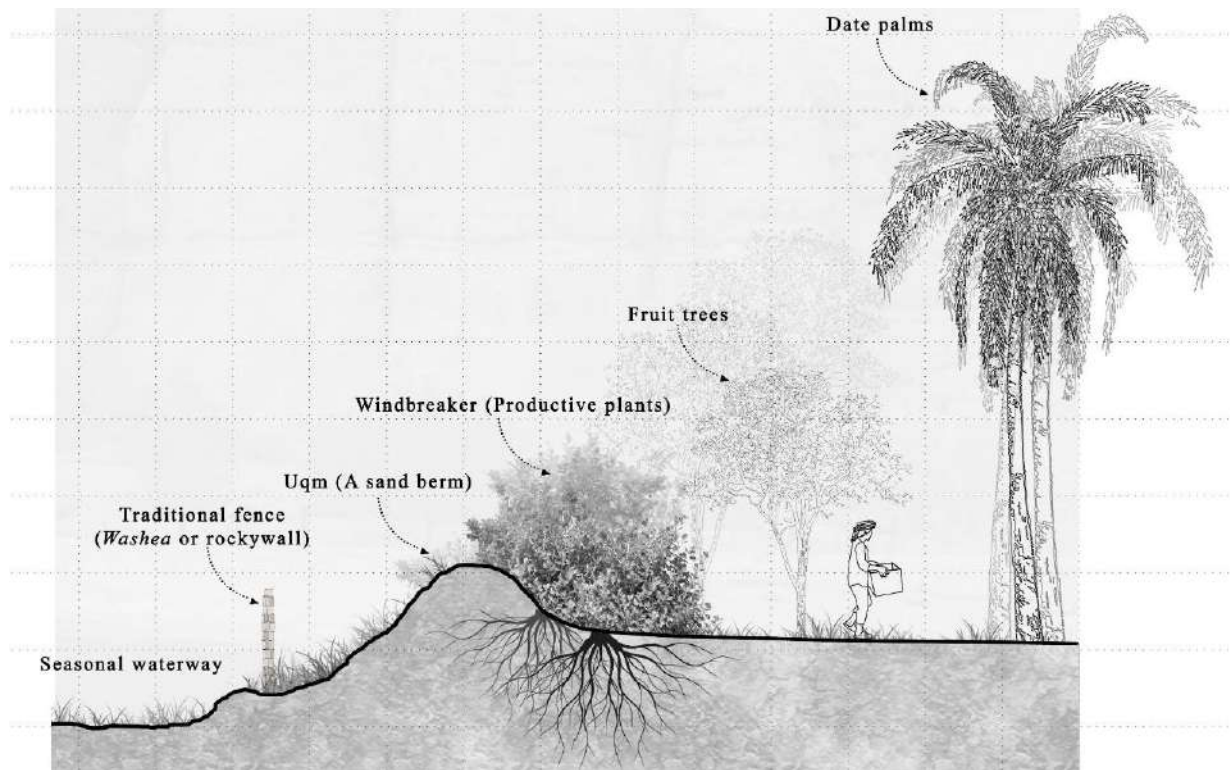


Figure 5-26: This section shows a combination of traditional techniques, such as *oqoom*, windbreaks and traditional fences, protecting oases from flash flooding and sandstorms. This method was observed in many places, such as Hegra, Shalal and the Cultural Oases. *Source:* the researcher and published in Alshami et al (2023).

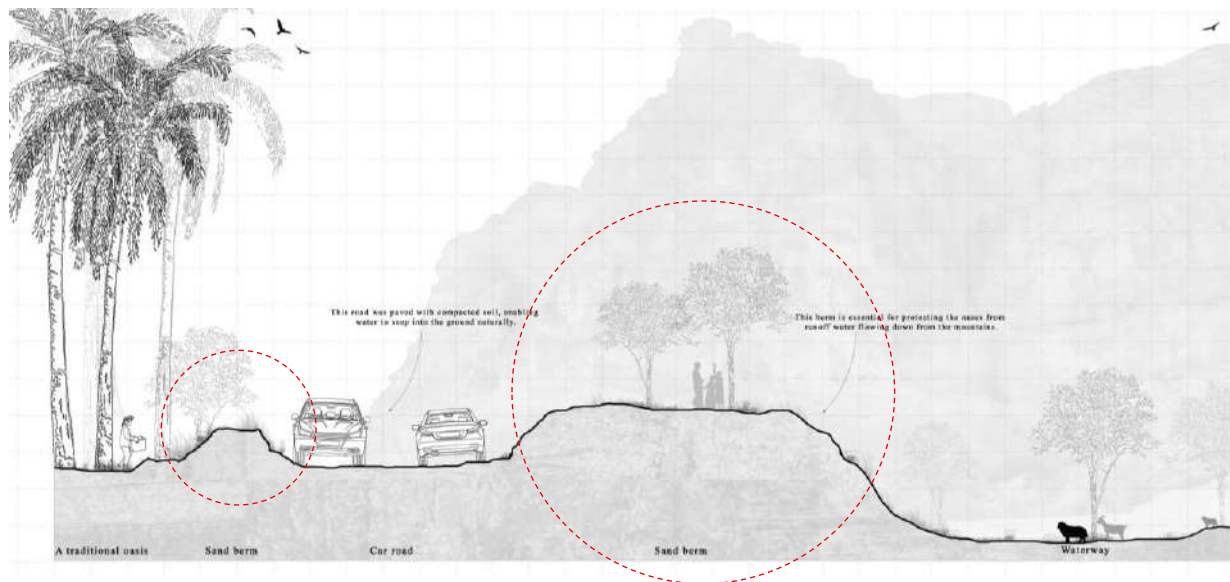


Figure 5-27: This section shows another technique, the adaptation of ground form to make a series of sand berms that reduce the risk of flash flooding. This traditional technique was observed between the Dadan cultural heritage site and the Cultural Oases. *Source:* Drawing by the researcher.

5.3.1.3 Ethical respect for the natural environment

Respecting the natural environment is another traditional factor that contributes to mitigating desertification. The elders believe that respecting the natural environment is part of Islamic environmental ethics, which does not allow them to cut any productive tree (shade or fruit trees) that benefits humans or animals.

Respecting the environment within the region of AlUla can be seen in terms of three concepts: preventing tree cutting, avoiding waterways, and leaving a distance between oases and mountains.

Participant 10 provided an example of the first concept:

Our religion instructs us to preserve trees and avoid cutting them or polluting shaded areas. We adhere to the environmental ethics outlined in the Quran and the Sunnah [the sayings of the Prophet Muhammad (PBUH)], avoiding cutting trees that benefit people [e.g. trees providing shade for pedestrians]. When a palm tree falls, we repurpose its wood to

repair our ceilings and doors. For firewood, we use only dry pieces, avoiding green wood. We honour the environment as our elders taught us, consistently respecting their guidance to protect green vegetation and utilise only what is dry.

However, exceptions are also considered by the elders. Participant 2 mentioned that, although they do not cut green branches, they may cut a branch or a tree when there is harm caused by that tree, such as the example mentioned by Participant 3 regarding a grape tree whose root system affected the water flow of a water spring. Even when they cut a tree, it is done in the public interest.

The second form of respect was highlighted by Participant 10: 'Oases are always located at the edges of the valleys (leaving a distance between them and the seasonal river/water stream), which shows respect towards ecosystems. They do not go against nature.' Local communities respect waterways and do not locate their houses or agricultural lands on them, as confirmed by Participant 5, given that oases and houses may be affected by flash floods. 'Respect' in this context means that someone acknowledges the importance of a natural feature and acts in an appropriate manner that contributes to the sustainability of the ecosystem as a whole.

The third observed example of environmental respect is maintaining a buffer zone between mountains and residential or agricultural areas. This buffer allows locals to manage water runoff from the mountains, reducing risks from flash floods and falling rocks. This practice and traditional pattern were evident in various sites, such as the Hegra, Shalal and the Old Town of AlUla, where locals constructed rocky dams between the urban area and the mountains to control flash floods and redirect water to the oases, as explained by the elders (see Figures 5-28 and 5-29). This action was mentioned by Al-Shanqiti (2019), who stated that a dam was implemented between the Castle of Asim and the mountain to manage the water passing through that area (pp. 174–175).



Photos 5-28: Left: the photo shows where elders used to implement rocky dams; however, the site has changed owing to the current development to make the site a tourist destination. Middle: The photo shows a new paved water canal collecting and redirecting water coming from the mountain. The traditional one was paved with soil, which allowed plants to grow and contributed to reducing the water speed; this one may increase the speed of the flow. Right: the photo shows another new water-harvesting/management technique that is not related to the local TEK of the community.

Source: Photos by the researcher.

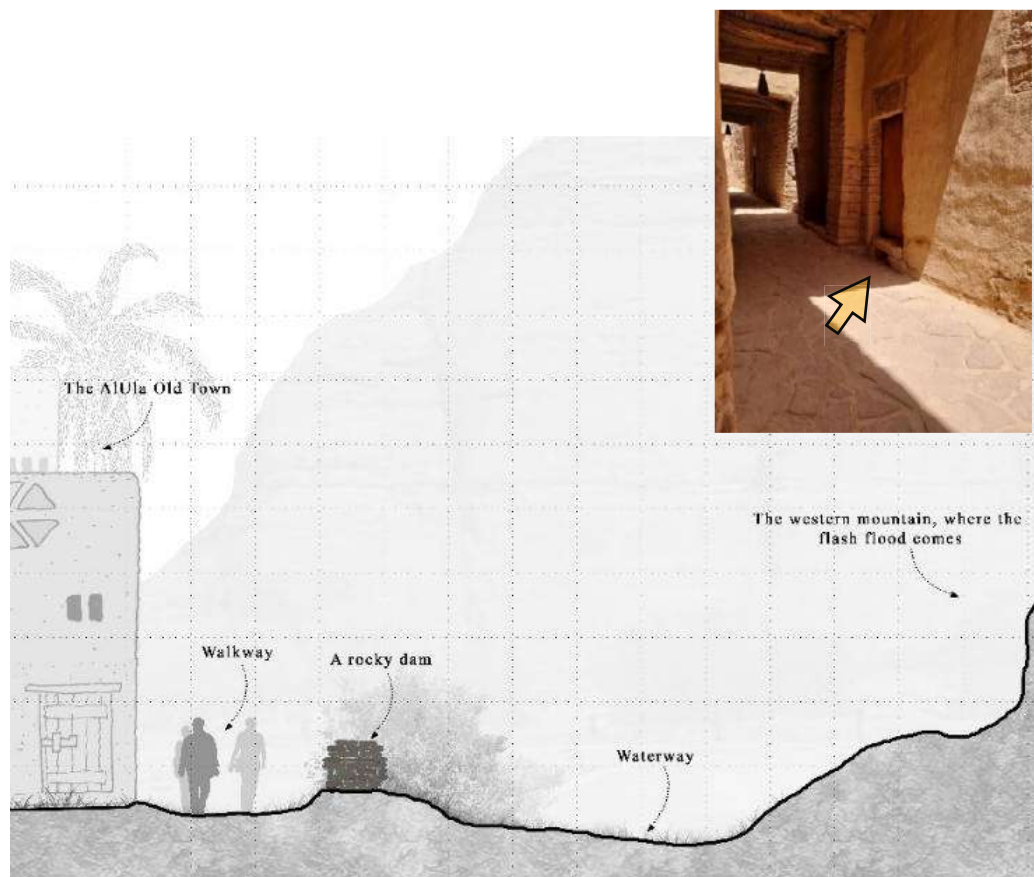
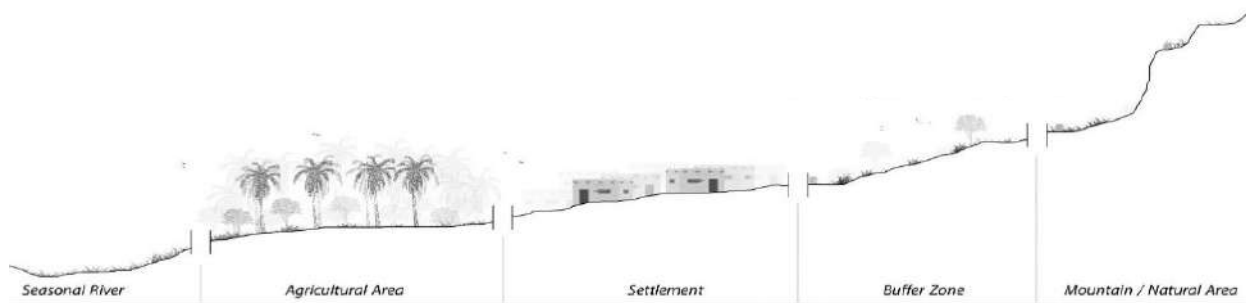


Figure 5-29: Top: The section shows the traditional pattern identified during many site visits.

Source: Alshami et al (2025). Bottom: The drawing illustrates the elders' explanation of constructing a rocky dam in the buffer zone between the urban area and the mountain to protect houses and oases from flash flood risks. This dam redirects water flow into canals beneath the houses, allowing rainwater to irrigate the oases without damaging the houses. The small photo shows one of these water canals designed to capture and harvest rainwater from the mountains.

Source: the researcher and published in Alshami et al (2023).

5.3.1.4 Planting native plants

Native plants are vital for the ecosystem and community, thriving naturally and suited to the conditions of the site. Participant 9 remarked, ‘Given the extensive logging, we need to increase local plants like Assmr [*Acacia tortilis*] as they are part of our culture and help increase ground cover.’ The local community regards native plants as part of their culture and identity. This is similar to the beliefs held by the Ebel-es-Saqi inhabitants, as reported by the landscape architect Jala Makhzoumi, where the locals considered olive trees as part of their Roman heritage in Lebanon (Makhzoumi, 2014, p. 242).

Planting these plants benefits both the environment and the people. Participant 3 explained, ‘Allah [God] created these plants here to preserve life, including humans. That’s why you see Assmr [*Acacia tortilis*] and Attalh [*Acacia farnesiana*] planted next to oases.’ He meant that planting these native plants provides protection, such as surrounding oases to shield them. Participant 6 highlighted that native trees such as the Athel (*Tamarix*) fix the soil, stop sand, reduce evaporation and provide food, oil and wood for furniture, doors and windows. The elders emphasised that native plants could endure drought and remain productive. For example, Athel and olive trees, once established, rely on underground or rainwater, requiring minimal irrigation. Also, some of the fruit can be stored for a long time. For example, the date fruit of *Phoenix dactylifera* is a staple in the region and can be stored for years, as explained by Participants 2 and 3.

In terms of the plants cultivated in the area, the elders listed approximately 35 types of fruits and vegetables. I observed most of them within the oases, except for 10 (see Table 4-1).

Table 4-1: The fruits, vegetables and native plants mentioned by the elders or observed in the county of AlUla (by the researcher).

Name	Mentioned by	Observed ?	Name	Mentioned by	Observed ?	Name	Mentioned by	Observed ?
<i>Phoenix dactylifera</i>	All	Yes	Wild fig <i>Ficus palmaria</i>	1-2-3-9	Yes	Banana	3-5-8	Yes
Sweet Lemon Lemon Bin Al Zuhair	1-3-4-5-8-9-11	Yes	Mandarin	2-3-5-8	No	Tomatoes	5-7-9	Yes
<i>Tamarix aphylla/nilotica</i>	4-6-9-10-11	Yes	Peach	2-3-9-11	No	Eggplant	5-7-9	Yes
Orange	2-3-4-5-7-8-10	Yes	Mango	5-6-8-9	Yes	<i>Corchorus olitorius</i>	2-4	Yes
Pomegranate	1-3-6-7-11	Yes	Onions	2-4-8-9	Yes	Corn	1-2	Yes
Grapes	1-2-3-8-11	Yes	Barley	1-2-10	Yes	<i>Moringa peregrina</i>	3-9	Yes
Wheat	1-2-7-10	Yes	Clover	2-4-8	Yes	Watermelon	2-7	No
Garlic	8-9	Yes	Okra	2-4-7	Yes	Olive tree	4-9	Yes
Mint	11	Yes	Millet	2	No	Watercress	4	No
Zucchini	5	Yes	Potatoes	5	No	<i>Lawsonia inermis</i>	6	Yes
Guava	7	No	Beans	7	No	Ash Gourd	7	No
Cucumber	9	No	<i>Cordia myxa</i>	9	Yes	–	–	–

Many researchers have indicated the importance of planting native plants to protect an ecosystem in the context of *hima* TEK (e.g. Llewellyn, 2003, pp. 24–25; Seddon & Khoja, 2003, p. 70; Serhal et al., 2011; Zahran & Younes, 1990). In short, planting native vegetation and protecting it from being cut is essential and can reduce the impact of desertification factors; further, it contributes to the community's well-being by providing needs such as food, fodder, raw materials and identity enhancement (see Figure 5-30).



Figure 5-30: This photo shows an elder drawing in the sand to illustrate the traditional vegetation zones of local grazing plants and the functioning of the irrigation system. He explained how the main waterway (the long blue line) distributes water between fodder zones, starting from the higher areas and flowing down to the lower ones. *Source:* Photo by the researcher.

5.3.1.5 Managing the soil

The soil of AlUla is a key element in the region because of its high fertility. Recently, the development has affected the natural environment by implementing new roads, an international airport, and many urban and tourism projects. These projects contribute to the degradation and decline of fertile soil.

The elders pointed out the importance of maintaining and caring for the soil and explained how that mitigates desertification. For example, Participant 1 said:

These ancient farms are made of clay soil, which is considered one of the best types of soil. Our current farms, however, are sandy. Therefore, we filled the farm with a mixture of sand and clay soil known as yellow soil [sand is not suitable for flood irrigation, so some locals use drip irrigation with sand, while clay soil can be irrigated using flood irrigation methods]. Also, the soil in oases is clay and easy to work with, whereas the soil in historical sites like Madain Saleh [WHS] is sandy and requires treatment (such as mixing) to make it suitable for using ancient techniques.

Participant 5 commented:

The soil here [between Shalal and Hegra] is excellent, the agriculture here is excellent, the soil is coherent, and we don't face sandstorms like others. Here, when you plant anything, it will be successful; the clay soil that we have contains most of the essential materials, so we don't have to use any organics.'

The participant referred to the sandstorm factor when talking about soil, highlighting the risk of desertification on the soil. The elders also indicated the importance of soil and the impact of sandy soil and sandstorms on the production of oases. Therefore, they implemented different techniques to protect and maintain the soil. For example, Participant 8 commented:

Soil protection is crucial due to the forceful impact of water, which can affect the soil. Therefore, we use these leather-like covers, similar to mats or flooring, to reduce water's impact on the soil and minimise water seepage into the ground in this area, thereby stabilising the soil (see Figure 5-32).

Additionally, implementing barriers significantly aids soil management by reducing the impact of sandstorms and flash floods. Other methods I observed for protecting soil include designating specific walking paths and restricting access to soil-sensitive areas (see Figure 5-31). During my visits, participants strictly adhered to designated paths and cautioned me against straying from them. When I inquired about this practice, a farmer from a traditional farm explained that they do not want people to step on small plants, seeds or the soil, so they allocate these paths for walking.

This practice is similar to one of the main types of *hima* in which grazing is forbidden, and a limited number of locals can go inside the *hima* to harvest fodder and resources. Zahran and Younes (1990) studied the quality of soil inside and outside *hima* lands, and the results show how locals maintain high-quality soil to mitigate the risk of desertification.



Figure 5-31: The red lines indicate the ways people can walk through. Source: Photo by the researcher.



Figure 5-32: This is one of the places where a blanket is used to protect the soil from the strong water flow. *Source:* Photo by the researcher.

5.3.1.6 Recycling farm waste

The recycling farm waste category does not mitigate desertification directly, but it reduces the pressure on natural resources enormously, contributing to protecting the natural environment. When people find that their needs are met within their oases, they do not need to go out to consume the natural resources. At the same time, they will maintain and ensure the sustainability and continuity of the oases and natural resources.

During the site visits, I identified various forms of waste recycling. For example, dry palm leaves are used to make *washea*, and door locks, doors, ceilings and furniture are crafted from the trunks of palm trees and Athel trees. Expired fruit is fed to farm animals and birds, and some of it is reused as compost for the soil (see Figures 5-33 and 5-34). Discussing this with the elders, Participant 9

explained, 'Recycling is part of our culture. We do not throw away farm waste. Plant leaves serve as fodder for our animals, and some are burned inside the oasis to kill insects and diseases.' They find ways to recycle and reuse what they have. When they cannot meet their needs from their resources and surroundings, they ask their neighbours. If necessary, they search the valleys but always maintain their respect for the natural environment, as detailed in Section 5.3.1.3. Participant 9 highlighted that recycling farm waste reduces the need for modern chemicals to heal the soil or plants, demonstrating that local TEK can address modern farming issues.

In short, recycling farm waste helps reduce the stress on natural resources, contributing to the sustainability of the ecosystem.

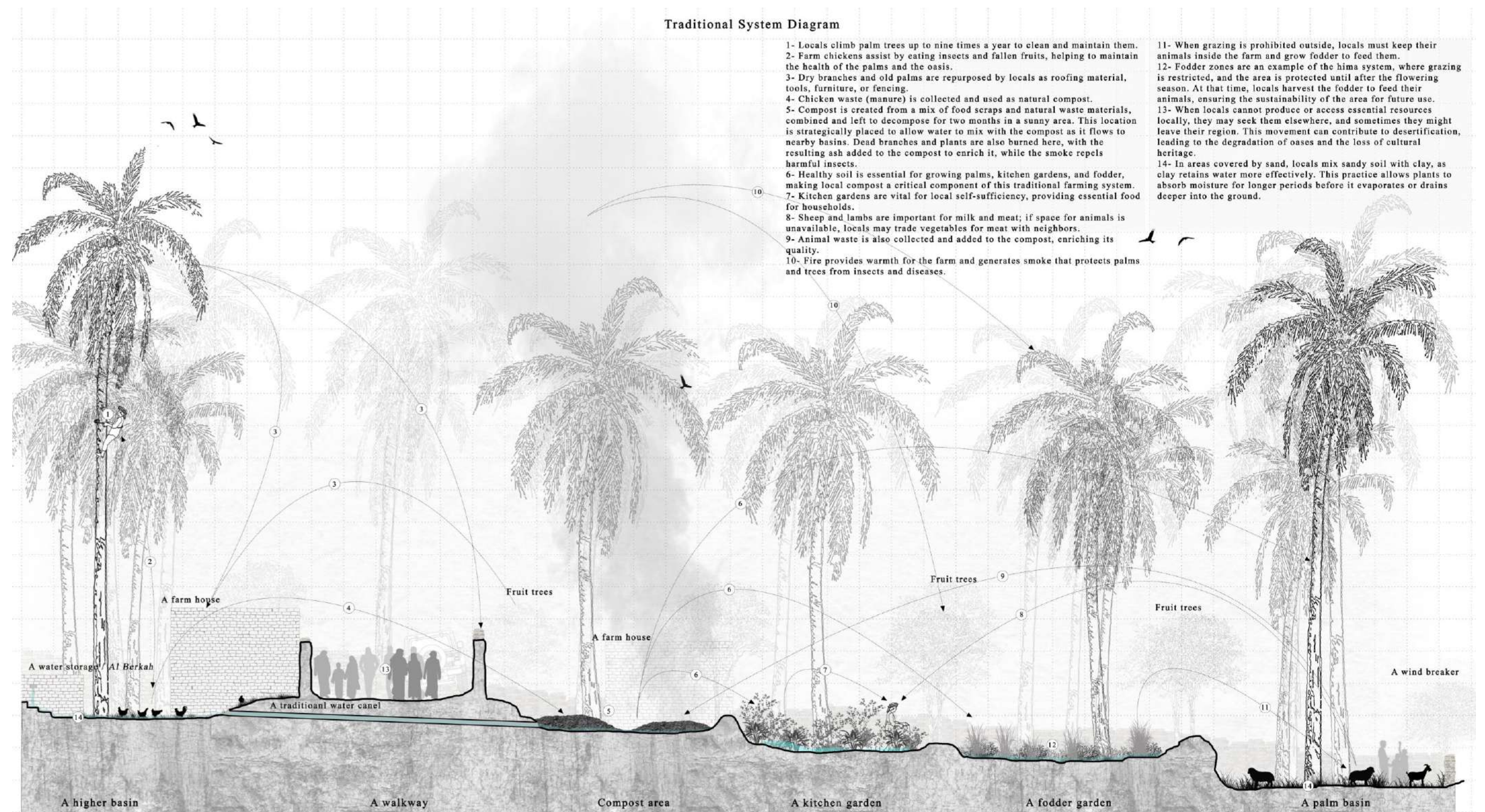


Figure 5-33: The diagram shows the traditional waste management system observed during the site visits and the different types of waste that are recycled to be used in different places. *Source:* Drawing by the researcher.



Figure 5-34: (1) A rubbish pan and a chair made of a palm tree trunk. (2) Burned natural waste was added to fertilise the soil. (3) A walkway shaded by palm tree leaves. (3) A door made of Athel branches. (5) A door lock made from the Athel tree trunk. (6) A sitting area shaded by palm leaves. (7) A place where all the natural waste of the oases is gathered to be dried and mixed with other materials for two months to make compost to be distributed between basins.

Source: Photo by the researcher.

5.3.1.7 Eradicating insect and bird pests

The final factor contributing to the enhancement of the productivity of oases within this subtheme is the expulsion of harmful insects and birds. As discussed in Section 5.2.2, some insects and birds significantly contribute to the desertification of the land. The elders have developed various techniques to mitigate this impact, including (1) generating smoke, (2) physically expelling birds, and (3) creating *Assallom* (a wooden doll).

Burning farm waste serves multiple purposes. In addition to preparing for the soil fertilisation, as previously explained, the smoke produced from burning waste expels harmful insects and birds. Participant 3 noted, ‘We gathered straws and plant waste to make smoke that expelled insects.’ During site visits, the smell of smoke was noticeable almost every morning in some oases (see Figure 5-35). However, this act may improve community well-being. For example, Participant 3 said, ‘Some people burn fallen Athel and palm trees throughout the night to protect the oases from frost and to keep the houses warm.’

Regarding the second and third strategies, the elders mentioned the collective efforts to expel birds and insects during their migration. Participant 3 stated:

Regarding locusts, locals prefer to hunt and eat them [in case of a small number of locusts]. For birds, the entire family, including grandparents and children, would go out into the oasis to expel birds and prevent them from eating the fruits.

When manpower was insufficient, the elders would create a wooden doll called *Assallom*, which moves with the wind and makes sounds to scare away the birds. These practices and techniques are crucial for mitigating the impact of harmful birds and insects, which elders identified as contributing factors to desertification.



Figure 5-35: During a site visit with one of the elders, we passed an area where active ash was distributed to allow the smoke to spread within the oases. *Source:* Photo by the researcher.

5.3.2 Mitigating desertification through traditional water management activities

The second subtopic identified in the data represents traditional water management techniques and activities that mitigate desertification. Under this subtopic, I explained five categories: maintaining waterways, managing the extraction of water, modifying irrigation systems, implementing water-harvesting techniques and creating *hammams* (public water basins; see Figure 5-44 and Table 5-1). Here, it should be noted that some scholars have explored and studied the traditional irrigation management system associated with water springs in AlUla, for example, Nasif (1981). However, this section highlights the details associated with desertification mitigation and is based on the elders' experiences from the AlUla Old Town and

other villages in the AlUla region, such as Hegra and Shalal, which were lacking in the previous studies.

5.3.2.1 Maintaining waterways

Maintaining waterways is the first category contributing to mitigating desertification, as explained by the elders. This category includes two sections: cleaning waterways and water distribution.

Removing obstacles and cleaning waterways are essential traditional water management activities, reducing the probability of decreased amounts of water, as explained in Section 5.2.2.4. Water springs and canals may face issues and accidents, such as soil collapse, root system growth and fallen rocks, which may disturb the water flow. Therefore, regular cleaning and removing obstacles are key to sustaining these water sources.

For example, Participant 3 explained: ‘Water springs need cleaning. We must protect the water from algae and small rocks because both may reduce or stop the water. I go inside the canal regularly with a bag and remove all the obstacles I find within the 200-meter-closed canal. Therefore, maintenance and cleaning will sustain the water longer ... and that applies to water wells too.’ Another example provided by Participant 3 is a story about a grape tree with a root system that grew inside a canal and disrupted the water flow that served hundreds of locals; they cleaned the canal many times, but the root still grew rapidly and affected the flow. Later, the elders decided after a long discussion to remove the whole tree to sustain the spring that served the public. When visiting one of the springs, I noticed one of the locals was removing algae from *Al-Berkah* (a water pond where the spring water and well water are collected to irrigate oases; see Figure 5-36).



Figure 5-36: Left: the photo shows *Al-Berkah*, which collects water coming from the water spring, where I found one of the locals cleaning and removing rocks and algae. Right: the photo shows that, even when there is a barrier that protects the canal, there are still some fallen rocks inside, which disturb the flow. *Source:* Photo by the researcher.

The second point relates to water distribution. The elders mentioned that during times of drought or decreased water, they would modify a waterway to irrigate the areas in need of water. For example, Participant 3 pointed out: ‘In case of decreased water, there are different strategies that we may take. For example, we redistribute the water to vegetable and grain fields and cut it from palm tree fields. Palm trees can bear the drought.’ In addition, Participant 4 added:

Instead of irrigating palm trees every week, I will try to irrigate every two weeks; I’ll preserve the water until the mercy of Allah [God] comes [he meant the rainwater]. I’ll irrigate the minimum amount that is needed to sustain a tree’s productivity. For example, instead of irrigating the whole basin, I may irrigate just the area around a tree trunk. And when the water flow becomes normal, everything will go back as usual [meaning they will stop the modified system and return to the traditional one].

Another method was mentioned by Participant 6 during the site visit as we passed a narrow water canal:

There are two benefits of implementing narrow water canals. First, it saves water and fastens its flow; second, it saves time, meaning I can irrigate in an hour and a half instead of irrigating for four hours. Therefore, I save water and time.

These quotes reveal the flexibility and multiple strategies associated with the local TEK. It could be argued that narrow water canals could even contribute to a reduction in water evaporation owing to the windbreak created by the sides that direct the flow. I also noticed that traditional oases have unique atmospheres (bird sounds, smells, temperature, breezes, etc.) that create a feeling, which is lacking in new eco-tourism sites implementing drip irrigation systems. It is important to mention this aspect as it adds value to the use of traditional techniques.

5.3.2.2 Managing the extraction of water

Water use management is essential for preserving water and allowing the natural recharge of aquifers. In the past, each farm had a set number of hours to be irrigated from water springs or wells. This number was decided based on the number of individuals serving the spring and the amount of effort provided by these individuals. This system was highly respected, and no one could change it because the community had agreed to it.

However, owing to the depletion of water springs, the traditional irrigation system ceased to be used, and some locals dug deeper wells to obtain more water, which affected the whole environment, given that this decreased the water further.

When discussing desertification issues and traditional solutions, Participant 5 commented, 'People used to extract water from wells for just a few hours a day, for example, 6 hours a day, but now there is a huge amount of water extracted from the ground every day.' This was observed on site visits. Most of the oases have wells, while in the past, many relied on one or two wells or a spring. Further, many oases in the region have been converted for economic and trading purposes instead of local use and need. This change encouraged people to extract more water to irrigate their extended farms. However, managing and limiting water extraction for small oases

and personal use only as before would likely support the natural recharge of the aquifers and may revive traditional water springs. Participant 5 noted, 'We believe that if we stop the unmanaged use of water, springs will be refilled and work again, especially when the water level becomes higher than the spring canals.' He meant that people should use water wisely and when needed, rather than for trading, and this may be beneficial for the aquifers. Recharging the aquifers and reviving water springs is likely to contribute to mitigating the desertification process. This is not impossible since around 40 water springs were revived and restored by locals, as observed by Nasif (1995, pp. 113–120). Therefore, managing water extraction is important in mitigating desertification factors.

5.3.2.3 Modifying irrigation systems

The third point is the modification and development of irrigation systems when needed. For example, Participant 10 stated:

We need to preserve the traditional urban fabric and the traditional irrigation system and develop them in a way that suits the present time and shows the traditional identity of the place. We do not want anyone to distort the visual uniqueness of our place.

This quote shows that modifying the system is traditionally accepted, and it shows that elders acknowledge the change between the past and present. Participant 10 pointed out:

Look! Modifying and minimising are important. In the past, I used flood irrigation, and when my allocated amount of water is high, I'll make the whole oasis a water basin to get the whole amount.^[36] However, when the allocated amount is low or the timing is less than others, I will make small basins around my plants.

Traditionally, locals would modify the design of the oases and waterways based on the allocated amount of water. Surprisingly, the implementation of modern irrigation systems was suggested.

³⁶ The amount of water is due to the amount of effort and time someone provided to serve and maintain the main water spring. Additionally, the amount of water means the allocated irrigation hours or minutes where water feeds an oasis.

Although there are many ideas associated with reducing water and preserving it traditionally, some elders may suggest modern techniques because they save time and effort, and achieve their needs, as explained by Participant 10 (see Section 5.2.1.2).

During site visits, I identified two approaches to using modern irrigation systems. The first approach aims to preserve the system but modify some parts of it when it is needed. For example, Participant 2 commented: ‘Yes, I modified some parts of the system to reduce the waste of water, and I kept the area of wheat and trefoil to be flood irrigated.’ In addition, Participant 10 stated: ‘Using some modern irrigation techniques is needed to reduce the waste of water.’ During the site visits, I found sites with mixed traditional and modern techniques, such as the SV-14 Site (see Figure 5-37). The second approach aims to change the whole system to preserve water. For example, in areas with very low water amounts, locals change the whole system to sustain their oases. This strategy was observed on different sites. Participant 9 stated that people whose oases are in Mogayra village need to use modern techniques because of the depletion of the aquifer in their area.

During the workshop, Expert AC, who is involved in the development of the region, highlighted this issue and stated that they (the official institutions) aim to change the whole irrigation system in the Cultural Oases to be a thoroughly modern system with drip irrigation. I acknowledged the problem but also stated the associated impacts resulting from the move to modern irrigation systems, such as losing the site identity and atmosphere, including the natural sounds, the birds, the temperature and the smell, as observed in many newly developed sites within the SV-6 Site. They agreed on the importance of water canals and their association with the abovementioned factors (temperature, smell, birds and sounds, etc.). However, they stated that their primary focus within the development is water saving, followed by the place’s traditional identity.

In short, connecting what was presented in Section 5.3.2.1 with this category, we can see that modifying traditional irrigation techniques to contribute to desertification mitigation is

traditionally accepted to reduce water waste. However, it needs to be carefully planned to preserve other traditionally associated values, such as the atmosphere of the oases.



Figure 5-37: Left: The photo shows two techniques, modern pipes and *Alberbakh* (البرباخ), which is a traditional implementation located in a place where the water moves from a higher level to a lower one, indicating by sound that the water has reached an area. Right: the photo shows a traditional oasis with a modern irrigation system. *Source:* Photos by the researcher.

5.3.2.4 Implementing water-harvesting techniques

To mitigate desertification and address water scarcity, the local people employ various water-harvesting techniques. Four key methods are highlighted. The first is related to harvesting and transferring water. The local community has constructed water canals beneath the urban fabric of AlUla Old Town to capture rainwater from the mountains and channel it to agricultural fields in the valley. This method not only conserves water but also protects homes. Participant 11 noted, 'The water canals in the Old Town showcase a thriving Islamic civilisation. They collect mountain runoff and direct it under houses to the open space of *A'ddrb*, irrigating the oases. This technique helps preserve our heritage' (see Figure 5-38).

The second point relates to water ponds and their locations. Water ponds, or *Al-Berkah*, are strategically placed in higher areas for irrigation and human use, and to support birds and wildlife. These ponds are typically shaded to minimise evaporation. Participant 6 explained, 'We position water ponds away from sunlight to prevent evaporation and wastage.' Observations confirmed that most ponds are situated under large trees or covered with palm leaves (see Figure 5-40).

The third point is about storing water. The elders from the Old Town and traditional/Cultural Oases reported that they historically did not store water owing to the consistent flow from numerous springs. They would temporarily collect water for a day or two. However, Participant 6, also from the Old Town, referred to *Al-Berkah* as a temporary storage method. Elders from the north, such as those from Hegra, emphasised the natural storage of water in mountain tops or valleys after the rainy season, which they used instead of depleting their wells. Experts from the third workshop confirmed this point. Thus, water storage and harvesting are integral to the AlUla region, in both the Cultural Oases and the northern areas.

The fourth point relates to sand berms and rocky dams. Although not explicitly mentioned in interviews, *oqoom* (sand berms) and rocky dams (discussed in Section 5.3.1.2) are considered water-harvesting techniques. These structures are typically placed near seasonal waterways to shield oases and homes from flash floods. When discussing some of the barriers with Participant 11, he emphasised that rocky dams should have gaps to allow water to flow downstream, as well as slowing down the flow, enhancing soil absorption and recharging aquifers.

In summary, traditional water-harvesting techniques not only mitigate desertification but also protect heritage significance and structures, essential for the sustainable development of the region. Some of these techniques can be seen in the Nabataean sanctuary area (see Figure 5-39). In a number of *hima* studies, researchers presented various water-harvesting techniques,

such as rocky dams, water canals, ponds and natural water collections within *hima* areas (see Al-Shanqiti, 2013, 2019; Al-Utaibi, 2006).



Figure 5-38: These photos show one of the water canals that harvests the rainwater coming from the mountains and redirects it to the oases. *Source:* Photos and modification by the researcher.



Figure 5-39: These are the canals that the Nabataeans implemented to harvest and preserve water in the Hegra WHS. *Source:* Photos and modification by the researcher.



Figure 5-40: (1) and (2) show traditional water ponds that are usually shaded by the surrounding trees. (3) and (4) show Nabataean water storage created inside a mountain and prevented from direct sunlight. *Source:* Photos by the researcher.

5.3.2.5 Creating *hammams*

The final traditional technique for preserving and maintaining water involves creating a *hammam*, a public water basin with a small waterway. This small pond or basin, located within the water network but outside the oases, allows spring managers to control irrigation timing and water direction between oases without entering private property. Participant 2 explained:

There is usually a gap in the oases' fences for spring managers to enter and adjust the water flow. However, if an oasis owner prefers privacy, they can build a *hammam*, allowing managers to modify water direction without intrusion. Any mistakes within a private oasis are the owner's responsibility [see Figure 5-41].

This method enables efficient water management and reduces waste while respecting individual privacy (see Figure 5-42). Additionally, locals can freely drink and use water from the *hammam*, reflecting a community tradition. In conclusion, traditional water management techniques are crucial for mitigating desertification.



Figure 5-41: In this photo, the participant explains the design and function of traditional hammams. He described how the water manager can access the water basin to redirect the water flow without breaking the privacy of the oases. Source: Photo by the researcher.

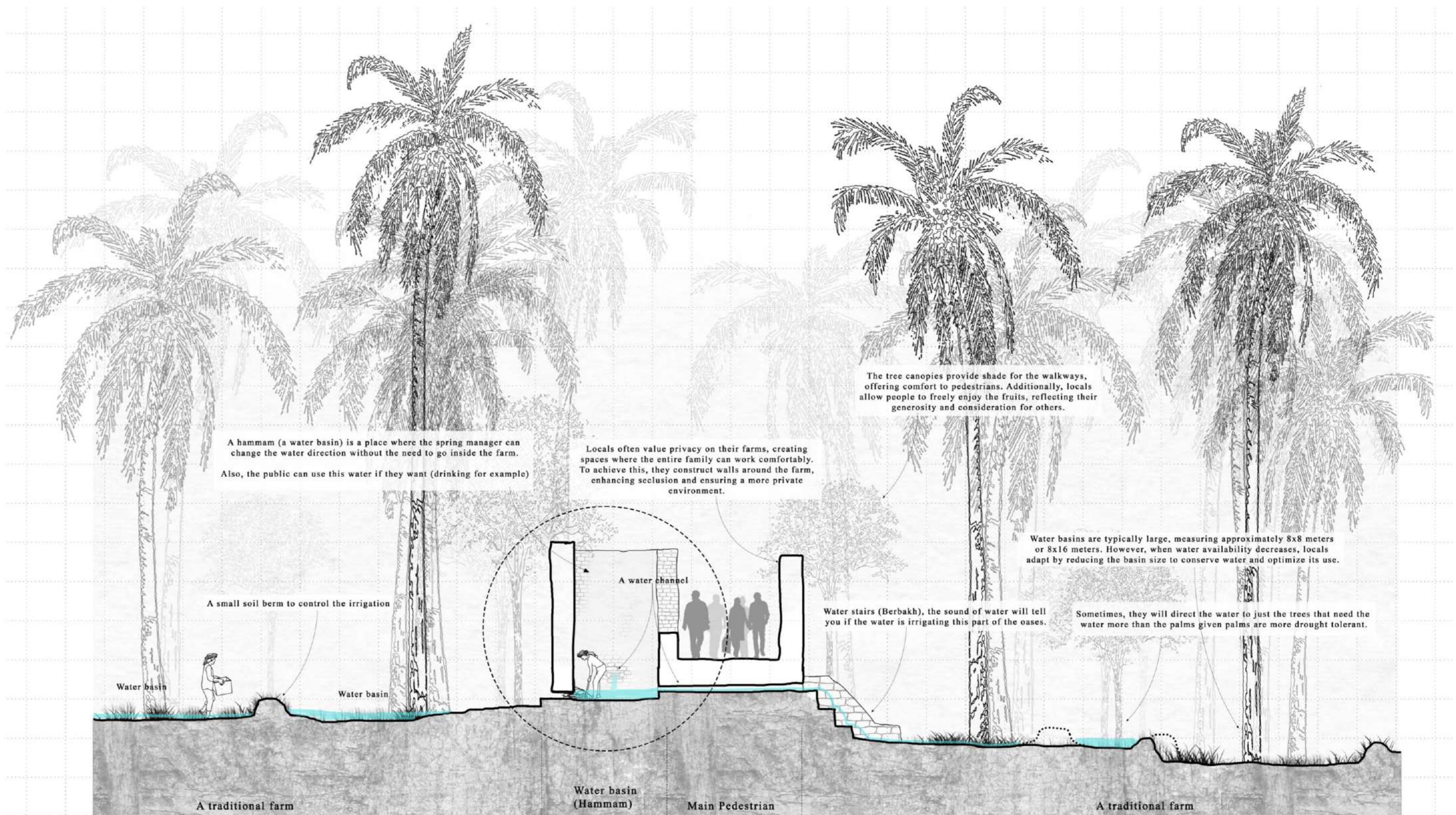


Figure 5-42: This section shows some traditional irrigation techniques, including *hammam* (حمام) and *Alberbakh* (البركة), and some traditional modifications implemented by locals in the Cultural Oases, AlUla, to maintain water. Source: Drawing by the researcher.

5.3.3 Mitigating desertification through community activities

Following the discussion on traditional agricultural and water management techniques, it is crucial to highlight the role of local society in mitigating desertification. This section identifies traditional social activities in AlUla that contribute to combating desertification. These activities can be categorised into six key areas: the establishment of a community association, conducting regular inspections of key resource areas, limiting accessibility, storing palm dates traditionally, being self-sufficient and transferring traditional knowledge. These community-driven efforts are essential for sustaining the region's ecosystem and cultural heritage (see Figure 5-44 and Table 5-1).

5.3.3.1 Establishing a community association

Although some actions reduce the process of desertification and can be carried out individually, other tasks need a group of people working together to mitigate desertification. Several elders mentioned the need to allocate a group of people to specific tasks. Participant 10 observed:

To reverse desertification and revive oases, we need to go back to the idea of making a community organisation or finding an investor or a company to develop the oases. In this case, it is possible to replant native plants and preserve the traditional urban fabric and irrigation system.

Participant 11 mentioned that he is a member of several organisations associated with local heritage and natural conservation.

This concept can be seen in the local tradition. Participant 2 stated that 'the community was in synergy with each other'. Participant 3 detailed, 'In case water decreased or stopped, the impacted people will agree with other water springs' owners to get some water to survive.' By doing this, all can work together to modify waterways and move the water to new areas without affecting the oases, which rely on the operated water spring. Further, the affected people do not have to dig a well or go to other valleys to collect the limited preserved water. Another example

provided by Participant 1 was as follows: ‘At the time of *Tawbeer* (Palm tree pollination time), you will find that mothers, daughters and the fathers are all working because, in that time, there were no agricultural labourers, all of which depended on the family’s work.’ Whether from a familial or social perspective, this collective approach is crucial for maintaining natural resources and combating desertification. This concept is presented in the literature, for example, in studies by Eben Saleh (1998c, p. 179) and Gari (2006, p. 219), where locals designated specific individuals for particular tasks regarding landscape management.

5.3.3.2 Conducting regular inspections of key resource areas

Regular visits by the locals and inspections of key resource areas and surrounding natural resources are essential for the early detection and resolution of environmental issues. Participant 9, previously mentioned in Section 5.2.1.2, emphasised that maintaining a presence in these areas allows for the observation of changes and prompt action to address potential problems. Although this practice has been referred to in earlier discussions, it warrants a focused examination owing to its critical role in protecting the ecosystem against desertification.

Participant 9 noted that frequent visits and a strong attachment to oases enable locals to detect negative environmental changes in their early stages and take corrective measures. Historically, locals resided in oases for six months during the summer and continued regular visits during the winter. Although lifestyles have evolved, the elders still visit the oases regularly, not only for maintenance, but also for relaxation and to enjoy nature. Participant 10 explained:

Visiting the oases is part of our culture, and it is inherited from our fathers. I have houses in different areas, but nothing can make me happy like the oasis. I feel good psychologically when I see the greenness, hear the water and smell the wind.

Thus, regular visitation contributes to both mitigating desertification and enhancing community well-being. The strong connection between locals and their oases is further evidenced by the preference of most interviewees to meet and conduct the interviews within their oases. This

cultural practice underscores the integral role of frequent inspections in environmental stewardship and community health. Implementing monitoring missions is *essential to protecting natural resources and conserving cultural heritage sites from desertification factors*, such as flooding, as explained by Nguyen and Baker (2023).

5.3.3.3 Limiting accessibility

Limiting accessibility to natural resources is a traditional method used for mitigating desertification in AlUla. This concept includes various practices, such as making it difficult to reach resources, restricting irrigation timeframes and allocating specific quantities of wood branches or fruit. When modern tools and equipment are used to intensify resource extraction, the process of desertification accelerates, as noted by the elders. For instance, the introduction of machines for water extraction led to increased well digging and the overuse of water resources, which contrasts with the traditional practice of limited irrigation, as mentioned by Participants 2, 3 and 5. This approach had been in place for over 800 years but has declined in the past 40 years, coinciding with increased desertification.

Another example is grazing. Traditionally, locals would walk long distances to feed their animals in designated grazing areas, as noted by Participants 6 and 9. However, modern transportation now enables farmers to either transport animals directly to fodder fields or bring fodder back home, resulting in overgrazing. To effectively protect natural resources, the principle of limiting accessibility must be adapted to contemporary contexts. This strategy is one of the key practices in the TEK of *hima*, contributing to desertification mitigation (Gari, 2006, pp. 214–215; Llewellyn & Altlasat, 2017).

5.3.3.4 Storing palm date traditionally

Date fruit is the main traditional food in the AlUla region, and it can remain edible for years when stored appropriately using traditional methods. Storing palm dates is crucial because it prevents

over-hunting and migration in search of food. Participant 5 noted that, during droughts, some locals from northern areas moved to Jordan to find sustenance, whereas those from the Cultural Oases relied on dates stored in *Al-Shannah*, a traditional bag made of sheep skin (see Figure 5-43). Participant 11 highlighted that AlUla's stored dates helped prevent starvation in Saudi Arabia during 1338³⁷ (1919–1920). Despite modern storage methods, locals still use *Al-Shannah*, and they celebrate this tradition through the *Al-Shannah* festival, where the community gathers to honour their heritage and to store dates. Thus, traditional date storage not only preserves food but also alleviates pressure on natural resources and the ecosystem.



Figure 5-43: These bags made of sheep skin are used to store palm dates in AlUla. *Source:* Photo by the researcher.

³⁷ Islamic/lunar calendar.

5.3.3.5 Being self-sufficient

A crucial point raised by the elders in discussions on desertification mitigation was self-sufficiency, as observed in various sites. From the elders' perspective, self-sufficiency involves maintaining balance and operating based on needs. The over-exploitation of resources such as water and plants accelerates desertification. Participant 1 remarked:

My father, may God forgive him and have mercy on him, never held a job. We lived off date palm trees, caring for them as our main source of life. We ate from them and traded items made from palm elements like fronds. We were self-sufficient. Orchards were about 5 meters by 10 meters or slightly larger, sized based on each family's needs.

He means that locals fully rely on their small oases, which contain the main needs (fruit and vegetables), as well as raw materials (such as wood and clay to make tools). They might make additional products (food/tools) to obtain some income to support themselves. Participant 5 reinforced this by stating, 'There was self-sufficiency. In the past, the number of palm trees was fewer, yet people thrived. Now, the number has increased significantly because people aim not just for personal and family needs but for trade.' Another example supporting this category is found in Section 5.3.1.6 (Recycling farm waste; see Figure 5-33). Thus, self-sufficiency is a traditional approach to alleviating pressure on natural resources.

5.3.3.6 Transferring traditional knowledge

The transfer of traditional knowledge is a critical component in mitigating desertification, as many elders emphasised. Desertification mitigation is a long-term process requiring continuous interaction with the environment, achievable through educating and teaching the younger generation about ecological traditions. Participant 10 noted, 'The knowledge and practice were inherited from one generation to another. In AlUla, locals are interested in heritage and traditions.' Participant 1 shared, 'I learned agriculture because it was essential for living.' Here, 'agriculture' refers to TEK, as he previously mentioned that his father practices and encourages

these traditions. Participant 3 advised, ‘Unfortunately, we have shortcomings towards our kids. Each family with the knowledge and traditional skills should pass them on to their kids.’ He emphasised the importance of teaching children how to maintain the environment. During a site visit in Hegra, I observed a child working with his grandfather on the oases and maintaining waterways. Unfortunately, this was the only instance in which I noticed young generations actively engaged with elders in traditional practices. Involving younger generations not only protects the environment from desertification but also conserves the local TEK and practices as an intangible cultural heritage.

5.4 Conclusion

In this chapter, I presented two themes identified in the data and associated with the local way of living in desert ecosystems and relating to the context of desertification mitigation (see Figure 5-44). The research question related to this chapter is ‘How can the TEK of *hima* enhance living with desert ecosystems within Saudi cultural heritage sites?’ The second theme answers the question directly, while the first theme presents the factors that lead to desertification and ecosystem degradation from the elders’ point of view. In the first theme, I presented two factors that lead to desertification: human and non-human. Then, for the second theme, I described the traditional ways of living to mitigate desertification. The knowledge and practices of the elders highlighted three subthemes: traditional agricultural activities, traditional water management and community activities, and all show the role of *hima* TEK in enhancing desert ecosystems and mitigating desertification.

The new urban developmental master plan in the AlUla region was established based on 12 sustainable development principles, sustaining the ecosystem and wildlife, safeguarding the natural and cultural landscape, celebrating heritage and culture, enabling the local community, and revitalising, restoring and regenerating the built environment (RCU, n.d.-c). Although the AlUla development approach encompasses essential issues and aspects, an integration of the

local TEK and the practices of *hima* in the new development framework is missing. Further, desertification factors within natural and cultural landscapes and heritage sites are not comprehensively addressed, particularly in areas where cultural heritage oases and the urban fabric are intertwined, potentially resulting in further degradation of ecosystems. This research claims that integrating the traditional way of living with desert ecosystems and the involved traditional practices within the new development approach may be needed to mitigate desertification and achieve a sustainable development that addresses cultural heritage conservation, ecosystem enhancement and local community well-being.

The data show opportunities for *hima* TEK and its practices to be integrated and proposed within the Master Plan (OMP) to mitigate desertification as well as realise AlUla's vision. An example is the SV 14 Site, where a flash flood came from the surrounding mountains and damaged the oases and houses (see Figures 3-2, 3-3 and 5-15). This site used to have a series of *oqoom* (traditional sand berms), including a huge waterway between the mountains and the oases, to reduce the risk of flash floods (see Figure 3-3). However, even with the implementation of these techniques, the site experienced two major flash floods that caused major issues. Currently, the site has a 10 m wide road for cars that disturbs the main waterway.³⁸ Recently, the road was expanded further to include the proposed ideas, such as an electric tram and a bicycle path, as shown in the OMP of AlUla, which may increase the risk of flash floods and their impact (see Appendix I).³⁹ The local TEK offers several solutions to minimise flash flooding risks and maximise the benefits of harvesting and managing water. Solution 1: The risk of flash floods for oases and cultural heritage can be reduced using a series of *oqoom*, which reduce water flow, mitigate the flow's power, and create small microclimates that support the local ecosystem. *Oqoom* can also work as swales to collect water to feed the aquifers and vegetation cover. Further, implementing water canals is another traditional technique that facilitates the transit of water to feed oases, farm animals and

³⁸ This point was observed during the main site visit in 2022.

³⁹ This point was observed during the second site visit in 2023.

the local community (see Figure 3-3, Future with TEK). Although the last section in Figure 3-3 presents traditional techniques to mitigate specific desertification factors, the ideas in the OMP can be addressed and proposed with minor modifications, such as adding the traditional sand berms between the different spaces to enhance the protection of the place. This example illustrates how the traditional techniques associated with traditional water management and agricultural activities can contribute to mitigating desertification factors. These design aspects and ideas were missing from the initial design investigation presented in Chapter 4.

In terms of community activities, some can be proposed to enhance the protection of the site, such as allowing for regular visitation. Regular local visitation allows people to monitor the site, notice any negative environmental changes in the early stages and report to official organisations, who can make earlier decisions to mitigate any potential risk, and sustain the environment and cultural heritage. Regular visitation, a traditional way of living, in this case, will contribute not only to the sustainability of the place but also to the locals' well-being by allowing them to interact with their surrounding nature, which is considered part of the local tradition and culture.

Regarding LA design, the results highlight valuable data that can inform LA at three different scales. At the broader landscape planning level, three traditional aspects that are crucial for mitigating desertification have been identified: agriculture, water management and societal practices. These aspects are essential for developing comprehensive strategies to combat desertification. At the urban design scale, local TEK reveals a spatial pattern in which agricultural lands are situated close to waterways without disturbing the water flow (e.g. see Figure 5-29). Urban areas are positioned on higher ground, yet not too close to mountains, for safety reasons. Additionally, various zonings, such as buffer zones, grazing areas, social spaces and agricultural lands, play a significant role in mitigating desertification, each contributing uniquely to the ecosystem's balance and community well-being. At the site plan scale, specific traditional

techniques and activities, such as water harvesting, maintaining oases and controlling accessibility, are instrumental in desertification mitigation. Each technique serves a particular function, reinforcing the landscape's resilience against desertification. The insights from this chapter can effectively guide the design process of a site.

The local people's TEK and the associated practices reflect a holistic approach. However, understanding it requires meetings with elders from different sites and villages, and asking them about the history of the place and its present condition, and about how they would deal with desertification issues surrounding them. AlUla has diverse ecosystems and contexts; therefore, embracing the AlUla hinterlands and the local people's traditional practices can assist in achieving a more sustainable approach.

Although the next chapter focuses on the traditional ways to conserve cultural heritage, some insights have already been provided in this chapter. It shows the complexity of the local TEK and its comprehensiveness, since the *hima* TEK has been developed not only to protect the environment and natural resources, but also to contribute to cultural heritage conservation and community well-being. An example of these insights is the implementation of traditional barriers and fences. Using plants as windbreakers contributes to the protection of the oases and cultural heritage artefacts against sandstorms by halting the sandstorms and sand movement that may negatively affect the cultural heritage features, local ecosystems and vegetation cover, as was seen at *AlDewan* and the ancient oases in Hegra WHS (see Figures 5-9 and 5-10). Although these plants provide protection, they are multifunctional and productive, since the local people rely on their fruits and oil. Therefore, integrating these traditional concepts to realise the future of AlUla may be essential to protect and preserve the nature, tradition and culture of the area.

Connecting this to the initial design investigation conducted in the first stage, the results of this chapter show that traditional techniques are not simply a tool implemented to solve an issue; they are an inclusive system and a traditional way of living within desert ecosystems. They

contribute to sustaining and enhancing the surrounding ecosystems and associated cultural heritage elements. However, determining how the local TEK is employed to preserve tangible cultural heritage, such as tombs and other structures that are part of the surrounding ecosystem, remains to be addressed. The next step is to examine how they can be protected from the impacts of desertification as well as other threats, such as urban development and negative human interactions. This is explored in the next chapter, which, along with this one, follows the RFD approach.

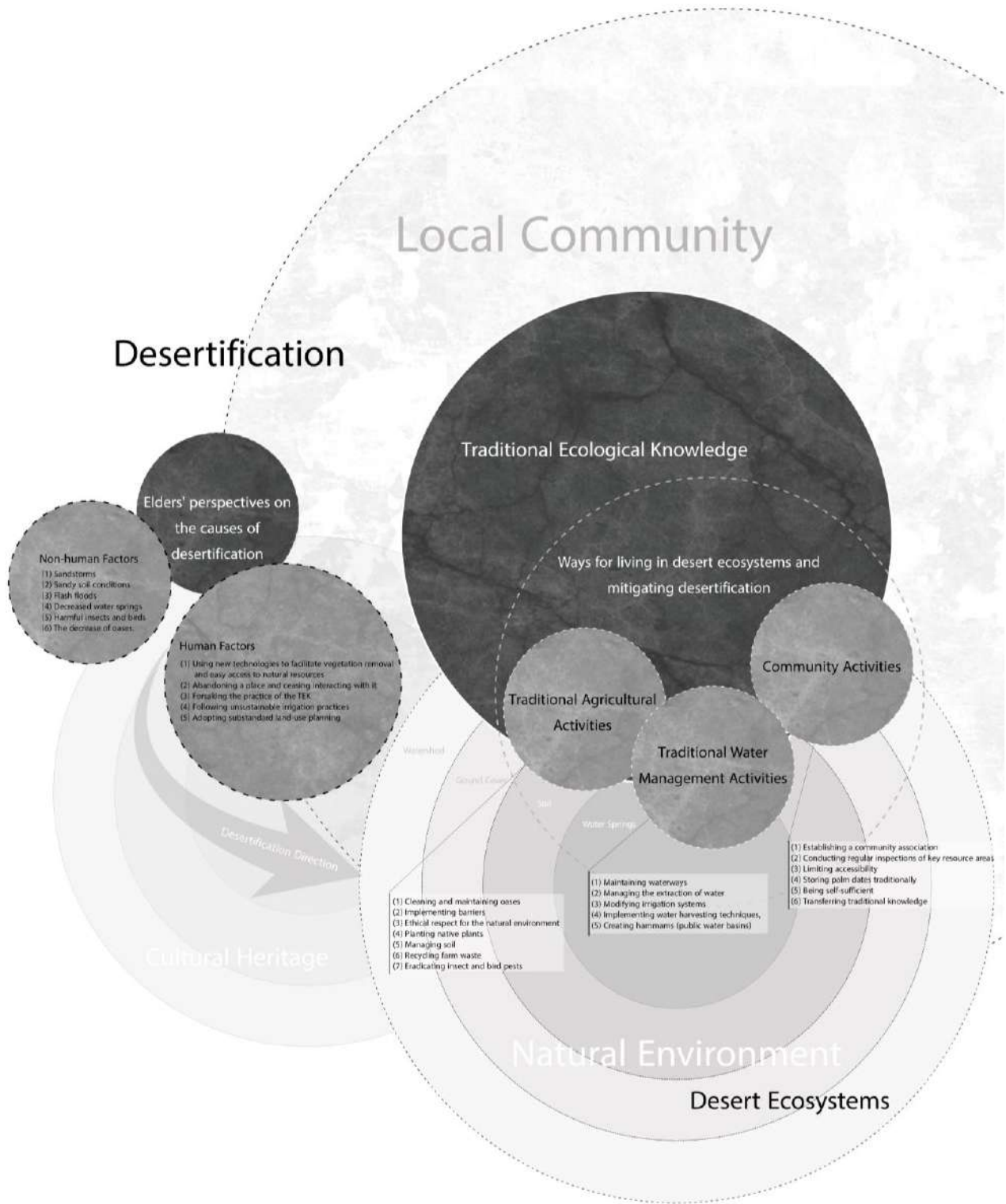


Figure 5-44: The identified themes, subtopics and categories related to the first research question.

Chapter 6: Traditional Ecological Knowledge and Cultural Heritage Conservation

6.1 Introduction

After examining the local people’s way of living with desert ecosystems and the traditional strategies that contribute to mitigating desertification, this chapter focuses on another aspect of local TEK. The chapter focuses on the relationship between traditional ecological practices and cultural heritage structures and sites, and explores how local TEK may contribute to preserving such tangible cultural heritage. The results presented in this chapter aim to answer the second research question: How can the practices of *hima* TEK contribute to the conservation of cultural heritage sites in urban settings? Based on semi-structured interviews and site visits, the results of this research produced three main areas in answer to the research question, and these have been divided into three major themes, each with two to three subthemes (see Table 6-1).

The three main themes I identified are (1) Inclusive heritage conservation and regeneration, (2) community engagement and heritage stewardship, and (3) traditional conservation techniques. However, before presenting the results, it is essential to highlight and clarify that the local TEK was not developed to preserve tangible cultural heritage, such as the WHS or other ancient structures in the region, but to maintain and manage what is important to the local community, such as natural resources. However, based on the literature review, the interviews with the elders and the site visits, the results indicate that the local TEK played a role in conserving tangible cultural heritage elements, some of which may not be related to the local community’s history or culture, such as Nabataean rock art.

Table 6-1: This table summarises the results regarding the second research question.

Chapter’s main themes (This is the classification created to present the results)	Subthemes (These are the groups created to present the elders’ knowledge and opinions)	Categories (These are the ideas, methods and issues mentioned by the elders)

Inclusive heritage conservation and regeneration	Heritage site regeneration	Regenerating oases and planting in cultural heritage sites Reviving and restoring heritage water springs Restoring cultural heritage sites and buildings Adapting uses for heritage places and sites, and their facilities Regenerating <i>hima</i> sites Representing the cultural heritage sites using modern techniques
	Inclusive design and conservation	Protecting site identity and using traditional materials Conservation as a purpose Integrating the surroundings Allocating and determining boundaries, entrances and exits
Community engagement and heritage stewardship	Local involvement and empowerment	Appropriate defenders Increasing engagement between locals and decision-makers Connecting development to the local needs Working as a collective and making associations
	Knowledge transfer and education	Transferring knowledge to the new generation Keeping record books Organising school trips
	Active engagement and site monitoring	Walking around heritage sites Grazing local livestock Living near heritage sites Restricting interaction
Traditional conservation techniques	Physical protection	Implementing <i>oqoom</i> (traditional sand berms) Making <i>washea</i> (frond fences) Implementing rocky dams Making walls
	Environmental management	Managing water flow Controlling sand impact

6.2 Inclusive heritage conservation and regeneration

This theme presents the traditional ecological ideas and strategies associated with regeneration and inclusive conservation that contribute to the protection of tangible cultural heritage. I see this topic having two subthemes: (1) heritage site regeneration and (2) inclusive design and conservation.

6.2.1 Heritage site regeneration

This subtheme comprises six concepts associated with restoring and regenerating sites and structures, and this regeneration may contribute to the conservation of tangible cultural heritage. The six subthemes highlighted by the elders are (1) regenerating oases and planting in and around cultural heritage sites, (2) reviving water springs, (3) restoring cultural heritage sites and buildings, (4) adapting uses for heritage places and sites, and their facilities, (5) regenerating *hima* sites, and (6) representing the cultural heritage sites using modern techniques.

6.2.1.1 Regenerating oases and planting in cultural heritage sites

The local population's strong attachment to their oases manifests in a commitment to safeguarding not only the oases themselves but also their surroundings that may contain heritage structures. Regenerating agricultural lands and planting the areas near cultural heritage sites play a crucial role in protecting these artefacts. Having regenerated areas around heritage sites allows the locals to observe and protect them and maintain regular maintenance (see Figure 6-1). Participant 5 highlighted this by saying:

There is a valuable mountain full of inscriptions and rock art artefacts called *Huwara*, and no one could distort them due to the oases surrounding the mountain. People are locals [meaning they know each other]. Therefore, if a stranger or one of the locals came close to them, we would notice.



Figure 6-1: This image illustrates the proximity of the oases and cultivated areas to the mountain that contains some heritage elements. This close relationship enables locals to monitor the mountain and any activities occurring in its surroundings. Oases work as a green belt that may reduce the impact of sandstorms towards heritage rock art elements. Source: Photo by the researcher.

This implies that the close-knit community is vigilant and protective of its surroundings, which includes heritage elements, such as inscriptions and rock art drawings. Participant 5 also noted that, if anyone enters their *hima* (protected area), they will question the individual and their intention, whether they are a guest or an intruder. I experienced this firsthand when I was about to conduct a site visit; the some of the locals inquired about my intentions to visit and explore the oases and cultural heritage sites.

Participant 1 provided another example, 'Planting around our farms [which include their houses and some heritage artefacts] has advantages. For example, in Hegra, sandstorms may cover whole farms, but planting Athel trees in the surroundings protects the place [including heritage structures] from it.' Although this statement may refer to traditional barriers and windbreakers,

it suggests that cultivating and regenerating agricultural areas near cultural heritage sites can contribute to the conservation of the heritage by fostering daily activities and interactions with the site.

Additionally, during my site visits, elders, like Participant 6, emphasised that cultural heritage is an integral part of the oases, where locals ensure its safety and protection, and acknowledge its value and significance since it is part of the surrounding environment. This relationship and integration between oases and tangible cultural heritage form an indivisible ecosystem, as observed in the locals' traditional oases (see Figure 6-2). Therefore, regenerating areas around cultural heritage sites and planting green belts may significantly contribute to the protection of heritage structures and sites. A similar concept can be observed in *Hima Al-Shajar*, where the vegetation surrounding the city of Medina acts as a green belt, protecting the urban fabric of the city (Al-Shanqiti, 2013; Llewellyn & Altlasat, 2017). Although this green belt primarily protects against desertification factors, the land itself has become a crucial protective element.

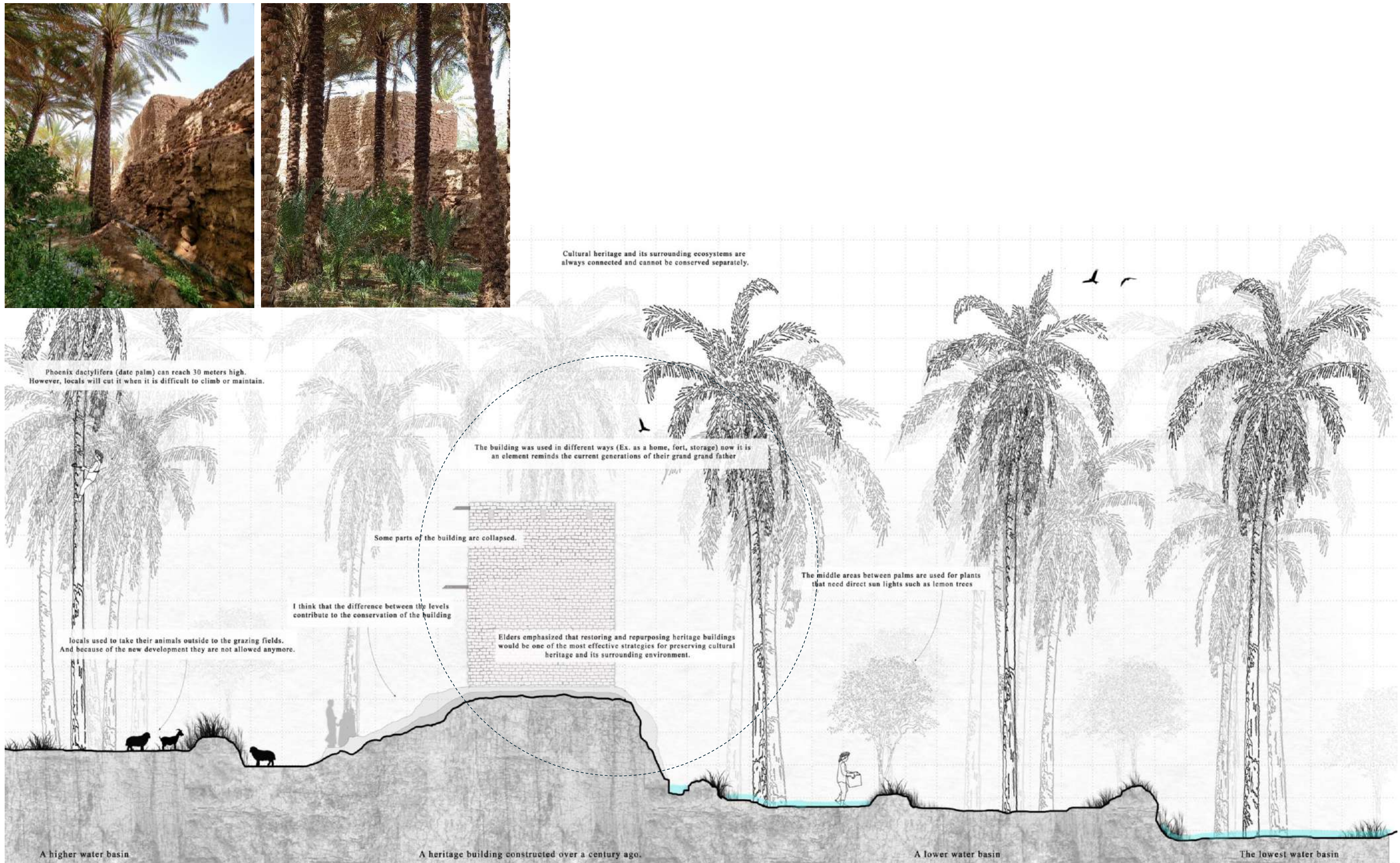


Figure 6-2: The top two photos illustrate the integration of cultural heritage with the surrounding oases. The bottom section shows the site context and how both the oasis and the heritage structure are connected. Source: Photos and drawing by the researcher.

6.2.1.2 Reviving and restoring heritage water springs

The cultural heritage elements associated with water springs and management systems hold significant value for the local community. Reviving and restoring these springs, along with their management systems, may contribute to the conservation of cultural heritage. The importance of this category stems from three factors: (1) water and water springs are the primary reason for human settlement in the area, (2) the water springs are cultural heritage assets in themselves, some of which are connected to heritage sites via water canals, and (3) a wealth of information, stories and knowledge is linked to these systems. Thus, reviving and restoring them has the potential to contribute to preserving local cultural heritage and history.

During site visits, the elders recounted stories and important information about water springs that had collapsed or had been covered by soil and vegetation. Restoring these springs will not only conserve the associated knowledge but also protect the local values tied to these places. For example, Participant 10 stated:

Restoring old water canals and springs is considered cultural heritage conservation. Furthermore, if someone can re-function water canals by bringing water even from another source, that would be enough, so people can see how the water used to move between oases and heritage sites.

This highlights that reviving water springs and canals allows younger generations and visitors to understand their historical operation in context. Participant 1 emphasised that, during discussions with officials about new developments, he suggested creating a sample of a real water spring to demonstrate how locals historically managed the area, including springs and canals.

These strategies were observed during site visits within the Cultural Oases, as shown in Figure 6-3. One of the locals had restored part of an ancient water spring to conserve the place's value and preserve its identity. Identity here encompasses the natural sounds, smells and

temperatures of the environment of the oasis, which are integral to the Cultural Oases. Discussions with experts involved in AlUla's development revealed that this aspect was missing from the official approach.⁴⁰ Therefore, to effectively conserve cultural heritage, it is essential to revive and restore water springs, which will also contribute to preserving the site's landscape systems and identity. This issue has been referred to in many studies, such as Nasif (1981, 1995) and Nehmé et al. (2006), in which ancient water springs and wells were revived by locals.

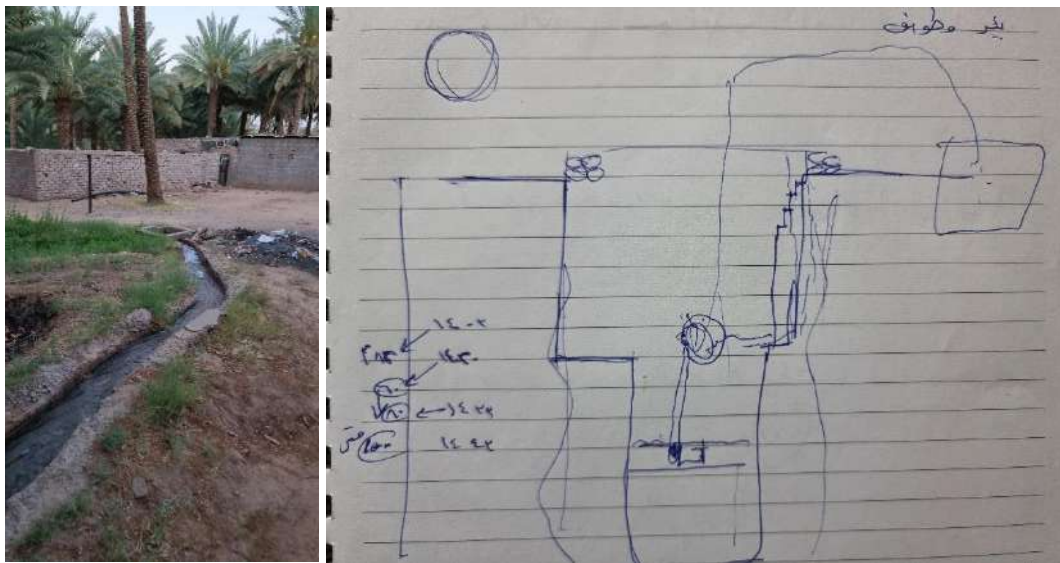


Figure 6-3: Left: An example of a restored water canal in one of the visited sites. Right: A heritage water spring called *Wataef*. The participant attempted to sketch the main elements of the water spring with me. Source: Photo by the researcher.

6.2.1.3 Restoring cultural heritage sites and buildings

To conserve tangible cultural heritage, such as ancient buildings, restoration is a key method within the local TEK. Although previous examples focused on regenerating agriculture and water springs, this approach is related to buildings and sites. Participant 11 highlighted traditional methods, such as 'restoring houses, caring for them, and preserving them'. Similarly, Participant 8 emphasised 'restoring, fixing, preserving and maintaining cleanliness' as the preferred methods for conserving ancient buildings. Participant 9 underscored the importance of

⁴⁰ This point will be explored further in Chapter 7.

restoration by recounting a conversation he had with his father about restoring an ancient water well near an old mosque, both of which reminded him of his grandfather, who built the well. He noted that the surroundings are rich with stories and values that need to be restored and preserved. Additionally, he suggested that restoring these sites and implementing walkways between them would enliven the area, contrasting this with the 'silent sites' developed by official organisations.

Participant 4, as well as Participants 6 and 9, mentioned that 'reintroducing these sites, restoring them and showing how people used to live here' is a vital method for conserving cultural heritage. During site visits with an elder within the Cultural Oases, several significant buildings and sites were observed (see Figure 6-4). For example, a mosque held special significance for the local people because one participant's grandfather cared for it and called for prayer from it. Another example is a building managed for over 10 decades, which was restored multiple times for various uses, such as a home, fort, storage and, recently, a family landmark. These examples demonstrate that restoring buildings and sites is crucial for the conservation of cultural heritage.



Figure 6-4: Left: an ancient mosque associated with many stories and values of the local community within the Cultural Oases. Right: An ancient building whose function and use were changed by the locals many times. *Source:* Photos by the researcher.

6.2.1.4 Adapting uses for heritage places and sites, and their facilities

Another significant category that may contribute to conserving tangible cultural heritage is by maintaining the use of the cultural heritage sites. Observations, site visits and interviews with elders revealed that proposing alternative functions and uses for heritage structures or sites to ensure that they remain actively used by the community may contribute to the preservation of these cultural heritage structures or sites. This idea was highlighted in various ways. For example, Participant 10 stated that ‘the best way to conserve cultural heritage is by functioning it and operating it, such as making it a landmark for visitors and locals, making it a tourism destination or encouraging locals to operate and revive it’. This approach was evident during site visits, where many elders had repurposed their oases and heritage sites to preserve them. For instance, Participants 2 and 6 transformed their fathers’ oases and houses into ecological resorts. Another participant turned his great-grandfather’s house into a landmark. Although these new uses appear modern, previous generations also changed the use of heritage places, as noted by Participant 6. Participant 3 emphasised that finding alternative uses for heritage buildings and sites that benefit the community leads to their conservation. He noted that many traditional products recycled from oases could be reintroduced and promoted within cultural heritage sites. This idea was further supported by Participant 6 during site visits, highlighting the

ongoing relevance and potential of re-operating cultural heritage sites to ensure their preservation. Traditional products that can be promoted within cultural heritage sites may include wooden chairs, tables, baskets and hand fans, all crafted from palm trunks and leaves (see Figure 6-5). Another idea is to use heritage sites as educational venues where visitors and students can observe how elders and locals make traditional tools for their homes and oases. Participant 11 suggested that organising traditional events and social gatherings at heritage sites not only protects these sites but also fosters interaction with them, reinforcing their cultural significance. Participants 2, 3, 6 and 11 noted that attending gatherings at cultural heritage sites serves to remind the community of the value of these places and the importance of their preservation. This concept will be further explored under the second theme in Section 6.3 (Community Engagement and Heritage Stewardship).

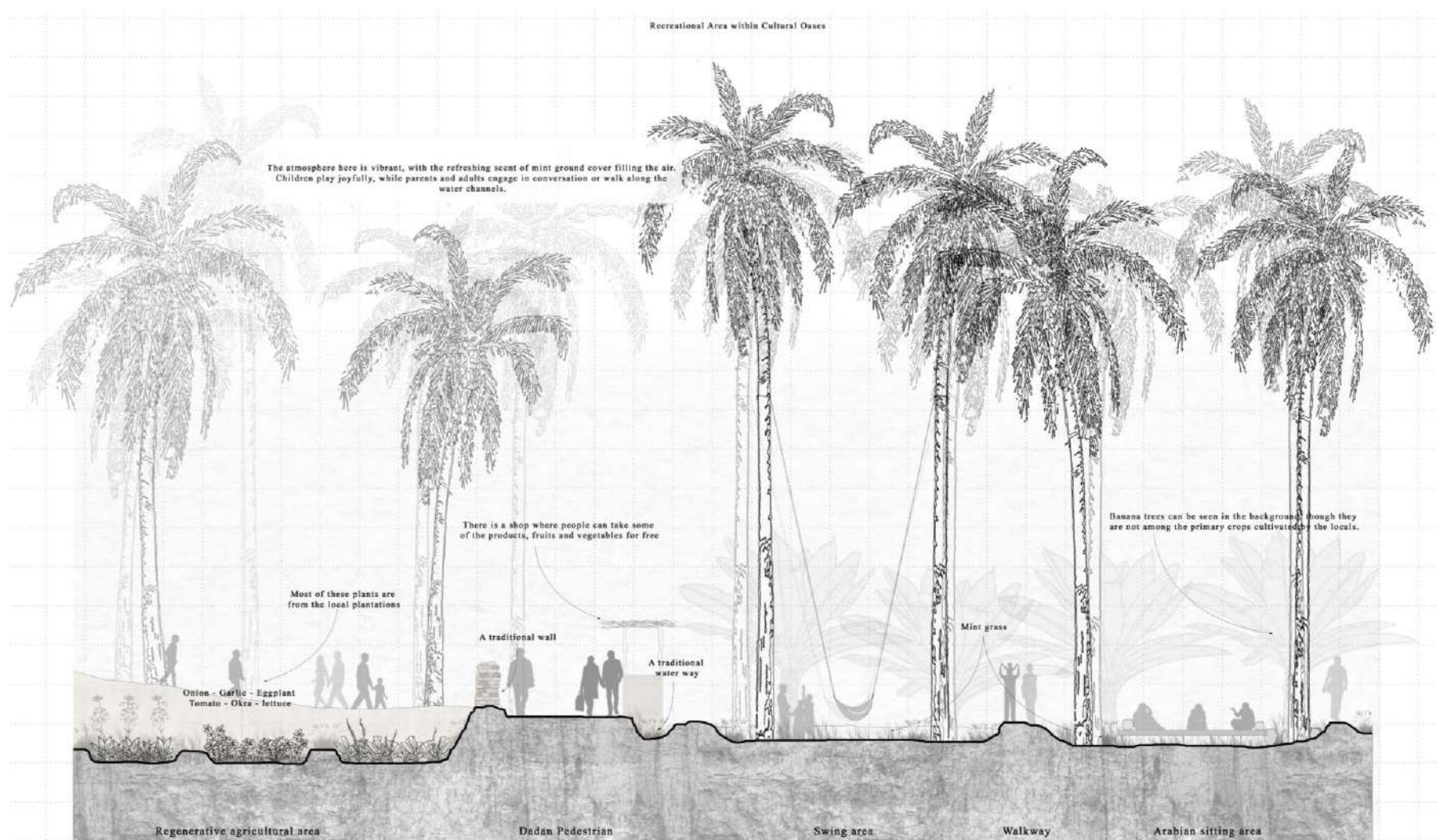
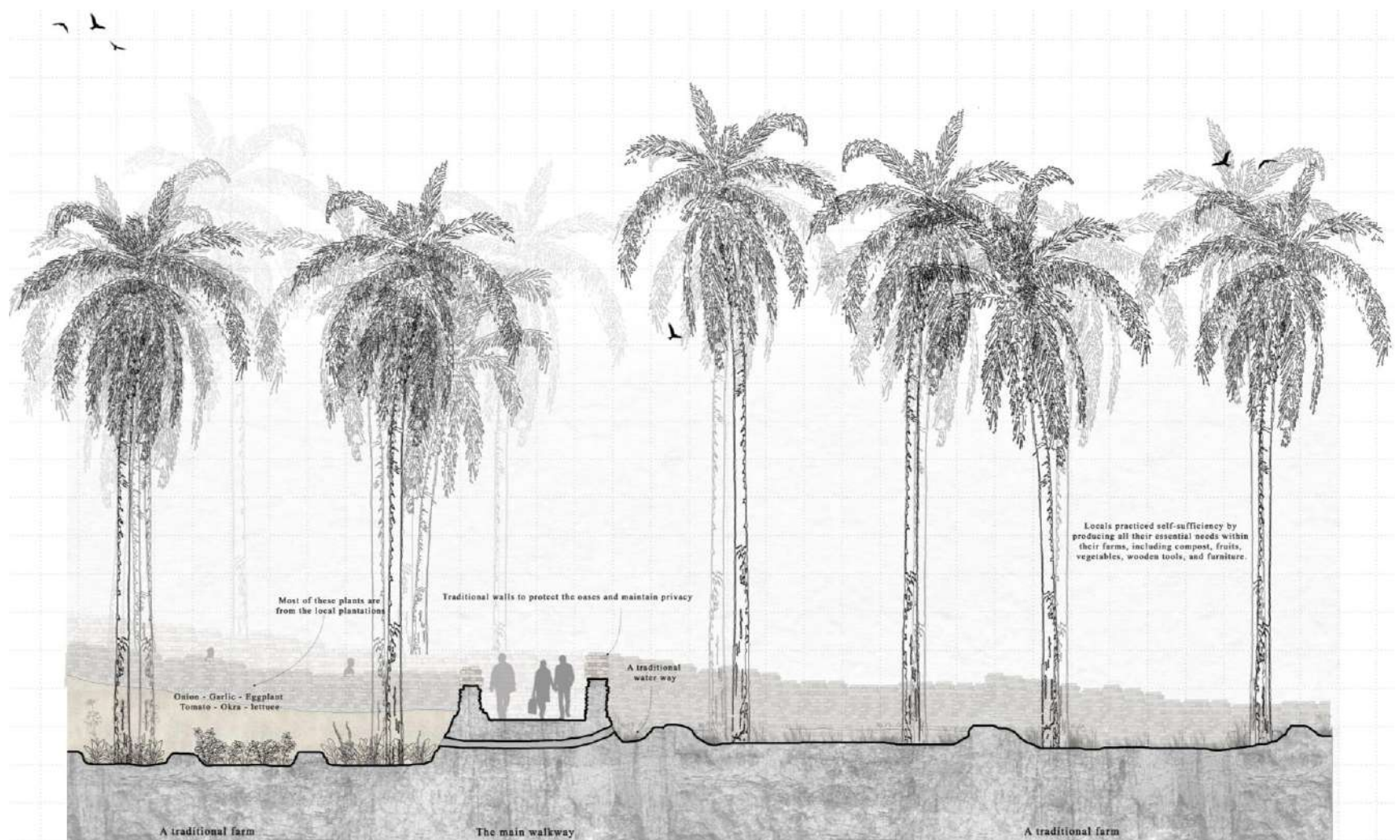


Figure 6-5: These two landscape sections present a heritage site within the Cultural Oases. Top: the section imagines the site in the past based on the description of the locals and site observation. Bottom: This section shows the development of OMP, where some attractive activities are implemented to increase the engagement of people with the site and its cultural uses. Source: Drawings by the researcher.

6.2.1.5 Regenerating *hima* sites

Regenerating *hima* sites is another important traditional strategy for conserving cultural heritage sites. As highlighted in the literature, *hima* refers to a protected area that safeguards natural resources and contributes to the preservation of land that may contain tangible cultural heritage artefacts.

When I asked about traditional conservation systems for local cultural heritage and ecosystems, Participant 10 mentioned the *hima* system as a pre-Islamic practice that aids in regional conservation. He stated that ‘the region was managed by different tribes. Each tribe owned a land (a *hima* site) and prohibited others from grazing on it. These tribal lands were recognised by the community’. He added that ‘when foreign visitors came to visit the Dadan heritage site, locals stopped them until granted permission from AlUla’s leader’. This statement underscores that the local people of AlUla are concerned about the protection of cultural heritage sites that are located close to their oases, and they halt unconfirmed human interaction by outsiders with these heritage sites. Additionally, this statement contradicts the claim that states that Saudis are not interested in cultural heritage aspects (Alrawaibah, 2017, p. 280). Instead, this statement supports Alrawaibah’s finding that Saudis do indeed care about cultural heritage dimensions. The difference here is that this statement comes from an individual living around a cultural heritage site. It is important to highlight that, when I asked some of the elders a direct question about how the community’s TEK contributed to the conservation of cultural heritage sites such as the WHS, they said that they were not interested in the conservation of such cultural heritage, probably because it implies a need for institutional rules. However, when talking about their landscape and what it includes, they mentioned these stories and strategies associated with *hima* areas and concerning protecting cultural heritage artefacts. This implicitly indicates that *hima* TEK and the regulation of its access indirectly played a role in safeguarding the heritage structures in the AlUla region.

The literature reveals that cultural heritage sites have historically been part of *hima* territories, as observed in the central Arabian Peninsula and Medinah by various scholars. During the first workshop with experts, it was highlighted that regenerating former *hima* areas may aid in conserving cultural heritage sites, given that *hima* TEK involves daily activities and routine, such as regular monitoring by locals, which may contribute to the conservation of cultural heritage elements. Thus, revitalising *hima* areas could be a key strategy for conserving cultural heritage sites. It is worth mentioning that this category may be similar to that in Section 6.2.1.1 (Regenerating oases and planting in cultural heritage sites). However, it is more inclusive and holistic, since *hima* encompasses a broader range of activities, such as grazing and honey production. AbuZinada et al. (2004, as cited in Gari, 2006), highlighted that regenerating the *hima* may contribute to the conservation objectives of our contemporary time.

6.2.1.6 Representing cultural heritage sites

Representing cultural heritage artefacts is a crucial method for ensuring heritage conservation, since it helps to disseminate the values of these places to the public and visitors. When discussing cultural heritage conservation methods, Participant 11 mentioned ‘using technology and virtual reality to photograph heritage sites and include simple explanations’. He emphasised that documenting heritage sites with modern presentation technologies and tools, along with simple annotations, aids in conservation. Additionally, he noted that studying these documents could enhance our understanding and care for the surroundings, as part of providing guidance on heritage management. Participants 2 and 3 confirmed this by stressing the importance of representing heritage artefacts as a conservation strategy. Participant 10 indirectly supported this view by highlighting the significance of situating ecological resorts near cultural and natural heritage features as a way to showcase these valuable elements.

During my site visits, I visited and observed a local registered museum, where hundreds of tangible heritage tools and features were displayed with short explanations to preserve not only

the items, but also their intrinsic value. I also visited a resort in Shalal managed by locals (see Figure 6-6). The design of the resort directs the eye to the unique natural forms on the surrounding mountains, and to the rock art and ancient drawings. The design represents heritage features and encourages visitors to the site to engage with cultural and natural heritage. Since ALUla's official institutions aim to represent heritage artefacts, this category might reflect ongoing development efforts towards community engagement and represent an innovative approach. This identified pattern may be significant for its potential to contribute to conservation, demonstrating that traditional knowledge is adaptable and can evolve to fit contemporary contexts. It highlights how conservation efforts can benefit from showcasing the value behind heritage elements, buildings and sites as was observed.



Figure 6-6: *Lift and middle*: A stage that was implemented to present rock art drawings to the visitors of the resort. *Right*: A local museum where the locals represent heritage elements and artefacts. *Source*: Photos by researcher.

6.2.2 Inclusive design and conservation

The second subtheme is inclusive design and conservation, which I separate into four categories: (1) protecting site identity and using traditional materials, (2) conservation as a purpose, (3) integrating the surroundings, and (4) allocating and determining boundaries, entrances and exits.

6.2.2.1 Protecting site identity and using traditional materials

The collected data revealed that preserving the traditional identity of cultural heritage sites is crucial for their conservation. Tangible cultural heritage has a unique identity, which can be altered or negatively affected by long-term development and management practices. For example, Participant 10 stated during a discussion on cultural heritage conservation that ‘the surrounding area should be conserved without any visual distortion’. He further noted that the community would strongly oppose any expansion of car roads within cultural heritage sites more than officials would because they value these sites deeply. He highlighted that allowing more cars in the area would affect the smell, noise and overall atmosphere of the site owing to road expansion. Participant 9 also emphasised the importance of using traditional materials for restoration, stating:

The walls of our ancient building were made of clay. When we need to modify or restore a wall, we use clay and avoid any type of painting ... Also, the way we make the soil mix follows the traditional method.

This is significant because using modern materials for restoration may lead to the loss of heritage.

In the AlUla Old Town, I observed paved walkways and noted that rainwater and runoff from the nearby mountain could severely affect the buildings and urban fabric owing to increased water flow speed (see Figures 5-28 and 5-29). The elders explained that the walkways were previously unpaved, allowing water to leak into the soil and replenish the aquifer. Changing the material of the place, an integral part of its identity, can contribute to the loss of cultural heritage not only physically, but also visually and functionally. Thus, protecting site identity is essential for cultural heritage conservation.

6.2.2.2 Conservation as a purpose

Based on the opinions of the elders, it is important to consider protection and conservation as the primary objective of developing cultural heritage sites, rather than tourism. Prioritising protection ensures that all decisions align with this goal. Participant 8 remarked that ‘protection was always a priority. For example, the design of walkways was to disable enemies’. In other words, the design of the walkway network within the oases and the AlUla Old Town was to enhance protection. The participant then explained that the aim of the design was to slow down and hinder enemies, particularly those on horseback, camels or donkeys.

While walking through the oases and urban areas of the Old Town, I aimed to observe this aspect and identify the different functions and qualities these walkways have. One of the interesting elements pointed out by the elders is that some of the houses and walls contain ancient Dadanic bricks that were taken from the Dadan site. There were many areas with traditional values, such as the *Tantorah* open space. It appears that the walkway network is the main line of defence against anyone who wants to steal or distort valuable elements, although the main purpose of the walkway network design is to protect people and their valuable belongings, as noted by the elders.

Another observed characteristic is the narrowness of the walkways. I witnessed that this narrowness creates shaded areas and places for locals to meet and talk. Although Participant 8’s statement is related to how the walkways enhance safety for the community and the urban area, the walkway design offers multiple functions. This multifunctionality was evident in various places, such as the *Al-Sabaa* Wall on the north side of the traditional oases, which simultaneously protected the city from attacks and reduced the impact of northern sandstorms. Therefore, prioritising the safeguarding of valuable assets is a traditional aspect that needs to be considered when developing such sites with traditional heritage qualities. This approach is not

incompatible with additional functions that benefit the environment and the community, which all illustrate the comprehensiveness of local traditional knowledge.

6.2.2.3 Integrating the Surroundings

Another aspect is integration and inclusion with the surroundings. When conserving cultural heritage, the conservation procedures should integrate the surrounding natural elements such as mountains, rivers, oases and sand dunes. This consideration is deeply embedded in local practices, demonstrating their inclusiveness. Participant 9 stated:

When I asked my elders about the reason behind choosing this region [the Old Town of AlUla] as a place to live in, they replied that this place is the highest, far away from seasonal waterways, and protected by mountains.

Most heritage sites have a symbiotic relationship with their natural surroundings, which can serve as protectors, such as mountains, or threats, such as major waterways. By incorporating mountains and oases as integral parts of heritage sites, conservation practices become more holistic, ensuring the continuity and preservation of cultural heritage sites and features.

6.2.2.4 Allocating and determining boundaries, entrances and exits

To effectively preserve cultural heritage sites, it is crucial to understand and delineate the boundaries of a heritage site, as well as determine the optimal location for entrances and exits. Participant 11 remarked, ‘To protect AlUla, locals built walls on three sides—north, south, and east ... For some periods, the main gate was on the eastern side.’ Building a wall requires knowledge of the edges of cities, sites and oases, and determining what should be included and excluded. The presence of boundaries helps in managing human interaction with the heritage site. Based on the elder’s statement, it appears that the gates may be reallocated based on the spatial and temporal context of the site.

This characteristic/practice is evident in the *hima* system (Al-Shanqiti, 2013; Eben Saleh, 1997, p. 291; Llewellyn, 2013, p. 214; Llewellyn & Altasat, 2017, pp. 18–19). Although it might be argued that this system primarily protects natural resources, Al-Shanqiti (2013) highlighted that heritage sites and built elements are often included within these protected areas. Therefore, this traditional practice may add value to the conservation of cultural heritage besides safeguarding natural resources.

Regarding entrances and exits, I observed this practice in two sites in the Shalal area and in traditional oases that include heritage structures. The participants guided me through a specific route and entrances, and warned me about the areas that I should avoid. For example, one of them asked me to maintain a distance between myself and an ancient building that we visited. This practice illustrates how controlled access aids in managing interactions with the site, thereby contributing to the preservation of tangible cultural heritage.

6.3 Community engagement and heritage stewardship

This theme focuses on the role of the local society in contributing to the preservation of tangible cultural heritage, such as buildings and sites. I have divided this into three subthemes: (1) local involvement and empowerment, (2) knowledge transfer and education and (3) active engagement and monitoring.

6.3.1 Local involvement and empowerment

This subtheme relates to the involvement of the locals and their role in the process of cultural heritage preservation. The four categories are (1) appropriate defenders, (2) increasing engagement between locals and decision-makers, (3) connecting development to local needs, and (4) working as a collective and making associations.

6.3.1.1 The Appropriate Defenders

Many elders affirmed that locals are the best defenders of tangible cultural heritage owing to their longstanding relationship with these sites. Participant 5 stated that ‘the preservation of cultural heritage sites is ensured by the presence of nearby inhabitants. Without them, the heritage would be stolen or ruined. Therefore, inhabitants are the defence line for heritage’. This reflects the belief that the local community feels responsible for preserving their cultural heritage and views its care as their duty. Their long-term interaction with their surroundings enhances their awareness of the significance of the local heritage, such as the WHS. Participant 10 exemplified this care, noting that locals would resist urban developments, such as road expansions, more strongly than officials because they acknowledge the site’s value. This statement indicates the importance of locals being engaged in the process of development of the urban areas in AlUla County.

Another critical aspect is the potential negative impact of officials or stakeholders who may lack full awareness of the site’s value, leading to further degradation and loss. Participant 6 pointed out that developments ignoring the local community lead to the loss of local heritage, since foreign decision-makers might not fully understand the site and its history. This insight highlights the locals’ deep sense of responsibility towards tangible cultural heritage, a perspective often overlooked in the literature. This sense of responsibility may have been missing in previous research, owing to the participants’ backgrounds, in that they were often not from the region or were non-Saudis with short-term relationships with the area. However, speaking with local elders and tribal leaders clarified that the local community has always prioritised the preservation of their cultural heritage, even when the artefacts are not directly related to their ancestors. For instance, Participant 5 considered *Howara* Mountain a cultural heritage site despite its lack of direct connection to the local community’s history. This suggests the connection with and caring for the landscape may be more significant than ancestry. The next

section explores the importance of local engagement in the process of cultural heritage development and preservation.

6.3.1.2 Increasing engagement between locals and decision-makers

Enhancing engagement between locals and decision-makers is crucial to ensure effective development and heritage preservation. Participant 10 emphasised this, noting that ‘it is impossible to preserve without engaging the local community. If you made preservation a government responsibility, you would not achieve your goals and outcomes. Since the official institutions managing the conservation and development are mostly non-local experts and stakeholders, the participant highlighted the importance of integrating local knowledge and expertise to achieve not only economic, but also social and environmental goals within the conservation approach.

Engagement should occur on multiple levels and involve decision-makers and foreign consultants working with official institutions. Although Participant 2 noted that the official institutions provided opportunities to participate in workshops, Participant 6 observed that their interactions were primarily with regular official employees, not decision-makers. This distinction is critical. If the decision-makers understand local values, they can make informed decisions that respect and integrate local TEK. In contrast, regular employees might not fully convey the elders’ perspectives or the significance of local expertise to their managers.

According to the elders, current engagements have focused more on the ‘what’ and ‘who’ questions rather than the ‘how’ and ‘why.’ Participant 6 mentioned receiving frequent invitations from official institutions to discuss the history and inhabitants of various sites, but questions about why and how locals preserve and interact with cultural heritage were limited. Participant 11 suggested reducing the gap between locals and decision-makers through symposiums, workshops and seminars where both groups can exchange knowledge and experiences.

For decades, local communities have been responsible for protecting the surroundings, which include cultural heritage sites, such as the Dadan site, as noted by Participant 10. However, their management has now shifted to official institutions, which have hired fewer locals than expected, according to Participant 1. Nonetheless, there are encouraging signs of increasing local involvement resulting from various new programs. These involvements are not related to the indigenous knowledge of the local communities, but are job opportunities for younger generations (see RCU, 2023b). During my site visits, most of the tour guides within cultural heritage sites were young locals. However, when I asked some questions regarding the local TEK, I could not find an answer. For example, I asked four tour guides about the location of the water canals that harvest rainwater within the AlUla Old Town, and no one could locate them, although some acknowledged that they had heard about the canals before (see Figure 5-38).

Another aspect of local involvement concerns job sectors. Participant 10 underscored the need for local community involvement in operating and reviving sites:

If they are involved in the management and revival of these sites, they will preserve them and be aware of them. They will feel that the surrounding heritage is part of them. When I go to a site that benefits me and provides me with a daily income, I will be more excited to preserve it.

This underscores that the engagement of the locals should be more than just as a tour guide. They need to be involved in other positions that enable an understanding of the evolution of the landscape and cultural heritage. These engagements can align with the guidelines of official institutions while incorporating the indigenous knowledge and ecological experience of elders to ensure that the values of the heritage sites are fully understood and preserved.

6.3.1.3 Connecting development to the local needs

The concept of need is a significant factor influencing the local community. When cultural heritage preservation aligns with the needs of the local people, the community is more likely to

contribute to preservation efforts. Participant 10 noted that a need linked to preservation creates a desire, which then motivates people to engage in cultural heritage preservation. The elders have observed that many people, particularly the youth, leave the region in search of better job opportunities. With changing lifestyles and daily needs, the younger generation may not be interested in the elders' practices that contribute to preserving the surroundings. Thus, by connecting the needs of the younger generation and the locals in general to cultural heritage management, it is expected that locals will be more motivated to preserve heritage sites.

Participant 1 expressed surprise at the low number of locals employed by related official institutions, despite being invited many times by these institutions. Given the recent efforts to present the Kingdom's heritage to the world and the significant initiatives in AlUla, it is important to consider this aspect. Although the connection of this category to local traditional knowledge may not be strong, it was a pattern identified in the data and was presented by the elders as a method for preserving cultural heritage.

6.3.1.4 Working as a Collective and Making an Association

Working collectively is a crucial social factor in preserving tangible cultural heritage, as noted by the elders and observed during site visits. Participant 11 stated that 'every tribe distributes security tasks, similar to the night shift idea'. Similarly, Participant 6 commented, 'The wall of Sabaa, built between 1307 and 1309 (approximately between 1989 and 1992) to stop foreign attacks, was a collective effort with each tribe responsible for a section.' In these examples, the community worked together to protect their surroundings and build the wall, dividing the labour among the tribes.

This collective effort extends to water management systems, where tasks such as maintaining and cleaning water springs are distributed among families to prevent accidents. During my visits, I observed brothers maintaining a heritage building in their father's oasis. When significant issues

arise concerning community safety and tangible heritage, tribal leaders convene to discuss and find solutions, underscoring the importance of community engagement in heritage preservation. Participant 10 emphasised the necessity of involving the local community in preservation efforts, since it is a concept deeply rooted in local culture and tradition.

When collective work is a challenge, the community may form associations or groups responsible for preservation tasks. Participant 10 noted that ‘in this case, we need to go back to the community association’. By establishing community associations, locals can revive sites such as oases and heritage buildings, preserving the urban fabric and traditional identity. Participant 11 supported this idea, noting his membership in multiple associations aimed at preserving local cultural heritage sites. He explained that the efforts served to remind homeowners in the Old Town of the historical and cultural value of their houses. Participant 11 stated: ‘I believe that community associations are the ones that can sustain the heritage.’ In summary, both forming community associations and working collectively are key approaches that contribute to the preservation of cultural heritage.

6.3.2 Knowledge transfer and education

Education and knowledge transfer are the second subtheme associated with the community, contributing to cultural heritage preservation. I defined three categories: transferring knowledge to the new generation, keeping record books and organising school trips.

6.3.2.1 Transferring knowledge to the new generation

One crucial factor in preserving cultural heritage is the transmission of traditional knowledge to the next generation. Participant 10 emphasised the importance of the intergenerational transfer of values and meanings, stating, ‘These meanings and values were inherited from one generation to another.’ Many elders recounted acquiring traditional knowledge from their fathers and elders, often through discussions and hands-on practice in the field. Participants 1, 6 and 9 shared that

they regularly engaged with their fathers in discussions about their cultural heritage, aiming to document as much as possible. However, most elders noted a decline in the next generation's interest in the traditional knowledge and practices associated with conservation owing to lifestyle changes. Participant 6 illustrated this point, noting:

There was an interest in teaching children and engaging them in managing oases and heritage sites such as water springs. My grandfather asked my father after he had finished elementary school, 'Who is going to irrigate our palms?' Consequently, my father stayed here. This is an example of protecting heritage.

Heritage in this context relates to the traditional practice and the tangible elements, such as oases and the associated structures. The above quote highlights not only the importance of knowledge transfer but also the awareness and respect youth had for their parents, contributing to today's preservation efforts. This statement shows that the built structures associated with ancient water springs and natural resources are considered tangible heritage, highlighting the comprehensiveness of the local TEK and the complexity that TEK is confronted with.

As highlighted in the previous section, during my visits, I inquired about the water canals that channel rainwater from elevated areas to the oases, and none of the young locals involved in site management could identify the locations of the canals. This highlights the need for transferring knowledge to the next generations. Additionally, during informal talks with tour guides, it appears that narratives from official institutions are favoured over those of the elders. For example, during two site visits with elders, they mentioned that heritage sites had recently been renamed, for example, traditional oases to Cultural Oases, and the *Al-Sa'ah* Walkway to the Dadan Heritage Trail. On a subsequent visit with a newly employed local tour guide, she used the new names rather than the traditional ones, which are imbued with cultural heritage values and stories. This change in terminology could adversely affect cultural heritage preservation, given that these important terms and meanings might be lost. Therefore, it is essential to facilitate the direct

transfer of knowledge from elders to the younger local generation to effectively preserve cultural heritage.

6.3.2.2 Keeping record books

Documenting local heritage in writing is a traditional method of preserving cultural heritage that is well practised in the AlUla region. Participant 10 highlighted the abundance of Nabataean, Thamudic and Islamic texts and inscriptions found throughout AlUla's mountains and valleys, which have helped preserve the area's history. Similarly, locals use this method to document cultural heritage sites and their narratives. Many elders acknowledged the contributions of locals who have recorded numerous sites and stories in books and papers. For example, one participant showed me letters that had been preserved for over 500 years, detailing events related to heritage sites. Ten out of eleven elders mentioned specific local writers or books by local individuals in which more documented information can be found. Participant 11 stated, 'I think that writing booklets contributes to heritage preservation.' This statement indicates that writing even short books about local natural and cultural heritage assists in natural and cultural heritage preservation.

Keeping record books is significant. I faced considerable difficulty finding books about the AlUla region that were available for purchase or to borrow during my stay in AlUla. I visited all the local bookstores found on Google Maps and could not find more than four books about the natural ecosystem, history and people of AlUla. I found many books that had been preserved and kept by the elders, with no additional copies available. I am grateful to the elders who allowed me to read and borrow some of these books. In summary, keeping record books, booklets and even journal articles may be crucial for preserving and presenting AlUla's cultural heritage and its associated values.

6.3.2.3 Organising School Trips

The final category within this subtheme highlights the importance of organising school trips to heritage sites, since this may contribute to cultural heritage preservation. Participant 11 emphasised that taking school students to visit heritage sites effectively promotes heritage preservation. Participants 2 and 3 shared that they had the opportunity to visit many cultural heritage sites, such as the Nabataean tombs, during their childhood as a hobby. These visits fostered their interest in preserving cultural heritage and its associated knowledge and practices, complementing what they learned from their elders.

Although it has traditionally been important for children to visit heritage sites, these statements demonstrate the local community's flexibility. The elders mentioned the engagement not only with their own heritage sites, but also with those related to other cultures, such as the Dadanic and Nabataean sites, thereby contributing to the overall preservation of the region's cultural heritage. School trips play a vital role in educating the younger generation about their surrounding heritage, providing them with knowledge from various sources, including elders and family members.

6.3.3 Active engagement and site monitoring

This subtheme relates to traditional concepts that are more associated with landscape design and walkability. I found four categories: walking around heritage sites, domestic animal grazing, living near heritage sites and restricting interaction.

6.3.3.1 Walking around heritage sites

Walking within cultural heritage sites is a traditional activity that contributes significantly to tangible cultural heritage preservation. This category includes three key aspects: walkability, purpose and design.

All the elders emphasised the advantages of walking activities for cultural heritage conservation, both directly and indirectly. Participant 9 described discovering an exciting route that passed various heritage sites, wells and buildings, stating: 'AlUla cannot be fenced. It is rare to find a mountain without a rock art piece or a historical element. Creating a walking track is an interesting idea that preserves heritage and benefits people.' He suggested that a walking track connecting different heritage sites and elements would help protect the heritage by increasing foot traffic, deterring vandals and providing spaces for locals and visitors to walk.

Although similar routes have been implemented by official institutions, locals proposed different, more valuable routes that are rich in heritage and stories from the past. When I asked about the difference between local and official walkways, Participant 9 remarked that 'the new walkway [the official one] is almost silent'. In other words, the official walkways lack the number and richness of heritage sites found on traditional routes. He elaborated, 'There are other walkways full of heritage where you can see wells, water systems, springs, an old mosque where people celebrate marriages, and even homes with various spaces for living, sleeping and hosting guests.' The traditional walkways chosen by elders are richer in heritage, allowing locals, especially young people and visitors, to interact with and explore more of the local heritage.

The elders recommended many areas and valleys for observing and exploring cultural heritage. At the SV-20 Site, I saw rock art drawings in the middle of the city, rarely noticed by local residents and unprotected by official organisations, since there were no fences or signs (see Figure 6-7). Participant 9 mentioned that many open public parks and valleys contain ancient drawings and inscriptions. He suggested that implementing walkways in such areas would allow people to explore the heritage and enjoy walking close to the mountains, contributing to heritage preservation by enabling walkers to observe and report any harmful actions or behaviours. He added that he had proposed to officials the idea of installing cameras for protection, but had not received a response.

Participant 10 stated that ‘constant movement within heritage sites not only allows visitors to interact with the site, but also indirectly serves as a site monitoring tool that reduces infringements’. In other words, visitors would report any actions that might harm inscriptions or heritage features. This practice is rooted in tradition, as illustrated by Participant 6’s statement about a valuable spring: ‘That spring was interesting; in winter, the water is hot, and in summer, it’s cold. At that time, the spring was decreasing.’ This shows that the community’s constant interaction allows them to notice changes; in this specific case, it was the decrease in the amount of water in the spring.

During my site visits, I noted some of the advantages of walking. For example, one issue that can arise in heritage and oasis sites is illegal private land expansions. Constant movement within heritage sites may reduce such expansions, helping to preserve both heritage and the surrounding environment. Although Participants 2, 3, 7 and 11 emphasised the importance of regular visits and walking within heritage sites, Participant 8 stated that walkways should be designed to contribute to site protection. This is an important consideration for landscape architects when developing cultural heritage sites. Walkway design should ensure the protection of tangible cultural heritage, the surrounding natural factors and the visitors, as observed during site visits.



Figure 6-7: This is one of the interesting examples of rock art pieces located close to the Cultural Oases and mentioned by some elders. *Source:* Apple Maps, photos by the researcher.

6.3.3.2 Grazing local livestock

Grazing is another traditional activity that contributes to the preservation of cultural heritage through engagement and monitoring. Both Participants 6 and 8 highlighted this aspect. Participant 8 recounted, ‘I used to take my sheep for grazing near the Dadan site, and sometimes a sheep would enter one of the lion tombs.’ He added that, during these times, he would observe the site, driven by his interest in Dadan. This demonstrates how, while grazing animals, locals often engage with heritage sites, such as the Dadanic tombs, to monitor and observe their condition and surroundings.

Participant 6 shared a similar experience. He explained that he used to accompany his mother and other female neighbours to the *Harrat Uwayrid*,⁴¹ where they would take their animals to graze. The *Harrat Uwayrid* is home to many cultural heritage sites and elements that they would encounter during their walks. This practice not only supports the livelihood of the locals but also facilitates regular interaction with, and monitoring of, heritage sites. It is essential to be mindful that the primary purpose behind these activities is not the preservation of tangible cultural heritage; however, these activities might contribute to it.

6.3.3.3 Living near heritage sites

Another factor that may contribute to the conservation of cultural heritage sites is by living near them. Participant 5 explained in Section 6.2.1.1 (Regenerating oases and planting in cultural heritage sites) that residing near heritage sites enables the local people to observe their surroundings and question visitors about their purpose. Participant 7, an elder who has lived near the Nabataean tombs for decades, mentioned that he and his tribe monitor Nabataean heritage structures, including many ancient water wells. During my visits to the Nabataean site, a tour guide pointed out the houses of her father and grandfather (see Figure 6-8). Therefore, living close to cultural heritage sites may significantly contribute to their preservation in various ways.

⁴¹ A Saudi Biosphere Reserve designated by UNESCO in 2022.



Figure 6-8: Some of the houses located close to the Nabataean tombs, surrounded by many ancient water wells. *Source:* Photo by the researcher.

6.3.3.4 Restricting human interaction

Although the previous categories focused on various actions that may contribute to the conservation of cultural heritage sites, this category emphasises the importance of implementing some restrictions on human–heritage interactions. Traditionally, interactions with cultural heritage have been restricted, as some elders noted. For example, Participant 10 highlighted that the community tended to stop foreign visitors and researchers from visiting the Dadan site and other heritage sites until they had received approval from the governor of AlUla. Similarly, Participant 5 mentioned that the community would prevent anyone from approaching historical elements within their surrounding landscape. During site visits, elders informed me where to walk within the heritage site and what actions were forbidden. These restrictions contributed to heritage preservation, but they also seemed to be for my personal safety. For example, I was asked to follow a specific route at a heritage architectural site, maintain a 1 m distance from the building walls and avoid certain areas. Although interacting with cultural

heritage is encouraged, some restrictions are necessary to ensure the preservation of tangible heritage and the safety of visitors.

6.4 Traditional conservation techniques

This third theme relates to the tangible cultural heritage conservation activities revealed in the data. This section is divided into two subthemes: physical protection and environmental management.

6.4.1 Physical protection

Four physical implementations revealed in the data may contribute to the preservation of tangible cultural heritage sites by protecting heritage from negative events such as flash floods. The four implementations are the *oqoom* (sand berms), traditional fences, rocky dams and walls.

6.4.1.1 Implementing traditional *oqoom* (sand berms)

The first physical technique is the *oqm* (plural: *oqoom*). An *oqm* is a traditional sand berm used by the local people to protect a site or a structure from negative occurrences such as floods. Participant 2 explained:

In the area where you entered the oasis, there were *oqoom*, but I removed them. However, between most of the oases, there are *oqoom*. In this area [pointing to another side of the site], I have a *washea* followed by an *oqm* from the external side ... *oqoom* are implemented when there is a risk.

Oqoom are typically placed between oases and sometimes around the periphery where entrances are located (see Figure 6-9). Although this technique is related to ecosystem conservation (see Section 5.3.1.2 Implementing barriers), it also contributes to preserving tangible cultural heritage, such as ancient buildings. The participant added, 'If the water floods, *oqoom* will protect not just plants but also buildings.' This technique was observed at many heritage sites, including Dadan, Hegra and the traditional oases (Cultural Oases) (see Figures 6-

9 and 6-10). Such techniques are essential for reducing the damage caused by flash flooding, as reported by researchers such as Nehmé et al. (2006) and Alrawaibah (2017), who noted that extreme floods have displaced historical artefacts from their original sites within Hegra WHS.

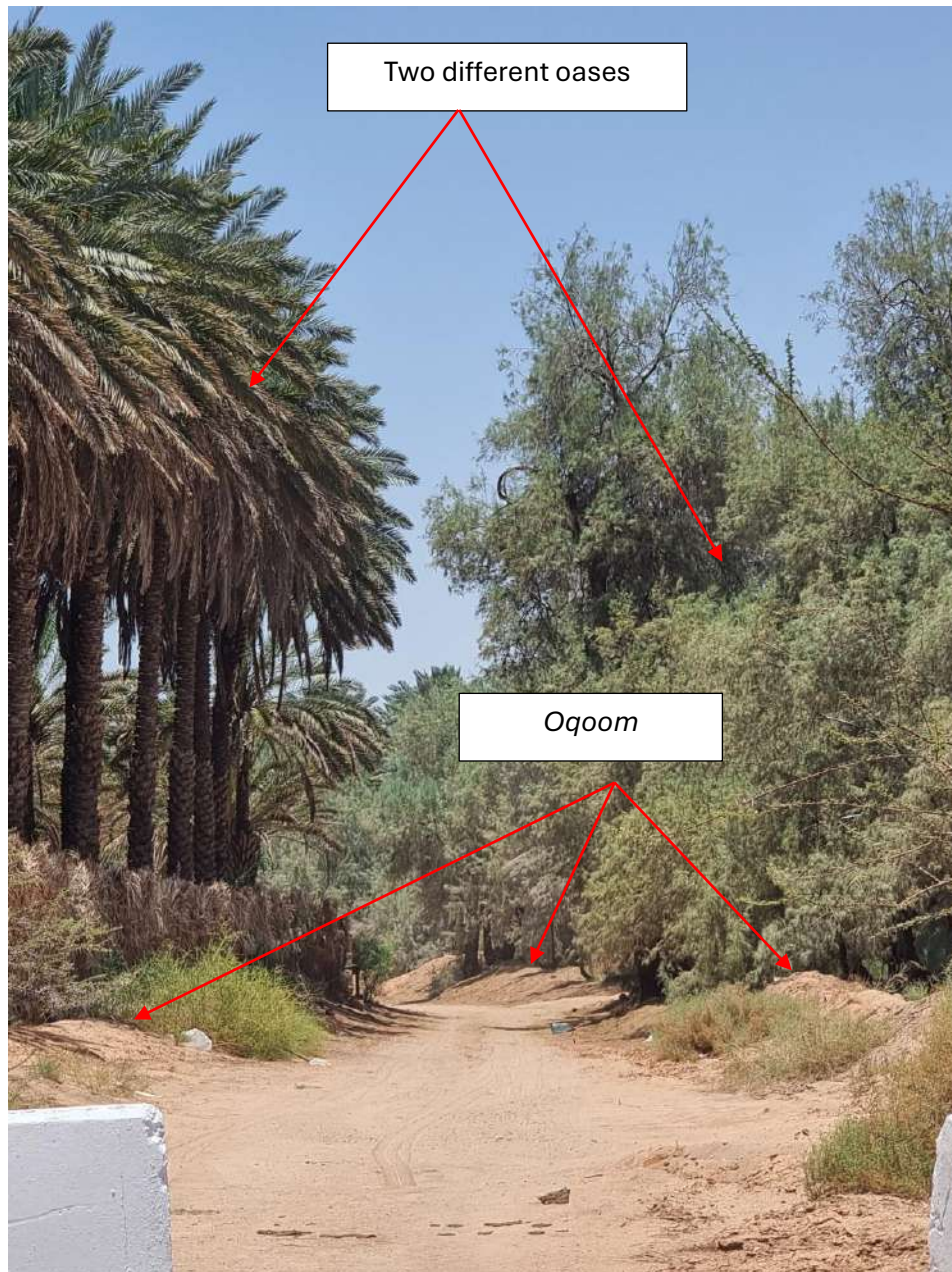


Figure 6-9: On the right side of the photo are the traditional *oqoom* (sand berms) that protect oases, including the heritage elements and buildings inside them, from the risk of floods.

Source: Photo by the researcher.

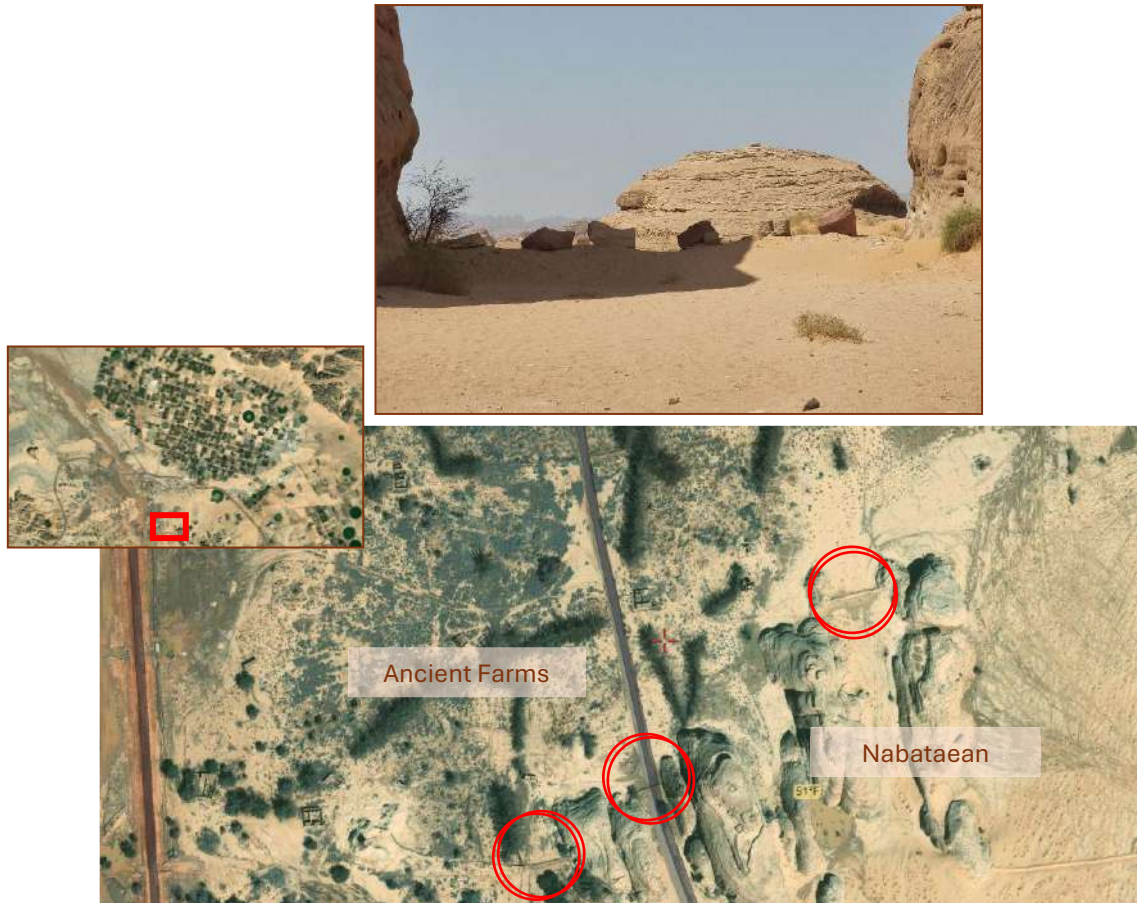


Figure 6-10: Traditional *oqoom* (sand berms) are used between tombs and ancient oases in Hegra. *Source*: Apple Maps, modified by the researcher.

6.4.1.2 Making fences (*washea*)

This technique is similar to that explained in Section 5.3.1.2 (Implementing barriers). Implementing *washea* and using it to fence cultural heritage sites contributes to their preservation. For example, Participant 9 mentioned that they used *washea* made from palm leaves to fence and surround an oasis, protecting it while preserving the heritage identity of the place. This means that *washea* is not only a protective element, but also has a traditional visual value representing the local identity or theme. Additionally, *washea* alone is sometimes insufficient to protect a site, requiring the local people to support it with *oqoom* to reduce the direct impact of floods or sandstorms. Participant 2 noted that he used the *oqoom* to enhance the function of *washea*. This type of fencing is commonly observed throughout the AlUla region (see Figure 6-11).



Figure 6-11: *Washea* surrounding heritage sites or oases that contain tangible cultural heritage, such as ancient buildings. *Source:* Photo by the researcher and published in Alshami et al (2025).

6.4.1.3 Implementing rocky dams

Elders also mentioned the use of rocky dams to protect tangible cultural heritage elements. For instance, Participant 7 explained that they used basic materials to build small dams that differ from modern ones. He described these dams as a combination of aggregates and small rocks. During the review meeting, the elders emphasised that the dams should allow water to pass through small gaps to reach agricultural lands with reduced force (see Figures 5-23 and 6-12). Participant 5 added that, when there is a waterway nearby, they implement rocky barriers to prevent the water from washing away the oasis and its elements. This strategy is similar to that described by Al-Shanqiti (2019), who explained that there was a dam behind the Castle of Asim to protect the castle and harvest water within the *hima* lands of Medina (pp. 174–175).⁴²

⁴² The Castle of Asim was presented in Section 2.4.1.2.

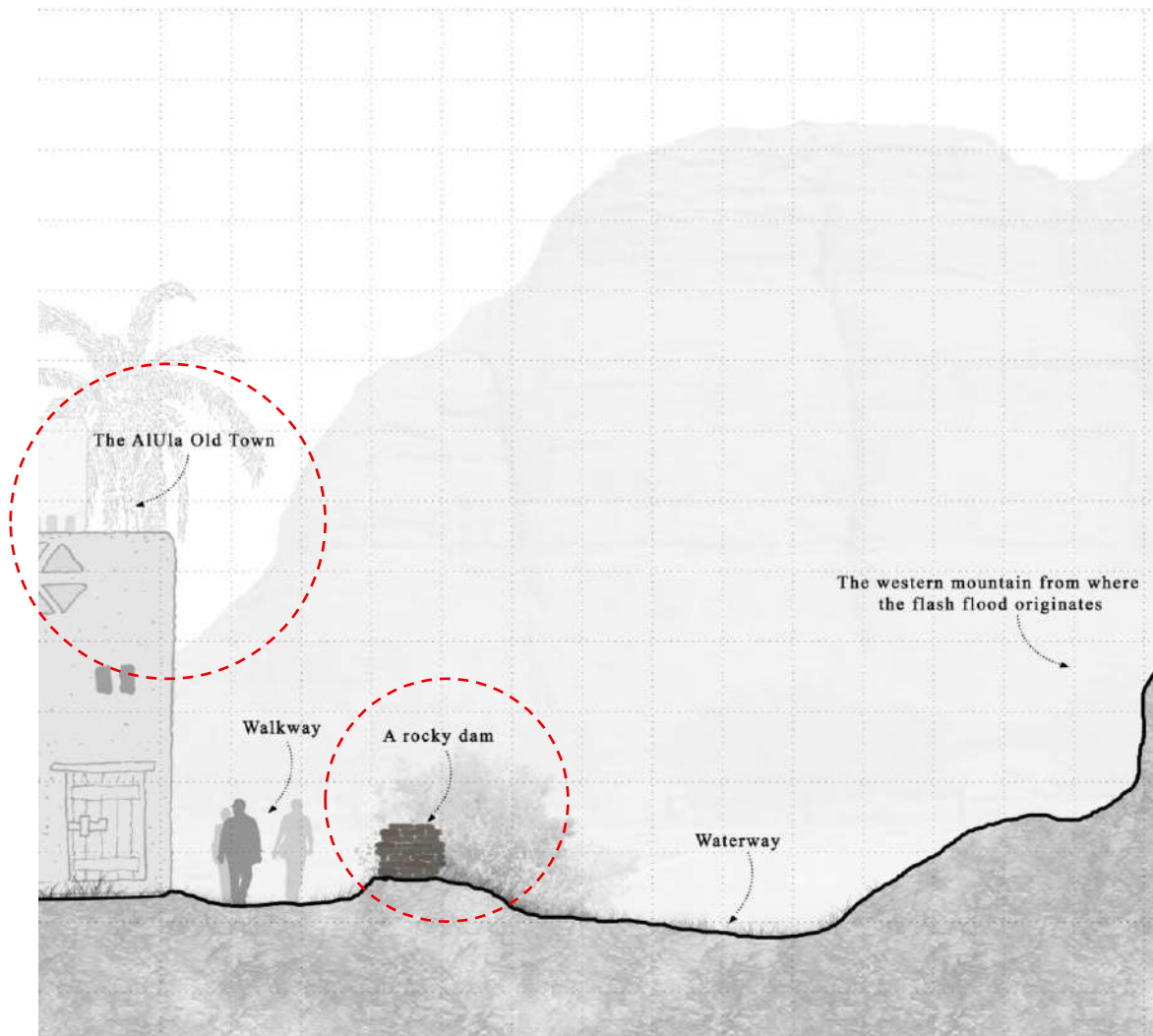


Figure 6-12: Similar to Figure 5-29, this rocky dam is constructed between the traditional houses and the mountain to mitigate the force of floods descending towards the village. It also directs the water into designated canals that irrigate the oasis fields. *Source:* the researcher and published in Alshami et al (2023).

6.4.1.4 Making walls

The fourth strategy observed in the region that may contribute to protecting heritage elements from desertification is the construction of walls. Participant 9 noted that the walls of *Sabaa*, including those on the south and east sides of the village, played a crucial role in safeguarding tangible heritage elements. Thus, the Old Town of AlUla was surrounded on three sides. The elders noted that this technique not only protects the site but also allows the locals to manage the movement of people. Participant 4 suggested that, although implementing rocky water dams is the best solution for protection, building walls can effectively reduce the risk of water flow.

In summary, these four physical techniques may contribute to conserving tangible cultural heritage, as well as oases and their associated structures. They protect heritage elements not only from desertification, but also from the negative impacts of human activities.

6.4.2 Environmental management

The last subtheme of traditional conservation techniques highlights two environmental management purposes that were identified in the data: managing water flow and controlling the impact of sand.

6.4.2.1 Managing water flow

The impact of flash floods on heritage structures has been highlighted in both the literature and this research, with the elders noting that seasonal floods cause damage to their oases and associated structures. The concept of managing water flow emerged from comparing Participant 4's observations with the literature. He stated that 'the torrent did not cross Hegra but passed it from the right side'. Observations at the site and Alrawaibah's (2017) findings on the displacement of heritage elements resulting from flash floods suggest that modifying water pathways could mitigate damage. Signs of erosion and damage on Nabataean artefacts, traditional oases structures and fertile soil caused by torrents were evident (see Figure 6-13). Therefore, managing the water flow, for example, by employing traditional techniques to modify waterways, could enhance the protection of tangible cultural heritage in the region (see Figure 6-14).



Figure 6-13: Photos showing the erosion occurring at different sites. *Source:* Photos by the researcher.



Figure 6-14: A series of photos showing the various strategies used to manage waterways. *Source:* Photos by the researcher.

6.4.2.2 Controlling sand impact

As in the previous category, sandstorms and sand movement also need to be managed. The elders stated that many oases and cultural heritage elements have been affected by sand and

are sometimes covered by it. For example, sand once covered most of the *Al-Dewan* space in Hegra (see Figure 6-15). Some elders recalled being able to touch the ceiling of *Al-Dewan* because the sand had filled up the space halfway.

Although using *washea* and small trees as windbreakers is common around oases, the elders emphasised the protective role of plants for cultural heritage sites, as discussed by Participant 5 in Section 6.2.1.1 (Regenerating oases and planting in cultural heritage sites). The presence of ground cover, oases and farms within cultural heritage sites helps mitigate the impact of sand and sandstorms. Traditionally, oases and cultural heritage sites are interlinked, as observed in Hegra, AlUla Old Town and Shalal. In Hegra, the elders noted that they used to cultivate farms near the Nabataean tombs, now known as the ancient farms (see Nehmé et al., 2006, p. 58). Another example is the Shalal area near the mountain of *Huwara*, where oases formed a green belt around the mountain, which contributes to mitigating the impacts of desertification.

Although these two categories have been mentioned in earlier sections, I chose to elaborate on them separately in the environmental management section owing to the elders' emphasis on their importance and probable role in contributing to the conservation of tangible cultural heritage features in the AlUla region.

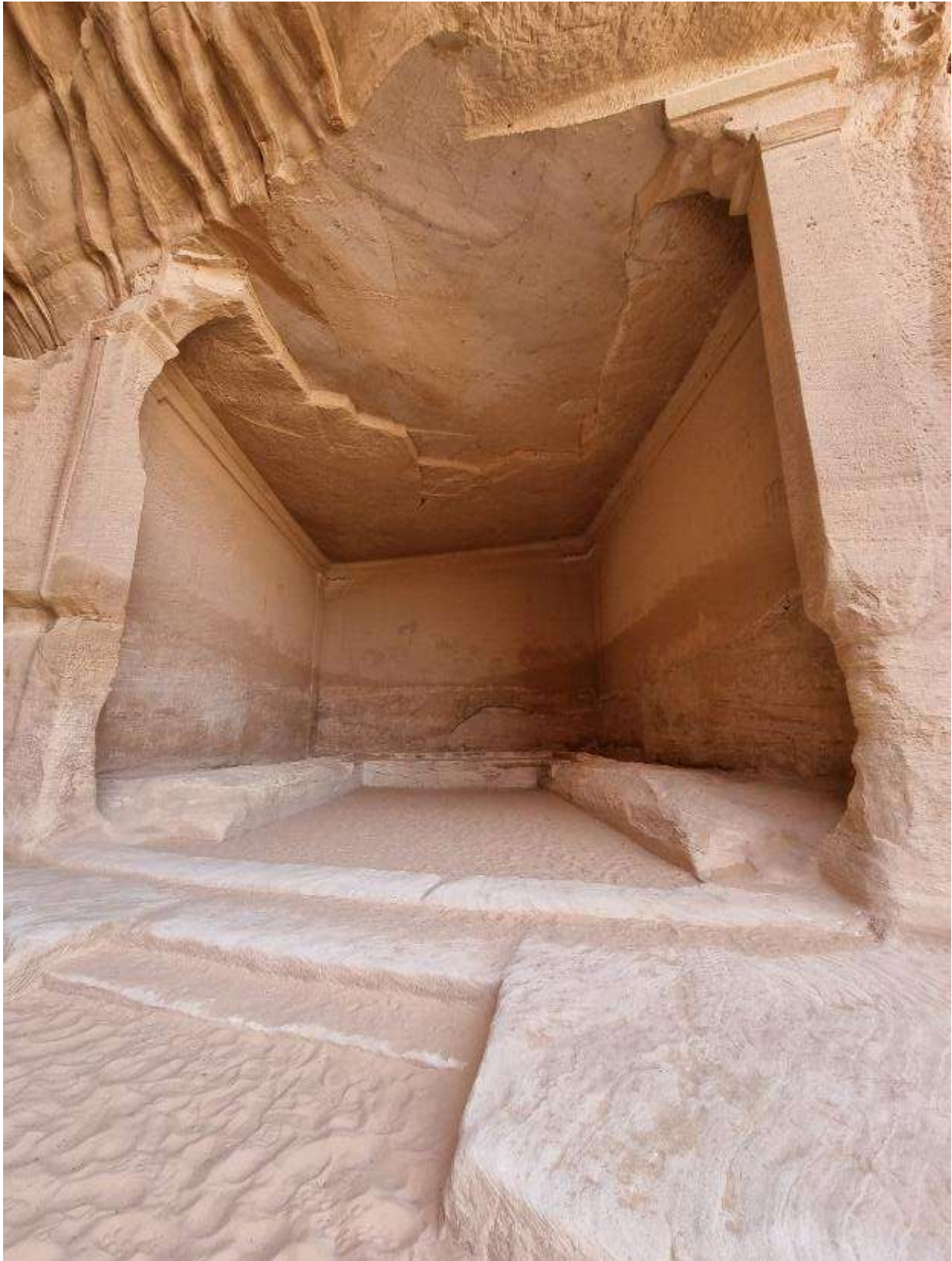


Figure 6-15: The horizontal line in the middle of the space indicates the ground level, as the sand gathered naturally, covering half of the space for a long period and affecting the heritage features. *Source:* Photo by the researcher.

6.5 Conclusion

This chapter introduced three themes to address the second research question, which examines how the TEK of elders can contribute to conserving cultural heritage. The three identified themes were (1) inclusive heritage conservation and regeneration, (2) community engagement and heritage stewardship, and (3) traditional conservation techniques. Each theme operates at a different scale (see Figure 6-16). The first theme focused on regenerating heritage sites and the surrounding ecosystems. The second theme emphasised various forms of interaction between people and heritage sites. The last theme addressed strategies and implementations to mitigate common threats to heritage artefacts in the region. These are the various traditional ecological practices among the *hima* TEK that have contributed to the preservation of cultural heritage. More importantly, the findings of this chapter demonstrate the intertwined and strong integration and connections among local TEK, the natural environment and cultural heritage.

In terms of the literature, it is essential to understand and discover the capabilities of the TEK of *hima* in reference to cultural heritage preservation, given that it is missing from most of the studies on *hima*. Additionally, after consulting with experts from the first workshop who are involved in the development of the AlUla region, it appears that these indigenous practices and strategies are not considered in the current developmental approach.

Regarding design, the results highlight valuable data that can inform LA projects across the three key themes. The first theme demonstrated how revitalisation projects can preserve cultural heritage sites through initiatives such as reviving old *hima* sites, environmental restoration, and restoring cultural heritage sites and water springs. The second theme emphasised the role of society, indicating that designers need to understand human–nature–heritage interactions to propose solutions that comprehensively suit the site’s context. The third theme underscored essential protection strategies, focusing on sand and water management. It is crucial for landscape architects and urban designers working on heritage preservation and urban

development projects in the region to understand these concepts. They need to know about the indigenous practices and values of elders, which have contributed to the preservation of cultural heritage elements to this day, and then integrate and incorporate them into contemporary master plans and development projects.

This RFD approach enabled us to comprehend the extent of the elders' knowledge and the interconnections among people, natural systems and cultural heritage. However, the challenge remains to integrate this knowledge into the design and the design process. How can we use this as a source of inspiration to design urban areas and incorporate these values into the OMP? What is the role of landscape design in this context, and what are the main design aspects that designers need to consider when aiming to integrate *hima* TEK techniques into urban development projects to mitigate desertification and preserve cultural heritage sites in the country? Following the RTD approach, the next chapter explores these questions.



Figure 6-16: This figure shows the themes, subthemes and categories covered in this chapter, answering the second research question. *Source:* By the researcher.

Chapter 7: Design Opportunities and Ideas Guided by the Local TEK: Drawing Conclusions for Present and Future Landscape and Urban Design Projects Within Heritage Sites in Desert Ecosystems

7.1 Introduction

Taking into consideration the pivotal role played by the TEK of indigenous communities in mitigating desertification and preserving cultural heritage while living their way of life, this chapter investigates opportunities for integrating *hima* TEK into contemporary urban development projects, particularly from a design perspective. It sheds light on the important aspects raised by the national experts⁴³ in terms of the design process and designing a place, and how we can translate this valuable indigenous system into inclusive design ideas to mitigate desertification and preserve cultural heritage. The results and interpretations in this chapter can work as a design methodology inspired by local TEK for landscape architects, urban designers, planners and decision-makers when working with Saudi heritage sites threatened by desertification.

This chapter is divided into three sections: (1) the development of a conceptual master plan based on the elders' knowledge gathered from previous chapters, (2) the exploration of design ideas and possibilities to mitigate desertification and conserve cultural heritage with national experts, and (3) a discussion and reflection on the role of landscape design in working with local TEK. The aim of these sections is to answer the third research question: What is the role of landscape design in a *hima* context, and what are the main design aspects that designers need

⁴³ The national experts are individuals with academic qualifications and degrees in landscape architecture, planning or urban design. Most of them have long experience working with the traditional local communities in the Kingdom and are aware of *hima* TEK.

to consider when aiming to integrate *hima* TEK techniques into urban development projects to mitigate desertification and preserve cultural heritage sites in the country? This chapter employs an RTD approach to illustrate the role of landscape design as a profession and show how landscape design can inform the *hima* TEK and be informed by it.

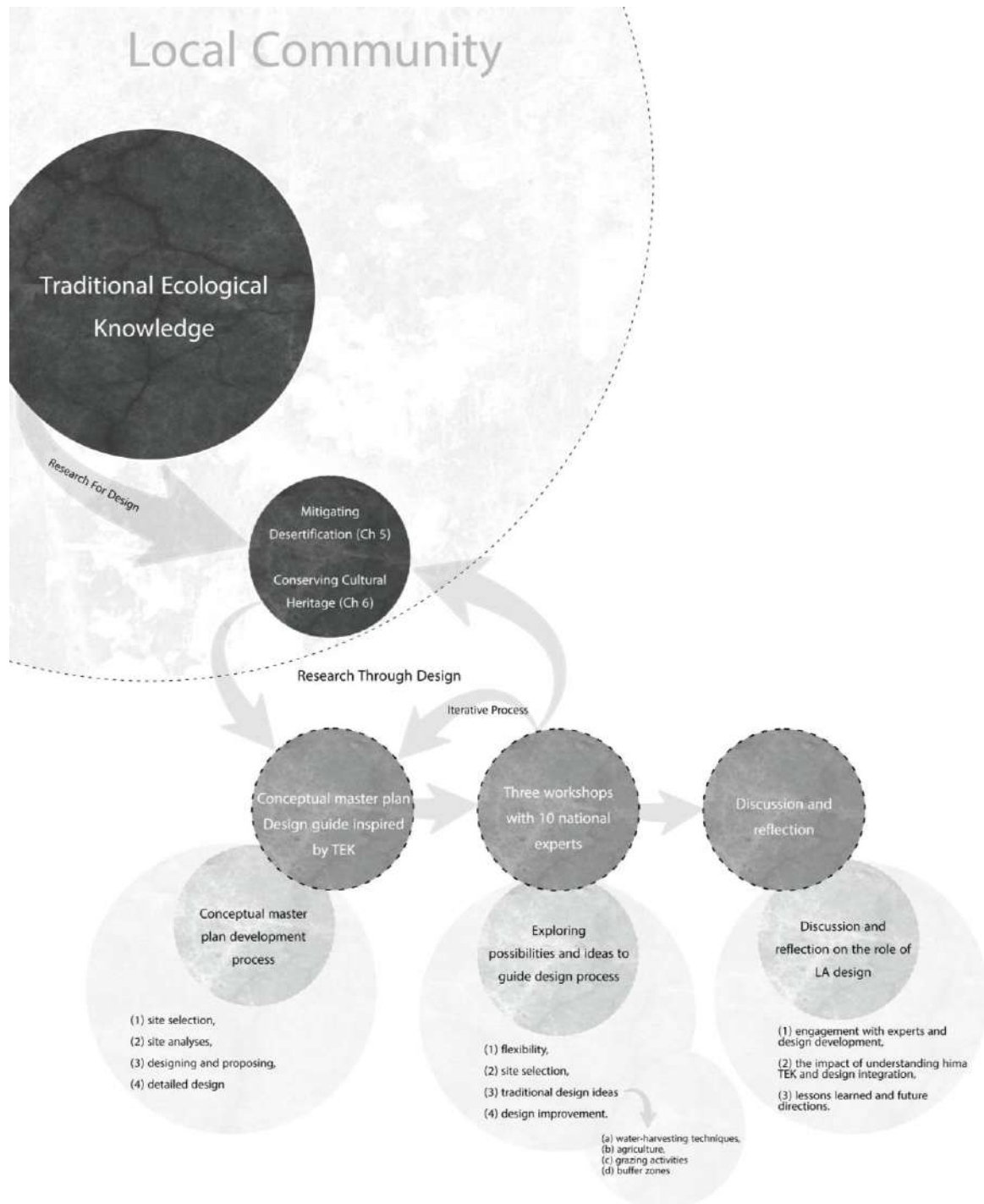


Figure 7-1: This diagram presents the RTD process and the main themes in this chapter. Source: by the researcher.

7.2 Conceptual master plan development process⁴⁴

This research into *hima* TEK informs an LA design investigation, including a conceptual master plan, which was developed as part of this research. The decision to develop a conceptual master plan came from the need to explore how *hima* TEK can be integrated into contemporary urban design and official master plans, especially within contexts of cultural heritage that are under the risk of desertification, such as AlUla County. AlUla, as a region undergoing significant transformation driven by large-scale urban development, international eco-tourism and heritage conservation projects, presents an opportunity to test the applicability of *hima* TEK within official urban master plans. The conceptual master plan of this research serves as a practical tool to bridge the gap between the *hima* TEK practices of the local elders and the official experts, decision-makers and professionals in design fields such as LA, and urban design and planning.

The development of the conceptual master plan unfolded in three successive stages: initial site design, expert consultation, and implementational and integrational aspects. The first phase was based on designing with the TEK of the local elders. It involved designing a preliminary conceptual master plan by amalgamating insights from the elders with my own interpretations of how these practices conserve cultural heritage and maintain natural resources by mitigating the desertification process. The initial design investigation presented in Section 4.6 was insufficient to reach the current stage of understanding. However, the RFD approach enabled the integration of more detailed information about local TEK and its contributions to heritage conservation and ecosystem protection against desertification.

⁴⁴ In Section 3.4.3 (The Third Data Collection Stage) and, more specifically, Section 3.4.3.1 (Design Development), I discussed the stages and iterations that led me to generate the results of this chapter.

Subsequently, the developed design ideas underwent thorough deliberation and discussion with 10 national experts—this collaborative effort aimed to refine and evolve the design into a comprehensive and inclusive concept.

The final stage encompassed translating the refined design and discussions into key design aspects. This involved delineating different strategies where *hima* TEK is integrated, reintroduced and proposed within the regional official master plan, aiming to counteract desertification, preserve cultural heritage and enhance the community's overall well-being. Although the first phase is explained in this section, the third phase is presented in Section 7.3 (Exploring Possibilities and Ideas to Guide Design/Design Process). The development of the conceptual master plan involved four primary elements: (1) site selection, (2) site analysis, (3) designing and proposing, and (4) detailed design.

7.2.1 Site selection

Selecting a site for the conceptual master plan was essential for grounding this design exercise in a tangible context to allow for a focused exploration of how *hima* TEK can be integrated into real-world planning and design practices. Designing a specific site makes it possible to test and demonstrate the practical application of *hima* TEK concepts and ideas, and show how they address local environmental, cultural and development challenges. This site-specific approach provides a framework for landscape and urban design researchers to translate theoretical knowledge into actionable design strategies and ideas to ensure relevance and applicability to ongoing projects in AlUla County.

Many factors played a role in selecting the site, but three main factors can be considered key. To implement *hima* TEK and the associated practices in a place, I selected a site containing natural resources and cultural heritage elements that face desertification factors, located close to an urban area to ensure human interaction with the site. Based on the understanding of the

collected data, suitable sites can be the transitioning areas (at the edges of the urban fabric), located between urban areas and natural environments, such as the area between towns and the surrounding deserts or mountains. The site I selected is located within the boundaries of AlUla's OMP. The site ownership is held by official institutions, not the locals. According to Kilani et al. (2007, p. 6), in the 1960s, the management and ownership of land were modified from tribal to national, specifically under the Ministry of Agriculture. Since then, the ownership might be transferred to other official institutions.

Traditional ecological practices such as *hima* are part of the lifestyle of the local community and can be implemented inside and outside the urban areas. However, most of the local practices and techniques, whether observed in the field or found in the literature (Gari, 2006), were associated with natural resources and implemented near urban areas, whether within traditional oases or *hima* sites (traditional protected areas), given that managing natural resources is part of the daily routine of the locals. Therefore, I selected a part of the valley next to the Dadan historical site and the Cultural Oases in AlUla (see Figure 7-2). This site contains fodder, seasonal waterways, and naturally collected water on the top of the mountain and Dadan tombs, and it ends in the traditional oases (named in the OMP as the Cultural Oases). Also, the site used to be a grazing area for the local community.

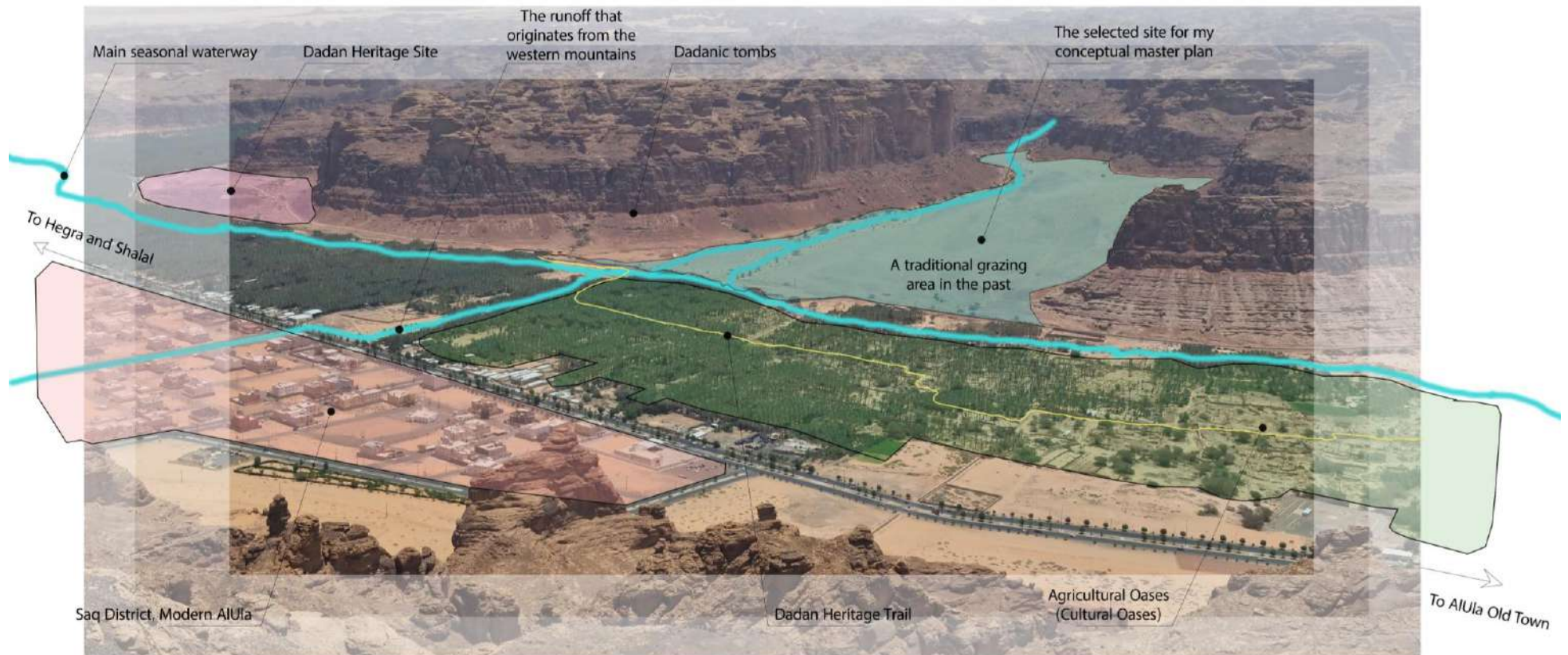


Figure 7-2: Photo showing an elevated view of the selected site. *Source:* Photo by the researcher.

7.2.2 Site analyses

I started the site analysis by understanding the site context and identifying and determining its natural, cultural and heritage factors, such as native plants, waterways and mountains, as well as built features, such as streets, buildings and agricultural lands (e.g. see Figure 7-3). Next, I identified the desertification factors mentioned by elders, such as flash floods and sandstorms, along with the traditional techniques implemented, such as *oqoom* (sand berms) and windbreakers. The relationship between these factors was analysed to understand the positive and negative impacts. For example, the change in the contour lines was studied to understand water flow and movement within the site, how it reaches the main seasonal waterway in AlUla and how it passes the oases. Additionally, I considered the traditional activities that locals performed at this site in the past, their significance and their needs, such as grazing land and collecting water. I also identified concerns the local people have about heavy rainwater and flash floods from the mountain damaging trees and houses. Finally, I analysed the new master plan (OMP) approved by official institutions to understand the future vision for this part of AlUla and the different ideas proposed for implementation. This analysis enabled me to assess the pressure added by the site's waterways on the main waterway under current conditions (see Figure 5-15). Given the recent developments, including the partial infilling of the main waterway for road expansion, the risk of flooding in the adjacent oases is likely to increase. The absence of alternative flood mitigation measures further reinforces this concern. Additionally, the proposed tramway by the OMP, along with road expansion and fencing, appears to act as a physical barrier, exacerbating the spatial disconnect between locals and their surrounding natural environment. These environmental and urban challenges prompted me to explore how TEK and traditional techniques could offer viable solutions while supplementing and enhancing the OMP's vision. For example, during my analysis, I considered how techniques such as *oqoom*, terraces, and similar methods like swales could help mitigate flood risks while also enhancing ground cover and soil stability.

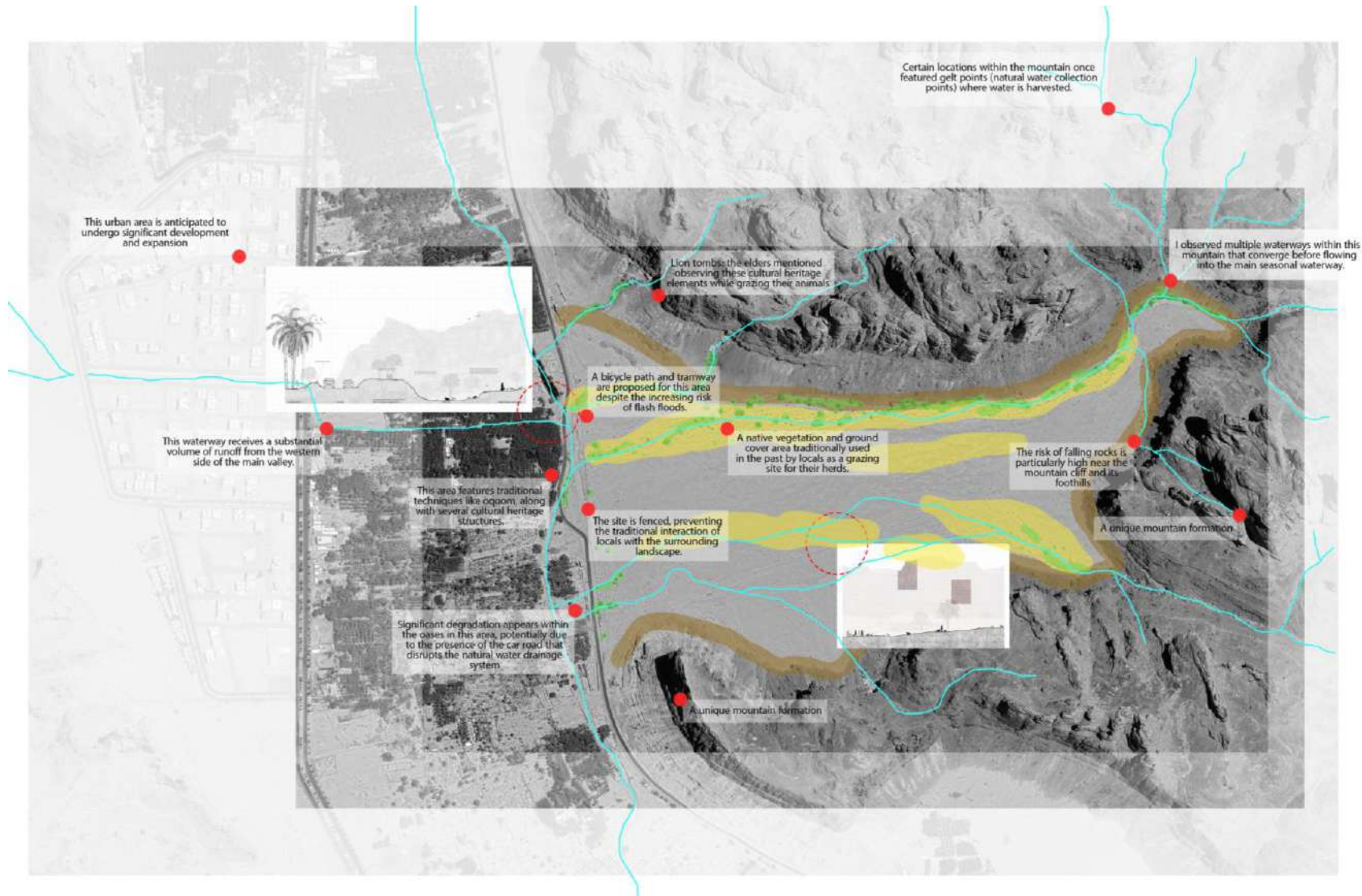


Figure 7-3: A collage showing some analytical drawings for the selected site. *Source:* by the researcher.

7.2.3 Designing and proposing

Nine aspects of the design process are considered in this section. The first step in developing this conceptual master plan was to address major environmental issues using concepts and techniques derived from local TEK while considering the locals' needs, heritage concerns and the proposed master plan. I addressed the mountain, the largest element on the site, as both an opportunity and a potential threat. To protect the mountain and its associated Dadanic heritage features, I proposed a buffer zone of at least 40 m to reduce the risk of falling rocks and prevent any development activities (see Figure 7-4 (1)). Water canals and terraces should be implemented to manage water coming from the mountain, and native plants and ground cover should be protected in this area.

Second, I proposed rocky dams and terraces on the higher part of the mountain to reduce water speed and the risk of falling rocks, as warned about by the locals (see Figure 7-4 (2)). Third, after understanding the waterways, I suggested a series of swales to manage and control rainwater and runoff from the mountain (see Figure 7-4 (3)). Swales, similar to traditional sand berms (*oqoom*), reduce water flow and manage its direction, allowing for aquifer recharge and supporting microclimates. Unlike sand berms, swales allow water to continue down the valley, irrigating agricultural areas, as emphasised by elders.

Fourth, I proposed planting native productive plants such as Athel (الأثل) trees (*Tamarix*), Alban (البن) tree (*Moringa peregrina*), Attalh (الطلح) trees (*Acacia farnesiana*), olive trees (*Olea europaea*) and Assmr (السمر) trees (*Acacia tortilis*) next to each swale, since the soil behind the swale would be the moistest (e.g. see Figure 7-4 (4)). These plants protect the soil, increase site productivity and provide shaded areas to reduce evaporation. Fifth, I proposed 12 seasonal grazing areas to support the locals with sheep (e.g. see Figure 7-4 (5)). This activity allows the local people to interact with the site and provides nature with the opportunity to recover and thrive. Seasonal agricultural activities, such as fodder and seasonal plants, can be implemented between swales

to increase the site's productivity. Sixth, I proposed multi-use spaces for visitors to interact with the site, enjoy the local natural system and observe cultural heritage surrounded by nature (e.g. see Figure 7-4 (6)). These spaces can be used for social or community gatherings, or traditional activities such as the *Al-Shannah* festival. Seventh, a main walkway is proposed to connect different areas and guide visitors to see the natural and Dadanic elements, while restricting access to the tombs to enhance their protection (e.g. see Figure 7-4 (7)). The concept of a living museum is considered, allowing locals to interact with the site and creating an opportunity for visitors and new generations to see traditional sustainable interactions and activities between the community and landscape. Eighth, an extension of the 'cultural' oases is proposed to mitigate the negative impact of desertification (e.g. see Figure 7-4 (8)). This extension reconnects the locals to the site, as in the past, and reduces the impact of the highway that separates the two areas (the oases and the selected site). Ninth, the site has an entrance and an exit to control accessibility and the number of visitors, which may enhance the protection of the site (e.g. see Figure 7-4 (9)). The conceptual master plan also aims to be economically beneficial for the locals in various ways. For example, natural products produced on the site could be used by the locals or sold to visitors, with profits going to the locals. Additionally, fees for events and activities can be utilised to manage and operate the site. For example, it can be given to the local people who are managing and maintaining the site. These design strategies were formulated to illustrate how the local TEK can be integrated into a conceptual master plan and to align the OMP more closely with the cultural heritage embedded in Hima TEK while ensuring its continued preservation. This alignment can be explained better in the following step, which involves translating this hypothesis from the conceptual master plan to a detailed scale before presenting it in workshops with national experts.



Figure 7-4: This is the conceptual master plan inspired by the TEK of the elders of the local communities of Alula County. This map was printed and discussed in the workshops with the experts. *Source:* Drawn by the researcher.

7.2.4 Detailed design

This section presents two aspects in detail where the *hima* TEK informs design: (1) my design approach to identifying opportunities from local TEK and (2) some detailed drawings that investigate possible ways of implementing the conceptual master plan on the ground.

7.2.4.1 Design Approach

Regarding the first aspect, two areas located between my selected site and its adjacent oases were examined. I chose these two areas because I am aware of the history of the sites, such as the extreme flash flood events that the two areas experienced in the past. In addition, I can imagine, to some extent, how these two sites will look in the future based on the rendered perspectives of the OMP. This exercise illustrates how the design approach enhanced my understanding of the site. This enhancement came from drawing the existing and historical sections of the areas and connecting them to the data collected from the interviews and site visits.

The first area is part of the selected site and one of the visited sites (SV-18; see Figure 7-5). Based on site visits and elders' stories, I created a contextual drawing of the site, presenting different time periods (see Figure 7-5).

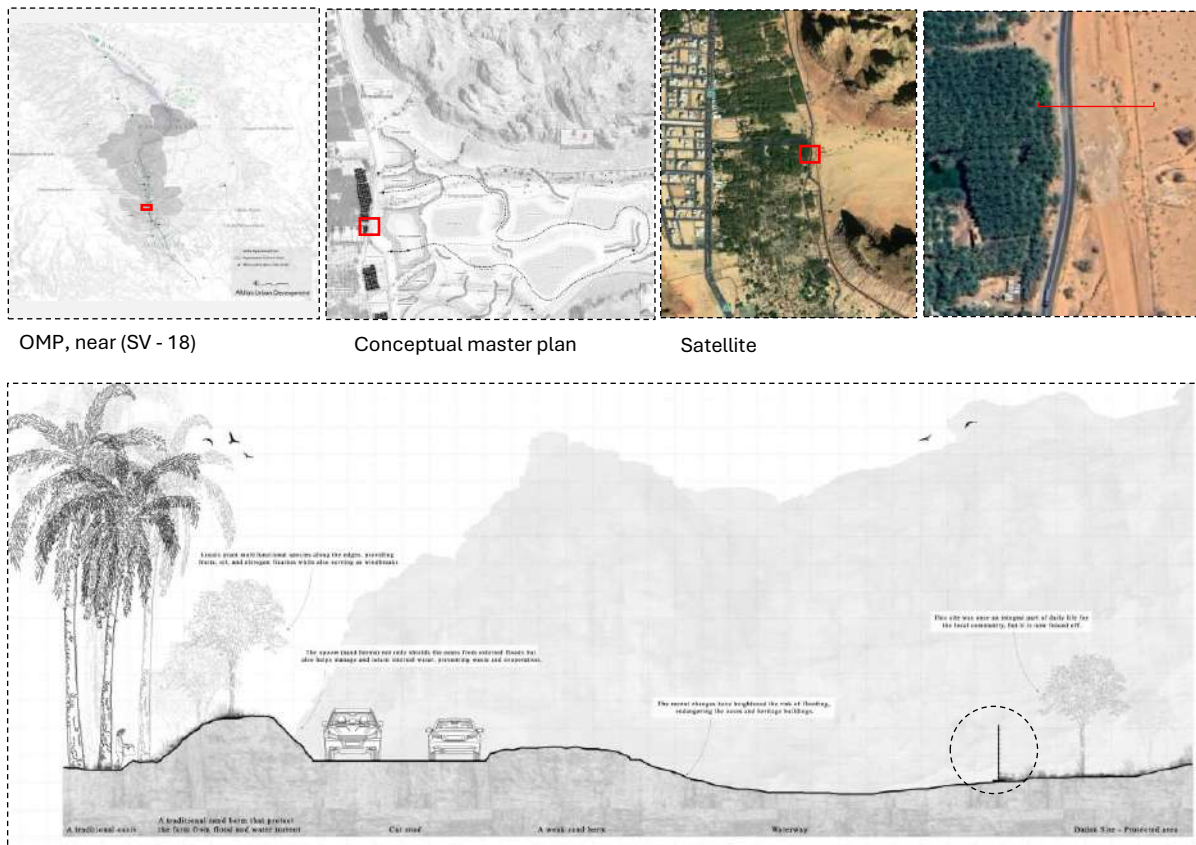


Figure 7-5: Site SV-18—The situation of the site during the site visit shows that the waterway is almost backfilled, and the natural site is fenced (see the circled element) to limit accessibility and protect the Dadanic tombs. Source: Drawings and modifications by the researcher and satellite images by Apple Maps.

Currently, locals cannot access the site to graze their animals due to the fence, and only a few sand berms protect the edges of the oases (see Figure 7-5 (between the car road and the oases)). However, observations and interviews revealed that the site was different in the past. Previously, livestock owned by local people grazed there, and a clear waterway was implemented to manage runoff and rainwater, which is now backfilled (see Figures 7-6, Historical Section and 5-15). The site had abundant ground cover but faced two flash flood events that caused significant damage to the oases and the associated structures and houses. Some *oqoom* were implemented to protect the oases from these threats. In the past, locals effectively managed and monitored the natural resources and cultural heritage, ensuring the conservation and protection of their natural surroundings. Now, the increased risk of flash floods endangers oases and local communities.

I translated the OMP into landscape sections based on the published 3D views, perspectives and maps (see Figures 4-5, 4-6 and 4-7) to better understand it and explore ways to integrate *hima* TEK. It appears that the risk of flash floods in this area was not considered in the OMP. The OMP proposes a walkway, bicycle path and electric tram passing through the site with an almost flat surface, potentially increasing flood risk for the oases and the local communities in the future (see Figure 7-6: Future section based on the OMP). I consider how local TEK could be integrated into future designs to address this issue and reconnect locals to their natural and cultural heritage. Two design options are produced (see Figure 7-6: Section through proposed design with integrated TEK – Option 1, and Figure 7-7).

In the first design option, I suggest implementing a series of swales along the valley to reduce water speed, manage it and redirect some of it to small natural water basins to generate ecosystems and support the native plants, as shown in Figures 7-4 and 7-6 (Option 1). This strategy should be informed by anticipated rainfall and runoff volumes, and complemented by sand berms to enhance the protection of oases. Water canals are proposed as well to transfer water to the middle of the oases, contributing to the irrigation system during the rainy season (see Figure 7-6: Option 1). The natural site can remain open, allowing easy access while restricting some areas for regeneration and protection. Many native productive trees, such as olive and Alban trees, are proposed to enhance the local ecosystem and mitigate the pressure of runoff water.

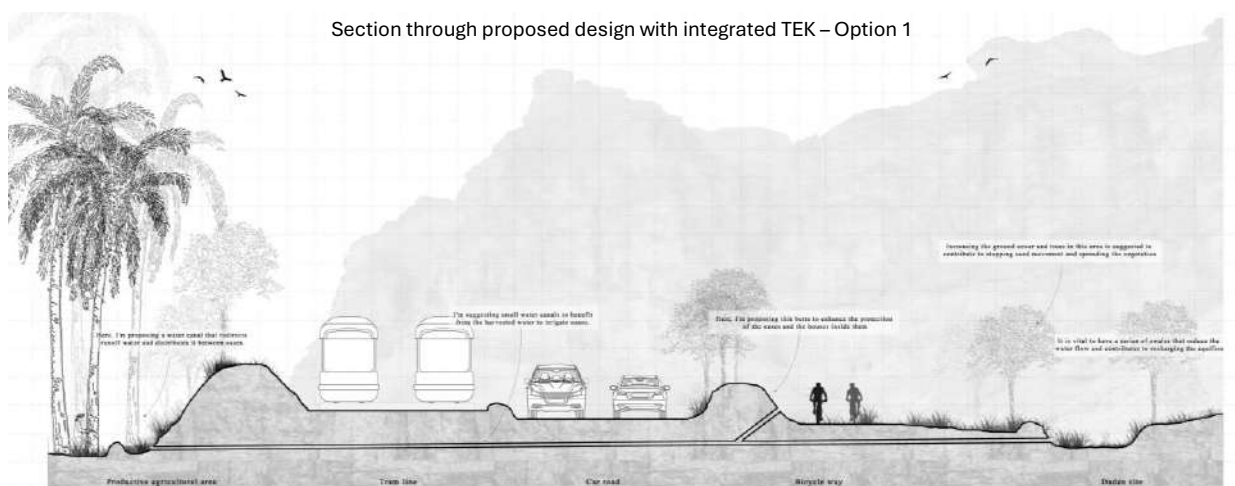
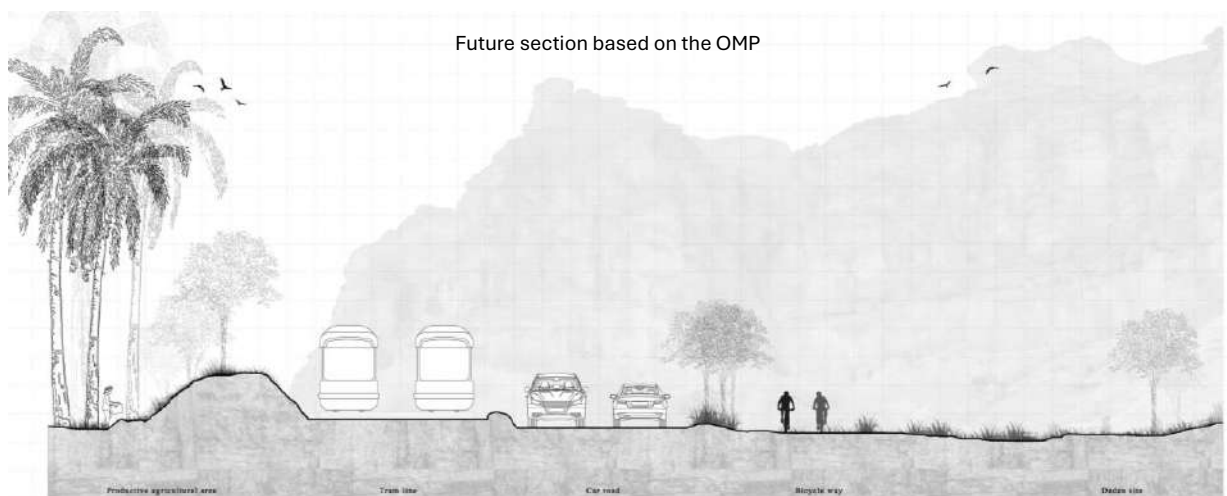
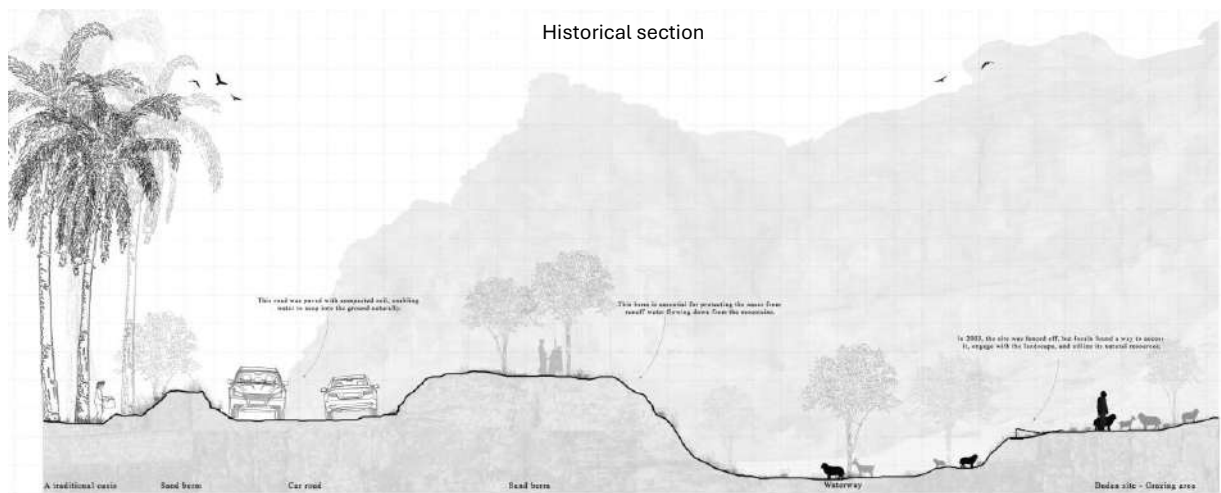


Figure 7-6: Three sections show the site in different periods. *Source:* Drawings by the researcher.

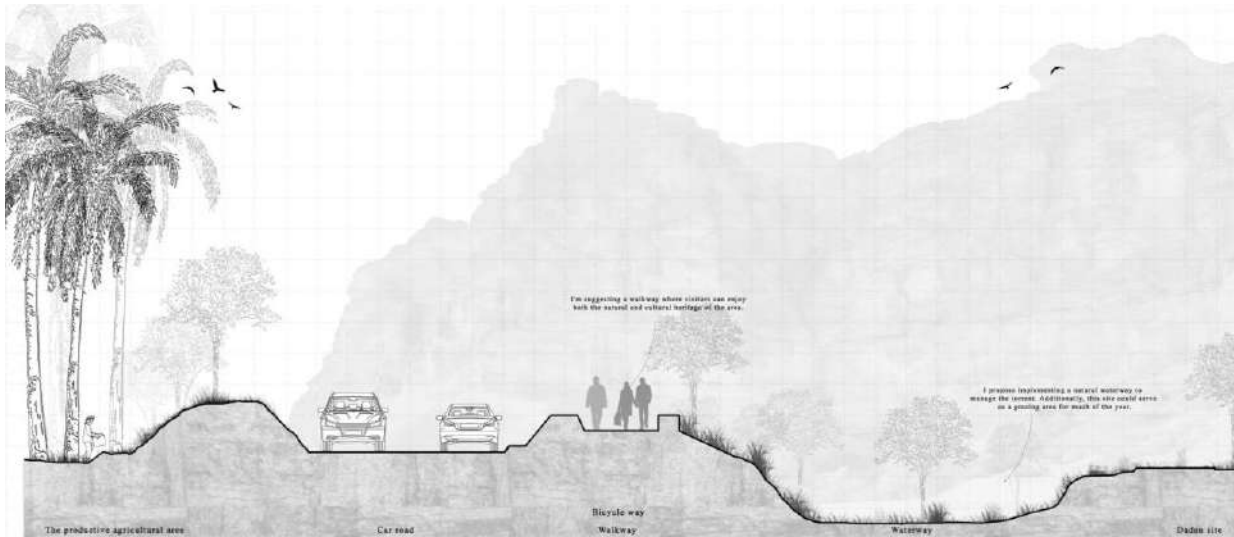


Figure 7-7: Section of proposed design with integrated TEK – Option 2. *Source:* Drawn by the researcher.

In the second option (see Figure 7-7), I suggest reinstating the main waterway with a series of swales to mitigate flood risks. I retained the proposed bicycle path and the walkway but removed the tram, considering bicycles to be more environmentally friendly and aligned with the visual identity emphasised by the elders. Additionally, I propose regenerating and planting the natural area (on the right side of the walkway) to enhance ground cover, which would help reduce the risk of flash floods and soil erosion. However, experts later critiqued this design decision, leading to more developed design ideas (see Section 7.3: Exploring Possibilities and Ideas to Guide the Design Process).

The second detailed site is the area that connects my selected site to the Dadan Heritage Trail (traditionally called the *Al-Sa'ah* Walkway - see Figure 7-8). This walkway connects various sites, starting from the Dadan Heritage Site to the AlUla Old Town, passing through most of the 'Cultural' Oases.

Conversations with elders revealed that this site had been flooded many times, affecting plants and built structures. The site is covered by clay soil and includes two sand berms at its edges to maintain privacy and protect the oases from runoff water (see Figure 7-8). These sand berms typically support productive shrubs, small trees and windbreakers. The OMP proposes a lifted

pedestrian walkway with an electric tram underneath, offering visitors unique perspectives to interact with the oases (see Figures 4-7 and 7-9). However, the collected TEK data show that this idea is unwelcome since it raises privacy issues for the local inhabitants, puts pressure on the tranquil local atmosphere and distorts the area's heritage values, beginning with changing traditional names. A recent visit (in 2023) revealed that the walkway's width had been expanded, destroying parts of the traditional oases, *oqoom*, plants and oases' fertile soil (see Figures 5-14 and 5-15).

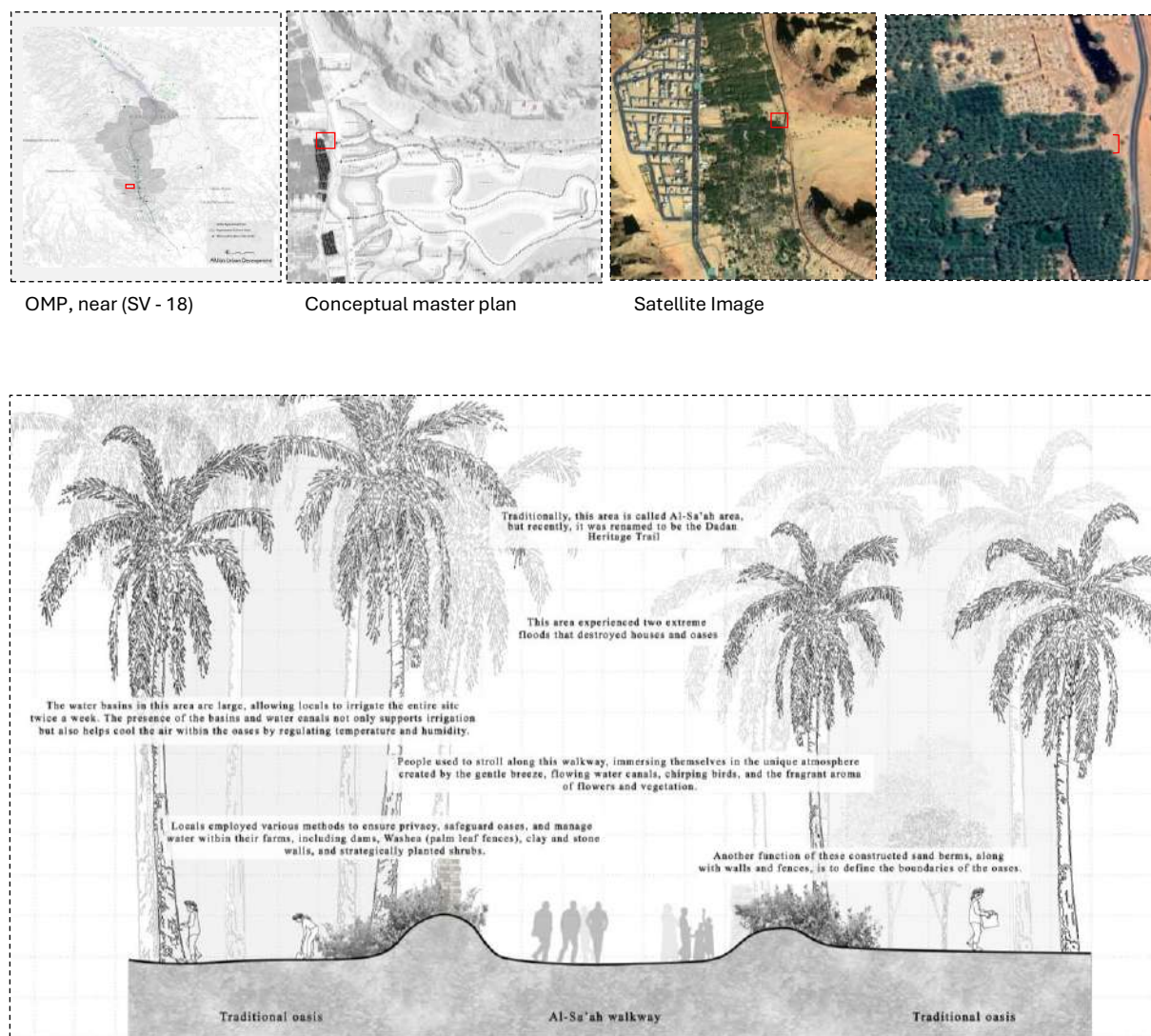


Figure 7-8: This section presents the second area that connects the selected site with the Dadan Heritage Trail. It aims to explain local TEK opportunities and show how they can be integrated. *Source:* By the researcher and published in Alshami et al (2023).

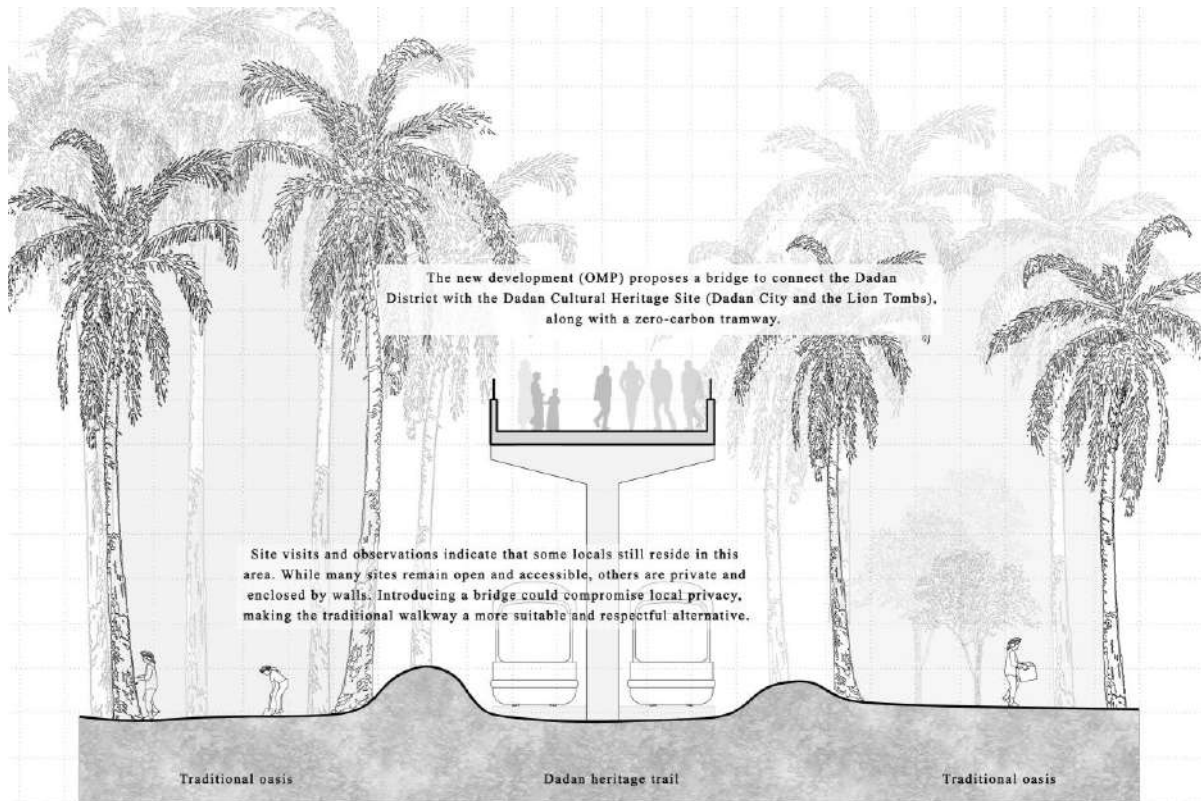


Figure 7-9: An imagined section of the site after implementing the OMP and its proposed elements and ideas. The bridge may be higher to allow visitors to see the oases from the top.

Source: By the researcher and published in Alshami et al (2023).

Based on the knowledge gained from the previous chapters, there are many traditional ideas that can be drawn from the local TEK to preserve traditional values and appropriately address the proposed OMP. As explained in Section 5.3.2.5: Creating hammams, privacy is crucial to the local people, especially those who have walled and fenced their oases. Along this walkway, many oases are hidden behind clay walls, *washea*, or *oqoom* (sand berms), preventing the public from seeing inside (see Figure 7-8). Although one expert noted that the land use type of the ‘Cultural’ Oases was changed from private to semi-public,⁴⁵ many walled or fenced private oases are still managed by locals who prefer to keep their land private.

Consequently, I propose lowering the pedestrian walkway to the level of the tram, both on a raised platform that allows water to run underneath (see Figure 7-10). Combining walkways with

⁴⁵ This point is expanded in Section 7.3.2 (Site selection).

other forms of public transportation would be more acceptable and suit the local culture. This alteration would also engage visitors more with the surrounding environment, allowing them to pick and eat hanging fruit, practising traditional generosity. For example, if fruit hangs over a wall and is reachable, pedestrians can take it without asking the oasis owner. Visitors will also discover the various traditional techniques used to protect plants and the ecosystem. Walking through the oases, they can experience the cooling breeze from water canals, the unique smells from different plants and the sounds of various birds, creating a unique atmosphere (see Figure 7-10).

Altering the irrigation system, changing plant species or adding new elements such as the tram⁴⁶ could permanently disrupt this atmosphere. I want visitors to experience and learn about the elements that create this environment. By walking through the oases, people can observe the locals maintaining them and see changes in the water direction among the palms, creating a living museum. This educates not only visitors, but also the younger generation of locals who do not know the traditional ecological system. These examples illustrate my design approach. The next section presents detailed aspects of the conceptual master plan.

⁴⁶ This aspect is discussed by the experts in the next section.

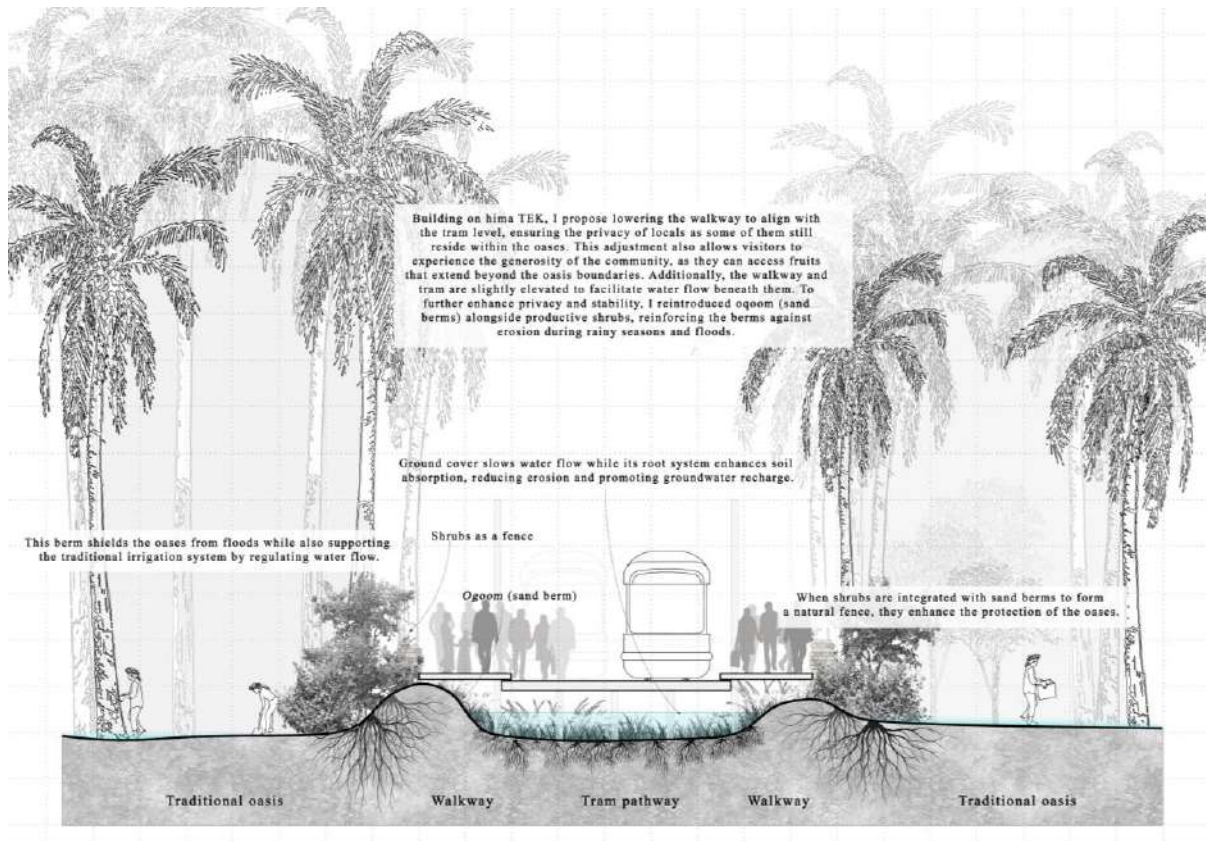


Figure 7-10: This is a section through the OMP proposed design integrated with TEK. Source: By the researcher and published in Alshami et al (2023).

7.2.4.2 Detailed Design Ideas of the Conceptual Master Plan

This section details how I incorporated the local TEK of the elders into my conceptual master plan discussed in Section 7.2.3 (Designing and proposing). This integration goes beyond merely reintroducing traditional practices and techniques; it addresses traditional values and concepts, contributing to nature conservation and heritage preservation.

The primary aim was to use *hima* TEK and techniques to protect natural and cultural heritage and to mitigate desertification. For example, the main walkway inside the site increases foot traffic, encouraging more people to interact with and observe the site (see Figure 7-4 (7)). This heightened presence helps to conserve the site, since locals and visitors can report any negative actions or activities. Another example is the grazing activity, which allows locals to graze their animals and benefit from natural fodder, while using their knowledge and experience to monitor

and manage environmental issues (e.g. see Figure 7-4 (5)). Additionally, a 40 m buffer zone around the mountain prevents people from climbing the mountain and protects them from falling rocks (see Figure 7-4 (1)). This buffer also offers visitors a panoramic view of the mountain, tombs and surrounding landscape. Combining cultural landscapes with traditional activities such as grazing and monitoring demonstrates sustainable living practices, as shown in Figure 7-11. Although the buffer zone would generally be off limits, it would allow limited local grazing for specific periods based on site conditions.

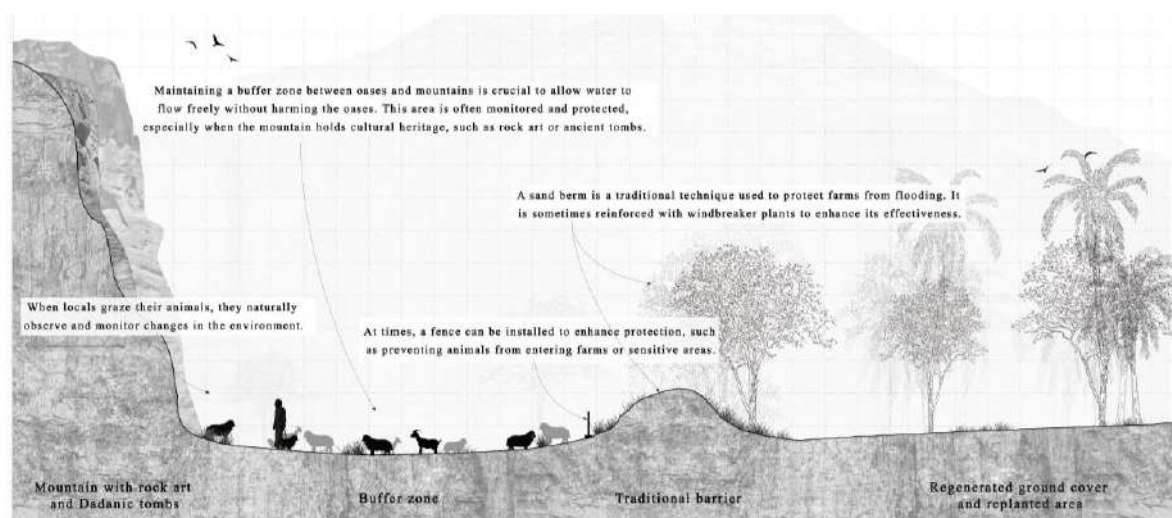


Figure 7-11: This section illustrates the buffer zone and its various elements contributing to the site conservation. *Source:* Drawn by the researcher.

Preserving water and recharging the aquifer are also key project goals. To regenerate and enrich the ecosystem and ground cover, I propose multiple swales and terraces. Planting native plants in parts of the area will increase shaded areas and facilitate water absorption into the soil, as shown in Figure 7-12. This is expected to improve ground cover. Although the main walkway supports the traditional concept of constant monitoring, introducing activities such as grazing within the buffer zone further emphasises this traditional practice.

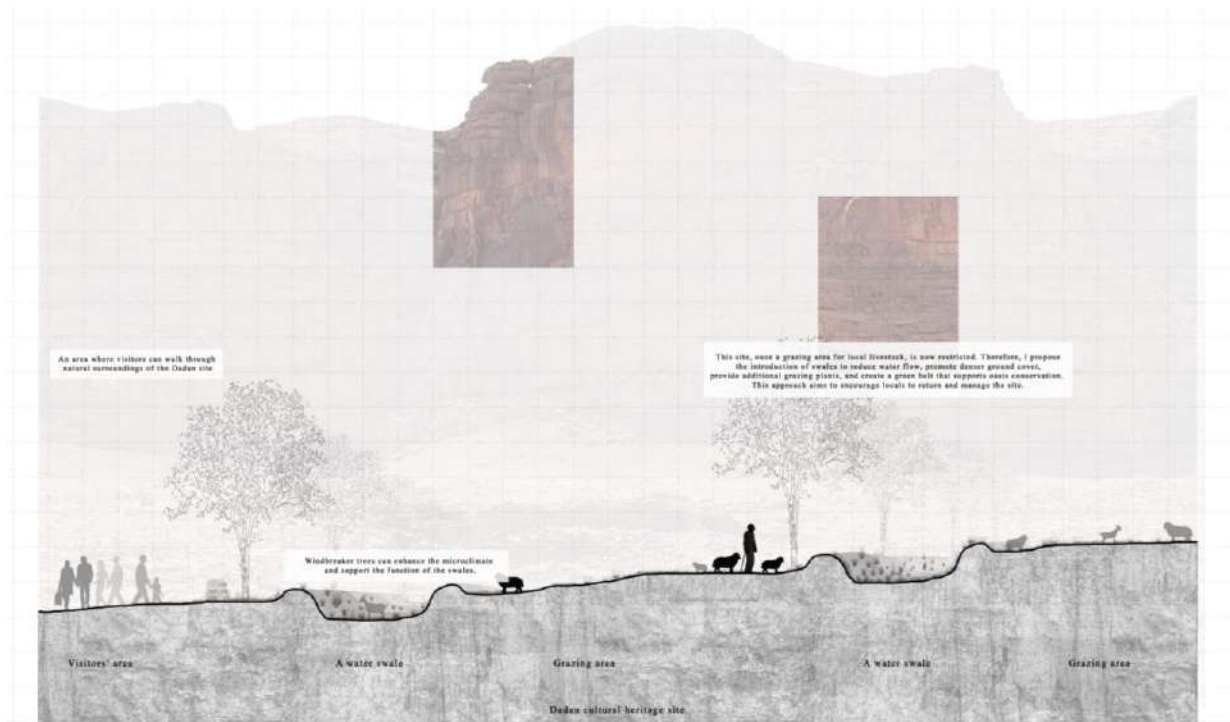


Figure 7-12: This section shows the proposed swales and planting areas. *Source:* Drawn by the researcher.

7.3 Exploring possibilities and ideas to guide the design/design process (points and aspects discussed with experts)

Having illustrated how *hima* TEK informs LA design, I now demonstrate how the design process informs *hima* TEK by identifying the main aspects associated with integrating *hima* TEK in the proposed OMP. It presents and discusses the critical points generated from the three workshops. As explained in Section 3.4.3.2 (Workshop with Experts), I conducted three workshops in three different cities with 10 national experts who have extensive experience working with local communities and protected areas, as well as LA and urban design backgrounds, enabling them to review, critique and discuss the design outcomes of my thesis and the outcomes of Chapters 5 and 6 (see Table 3-3). During the workshops, the experts examined and critiqued the design ideas and my conceptual master plan that was inspired by the local TEK of the local community in AlUla County, which led to crucial considerations regarding

designing a site using *hima* TEK values. The main topics discussed in this section are (1) flexibility, (2) site selection, (3) traditional design ideas and (4) design improvement.

7.3.1 Flexibility

One key point discussed in the workshops was the inherent flexibility of local TEK. Local TEK is spatially, methodologically and temporally adaptable, which explains its continued relevance. Expert BA noted that *hima* had been implemented in diverse locations such as Zanzibar, Tanzania and Indonesia. Despite originating in the Arabian Peninsula, Expert BA added that various civilisations, including the Ottoman Empire, established numerous *hima* sites. Further, local communities can modify their traditional approach to community-based conservation where policies hinder the implementation of *hima*. Expert BB highlighted that *hima* practices are also relevant in non-desert environments, citing examples from southern Saudi Arabia, where mountains and valleys dominate. Expert BC emphasised the temporal flexibility of *hima*, stating, ‘Add to your design criteria the temporal element to realise the concept of flexibility; for example, the change of the use within an area when the climate, environment or even the season changes.’ This is akin to the rotational grazing practice, where locals designate a small grazing area each month, allowing the rest of the site to recover for the following year.

In the third workshop, Expert CA reiterated the flexibility of *hima*, noting that ‘*hima* can be changed over time’, underscoring that local TEK is not rigid but can evolve. However, he distinguished *hima* from other ecological practices such as water harvesting, stating, ‘*Hima* is a special way or system to manage natural resources for specific and general benefits of private or public purposes to ensure the natural resource’s sustainability.’ This highlights the adaptability of landscapes when seen as fluid ecological systems, since natural resources and their contexts can vary, demanding different protection approaches and techniques.

This flexibility of *hima* TEK is well documented in the literature. Ten Veen (2022) presented five case studies of *hima* implementation in diverse regions, including Indonesia, Iraq, Tanzania, Lebanon and Saudi Arabia. Although the Arab countries share many common aspects, Tanzania and Indonesia differ significantly in local culture and environmental context. Hassan et al. (2015) also reinterpreted *hima* principles for use in neighbourhood open spaces to protect the environment and natural resources. In essence, *hima* TEK can be modified and developed according to the purpose of the protection, and the social, spatial and environmental context of the site. Landscape architects, urban designers and decision-makers must recognise this flexibility when integrating traditional knowledge in heritage and urban development for conservation purposes.

7.3.2 Site selection

One of the primary steps in design is selecting a site that aligns with the project's goals. Although I outlined the criteria for selecting a site suitable for implementing TEK values, the experts raised several considerations regarding land use and site type.⁴⁷ Since the chosen site includes protected areas, agricultural lands and semi-public spaces such as walkways between oases, Expert BC highlighted the need for clarity in the site's use, advising, 'You need to determine a specific type of land to focus on. For example, focusing on national parks. In this case, you need to focus on and select specific areas within the national park.' He suggested that choosing one of the national parks within the county to implement my conceptual master plan may be more appropriate than the selected one. This implies that a site with a specific land use is ideal for implementing *hima* TEK. Another reason for proposing national parks is their status as protected

⁴⁷ In this context, 'land use' refers to the designated official function of a site, such as recreational, commercial, agricultural, residential or industrial. However, 'site type' refers to its classification as public, private, semi-public, etc.

areas managed by official institutions, which allows for a degree of flexibility, such as enabling limited development to support ecosystem enhancement or promote eco-tourism initiatives.

Expert BA added that ‘there are previous local *hima* sites in the region, such as tribal *himas*, grazing *himas*, the *hima* of a well and the *hima* of a river’, and asked, ‘Did this site or part of it work as a *hima* site for the locals (a traditional protected area) in the past?’ The experts seemed to suggest focusing on one official land use type, unless the site has historical significance as a *hima* site. This approach may help direct designers who wish to implement TEK values to a specific site type.

In the third workshop, Expert CB questioned the main use of the selected site and suggested that focusing on picnic areas in AlUla for implementing *hima* TEK values is acceptable, but requires a smarter approach. Expert CA noted that ‘the selected site is not a bad choice, and it is possible to use it as a case study’. But he suggested that agricultural land or an agri-tourism site might be more suitable for reintroducing the traditional system and showcasing local TEK to visitors. Although these suggestions make the research outcomes more accessible, they narrow the research goal of illustrating TEK’s broad potential and opportunities.

Expert BA emphasised the importance of highlighting the lifestyle aspects associated with *hima* TEK, noting, ‘One of the gaps found between *hima* scholars and Islamic thinkers is the lack of detailed information about the system and its protection methods. Many have talked about theories and commons and missed the aspect of HOW it works.’

To conclude, *hima* TEK is complex and comprehensive, and I chose this site as a case study to present this complexity, despite its varied land uses. Nevertheless, the alternative sites suggested by experts can be considered viable locations for integrating local TEK into contemporary design and planning proposals. Although these suggested sites may not encompass all the factors present in the chosen site, they might include one element, such as a

natural resource, a heritage component or a desertification factor, which can be addressed through *hima* TEK. Although these additional sites may not fully capture the breadth of local TEK, implementing local TEK there might also contribute to preserving the traditional system and addressing environmental or conservation issues.

Another significant point discussed in the third workshop was the change in the land use type of the Cultural Oases from private to semi-public. Expert CA questioned whether the RCU bought all the oases for development or used an approach similar to that of the Williamson Act (see PlumasCounty, n.d).⁴⁸ Expert CB clarified that the RCU did not establish any approach other than changing the land use to semi-public, and promising landowners financial benefits and income from the land profits generated. This information was confirmed during site visits with elders and in the first workshop. Designers and decision-makers must consider this aspect when designing a site in the county. They may need to find a better solution to maximise the benefits for locals, thereby enhancing their socioeconomic well-being. For example, rather than modifying the land type from private to semi-public, alternative solutions should be considered to preserve the original land designation preferred by the locals. These solutions could involve temporary land use agreements or partnerships that allow for investment and development without introducing new challenges, such as privacy concerns or disruptions to traditional land use practices.

7.3.3 Experts' discussion of the implementation of traditional design ideas⁴⁹

This section addresses the critiques, concerns and recommendations of the experts concerning my conceptual master plan, focusing on the proposed traditional design ideas. The experts identified that the RTD showed four key areas for improvement of the AIUla master plan: water-

⁴⁸ The Williamson Act is the common name for the *California Land Conservation Act of 1965*. It permits 'certain agricultural properties to enter into a contract to be valued as an agricultural economic unit for at least 10 years' (Plumas County, n.d.).

⁴⁹ See Section 3.4.3.2 (Workshop with Experts) for more information about the role of the experts in this research.

harvesting techniques, agriculture, grazing activities and buffer zones. Although the first three aspects are clearly related to *hima*, as noted by Expert CB, the buffer zone was also highlighted as a crucial element for conservation and protection.

7.3.3.1 Water-Harvesting Techniques

Discussing the traditional water-harvesting techniques of the Nabataean people and the current local community revealed the local inhabitants' ability to sustain natural resources in the desert. Expert BB noted, 'You are right, and there is proof related to this claim. The agricultural terraces and traditional dams made by our elders in the south did not have negative impacts on the environment, unlike modern dams, which harm the environment.' This suggests that water-harvesting techniques vary by region. Although terraces are common in southern Saudi Arabia, they are rare in AlUla. This statement reflects that water-harvesting techniques as part of the *hima* system. Expert BB added, 'The elders were careful with their surrounding ecology and knew about the deepest details about it.' This confirms that the elders were deeply knowledgeable about their local ecology and tailored their techniques accordingly. Expert BA commented, 'However, this understanding and the traditional relationship between locals and the natural system are not a secret. They have existed for a long time until today.' I report these quotes because opinions diverged in the third workshop. Expert CA asserted:

No, for sure, they [water-harvesting techniques] are not part of *hima* practice. However, there is a connection between both [the water-harvesting techniques and the *hima* system] when it comes to managing a natural resource. Harvesting by itself is a process for agriculture. There are *hima* areas for water resources, such as the *hima* of the well (حمى البئر). In the past, locals may have protected an area around a well and prohibited any human activities near it to protect the water. However, there are also *hima* areas whose purpose is to help harvest water and to ensure that the water source will reach this *hima* [a protected area] or a place like a well. There are watersheds considered as *hima* areas, and the edges of these *hima* areas are the edges of the watershed.

This expert indicated that the water-harvesting techniques (perhaps agriculture too) are not inherently part of the *hima* system but contribute to it by protecting water sources and ensuring their sustainability. This perspective challenged my long-held belief that *hima* practices include water-harvesting techniques.

However, through further analysis of the three workshops, I found two key points to consider. First, Expert CA's views are based on his 40 years of experience working with locals in certain areas in the Kingdom, and it seems that, during the workshop, he did not account for the ancient history of *hima*, whether during the Nabataean period or the Islamic establishment period (1445 years ago).⁵⁰ The *hima* system is a lifestyle, rather than just a protected area (Alhammori, 2002; Gari, 2006; Kilani et al., 2007). People living in the desert must find a way to harvest and conserve water. Alhammori (2002) explained how Nabataeans established water-harvesting techniques within the desert as part of their *hima* lifestyle. Further, Al-Shanqiti (2013) also referred to water-harvesting techniques, such as water basins within *hima* areas established by locals around Medina (southern AlUla) during the time of the Prophet, and some of these areas did not include agricultural activities. Arguably, if these techniques are considered part of the traditional agricultural process rather than *hima*, there are many *hima* areas that include agricultural lands, which makes the traditional agriculture and water-harvesting techniques all parts of the *hima* system. Second, both Expert CA and Expert CB acknowledged the adaptability of *hima* practices over time, emphasising that traditional water management is a distinct, yet related, system. Expert CA pointed out that the living/daily needs of each generation may be different to those of the previous generations. Therefore, *hima* itself can be changed to meet these needs, as explained in Section 5.2.1.2 (Abandoning a place and ceasing to interact with it), Section 5.3.2.3 (Modifying irrigation systems), Section 6.3.1.3 (Connecting development to the local needs) and Section 7.3.1 (Flexibility). Expert CB recommended that this research should focus on local TEK

⁵⁰ The latter period (1445 years ago) is crucial in shaping the foundations of the modern *hima* system (see Sections 2.2 and 2.4.1.1).

in general, given that he views the *hima* system as one special, standalone approach to sustaining natural resources and ecologies, while traditional water management is a separate system with its own standards. In the end, I decided to consider these water harvesting techniques and management a part of the *hima* system, while keeping in mind the different opinions resulting from differences in socioeconomic, historical and environmental contexts.

From a design perspective, understanding the ecological context is crucial. Traditional ideas and techniques must be adapted to the site and local needs. For example, the proposed terraces in the conceptual master plan, though uncommon in AlUla, may manage water flow effectively. Also, the elders and experts highlighted that managing the naturally collected water within the mountains is part of local TEK. Although the terraces are considered human-made, they provide a similar function, where water is collected naturally. Additionally, this concept contributes significantly to the ecosystem by creating micro ecologies that benefit not just humans but also wildlife. Expert CA stated:

Gelt (قلت) is a part of the tradition [local TEK] for sure, and *gelt* is the name of the place where water is collected in mountain areas. These places will be used in times of need. They [locals] allow animals to drink from it. Sometimes, they may bring some water to their homes. They are mostly naturally collected water. However, sometimes, locals may modify the area to enhance the harvesting function by digging the area to be a natural pond.

Although the need to climb mountains to obtain water for human use may not be relevant today, animals such as grazing animals and wild species, such as Arabian gazelles and wolves, may still need such techniques (see an example of *gelt* in Figure 2-11, right image).

The third point addresses the current water status and future plans, specifically whether traditional water-harvesting techniques can benefit AlUla's future. In the first workshop, the experts underscored that the region relies entirely on underground water. Expert AC, who is involved in AlUla development, remarked, 'There is also the quantity, and it is going down ... Right

now, it is 100% groundwater use in AlUla, and there's no desalination.' This indicates the increasing pressure on groundwater caused by the growing number of visitors, residents and construction projects. Additionally, the expert noted that there is only one wastewater treatment facility available for irrigation, which will not be utilised until the network is fully connected. The experts acknowledged this issue, and officials have implemented various strategies to assess the region's water resources. For example, Expert AC mentioned the installation of numerous smart meters at different sites and wells to measure the water quantity required for each land use, recognising the growing demand from construction activities. She noted that future water needs for construction projects over the next decade 'have not been addressed to date', and that there is a plan to source water from the nearest desalination plant. When Expert AB questioned Expert AC about the expansion of the Cultural Oases, Expert AC responded that, according to the master plan, there would be a reduction in agriculture and a shift from date palm cultivation to less water-intensive crops. She added, 'First and foremost, we're trying to switch over from flood irrigation, which wastes a lot of water, to drip irrigation. And from doing that alone, we should be able to reduce water consumption by about 30%.' Consequently, underground water is likely to remain the region's primary water source. Given the diminishing water resources, it is crucial to explore water-harvesting methods. As highlighted by Expert BB, traditional terraces and locally built dams may be more environmentally friendly than modern dams. These traditional methods are often better suited to local context elements such as climate and geography. They work in harmony with natural water flows and promote soil conservation. By integrating these traditional approaches into development plans, this research could help to identify sustainable water management strategies that reduce ecological disruption, support agricultural productivity and preserve the cultural heritage in the region. Such insights could guide future infrastructure designs and policies aimed at addressing water shortages.

7.3.3.2 Agriculture and Farming

The second point discussed by the experts concerns agriculture and farming as a means of conservation and desertification mitigation. Planting was recognised as an integral part of local TEK to enhance the protection of natural resources and the conservation of heritage. Although I proposed a few areas within the conceptual master plan for regeneration (e.g. see Figure 7-4 (8)), the experts suggested focusing entirely on one of these areas to illustrate the different techniques used for site protection. Experts CA and CB recommended considering the ways in which a traditional oasis can be designed for eco-tourism. Expert CA noted, 'It might be better to take a site as an experimental farm or agri-tourism to present different traditional agricultural functions and, at the same time, design an environment for guests and visitors to show them the traditions.' This recommendation not only addresses the changing needs of locals, but also to provides a space to serve visitors. Expert CB remarked, 'The issue is that most TEK practices and techniques aim to increase the productivity of a natural resource [e.g. fodder, wood or food] or to protect and sustain it. *Hima* TEK is connected to the basic needs of locals.' Since these needs have changed, they suggested that oases should now provide new benefits that would interest the current locals. The experts mentioned a good example of this in the first workshop, which I also observed during site visits: the RCU has advertised and established short courses within the Cultural Oases to teach visitors and locals how to make traditional mud bricks. These courses, especially popular with children, have been well received. These oases now include playgrounds and seating areas to attract families (see Figure 6-5: Bottom section). I noticed that these farms attract more visitors than the other oases, given the multiple services they provide. I agree with the suggestion to identify the new key elements that the locals may need, since this may reconnect people to the oases, enhancing conservation and desertification mitigation. However, it is also important to consider the ancient roles of plantations for soil stabilisation, wood and fodder production, and oil and fruit, and to design and propose these where and when needed.

7.3.3.3 Grazing

The third point concerns the proposal of areas for livestock fodder. Experts emphasised the importance of rotational grazing as part of the *hima* TEK to allow ground cover to regenerate. In the second workshop, Expert BB highlighted:

We have something called rotating grazing. We protect an area until the ground cover and fodder regrow. After the spring season, we allow livestock to graze for a period. Then, we stop and allow it to recover before enabling grazing again. This is the concept of circling and organising grazing.

Expert BC added, ‘This is part of the tradition. Some tribes use an area for grazing one year and move to another area the next.’ During the design discussion, they stressed the role of grazing in conservation and combating desertification.

In contrast, experts in the third workshop expressed a different view. They acknowledged grazing as a key traditional element and local need. Expert CA mentioned a tribal system that determines grazing seasons and prohibits grazing in certain areas. However, they questioned the relevance of traditional activities today, suggesting that grazing might not be as important owing to changes in the lifestyles of locals. They recommended developing new interpretations of *hima* TEK that suit the present day.

Although I agree with the need for new interpretations, the proposal for grazing activities remains relevant (see Figure 5-3). I observed many sites where some of the oases house livestock that traditionally grazed outside in the past (e.g. see Figures 5-33 and 6-2). The elders highlighted the need for accessible grazing areas. My proposal includes an educational aspect, showing visitors how the elders ensure ecological regeneration and sustainability. Twelve grazing zones, each one for a month, allow visitors to observe the traditions and the importance of traditional ecological concepts (e.g. see Figure 7-4 (5)). This design provides locals with opportunities to manage the site by participating in rotational grazing.

7.3.3.4 Buffer Zoning

The fourth point raised by the experts relates to buffer zones, which refer to an area positioned between two or more other areas aimed at minimising the likelihood of harmful interactions occurring among them. Based on my observation during site visits, I proposed a 40 m buffer zone between the mountains and built elements (see Figure 7-4 (1)). However, in the second workshop, the experts recommended increasing the size of the buffer zone. For example, Expert BA suggested, ‘Make this number [40 m] the minimum and increase it when it is needed.’ Conversely, Expert CA from the third workshop advised having a ratio. He said:

In my opinion, giving a specific number like 40 meters based on the average in multiple sites is not suitable because each site's context is different. Maybe having a ratio is better. This number may suit your site, but not the others, because of the differences in the sites' contexts.

He suggested creating a ratio based on the height of a mountain and the width of a valley or protected area, considering different factors. He then said that this approach would be more accurate than having a number that may not suit other sites. Using this ratio, designers would be able to find the optimum distance for a buffer zone based on the factors that exist in their project site. Although I believe that this number may suit most of the sites in the region, Expert CA's suggestion is more advanced, since this ratio could be used in other sites outside the region.

The buffer zone concept is a key element in local TEK, and it plays an important role in the conservation process. Expert BA commented, ‘We discussed transforming *Harrat Uwayrid*^[51] to be a biosphere reserve to illustrate the integration between local communities and the natural environment, and present it as a world heritage value.’ He then said that the reserve may include core areas as a protected area, buffer zones and transitioning areas such as villages. Here, the

⁵¹ Now, *Harrat Uwayrid*, in the AlUla region, is the second Saudi biosphere reserve recognized by UNESCO.

buffer zone is considered a part of the traditional ecological system, and it is a concept that needs to be considered by designers. In the literature, I found that some *hima* areas (protected areas) worked as buffer zones. Based on the previous discussions, I believe that buffer zones are a key tool in any *hima* area, sometimes becoming the entire *hima* (a protected area). Two examples are provided. First, as Expert CA mentioned, people may protect an area (buffer zone) to prevent it from being harmed by humans or other natural factors, such as fallen rocks that may affect a water spring or well. In this case, a buffer zone is a key part of the *hima* system. Al-Shanqiti (2013) identified the same functions within the ancient Islamic *himas* around Medina City. The second example proposed by Llewellyn and Altlasat (2017) was a *hima* pilot study. When describing their approach, they suggested that buffer zones between protected areas and community areas be used as grazing spaces for the community's livestock. Although a buffer zone works as a barrier to enhance the protection of a site, it can be multipurpose and provide different functions, such as being a grazing area. Nowadays, designers may need to devise better buffer zones that provide important functions, whether for locals or visitors.

7.3.4 Design improvement

The design process not only informed the *hima* TEK but also contributed to other design aspects. This section presents recommendations and discussions regarding the conceptual and official master plans for the region, focusing on non-traditional design concepts. The experts raised five key topics: (1) the electric tram, (2) highways, (3) local involvement, (4) site responsiveness and (5) educational eco-tourism.

The experts critiqued the OMP's development approach, focusing on several key elements. First, they opposed the proposal for a low-carbon emission electric tram for several reasons. Expert BC stated that 'the tram idea is not recommended based on multiple facts. It negatively impacts the identity and the natural environment of the place'. This concern is valid in terms of the natural ecosystem. However, the tram's historical context cannot be overlooked, given the existence of

the historic Hijaz train developed by the Ottoman Empire, which passed through this area and is now recognised as a cultural heritage element of the region. Therefore, the tram could be seen as part of the region's history and identity, supported by many preserved Hejaz stations. Conversely, Expert BB argued that 'the tram is better than cars, and its impact on nature is less'. Additionally, Expert CA from the third workshop noted, 'It seems there is no drainage system or even an expected flood events plan for 50 and 100 years, which makes me think that even the tramway may need to be removed from the master plan.' This critical point needs to be addressed, since I observed some areas along the proposed tram route lacking drainage systems and identified by elders as flood-risk zones (e.g. see Figures 5-15, 7-5, 7-6, 7-7, 7-8 and 7-9).

In my opinion, the tram is a functional idea that is potentially necessary for transporting visitors and locals between villages and main sites in the region. It is partially connected to the identity of the place, considering the historical train presence. However, its implementation must be based on an environmental assessment to determine its feasibility and impact. Additionally, the tram should align with the local community's needs and traditions. If the tram presents any harm or burden to the local community, such as the privacy issues previously mentioned, or even noise, it must be modified to mitigate these concerns.

The second point concerns highways. Expert CA highlighted the neglect of natural factors, such as waterways, in infrastructure and highway development projects. From the discussion in the first workshop, it appears that development and risk assessment occur simultaneously but are carried out by different teams. Although experts from the first workshop mentioned ongoing environmental assessments, I observed construction and expansion activities on various highways in the region, and these projects raise doubts about the reliance of these works on any environmental assessments. Expert CB from the third workshop stated, 'Now we have this new highway that separates the town from the Cultural Oases.' He added that the connection facilitating natural drainage is broken, and a disaster may be imminent. This suggests that some

decisions might have been made without considering some of the regional natural environmental aspects, such as water drainage and natural waterways. This environmental assessment issue can be seen in other global contexts and UNESCO WHSs, as explained by Nguyen and Baker (2023, pp. 12–13). Therefore, there is a need to develop urban design ideas based on an understanding of the region's natural factors such as topography, hydrology, geology, flora and fauna.

The third point relates to the involvement of the local people. The experts from the three workshops emphasised the need for locals to be involved. Expert CA commented, when asked what was missing from my design:

The human aspect in the design is not strong or obvious. I can't see it. But more importantly, where is the human in the general scheme RCU proposes and advocates? This RCU's idea of transforming AlUla into an open museum may take us back to the first point when we mentioned that the officials are dreaming [speculating] the heritage different from its reality.

In other words, by just looking at the design itself, can we see how the design addresses the needs of the locals and how it involves them? This aspect was not clear to the experts, especially when it comes to the OMP. Additionally, he added that when the locals are not involved, officials will create a heritage site that is different to the reality of the site. He then referred to the example of historic Jeddah (the UNESCO WHS in Jeddah, Saudi Arabia), where development institutions developed and presented the heritage site as a pleasant, beautiful, clean place, aiming to increase the number of visitors while disregarding the soul, atmosphere, purpose and function of the site. He emphasised the importance of considering these questions: 'Where are the locals of AlUla in this equation? What are the benefits that the locals will get from this project?' In my opinion, these questions are fundamental for any designer working on such projects. Expert CB added:

Humans may not be a key factor in your research and design, but as I mentioned before, they are important to be in the general framework. Your idea is to reintroduce local TEK. Therefore, the one who developed this traditional system is a key factor for you and should be involved.

In other words, undertaking such a project requires the participation of the local community. The project should meet the needs and interests of the local community. Meeting the needs of the locals embeds the project in lived reality, making it socially sustainable and contributing to realising the idea of a living museum. Expert CB further commented:

RCU advocates the idea of an open museum. However, we do not need an open museum; we need a living museum. See the AlUla Old Town; now it is all renovated. However, the real renovation is by bringing back the whole old life system that produced this environment, such as the old mosques and the coffee houses of elders and tribal leaders.

He emphasised the need for a design that can be a part of the daily routine of the locals in the form of a living museum rather than an open museum, highlighting the importance of reviving the entire historical assemblage. This entails restoring the traditional life system, such as old mosques and the coffee houses established by elders and tribal leaders, to foster genuine interaction within heritage sites. Consequently, we may be able to restore a true cultural value rather than a mere artefact display. In short, locals must be involved in such projects, and this involvement should be based on their daily needs and interests. Additionally, designers may need to develop ideas that attract locals to the site and encourage them to interact with it, for example, by managing it. I have explained to the experts how my design addressed this aspect by providing different needs and resources for the local community and ecosystem. However, I also acknowledge the need for more workshops between the locals and officials, especially decision-makers, to produce more liveable master plans.

The fourth point stresses that the design should respond to the site's specific characteristics and issues. As Expert CA highlighted during the third workshop:

The design needs to be a response to the site and what it includes. The creative aspect of the design was not clear. I did not feel it. I think the design needs more creative adaptation rather than compulsory dictation from the heritage and the knowledge [TEK].

This statement underscores two points. First, it emphasises the idea that the site itself should drive the proposed design process. Second, it suggests that, although the local TEK is valuable, design solutions should not simply replicate traditional techniques verbatim. Instead, they should be developed, modified or combined with modern techniques to ensure they are contextually appropriate and effective. Expert CB further added, '*Hima* TEK is more about a function or a tool to solve a specific issue. Reusing local TEK techniques traditionally in another site could be considered something placed out of its context, and it will appear as something wrong.' This statement highlights the need to adapt and modify traditional techniques to suit the specific context of the site, rather than applying them in a generic or disconnected manner. Thus, the quotations underline the importance of designing in response to site-specific factors, while also adapting traditional knowledge to ensure contextual relevance and effectiveness. I agree with these two comments. The conceptual master plan adapted traditional techniques such as *oqoom* 'traditional sand berms' and modified them to swales to improve the efficiency of recharging aquifers and reducing evaporation. Also, each proposed traditional technique responds to an issue or a factor on the site. For example, terraces were proposed to manage water flow within the mountain, even though it is not a common traditional technique used in the region. Therefore, designers may need to take these two aspects into consideration when working on such design projects.

The fifth point focuses on the concept of educational eco-tourism, which involves integrating eco-tourism into educational initiatives. In this context, eco-tourism works as a platform for

showcasing the teachings of elders and the values of the local TEK to visitors and site users. During discussions with Experts CA and CB, the idea of transforming the site into a resort that creatively presents *hima* TEK and traditional techniques was explored. Expert CA proposed the idea of promoting the traditional waste management practices of the elders within the resort setting. He emphasised the potential appeal of showcasing the site as a zero-waste resort that implements traditional waste management methods that have been in use for over 2000 years. He highlighted the attractiveness of adopting this approach, which aims to collect human and farm waste for use as soil fertilisers, aligning with current trends such as recycling and sustainable material management. He suggested leveraging local TEK to generate innovative ideas that resonate with contemporary environmental values and practices. He added that ‘there are a lot of ideas you can generate based on the traditional concepts’, supporting his statement by noting the achievements of the Palm Research Center at King Faisal University, which created new building structure materials from palm leaves. He said, ‘You need new interpretations and explanations.’ Further, Expert CB stated the importance of incorporating elements into my design to captivate children’s curiosity and educate them that these elements are part of their heritage and embody the wisdom of their elders. He also asked me to consider incorporating features such as fountains or interactive installations that convey a message to children, since this connection serves as a bridge to the new generation, fostering conservation efforts and the transmission of knowledge. The experts pointed out that adopting this approach aligns with the Western methods⁵² followed by the RCU, potentially appealing to school students, locals and visitors.

⁵² I think the expert’s reference to ‘Western methods’ relates to modern, technology-driven approaches that may appear unfamiliar or incongruent within the local context.

The abovementioned points demonstrate how landscape design and its processes can inform *hima* TEK. Conversely, the previous section of this chapter highlighted how *hima* TEK informs and guides landscape design practices.

7.4 Discussion and reflection on the role of the landscape architectural design process

This section discusses and reflects on the role of the LA design process, which includes design development, and identifies how the three workshops are significant to this research and future directions. This reflection is divided into three parts: (1) engagement with experts and design development, (2) the impact of understanding *hima* TEK and design integration, and (3) lessons learned and future directions.

7.4.1 Engagement with experts and design development

My collaboration with experts significantly influenced the development of design ideas by providing insights into the possibilities and opportunities inherent in local TEK from an LA and urban design perspective. It shed light on aspects of my design that required enhancement and considerations essential for such projects. For example, the diverse array of sites suitable for TEK implementation, including recreational areas, traditional farms and national parks, exemplifies the opportunities identified. In terms of possibilities, it led me to explore the potential for combating desertification and conserving cultural heritage through the application of the local community's TEK. Further, the experts recommended enhancing the educational aspects of my design and emphasised the importance of creativity and new interpretations of *hima* TEK that suit our contemporary time. Even the drawing style was discussed, with Expert CA suggesting I redraw the palm trees to resemble *Phoenix dactylifera* instead of coconut palm trees.

The insights derived from the discussions and critiques of my design concepts varied among the experts participating in the workshops. Although I initially planned to conduct one workshop with three national experts, the decision to conduct three workshops with ten experts proved beneficial, adding value to the research owing to the diverse range of experiences and engagements involved.

In the first workshop, I met four experts from an official institution in AlUla who were involved in the development process. Their backgrounds were in urban design, planning and sustainability. Although their feedback was general and somewhat limited regarding local TEK, they explained AlUla's vision, development principles and OMP, which is being followed by all the official institutions associated with AlUla's development. This workshop allowed me to see the future directions and main issues in the region and assess the extent of local community involvement and local TEK in the OMP and associated project.

In the second workshop, I engaged with four national experts, two of whom are well-versed in the concept of *hima* TEK and familiar with local communities from all around the Kingdom, including those in AlUla. One of the two used to practice *hima* TEK in the southern regions of the kingdom. The experts are landscape architects and are involved in an official organisation associated with the management and protection of natural areas. The feedback received was detailed, focusing on *hima* TEK and my design. Although most of the comments were positive and supportive, they raised some important aspects, such as the types of sites that can be selected for TEK implementations. Discussions during this workshop addressed key topics, such as desertification factors and land ownership issues, demanding further reflection on current perspectives of *hima* TEK.

The third workshop involved two landscape architects and academic professors from one of the Saudi universities. One of them originates from AlUla, and the other is one of the national experts in *hima* TEK. Both offered insights into design details and the conceptual master plan. This

workshop was unlike the previous one in that some disagreements were raised, such as the definition of *hima* and its scope. These disagreements led them to question and discuss various aspects of my design, including the OMP, the integration of local TEK, and the involvement of the local community. However, their discussions provided valuable insights and enlightened me, revealing aspects that were unclear in previous meetings with experts and elders, such as how experts perceive *hima* TEK and how locals view the environment and natural resources.

Throughout these workshops, the experts raised essential questions regarding the definition and scope of terms such as the ‘local community’ and ‘AlUla’, underscoring the need for clarity and contextualisation in the research literature or introduction section. The experts discussed the interests and knowledge of the participants, my methodology, the previous results from Chapters 5 and 6, and the difference between my work and the OMP, providing me with research resources, references, recommendations and future directions. Overall, the feedback from the experts across these workshops contributed to a deeper understanding of the research context and informed ongoing refinement and clarification efforts within this research project.

7.4.2 Impact of understanding local TEK and design integration

The discussions with and between experts enhance designers’ understanding of *hima* TEK and its relevance to LA design in two aspects: the knowledge aspect and the design aspect in relation to how *hima* TEK can be reintroduced. I found that the experts perceived *hima* TEK differently. For example, in the second workshop, the experts viewed local TEK as a flexible system that can be modified and adapted based on the context of the site. In contrast, the experts of the third workshop regarded *hima* TEK as a more rigid system, while still acknowledging the need for adaptation. They emphasised the importance of new interpretations and implementations inspired by local TEK that align with the contemporary needs of locals. These distinct perspectives emerged through the workshops, providing valuable insights that were not immediately apparent to me prior to engaging in these discussions. In terms of design, the

discussions revealed that *hima* TEK can be categorised or divided into specific approaches, focusing on particular goals. For example, Expert CB noted the existence of traditional water spring management systems, *hima* systems and traditional agricultural systems, each with its own set of techniques. Consequently, design ideas proposed for the agricultural and ground cover should not be allocated within water areas or in places where water management is required. However, in my opinion, we should avoid such separations to develop comprehensive solutions that contribute to environmental conservation. Although this research presented similar categories in previous chapters, they were all considered part of one system, since the elders view it as a unified traditional system. Dividing *hima* TEK into smaller systems weakens the advantage of its comprehensiveness. This idea of division reminds me of one of the major issues covered in this research, namely the separation of cultural heritage from the natural ecosystems surrounding it. In conclusion, the discussions with the experts revealed differing perspectives on TEK, positively enhancing our understanding of *hima* TEK and design integration.⁵³

7.4.3 Lessons learned for future directions

In this section, I reflect on the lessons learned from this engagement, from a methodological perspective, relating to the future directions these discussions could lead, as an initial guide for designers who work with *hima* TEK as an integral part of their work. Based on this engagement, I extracted five lessons that should be considered for future researchers.

First, knowledge of *hima* TEK varies. Although the literature may shape a researcher's understanding of a topic, it does not necessarily mean that experts in the field are familiar with the published works on the subject. For example, the literature may suggest variations in *hima* characteristics and the potential for adaptation, as demonstrated by Hassan et al. (2015).

⁵³ By 'our', I mean the researchers from the field of LA and urban design.

However, some experts may disagree and reject such modern *hima* TEK adaptations. Additionally, the literature may discuss the same tradition in a specific context, while experts respond based on their expertise associated with a different context. Further, it is crucial to consider the temporal aspect. *Hima* practices in the first century differ from those in the early Islamic period, and from those in the present time. Therefore, it is essential to be mindful that experts may need to be informed of *hima* TEK, otherwise a researcher may receive unfamiliar responses.

The second point is that the experience of experts can vary. Although most of the experts who participated in the workshops are Saudis, their understanding of detailed *hima* values is slightly inconsistent. The experts from the second workshop accepted the idea of water-harvesting techniques as part of *hima* TEK, while experts from the third did not. However, after discussing what I had found in the literature with the latter, they preferred to maintain their stance, while acknowledging other researchers' opinions. Being aware of this aspect is important, given that it can be confusing for researchers to rely on experts' opinions or even the literature alone. Therefore, engaging with a larger number of experts is essential to gain a broader understanding of the issue.

The third point is about workshop flexibility. Although I conducted a pilot study and structured the presentation to be managed and organised, aiming to make it easy for the experts to understand the research and to engage with it, none of the workshops went as planned. The three experts could not come together simultaneously; therefore, I met them separately, with the other invited experts from their respective sides joining the workshop. This led to the workshops operating differently than expected. For example, I wanted the experts to comment on each other's opinions to see where they agreed and disagreed. Most of the time, the experts agreed with each other, except for a few instances when they did not. However, after analysing the three workshops, I found major disagreements that may not have appeared when the experts came

together, owing to cultural factors such as respect for seniors. Therefore, having a flexible research approach is important, since research goals and achievements may be attained through diverse pathways and approaches.

The fourth point concerns the experts' opinions on the research itself. The questions posed to elicit their perspectives revolved around whether the design incorporated *hima* TEK, and whether the design ideas could potentially contribute to mitigating desertification and conserving cultural heritage. In the first workshop, the experts expressed the need for studies focusing on the TEK of the local community in AlUla, such as this research. They also highlighted their interest in the reintroduction of the local traditional techniques and extended an invitation to present this research and its results to various official teams associated with natural areas protection and heritage conservation in the region. During the second workshop, the experts endorsed the research direction, emphasising the need for more detailed approaches to uncover how the system operates and how it can be reintroduced. They expressed enthusiasm about incorporating the final results of this research into their projects and initiatives across the Kingdom. In the third workshop, the experts acknowledged both the challenges and possibilities presented by the research. One expert, Expert CA, noted that, although *hima* TEK was integrated into the design and could potentially contribute to mitigating desertification and conserving cultural heritage, there is a need for further consideration of including modern techniques and interpretations.

The last point regards the decision not to present a modified version of the earlier design exercise. There are several considerations I want to highlight. Initially, I planned to produce an updated version of the design that incorporated all the experts' feedback and insights. However, such a step would likely require additional workshops to discuss the revised outcomes and resolve points of disagreement among the experts and myself, and this process would most likely have exceeded the time available for completing this PhD research. Further, the aim of the third

research question was to understand the role of landscape design in the context of local TEK, and to identify key design aspects for designers working on such projects. This objective was met through the analysis of the data collected during the workshops, which means that a revised design or an updated conceptual master plan would be unlikely to produce significant new knowledge beyond what has already been identified. Nonetheless, this line of inquiry remains open for future exploration, since I plan to pursue further research into the relationship between local TEK and design practices.

7.5 Conclusion

In conclusion, this chapter presented three critical sections: the formulation of the conceptual master plan, informed by the traditional knowledge of the elders outlined in earlier result chapters; the investigation of design concepts and opportunities to address desertification and safeguard cultural heritage through collaboration with national experts; and last, an in-depth discussion and reflection on the pivotal role of LA design processes, such as design development and workshops with experts, that focused on the potential for integrating local TEK into urban master plans. Together, these sections collectively address the research question: What is the role of landscape design in a *hima* context, and what are the main design aspects that designers need to consider when aiming to integrate *hima* TEK techniques into urban development projects to mitigate desertification and preserve cultural heritage sites in the country? The processes outlined in this stage serve as an initial guide for urban designers, landscape architects and planners when dealing with such projects in the Kingdom, providing critical points and aspects that need to be considered when designing or planning a site with such qualities. This illustrates how *hima* TEK can inform landscape design and be informed by it too.

Chapter 8: Discussion and Conclusion

8.1 Introduction

This chapter summarises the primary goals of the thesis and presents the main findings of the research. It also highlights the main contributions to the literature, discusses the implications of the findings, addresses the research limitations and suggests potential future directions.

Although the thesis follows a conventional thesis format, it includes some creative and practice components, facilitating the exploration, understanding and better presentation of the findings associated with *hima* TEK and its ecological practices in AlUla, Saudi Arabia. The main questions guiding this research were: (1) How can the TEK of *hima* enhance living with desert ecosystems within Saudi cultural heritage sites? (2) How can the practices of *hima* TEK contribute to the conservation of cultural heritage sites in urban settings? and (3) What is the role of landscape design in a *hima* context, and what are the main design aspects that designers need to consider when aiming to integrate *hima* TEK techniques in urban development projects to mitigate desertification and preserve cultural heritage sites in the country? The following section presents the main findings regarding these questions.

8.2 Main findings

There are three key findings of this research. These findings include the local elders' perceptions and methods of mitigating desertification, an explanation of how their ecological knowledge and practices add to tangible cultural heritage conservation and a description of the relationship between their TEK and today's design practices.

The **first** finding concerns how local elders perceive and mitigate desertification and its causes. Apart from the categorisations and themes described in Chapter 5 (and even Chapter 6), which were used to present and explain the local TEK, from the elders' point of view, there are 11 causes

of desertification: the use of new technologies to facilitate vegetation removal and easy access to natural resources, the abandonment of a place and ceasing to interact with it, forsaking local TEK practices, following unsustainable irrigation practices, the adoption of substandard land use planning, sandstorms, sandy soil conditions, flash floods, decreased water springs, harmful insects and birds and, last, the decrease in the number of oases. Understanding these causes helps us understand the local TEK, especially the practices developed to mitigate desertification. *Hima* TEK includes and encodes history of environmental relationships. The traditionally perceived causes of desertification include historical regional data that influence the modification and evolution of local TEK. An example of the historical regional data is the occurrence of extreme flash floods and their impacts on the natural environment, cultural heritage and local community (e.g. see Section 5.2.2.3: Flash flooding), encouraging the locals to improve their techniques to mitigate such threats.

Although global scientific studies on the causes of desertification are critical for understanding the degradation processes, they alone are insufficient (Davis, 2005). Indigenous perspectives and views may add value to a more comprehensive understanding of regional desertification (Davis, 2005), specifically in rapidly developing areas such as AlUla County. The extensive interaction of the elders with the ecosystem and their site-based knowledge of it can enhance scientific understanding by offering evidence that is rooted in the lived experience of communities within these ecosystems. Many examples illustrate how the local TEK adds value to the scientific views.⁵⁴ One example is related to the SV-14 area, which experienced two extreme flood events that destroyed oases and structures. The local community has built techniques in that area to mitigate such events in the future. However, the new OMP seems to have ignored the flash flood factor in this area by expanding and developing a car road that blocks natural waterways and drainage, and removes traditional techniques, without providing

⁵⁴ By scientific views, I am referring to the views of the official institutions, who rely on international scientists and expert opinions.

alternative solutions that may mitigate the risk of floods in the area (see Figures 5-14 and 5-15). In the first workshop with experts involved in the AlUla development, it was mentioned that the officials had claimed there was an absence of historical data. They also highlighted the role of one of the departments assessing the environmental risks of the region in informing and developing the OMP. However, by sitting and talking with the local elders about desertification causes, I received detailed information about the history of extreme events that could have potentially informed the OMP. The site analysis in Figure 5-15 is an example of how the local TEK and the elders' *hima*-based understanding of desertification can potentially add value to the scientists' outcomes. Adapting both scientific and traditional perspectives, including consultation with local elders, may mean that the urban and environmental planning for the area is more effective, socially fair and ecologically appropriate. Raising this aspect is important for combating desertification and avoiding issues such as the one that occurred in Morocco, where scientists' knowledge was privileged over the local TEK. This was later considered to be one of the factors that led to environmental degradation there (Davis, 2005).

The ever-present threat of desertification and its causes influenced the traditional ways of living within desert ecosystems, and the locals have developed ecological methods to mitigate these desertification threats. With respect to the question of how *hima* TEK might enhance living with desert ecosystems (my first research question), the elders highlighted 18 methods used to mitigate desertification. I have grouped them into three types of responses: (1) traditional agricultural mitigations, (2) water management mitigations and (3) community mitigations. The first type, responses associated with agriculture, includes cleaning and maintaining oases, implementing physical barriers, ethical respect for the natural environment, planting native plants, managing soil, recycling farm waste, and eradicating insect and bird pests. The second type includes maintaining waterways, managing the extraction of water, modifying irrigation systems, implementing water-harvesting techniques and creating *hammams* (public water basins). The last type includes the establishment of a community association, conducting

regular inspections of key resource areas, limiting accessibility, storing palm dates traditionally, being self-sufficient and transferring traditional knowledge.

These 18 methods, which are presented in Chapter 5, illustrate how local TEK may contribute to mitigating the causes of desertification and enhancing the living conditions of the local communities within these desert environments. The elders' statements and information included design guides associated with the traditional practices and techniques. For example, in Section 5.3.1.3 (Ethical respect for the natural environment), the elders explained the strategic positions of their oases, maintaining a buffer zone (40 m from mountains) and avoiding prominent cultivation on the waterways. In Section 5.4 (Conclusion), I summarised the traditional spatial pattern in which agricultural lands are situated close to waterways and urban areas are positioned on higher ground, yet not too close to the mountains, for safety purposes.

The **second** key finding relates to the second research question concerning the relationship between *hima* TEK and cultural heritage conservation, especially in the context of urban development. First, these results show that the local TEK is indirectly linked, but clearly contributes, to the conservation of cultural heritage. The results in Chapter 6 show that some of the local TEK methods and techniques contribute to conserving cultural heritage structures. Although the local TEK relates to, in general, the natural resources and the needs of the local community, it adds to the protection of the surroundings that may contain cultural heritage sites and structures. From the local TEK perspective, surrounding ecosystems and cultural heritage are not disconnected; however, I separated them into two chapters to explain how the *hima* TEK contributed to tangible cultural heritage conservation. Based on the local TEK, I found 27 actions and strategies, all of which contribute to cultural heritage conservation. These actions and strategies can be broadly categorised into three themes: (1) inclusive heritage conservation and regeneration, (2) community engagement and heritage stewardship, and (3) traditional conservation techniques. These strategies and actions include regenerating oases and planting

in and around cultural heritage sites, reviving water springs, restoring cultural heritage sites and buildings, adapting uses for heritage places and sites and their facilities, regenerating *hima* sites, representing the cultural heritage sites using modern techniques, protecting site identity and using traditional materials, conservation as a purpose, integrating the surroundings, allocating and determining boundary entrances and exits, appropriate defenders, increasing engagement between locals and decision-makers, connecting the development to local needs, working as a collective and making associations, transferring knowledge to the new generation, keeping record books, organising school trips, walking around heritage areas, grazing local animals around heritage, living around heritage and restricting human interactions. The elders highlighted the role of implementing *oqoom* (sand berms), rocky dams, walls and traditional fences, as well as the importance of managing water flow and controlling sand impact. I argued that these traditional methods would add value to the official conservation approach of the cultural heritage in the region, where people can see the heritage artefacts, including the traditional ecological practices developed around them. For example, introducing traditional activities within cultural heritage sites could transform these sites into a ‘living museum’, which aligns with the goals of official institutions in the county, rather than open-air displays (see Section 6.3.3: Active engagement and site monitoring). Further, increasing the managed interaction of people around cultural heritage sites can strengthen their protection by fostering community involvement and enabling visitors to monitor the sites and promptly report any actions that may harm cultural heritage elements.

The **third** finding addresses the third research question: What is the role of landscape design in a *hima* context, and what are the main design aspects that designers need to consider when aiming to integrate *hima* TEK techniques into urban development projects to mitigate desertification and preserve cultural heritage sites in the county? There are two parts to this research question: (1) the role of landscape design in the *hima* context and (2) the key design aspects, which could be informed by *hima*.

Regarding the first aspect, the involvement of LA design contributed to enhancing the understanding of environmental issues and how *hima* TEK addresses these in the context of AlUla. For example, during the discussion with the elders about the traditional techniques and strategies used to mitigate desertification or conserve cultural heritage, elders provided detailed technical information about the local TEK (e.g. Section 5.3.1.2: Implementing barriers, and Section 6.4.1: Physical protection), and some of them illustrated the techniques, whether on my notebook or in the sand (see Figures 5-30 and 5-41). These data were rich enough for me to visualise, draw and integrate *hima* TEK and its techniques into the OMP and my conceptual master plan. Also, to review and validate the visual materials and the other identified results, including the conceptual master plan, the national experts (who were mostly landscape architects and urban designers) added more value to the thesis results by clarifying, expanding, questioning and critiquing them. For example, the national experts explained how the socioeconomic shift negatively affected the practice of *hima* TEK in the region, which was not apparent during my analysis of the data gathered from the elders and site visits (see Sections 5.2.1.2 and 5.2.1.3). Therefore, the LA design and design process, which included talking with elders and then with experts, added to the interpretation of *hima* TEK. This addition means that the design process has contributed to filling the gap between local TEK and contemporary design and planning methodologies by highlighting the main aspects that need to be considered regarding how TEK can be integrated into contemporary urban design, planning projects and master plans. This integration is achieved not only through the ability to translate *hima* TEK into practical technical approaches, but also through the potential interdisciplinary expertise and skills that LA professionals may bring to the field.

Another example is that the design process highlights issues that may not be initially noticed. For instance, the experts from the third workshop disagreed on the *hima* framework and whether traditional water-harvesting techniques are part of it, unlike the experts from the second workshop. This disagreement showed me that *hima* TEK can be perceived differently owing to

spatial and temporal factors (see Section 7.4.3 Lessons learned for future directions). Another example of the potential role of the LA design process is the water issue discussion by the experts presented in Section 7.4 (Discussion and Reflection on the Role of Landscape Architectural Design). They reported, for example, that this water issue is not a local but a regional matter, and that it is associated with the current urban design of the region.

Therefore, the role of LA design in the context of AlUla, Saudi Arabia, could be in enhancing our interpretation and application of local environmental issues and *hima* TEK. In relation to this aspect of the question, it is clear that LA design and its process can add and inform *hima* TEK by finding potential methods for integrating local TEK. Consequently, this finding may help in developing local mitigation strategies by integrating professional expertise and local TEK perspectives.

Regarding the second part of this research question, the potential of *hima* TEK to inform LA and urban design, this thesis highlighted four key design aspects that landscape architects, urban designers, planners and decision-makers need to consider when integrating TEK into urban projects in Saudi Arabia. The four are associated with flexibility, site selection, traditional design ideas and design improvement (see Section 7.3: Exploring Possibilities and Ideas to Guide the Design/Design Process). For example, discussing *hima* TEK with the national experts led them to suggest several land uses in which *hima* could be implemented and integrated, such as national parks, previous *hima* sites, agri-tourism areas and agricultural sites. The experts emphasised the importance of finding new interpretations for implementing indigenous ecological techniques to suit contemporary issues and contexts. Additionally, *hima* TEK can provide design guides for designers working on such projects (as summarised at the end of Chapters 5 and 6—see Sections 5.4 and 6.5). These traditionally inspired guides helped me, as a landscape architect, to design a conceptual master plan that included several traditional techniques to mitigate desertification, conserve cultural heritage and provide for community needs. The feedback from

the national experts confirmed that this ‘designing with *hima*’ approach, and that the design ideas inspired by *hima* TEK, can potentially address the broad-scale and local environmental issues in the region.

In short, this finding shows that *hima* TEK can inform design. It reveals the potential for the LA profession to contribute to key urban developmental projects to conserve national cultural heritage, which adds to the realisation of the Saudi Vision 2030.

8.3 Research contribution

This thesis provides three main contributions, which can be classified as empirical, practical and methodological.

First contribution

Several studies on *hima* have revealed how local TEK protects natural resources and leads to a sustainable way of living with desert ecosystems and mitigating desertification. However, these revelations lack detailed explanations. An explanation of the practicality of the system and how it works in detail is missing, especially in the context of cultural heritage conservation. Researchers have called for a more detailed examination of this traditional ecological system (Al-Shanqiti, 2013, 2019; Gari, 2006; Kilani et al., 2007; Llewellyn, 2013; Llewellyn & Altasat, 2017). Chapter 5 addressed this issue by examining how *hima* TEK contributes to desertification mitigation, identifying 18 agricultural, water management and community methods that demonstrate the knowledge of elders in the AlUla region and their heritage of living within desert environments.

This chapter presented the causes of desertification based on the views of the local elders. To understand TEK’s role in mitigating desertification, this research analysed the elders’ perspectives on the factors that lead to desertification. The scientific literature typically identifies

three primary causes of desertification: deforestation, overgrazing and substandard land use management (Amin, 2004; Blilou & Hirt, 2023; Cowie et al., 2007; Edgell, 2006; Goudie, 2018; Massy, 2017; Schwartz, 2020; Vincent, 2008), sometimes detailing specific causes (Blilou & Hirt, 2023; Edgell, 2006; Schwartz, 2020). However, detailed perspectives of traditional communities on the causes of desertification affecting their lands are notably absent. Consequently, the first theme explored local views on the causes of desertification, divided into human and non-human factors (see Section 5.2: Elders' Views on the Causes of Desertification). The elders' understanding of desertification is crucial, owing to their long-term habitation of the region and the detailed observations and events they have experienced over time. This initial analysis of the desertification factors helps understand the threats posed to the environment, including cultural heritage and local communities, before studying the traditional strategies that were developed to address these threats and before studying their applicability in modern Saudi Arabia.

To my knowledge, to date, there has been little research undertaken to study *hima* TEK in a way that might be useful in guiding design within the cultural heritage sites that are under the threat of desertification. However, the results show that *hima* TEK enriches environmental design. The insights from the elders and observations within the region provide preliminary design guides that can inspire landscape architects, urban designers and decision-makers who see benefits in integrating indigenous ecological practices and knowledge into contemporary urban development in the region.

Second contribution

The *hima* literature recognises tangible cultural heritage as a part of *hima* protected areas (Al-Shanqiti, 2013, 2019; Al-Utaibi, 2006; Gari, 2006; Kilani et al., 2007). However, the role of *hima* TEK and its practices in conserving tangible cultural heritage remains unclear and needs further investigation (Gari, 2006; Llewellyn & Altlasat, 2017, p. 16). Therefore, Chapter 6 found a linkage between *hima* TEK and cultural heritage conservation, detailing how local communities have

developed their indigenous knowledge and practices to sustain the surroundings, which includes cultural heritage structures.

This link includes 27 traditional methods within three primary themes: inclusive heritage conservation through regeneration, community engagement, and traditional techniques and strategies, illustrating how indigenous practices contribute to safeguarding cultural heritage structures, such as the Nabataean tombs and water infrastructure in AlUla. These are the various traditional ecological practices among the ongoing *hima* TEK that have contributed to the preservation of cultural heritage, although the intention behind some of the strategies is not directly aimed at the preservation of ‘cultural heritage’ structures and sites. These findings not only establish the connection between local TEK and cultural heritage, but also enhance our understanding of *hima* sites and their surroundings. The analysis demonstrates how traditional implementations, including water-harvesting techniques and agricultural activities, contribute to the preservation of tombs and other cultural heritage elements. This comprehensive examination underscores the multifaceted holistic role of *hima* in cultural heritage conservation, highlighting its potential for broader application in safeguarding shared heritage. It proves that the local TEK contributes to the conservation of ecosystems and cultural heritage simultaneously as one system, rather than considering them as separate entities.

The results in Chapter 6 informed design guides and directions for landscape architects and urban designers aiming to integrate TEK into cultural heritage conservation projects. This integration fosters sustainable preservation practices and supports the continuity of indigenous knowledge within contemporary development frameworks.

Third contribution

The LA profession, and its perspective and methods, can be an essential aspect for integrating the *hima* system into cultural heritage preservation and environmental improvements,

specifically in mitigating desertification (Makhzoumi et al., 2012, p. 180). This integration is essential since it bridges the gap between past practices and contemporary needs. Makhzoumi (2016, p. 463) stated that the involvement of LA designers and researchers in heritage conservation projects in the Middle East is limited. Additionally, there is little connection between methods of landscape architectural design and *hima* TEK methodologies. Abdallah (2013) and Llewellyn (2013) highlighted several tools and data-gathering approaches suitable for use in *hima* contexts, such as PRA and RRA, including stakeholder analysis, literature review and interviewing local communities. However, modifying the suggested approaches to suit this research timeframe and the researcher's capabilities was important. Therefore, this research adapted design research in LA design/drawing to provide visual data explaining some aspects of *hima* that were found lacking in the literature. For example, the drawings and diagrams in Chapters 5 and 6 present and explain the different traditional strategies and techniques associated with desertification mitigation and cultural heritage conservation. Sometimes, multiple techniques are presented within one landscape design section, which provides a more comprehensive and detailed understanding of the local TEK. It includes workshops with LA experts, which are considered a part of the design process, to investigate the role of LA design in TEK research in Saudi Arabia.

This thesis presented an opportunity regarding the integration of *hima* TEK by LA research and practice, showing how LA researchers and practitioners⁵⁵ can be engaged in *hima* TEK research. In our complex modern world, design serves as a powerful tool that can be used to synthesise and address multifaceted issues, helping us to view traditional practices from new perspectives and adapt these practices to current contexts. Historically, the knowledge and practices related to *hima* were transmitted orally through generations and rarely documented in written forms.

⁵⁵ By this I mean researchers and practitioners, all eight of the ten national LA experts participated in this research, including myself and the three LA researchers on my supervisory panel.

Through design processes, including analysis, development and expert discussions (see Chapter 7), this research identified four key qualities associated with the integration of local TEK into urban design projects and master plans. The design process of this research highlighted the inherent flexibility within the traditional practices and techniques of *hima*, which aligns with the flux of landscape architectural practices. This flexibility enables multiple tasks related to nature conservation, cultural heritage preservation, and addressing the needs and values of local communities. Second, the design process revealed that *hima* can be applied to diverse land types and uses. Traditionally known as protected areas around villages or natural resources, this research found that *hima* can also be proposed within national parks, agri-tourism sites and even modern urban spaces. Third, this research found that the design process helps to identify important areas for grazing, community gatherings and water harvesting, expanding the potential applications of *hima*. Although there is a strong attachment to ancient structures and history, design offers the potential to update and develop traditional techniques. This ensures the preservation of identity while making these techniques accessible to the next generation. Additionally, this chapter finds that design encourages innovation within traditional frameworks, promoting continuity and evolution.

The design also highlights the challenges and opportunities of integrating *hima* into modern contexts. It plays a vital role in updating a system that originated 2000 years ago to suit contemporary urban settings. Although the focus is on reflecting, rather than creating design guidelines, the design process generates initial insights that can evolve into comprehensive guidelines and policies used by decision-makers, planners, urban designers and landscape architects.

The research outcomes that were found based on the LA perspective illustrate the potential to synthesise traditional and modern elements to offer new knowledge and methodologies inspired by the past, but relevant to the present and future.

8.4 The implications of the findings

8.4.1 Implications for official institutions and decision-makers

Chapters 5 and 6 explored the value of the local TEK employed by the local community of AlUla to live within desert ecosystems, mitigating desertification and its causes and conserving cultural heritage. The elders detailed 18 techniques in Chapter 5 and 27 strategies in Chapter 6 that were developed over centuries to manage surrounding ecosystems and cultural heritage. Although the system was passed down orally through generations in the past, this thesis passes the results and the value of *hima* TEK to official institutions and decision-makers to catalyse the integration of *hima* TEK into contemporary urban developmental visions. This research explained these techniques, providing visual materials, landscape sections and illustrations to show how those techniques work. It showed how these traditional techniques can be integrated into official master plans, such as OMP, and detailed the main concerns associated with these integrations, based on the national experts' point of view.

Historically, the indigenous practices of the elders were closely linked to cultural heritage preservation. Integrating this ancient TEK with tangible cultural heritage conservation will enhance the value of conservation and urban development efforts. For example, the elders recommended strategies such as restoring and re-purposing the surroundings of cultural heritage structures to attract more visitors. This increased foot traffic allows for better monitoring and observation by both users and locals, contributing to the preservation of cultural heritage. Official institutions, decision-makers and other foreign consultants participating in development projects in the AlUla region in Saudi Arabia may find the results a source of inspiration, drawn from the elders' and experts' stories and experiences to achieve more valuable outcomes in the region. For example, the official institutions and decision-makers may suggest developing a physical structure based on understanding the function of the various traditional barriers presented in this research. In fact, after conducting the three workshops, three experts

requested more detailed information about the traditional techniques documented in this research. They expressed their interest in reintroducing the techniques in some national projects, which highlights the empirical opportunity of this research.

8.4.2 Implications for landscape architects, urban designers and researchers

There are two aspects under this subsection. First, the feedback and insights provided by the national experts on the design process, design ideas and conceptual master plans are crucial for anyone working on similar projects. Landscape architects, urban designers and researchers may need to consider the key factors identified, such as site selection criteria, the flexibility of local TEK, traditional design ideas and design improvements. These considerations are particularly relevant for projects where cultural heritage and desertification impacts are primary concerns. Additionally, the experts' comments, based on their extensive understanding of such projects in Saudi Arabia, can be generalised to other regional projects within similar contexts inside the Kingdom.

The second part relates to the methodological framework presented in Chapter 3. During the literature review stage, I faced significant challenges in understanding *hima* TEK, owing to the lack of visual illustrations and drawings. As an LA researcher, I believe we have an obligation to document our heritage using our unique disciplinary skills. Therefore, this research developed a methodological framework based on the *hima* literature and landscape research techniques, such as visual and design elements, which facilitate a better understanding and integration of the traditional values of local communities in Saudi Arabia. This landscape research approach may enrich our understanding and bridge the gap between traditional knowledge and modern methodologies. Although previous generations in our field might disagree with such contemporary approaches, adapting and innovating to ensure the continuity and appreciation of

our cultural heritage in an evolving world is crucial. By doing so, we honour the essence of *hima* TEK, while making it accessible and relevant for future generations.

8.5 The thesis limitations⁵⁶

All research has its limitations. In this section, I outline the constraints of this study and reflect on the things I would change if I conducted it again. First, the COVID-19 pandemic significantly affected my research progress. In NSW, Australia, restrictions were eased in October 2021. Throughout 2021, I made the most of accessible resources, utilising libraries where possible and conducting many online meetings and discussions. However, I could not reach some resources, such as the King Fahad National Library, or consult with some experts from the beginning of my research. These steps can be considered an essential stage before collecting the primary data. Therefore, working from home and relying on accessible online data was the only option available at the beginning, which also involved other challenges, as I am a father of three.

The second main limitation is that the AlUla master plan includes ambiguous ideas and concepts. Although I tried to discover more about it, even on the official websites and those of the European companies working in AlUla, I could not find enough information to comprehensively understand it. This limitation could be due to the confidentiality of the official Saudi projects (Filippi & Mazzetto, 2024, p. 4). Therefore, I decided to make the spatial boundary of the OMP my research spatial boundary. Occasionally, I extended my research a few kilometres beyond these boundaries to cover specific sites or meet elders recommended by the community or other elders. However, I wished, but was unable, to visit several sites far outside the boundaries or in difficult-to-reach areas because some of them require special vehicles and equipment owing to challenging topography, such as isolated valleys.

⁵⁶ Three challenges and two limitations associated with the data collection stages were already discussed in Section 3.6: Limitation and challenges.

The third limitation concerns the reliance on qualitative research tools. Qualitative methods have been criticised for their limited generalisability owing to their dependence on a small number of participants and a specific context (D. Gray, 2014). However, generalising my findings was not my primary aim, although I feel that the practices in the AlUla context may not significantly differ from those in other Saudi regions with similar desert ecosystems. Instead, I aimed to explore and understand local TEK and its role in mitigating desertification and preserving cultural heritage.

8.6 Future research

I identified three future research opportunities that require further exploration. First, the role of female elders in managing *hima* sites and natural resources emerged as a significant aspect of *hima*. Experts from the second workshop highlighted that female elders, traditionally, held important responsibilities in managing natural resources. Owing to cultural sensitivities, such a research project might be better conducted by female researchers or male researchers with female assistants who have established deep trust within the local community. A study by Al-Tabini et al. (2012), which involved both male and female elders, provided a comprehensive understanding of *hima* management, focusing on rangeland viability, medicinal plants and livestock in Jordan. However, the cultural contexts of Jordan and AlUla are not the same. Also, in the context of traditional ecological practices in Saudi Arabia, documenting and studying the ecological knowledge and experiences of female elders alongside male elders may produce a more holistic understanding of *hima* TEK. This approach would be valuable in exploring how local TEK contributes to mitigating desertification and preserving cultural heritage.

The second opportunity is associated with conducting comparative studies. It is crucial to investigate various contexts within Saudi Arabia and compare these findings with the results of this study to assess the potential for generalisation. For example, *hima* practices in mountain and coastal ecosystems may encompass different techniques and strategies. Based on informal discussions with individuals from the southern mountains of Saudi Arabia, and based on the

review of *hima* TEK papers (e.g. Eben Saleh, 1995, 1996, 1997, 1998a, 1998b, 1998c, 1999a, 1999b, 2000a, 2000b, 2001, 2002, 2004), it appears that there are similarities and differences in terms of the traditional techniques related to water harvesting, natural resource management, agricultural methods and community activities. Studying *hima* TEK in these diverse contexts is vital for understanding it comprehensively, and for the preservation of traditional systems. Key questions to address include: What techniques are used to mitigate desertification and protect cultural heritage? How do these techniques function, and what do they look like? By exploring these questions, we can better understand the role of TEK across different ecosystems and its contribution to sustainable environmental management.

The third opportunity relates to refining and developing the design process. Despite making many changes and modifications to this research, I am still interested in testing the applicability of the design process (for both RFD and RTD approaches) in other contexts within Saudi Arabia. Further, I found that engaging more with experts in the design process is crucial. Although I printed an A2 sheet of my conceptual master plan to encourage the experts to illustrate their thoughts, they focused primarily on discussion rather than detailed drawings. Therefore, I asked these questions: Would conducting multiple workshops with the same experts lead to more refined and critiqued design ideas? What adjustments are needed in the workshop format to foster greater expert participation in the design process? Enhancing expert engagement and refining the design process through these interactions may significantly contribute to developing and implementing effective design strategies in similar contexts.

8.7 Conclusion

This PhD research has explored the role of the disappearing traditional ecological knowledge (TEK) of the local communities in the AlUla region, Saudi Arabia, in shaping the lives of the locals within desert landscapes and ecosystems that include cultural heritage elements and are threatened by desertification factors. By addressing the research objectives and questions, the

study has demonstrated how *hima* TEK, embedded in local landscapes, practices, and stories, contributes to mitigating desertification, conserving cultural heritage, and informing contemporary design methodologies and strategies. The interdisciplinary approach adopted in this research, including semi-structured interviews with elders, participatory-site visits, and workshops with experts, has bridged the gap between local knowledge systems and modern urban planning and design, offering insights into how TEK can be integrated into current and future development projects and master plans.

In response to the first research question, the study identified and documented 18 TEK-based actions and strategies to mitigate the surrounding elders-perceived desertification causes that jeopardise the landscape and the community. For the second research question, the data generated based on the elders' statements and fieldwork revealed a connection between the local TEK and cultural heritage conservation and documented 27 local strategies that may contribute to the conservation of heritage structures spread within the surrounding landscape. These two questions were addressed through a research for design (RFD) approach, while the third one was based on a research through design (RTD) approach. The third research question explored the role of landscape design as a medium for translating TEK into actionable strategies. Through participatory workshops and conceptual master planning, the study highlighted the importance of integrating local TEK into modern design frameworks to ensure resilience and sustainability in arid landscapes by addressing water issues in the region.

In closing, this research emphasises the significance of traditional ecological knowledge as a source of potential and opportunities to address the pressing challenges of desertification and cultural heritage preservation in Saudi Arabia. While modernisation and rapid development may pose threats to these invaluable knowledge systems, this study underscores the potential of TEK-informed design solutions in facilitating a more sustainable and culturally rooted approach to landscape architecture. Moving forward, more collaboration between local communities,

policymakers, researchers and designers will be essential to safeguarding both natural and cultural landscapes in the region and to realise the needs of local communities, and, hopefully, this research serves as a keystone for such direction within the context of the Arabian Peninsula.

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Appendices

Appendix A: UTS Ethical Approval—2/1

Your ethics application has been approved as low risk - ETH22-6858

research.ethics@uts.edu.au <research.ethics@uts.edu.au>

Tue 5/17/2022 4:13 PM

To: Martin Bryant <Martin.Bryant@uts.edu.au>; Abdulrahman Saud M Alshami
<AbdulrahmanSaudM.Alshami@student.uts.edu.au>

From: research.ethics@uts.edu.au

1 attachments (342 KB)

Ethics Application.pdf;

Dear Applicant,

Re: ETH22-6858 - "The New Relationship Between Green National Parks and Tourist Behaviours in Saudi Arabia (old title) Traditional Knowledge as a Catalyst for Ecosystem Enhancement, Community Well-being and Cultural Heritage Conservation in Saudi Arabia (New title)"

Your local research office has reviewed your application and agreed that it now meets the requirements of the National Statement on Ethical Conduct in Human

Research (2007) and has been approved on that basis. You are therefore authorised to commence activities as outlined in your application, subject to any conditions detailed in this document.

You are reminded that this letter constitutes ethics approval only. This research project must also be undertaken in accordance with all UTS policies and guidelines including the Research Management Policy.

Your approval number is UTS HREC REF NO. ETH22-6858

Approval will be for a period of five (5) years from the date of this correspondence subject to the submission of annual progress reports.

The following standard conditions apply to your approval:

- Your approval number must be included in all participant material and advertisements. Any advertisements on Staff Connect without an approval number will be removed.
- The Principal Investigator will immediately report anything that might warrant review of ethical approval of the project to the [Ethics Secretariat](#).
- The Principal Investigator will notify the Committee of any event that requires a modification to the protocol or other project documents, and submit any required amendments prior to implementation. Instructions on how to submit an amendment application can be found [here](#).
- The Principal Investigator will promptly report adverse events to the Ethics Secretariat. An adverse event is any event (anticipated or otherwise) that has a negative impact on participants, researchers or the reputation of the University. Adverse events can also include privacy breaches, loss of data and damage to property.

UTS Ethical Approval – 2/2

6/1/23, 8:45 PM

Mail - Abdulrahman Saud M Alshami - Outlook

- The Principal Investigator will report to the UTS HREC or UTS MREC annually and notify the Committee when the project is completed at all sites. The Principal Investigator will notify the Committee of any plan to extend the duration of the project past the approval period listed above.
- The Principal Investigator will obtain any additional approvals or authorisations as required (e.g. from other ethics committees, collaborating institutions, supporting organisations).
- The Principal Investigator will notify the Committee of his or her inability to continue as Principal Investigator including the name of and contact information for a replacement.

This research must be undertaken in compliance with the [Australian Code for the Responsible Conduct of Research](#) and [National Statement on Ethical Conduct in Human Research](#).

You should consider this your official letter of approval.

If you have any queries about this approval, or require any amendments to your approval in future, please do not hesitate to contact your local research office or the Ethics Secretariat.

Ref: 12a

Appendix B: KSU Approval

جامعة الملك سعود (034)
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عمادة الموارد البشرية

إدارة تنمية الموارد البشرية

وفقه الله

سعادة الدكتور عميد كلية العمارة والتخطيط

السلام عليكم ورحمة الله وبركاته .. وبعد:

إشارة إلى الطلب الإلكتروني رقم (SM-30658) الوارد من سعادة الملحق الثقافي في أستراليا بتاريخ 1444/5/17هـ بخصوص مبعث قسم التخطيط العمراني / عبدالرحمن بن سعود الشامي سجل مدني رقم () .

أفيدكم بموافقة الجامعة على قيامه برحلة علمية إلى المملكة لمدة (87) يوماً اعتباراً من 1444/6/12هـ الموافق 2023/1/5 م .

أمل الإحاطة وتوجيه من يلزم بتعبئة الإستمارة المرفقة وتزويد هذه الإدارة بها عند نهاية الرحلة العلمية.

والله يرعاكم ،،،

مدير

إدارة تنمية الموارد البشرية

فيصل بن سعود الحربي

صورة لمركز الاتصالات الادارية .

صورة مع التحية لسعادة الملحق الثقافي في أستراليا رمزاً للطلب الإلكتروني رقم (SM-30658) للإحاطة .

صورة لإدارة تنمية الموارد البشرية (صادر الإدارة) .

صورة لإدارة تنمية الموارد البشرية (التابعة) .

صورة لملفه رقم () مع الأساس .

144400049929

3/17/152609

UTS UNIVERSITY OF TECHNOLOGY SYDNEY



نمونه معلومات تلمیذار کتب

المعرفة التقليدية كمحيط لتخصيص اللقاح فليس ورقاية الإنسان وحدها. التراث الثقافي في المملكة العربية السعودية
 رقم مقالة لجنة أبحاث التراث البشري في جامعة مدني للتكنولوجيا (2014/12/28-2015)

تم الموافقة لجنة أخلاقيات البحث البشري في جامعة مدني للتكنولوجيا (E71/22-6858)

martin.bryant@uq.edu.au
 +61 (0) 400 430 877

الذي يجري هذه الدراسة؟

لماذا تبحث هذه الدراسة؟
 هذه الدراسة هي الأولى التي تبحث في إمكانات تعلم وإنتاج مواد تعليمية شبيهة بـ ChatGPT، في سياق الفئات التعليمية في المملكة العربية السعودية. فهي تدرس كيف يمكن لهذه التكنولوجيا أن تساعد في تحسين جودة التعليم، وتوفر أدوات تعليمية مخصصة، وتساعد في تطوير مهارات التفكير النقدي لدى الطلاب. كما تبحث في التحديات التي تواجه استخدام هذه التكنولوجيا في البيئة التعليمية، وتقدم توصيات لمعالجتها.

1000

وقيل للبحث:
 ١- ما أبحاث علمي متعة دارمية كذالك من سكر ما المتعة العربية السعودية لطاعة من الله تعالى

وبل البحث:

سُئل الممثلون على منصة دار النيابة كماله من يتكلم بما للمملكة العربية السعودية لمصلحة في كسبه. أجاب:

لوحین اللہامی

[illegible]

ماری وایت

ثروت المشركه، سواء حركت المشركه في احد الاجزاء ثلثه:

1- مقابلة نصف منظمة لمدة 80 دقيقة (المقابلة المصممة والاختبار)
2- اختبار الاختيار (اختبار الاختيار) (اختبار الاختيار) (اختبار الاختيار)

في الحيلة: حرف تعجب على أمثلة ح. (3) ما منعك من أن تصبر وصلة لث ث قلبي وتوسيم أيقاب القلبية التي أعده الجميع للتدبير التي تلهيهم منقلب تلك القوسية ومع وجود هذه الحيلة (بعض ح): أيقاب القلبية.

من وثقة أعزاء: عطفًا عطفًا من قبل الجائز من تعجب على الأمثلة التي ذكرها نفا ح. (4) نعيم القلوب القلبية وتوسيم حكمة الصالح الصبية.

توجد آية مخاطر / أو إلحاج؟

1. *Journal of the American Medical Association*, 1997; 277: 1039-1043.

شعير: ضلعة بالفتح، وإن لم تقم جوداً لم تضرمت فحسبته ذلك: علو: على ذلك، الضاحج في سرية آل العثر: في آل العثر: الضاحج: الضاحك، معاني: كهـ

و سكونت الفتاوى في سنة ١٢٩٠ هـ - ١٢٩١ هـ



DO I HAVE TO SAY YES?

Participation in this study is voluntary. It is completely up to you whether or not you decide to take part

WHAT WILL HAPPEN IF I SAY NO?

If you **withdraw** from the study, the audio will be deleted, and the transcribed will be destroyed. If you decide to leave the research project, we will not collect additional personal information from you, although personal information already collected will be retained to ensure that the results of the research project can be measured properly and comply with the law. You should be aware that data collected up to the time you withdraw will form part of the research project results. If you do not want them to do this, you must tell them before joining the research project.

If you withdraw from the study, the audio will be deleted, and the transcribed will be destroyed

If you decide to leave the research project, we will not collect additional personal information from you, although personal information already collected will be retained to ensure that the results of the research project can be measured properly and comply with the law. You should be aware that data collected up to the time you withdraw will form part of the research project results. If you do not want them to do this, you must tell them before joining the research project.

CONFIDENTIALITY

By signing the consent form, you consent to the research team collecting and using personal opinions and comments for the research project.

All this information will be treated confidentially. Your personal information will be de-identified. Your input and responses will only be used for the purpose of this research project.

We would like to store your information for future use in research projects that are an extension of this research project. In all instances, your information will be treated confidentially.

We plan to publish the research results in journal articles and conference papers to support the research field regarding the topics of this study.

WHAT IF I HAVE CONCERNS OR A COMPLAINT?

If you have concerns about the research that you think I, my supervisor or a local independent contact person can help you with, please feel free to contact us on:

Abdulrahman Alhami

Email: Abdulrahmansaudm.alshamir@student.uts.edu.au
Phone: +966557062149 / +61412909894

Professor Martin Bryant

Email: marin.bryant@uts.edu.au
Phone: +61 (0) 490 430 977

A local independent contact person

Planning Department
phone: +95611469513

You will be given a copy of this form to keep.

NOTE:

This study has been approved in line with the University of Technology Sydney Human Research Ethics Committee (UTS HREC) guidelines. If you have any concerns or complaints about any aspect of the conduct of this research, please contact the Ethics Secretariat on ph: +61 2 9514 2478 or email: ResearchEthics@uts.edu.au, and quote the UTS HREC reference number. Any matter raised will be treated confidentially, investigated and you will be informed of the outcome.

Appendix D: Consent Form—Arabic and English



CONSENT FORM

Traditional Knowledge as a Catalyst for Ecosystem Enhancement, Community Well-being, and Cultural Heritage Conservation in Saudi Arabia
UTS HREC APPROVAL NUMBER IS ETH22-6858

I, _____ agree to participate in the research project Traditional Knowledge as a Catalyst for Ecosystem Enhancement, Community Well-being, and Cultural Heritage Conservation in Saudi Arabia (the UTS HREC approval reference number **ETH22-6858**) being conducted by Abdulrahman Abuhani – 52-54 Walker St, Rhodes, NSW, 2138 – Phone: +61412608854.

I have read the Participant Information Sheet, or someone has read it to me in a language that I understand.

I understand the purposes, procedures and risks of the research as described in the Participant Information Sheet.

I have had an opportunity to ask questions and I am satisfied with the answers I have received.

I freely agree to participate in this research project as described and understand that I am free to withdraw at any time without affecting my relationship with the researchers or the University of Technology Sydney.

I understand that I will be given a signed copy of this document to keep.

I agree to participate in: ☐ Interview ☐ Workshop

I agree to be:

☐ Audio recorded

I agree that the research data gathered from this project may be published in a form that:

☐ Does not identify me in any way

☐ May be used for future research purposes

I am aware that I can contact Abdulrahman Abuhani if I have any concerns about the research.

Name and Signature [participant]

Date

Name and Signature [researcher or delegate]

Date



موافقة

المعرفة التقليدية كعوامل لتحسين النظام البيئي وإحياء الإنسان وجمعية التراث الثقافي في المملكة العربية السعودية

رقم موافقة لجنة أخلاقيات البحث في جامعة تكنولوجي سيدني (ETH22-6858)

أقر أنا، _____ وأوافق على المشاركة في المشروع البحثي الذي يهدف إلى تعزيز المعرفة التقليدية كعوامل لتحسين النظام البيئي وإحياء الإنسان وجمعية التراث الثقافي في المملكة العربية السعودية والمشاركة في مبادرات الحفاظ على التراث الثقافي في المملكة العربية السعودية (الموافقة المرجعية لعدد **ETH22-6858**) التي يجري تنفيذها من قبل عبد الرحمن أبو هاني – 52-54 Walker St, Rhodes, NSW, 2138 – هاتف: +61412608854.

• لقد قرأت ورقة معلومات المشارك أو قرأها لي أحد أفراد عائلتي

• أريد أن أكون جزءاً من هذا المشروع وأوافق على أن أكون جزءاً من مجموعة من المشاركين في هذا المشروع

• لقد فهمت أن المشاركة في هذا المشروع هي اختيارية وأنا أوافق على أن أكون جزءاً من مجموعة من المشاركين في هذا المشروع

• أوافق على المشاركة في هذا المشروع وأوافق على أن أكون جزءاً من مجموعة من المشاركين في هذا المشروع

• أوافق على المشاركة في هذا المشروع وأوافق على أن أكون جزءاً من مجموعة من المشاركين في هذا المشروع

• أوافق على المشاركة في هذا المشروع وأوافق على أن أكون جزءاً من مجموعة من المشاركين في هذا المشروع

• أوافق على المشاركة في هذا المشروع وأوافق على أن أكون جزءاً من مجموعة من المشاركين في هذا المشروع

إذا أقرت ذلك:

☐ تسجيل صوتي

أوافق على أن أكون جزءاً من مجموعة من المشاركين في هذا المشروع وأوافق على أن أكون جزءاً من مجموعة من المشاركين في هذا المشروع

☐ لا أوافق على المشاركة في هذا المشروع

☐ يمكن استخدامي لأغراض أخرى غير الغرض المعلن

إذا أوافق على المشاركة في هذا المشروع، أوافق على أن أكون جزءاً من مجموعة من المشاركين في هذا المشروع

التوقيع والاسم (المشارك): _____ التاريخ: _____

التوقيع والاسم (المشارك أو الممثل): _____ التاريخ: _____

Appendix E: Interview and Workshop Questions—English

Semi-structured interview

Introductory questions:

- How was the relationship between the locals and the surrounding natural and cultural elements?
- How do you think traditional knowledge and techniques can be essential to the environment, culture and values?

Scenarios 1 - (Desertification combat aspect):

The village of Hegra has to be self-sustaining in water use. We need to integrate traditional and new technologies to harvest water and regenerate oases. Both technologies and oases should reverse desertification and support cultural heritage conservation.

- In your opinion, what are the essential steps and techniques that should be considered to protect the ecosystem from desertification?
(For example, how do you prepare yourself for a long summer without rain)
- By relying on traditional knowledge, how can we collect, harvest and protect water during summer? What about rainwater and runoff water?
- What types of plants are very beneficial to the environment? and how are they helpful?
- How locals used to protect their farms?
- What are the different traditional techniques that can be implemented in a conserved cultural heritage site?

Scenarios 2 - (Cultural heritage conservation aspect):

To make cultural heritage essential in locals' minds, we need to design everyday traditional or required activities around the cultural heritage artefacts. We need to reconnect people to cultural heritage to become part of today's community's lives in a way that respects the locals' tradition and culture. The goal is to make the site a living heritage that contributes to the protection of cultural heritage elements.

- Therefore, what traditional activities can benefit the conserved cultural heritage features? And how do these activities work to achieve this goal?
- How can the cultural heritage site provide opportunities for locals and their traditions?
- Let's say that the cultural heritage features are under the threat of flash flood and moving sand; what do you suggest to protect them from these two factors?
- What do you think about having a farm within the cultural heritage site? What techniques would you consider?

Design aspect:

- Could you please describe X technique and how it should be implemented?

Workshop Questions

After presenting my landscape architectural design, I will ask the experts the following questions:

- Do you think that the design presents the local tradition in a way that suits the today's conditions? Why yes or no?
- Do you think the design can enhance the protection of the cultural heritage elements? Why yes or no?
- Do you think that the design can contribute to the desertification combat and reverse it? Why yes or no?
- What is missing from the design that may make it better? What aspects of the proposed design need to be enhanced to improve cultural heritage conservation and combat the desertification? And why?

Appendix F: Result Review Form—Arabic

جدول تقييم النتائج:
جدول (1) - المخرجات الرئيسية لمعالجة التصحر:

المخرجات الرئيسية	المخرجات الثانوية	الترميزات	ملاحظات/الصفات/التعليقات من المشاركين
عمل آمن للتصحر	عمل آمن للمساكنة	- استخدام تقنيات جديدة لمساعد على إزالة الأشجار - ترك السكان (مساكنهم) المنطقة السكنية أو (الزراعة) وعدم التعامل مع السكان ومبيدات الحشرات بشكل دوري - التوقف عن إدارة وصيانة المزارع - التوقف عن ممارسة التناثر البنية المحلية - استخدام التقنيات الحديثة لتسهيل الوصول إلى الموارد - الاشتراك (الزراعي) الجائر - الاستمرار في استخدام الماء - والتي يساهم بنورها في زيادة التلوث وخاصة في - الزوايا الزراعية - التي. الأنواع التي تساهم في زيادة الملوحة والتي تؤثر سلباً على القدرة والتأثيرات	المستخدمين استخدام الماء
عمل آمن غير مساهمة		- وجود ثروة محلية - والتي بنورها تسهل موضوع الترخيص - تقسيم الجيوب الشخصية - تجديد التراكيب تؤثر على تدفق مياه الجيوب - التي تؤثر الثروة داخل الجيوب وتقللها - الميلادات - تقلص الزوايا - الزوايا المحلية - تجديد بعض أنواع الطيور والمشاريع الصغيرة	و نقص انصاف التوزيع للمساكن و نقص على تدفق المياه على الأراضي و نقص على تدفق المياه على الأراضي و نقص على تدفق المياه على الأراضي
اصلاح لمساعد على مكافحة التصحر	المكافحة من خلال الانتفاضة الزراعية	- تنظيف وصيانة الواحات - إعادة تدوير مخلفات الزراعة - مثل تكوين السماد الطبيعي - عمل جدران من الجوارح والحصى للبيئات - الوسيع والذي يساهم في التقليل من التلوث - التلوث - تراكيب كميات للرياح - زيادة المساحات المنقطة - إزالة زحف الرمال - تجنب استخدام المواد الكيميائية في المزارع - المداينة والتربة - حفظ الثروة المحلية والتربة المحلية - للتقليل من مساحة التلوث - استمرار البنية الطبيعية والتي تعتبر إحدى القيم الإسلامية - الاصناف للزراعة التي تساهم في زيادة كمية التلوث - وحماية والتربة والتربة التي تساهم في زيادة كمية التلوث - الانحدار عن البناء بالقرب من الجوارح - ومحاري المياه الطبيعية - مع قطع الأشجار التي أو الأشجار المحلية - المجموعات المحلية - يمكن قطع الأشجار المحلية - أو الأصناف المحلية - زراعة التراكيب الحسنة أو المشتات حتى تكون - البيئات المحلية قد تكيفت جيداً مع المكان - إعادة الحياة المحلية الطبيعية والتربة - إعادة زراعة المناطق المتدهورة - طرد الطيور والمشاريع الصغيرة - إعادة الزرع المنظم	المستخدمين استخدام الماء و نقص انصاف التوزيع للمساكن و نقص على تدفق المياه على الأراضي و نقص على تدفق المياه على الأراضي و نقص على تدفق المياه على الأراضي
المكافحة من خلال الثروة المحلية		- إعزى الماء - الإدارة الموزونة لمعالجة استنزاف الماء والموارد الطبيعية الأخرى - عمل جمعيات للمساعدة الجيوب بتدوير مسارات المياه داخل الواحات	و نقص انصاف التوزيع للمساكن و نقص على تدفق المياه على الأراضي و نقص على تدفق المياه على الأراضي و نقص على تدفق المياه على الأراضي

ملاحظة: هذا الجدول هو نموذجي ويمكن تغييره وفقاً لاحتياجاتكم.

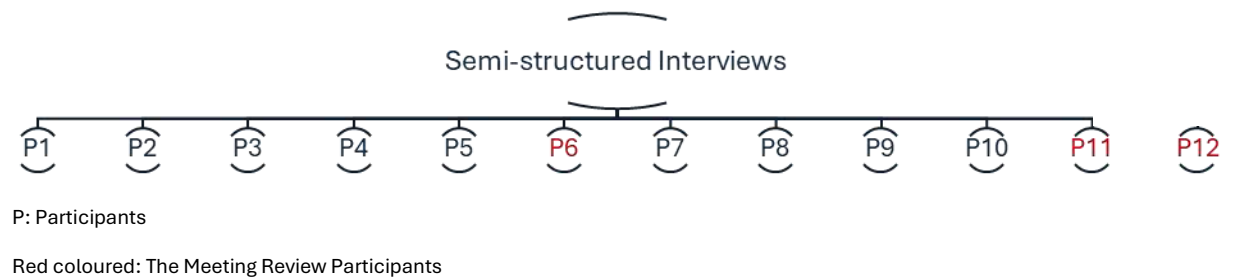
This is a page from the Result Review Form, where elders can indicate their agreement or disagreement and highlight points they wish to add or emphasize.

Appendix G: The Conceptual Master Plan Inspired By The TEK



This is the conceptual master plan inspired by TEK. It is proposed in a site that includes cultural heritage features and faces desertification issues (*Source: Drawing by the researcher*).

Appendix H: Numbering System—participants, interviews and review meeting



Appendix I: AIUla Journey Through Time Masterplan

(Source: RCU, n.d.-b)



Appendix J: Approval of the Amendment Ethics Application

Your ethics application has been approved as low risk – ETH23-8383

research.ethics@uts.edu.au <research.ethics@uts.edu.au>

Mon 10/16/2023 3:19 PM

[Redacted]
<[Redacted]>
[Redacted]
[Redacted]
[Redacted]

1 attachments (262 KB)

Ethics Application.pdf

Dear Applicant

Re: UTS HREC Ref. No. ETH23-8383 - "The New Relationship Between Green National Parks and Tourist Behaviours in Saudi Arabia (old title) Traditional Knowledge as a Catalyst for Ecosystem Enhancement, Community Wellbeing and Cultural Heritage Conservation in Saudi Arabia (New title)"

Your local research office has reviewed the amendment application for your above-named project and agreed that the amendments meet the requirements of the National Statement on Ethical Conduct In Human Research (2007). I am pleased to inform you that your amendment has been approved as follows:

1- I want to modify the number of workshops from one to three. 2- I want to modify the number of experts from three to ten.

This amendment is subject to the standard conditions outlined in your original letter of approval.

You are reminded that this letter constitutes ethics approval only. This research project must also be undertaken in accordance with all [UTS policies and guidelines](#) including the Research Management Policy.

You should consider this your official letter of approval. If you require a hardcopy please contact your local research office.

To access this application, please [click here](#). A copy of your application has also been attached to this email.

If you have any queries about this approval, or require any amendments to your approval in the future, please do not hesitate to contact your local research office or the Ethics Secretariat (Research.Ethics@uts.edu.au).

Ref: 12e

Appendix K: First publication (peer-reviewed conference paper)

Local Cultures – Global Spaces

WISDOM IN THE DUNES: UNDERSTANDING DESERTIFICATION FACTORS AND INDIGENOUS ECOLOGICAL KNOWLEDGE

Author:

ABDULRAHMAN S ALSHAMI* **, MARTIN BRYANT*, ANDREW TOLAND*

Affiliation:

*UNIVERSITY OF TECHNOLOGY SYDNEY, AUSTRALIA. **KING SAUD UNIVERSITY,
SAUDI ARABIA

INTRODUCTION AND OVERVIEW

Desertification poses increasing impact to one-third of the globe's land surface,¹ where it changes natural desert biomes into non-productive land, and thereby effects a reduction in productivity and ecological functioning.² While existing literature has commonly identified factors such as overgrazing, substandard land-use management and deforestation as contributors to desertification,³ some researchers have highlighted the role of declining traditional interactions between local communities and surrounding ecosystems.⁴ This has further implications: it is not only deleterious to natural ecosystems and the culture of communities that lived there, it also jeopardises significant cultural heritage sites and their environments.⁵ As Reed⁶ indicated, heritage conservation cannot be achieved without the ongoing involvement of local communities and their knowledge in a healthy environment.⁷ This paper explores this relationship in the northwest of like Saudi Arabia where desertification increase.⁸

Within the Middle East, a comprehensive indigenous ecological management system based on an understanding of the surrounding ecology developed over long spans of climate fluctuations, was developed to create a stable, interdependent relationship between local communities and surrounding natural resources. This system is known as *hima*, which literally means 'protected area'. It is a place where flora, fauna and other natural resources are protected from random harvesting and sustainably managed, monitored and used by local communities.⁹ It is the only practice that has remained constant for 1500 years to sustain the biodiversity of the Arabian Peninsula.¹⁰ Arguably, it is also a highly successful practice for combining natural preservation with human well-being.¹¹ This traditional practice involves techniques to combat desertification, harvest water and regenerate ecosystems.¹² This form of traditional ecological knowledge (TEK) is flexible, adaptable and tailored to the environmental context of a region. However, this practice has declined over the years due to multiple factors, such as changes in land management practices and shifting lifestyles within local communities.¹³ In many areas, *hima* has been abandoned altogether. Nevertheless, experts have indicated a need to study this system and understand how it works, since reviving these traditional practices may contribute to combating desertification and conserving natural and cultural heritage sites.¹⁴ The National Commission for Wildlife Conservation and Development's report confirmed the

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AMPS | Rochester Institute of Technology | Chinese University of Hong Kong | University of Melbourne

This paper can be accessed through this link: <https://amps-research.com/wp-content/uploads/2024/08/Amps-Proceedings-Series-37.2.pdf>

Appendix L: Second publication (peer-reviewed journal article)

Special Issue: Long-term intergenerational perspectives on urban sustainability transitions

Urban Studies

A *hima* traditional ecological knowledge perspective of the sustainability goals in AIUla's journey through time masterplan

Abdulrahman Alshami 

University of Technology Sydney, Australia
King Saud University, Saudi Arabia

Martin Bryant 

University of Technology Sydney, Australia

Andrew Toland 

University of Technology Sydney, Australia

Urban Studies

1–20

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Abstract

Saudi Arabia's 'Vision 2030' proposes a more diversified society and a less oil-dominated economy, enabled by several ambitious best-practice sustainability urbanisation projects, one of which is the 'Journey Through Time' Masterplan for the urban region of AIUla in the Kingdom's Hegra Valley. The Masterplan proposes an expansion and intensification of existing towns, economically supported by international tourism focused on the Hegra UNESCO World Heritage Site. It thereby couples tangible cultural heritage management with sustainable urban development. Yet, the AIUla Masterplan has shown little evidence of engaging with the intangible heritage of traditional ecological knowledge and practices, known in Arabic as *hima*, which have been intrinsically connected to the ancient heritage fabric for millennia. Based on interviews with community elders and traditional knowledge-holders, site observations of traditional practices and techniques, and a review of government documents and websites, this paper demonstrates that consideration of local *hima* practices has the potential to integrate urban sustainability transitions together with the preservation of tangible and intangible cultural heritage. It suggests that practices embedded in local *hima*, like water-use and land-use arrangements, offer sustainable resource management and disaster mitigation options for the AIUla scheme; and that *hima*'s intrinsic social dimension, and its culture of intergenerational transmission, offers opportunities

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Forthcoming accepted for publication by the journal