Chapter 19

In situ/ex situ: Geometries of density and spectra

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The site-oriented research work, workshops, and studio teaching discussed here lend from the phrase ‘landscape as laboratory’ (Fraguada 2018), emphasising the ability of the site to be the loci of both research activity and the generation of research questions. While not a new concept, the work also emphasises the implications of the use of the tool or apparatus on the site as a fundamental method. The relationship of a site to its abstract data sources, preparation for fieldwork and ritual onsite, and manner in which the student interacts with the site, are fundamental. This relationship was developed by the author in the research office Landskip, in collaboration with Ilmar Hurkxkens. It emerged from common work, and from our diverging application of those principles (Hurkxkens 2020), between the alps of Switzerland and the coastal regions of Australia. The particular thread of research discussed here focuses on aspects of interaction with the phenomena of site and its representative data, in relation to specific principles from twentieth century approaches to ecology.

The 1954 book, *The distribution and abundance of animals*, presented an attempt at a description of animal ecology that integrated a comprehensive understanding of all aspects of the interaction of non-vegetal organisms and their environment. The book charted the ecology of animal-based occurrence and was one of the first comprehensive studies of its kind. While the research referenced sites around the world, the authors noted they were inspired by the Australian context and environment, especially its extremes of climate and biodiversity (Andrewartha 1954), and relatively recent incursion of anthropic disturbance, however marked.

Importantly, it also sought to identify links between the environment and reasons for fluctuations in animal numbers. An environment with diversities that stretch between alpine and coastal, desert and tropical, temperate and arid, as well as its predilection to seasonal weather and climate extremes, made it the perfect research crucible; albeit one with often extreme reactions in local variations of local species. Researcher Dr. J. Davidson, to whom the book was dedicated, was quoted as seeing Australia as the perfect location in which to carry out this research. In this vein, it is potential for investigation in extreme environments that influenced the pedagogical framework of this particular form of site approach. Davidson’s “Bioclimatic

Zones of Australia” map, published posthumously in 1954 by his fellow researchers, differs greatly from current bioclimatic maps, this difference reasserting both the local tendency to extremes and the need for continuous reassessment of site.

The attempt to link ecologies to the occurrence of animals to multiple types of environmental influence and interaction challenged many previous notions of the word ‘ecology’ as discrete, or continuous, and rather as a series of ecologies that overlap and interact. Three principles were outlined in the manner of ecological study, each of which can inform our methods of approaching a site: that some experiments can only made in the field; that as complete a survey as possible should always be generated, with physiography, climate, soil, vegetation and living organisms included; and that the metrics, careful crafting of site experiments and modes of site understanding are conducted with awareness of the imperfect nature of data collection, avoidance of false equivalency and general distrust of the exact numbers, relying rather on tendencies and patterns (Andrewartha 1954).

These principles were not the genus of the studio site approach outlined here. However, they help to reinforce the foci and pedagogical reference for students undertaking fieldwork. Allowing them to work both in an analytical and phenomenological mindset, and differentiate local and distant approaches to site.

The complementary roles of onsite experiments and those works conducted in the remote laboratory are referred to henceforth as *in situ* and *ex situ* fieldwork. In situ fieldwork can be planned, executed, and documented in the same manner as scientific research, both with carefully calibrated and ad hoc site enquiry techniques, each revealing different qualitative site readings. Ex situ site work can allow the designer to work across scales, datasets, and logics, from the territorial to the chemical scale of the site. The physical limitations of in situ work mean resources usually require careful ex situ work to plan and define the scope and logistics of the fieldwork, and the relative abstraction of ex situ observations rely on the considered verification and codification, on site.

This approach to site is based on working professionally and in pedagogical modes throughout the world, and certainly influenced by the approach of Girot in Switzerland, among others. An iterative pedagogical mode of site input/output, or exchange can be installed, in which the designer can allow spatial data to inform the site work, with fieldwork as generator of entirely new spatial data for the site. This cyclical process feeds on the dichotomy of the gaze - within the site and outside it – an iterative loop that reveals thematics and holes in the datasets, and separates the phenomenology of site from the extrasensory characteristics of place (Girot 1999). The potential exists for treating each discrete research site as a focus for scrutiny with its own data and metrics. The further scope of site interaction lies in developing site-oriented tools which will reveal its specific characteristics and potential, a term which here does not imply intervention, yet acknowledges inevitable site transformation.

The focus on Australian coastal sites for this studio research revealed contrasting ecologies and anthropic influences. The first impression of site, like an anamorphic image, is difficult to unsee once seen. It is the thesis of this site approach, however, that it is possible for an act, an object, a tool, to activate another view of site. The strength of such tools is in calibration, to allow the viewer to unsee, or re-evaluate, the site through shifting metrics and lenses. A taxonomy of tools, historical and modern, and invented for specific sites, reveals that sophisticated contemporary tools subtly distance the user from specific site phenomena and the fundamental act of measurement.

Saussure’s Cyanometer from 1788 was a tool developed to determine the shades of blue of the sky from the Alps. It revealed the perceptual information particular to the site, and the water content of the air, as well as its shifts according to altitude. (Fischer 2015). Like twentieth century tools such as the soil texture triangle and soil colour indexes, they are tools that codify the data they represent; each creates a geometry or logic system for the specific data it describes. A complex combination of elements can be used to describe a wide variety of site phenomena, as demonstrated by comparing the recommended site kit of the national Swiss forest index (Düggelin 2020), with the author’s site kit from the August 2020 coastal site visit north of Newcastle. However, increasing complexity and sophistication of tools, from left to right, is not necessarily a positive development in pedagogic or immersive site process. Much of the work of the studio is about bringing the complex and refined measurements and site data back to the clarity and simplicity of the tools on the left of the scale.

Drones that steer themselves, cameras that expose colour/brightness automatically, videos that remove shake, microphones that remove background noise – each distances the observer from the specific site processes and conditions within which they are immersed. Each tool is simply an extension of the observer, severed. The resulting data and documents, rarified, instantaneous and optimized, are stripped of the feedback processes of their creation.

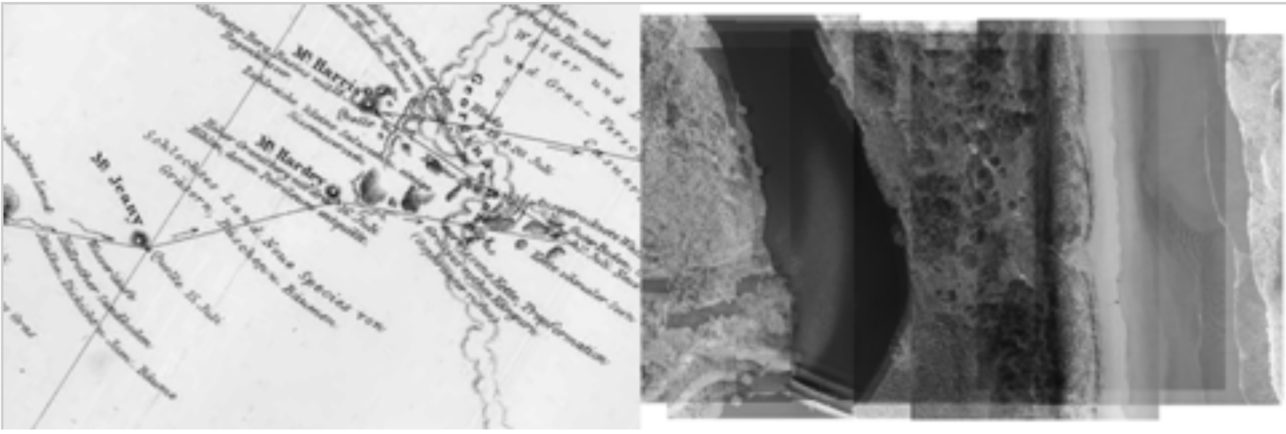

Figure 19.1: Tallows - (Left) historical + drone path Exploration map Western Australia, 1868, original in collection of the Author. (Right) UAV photographs over Tallow Beach, December 2019 .

This design research charts the pedagogic techniques, tools, and applications of fieldwork within the realities and data footprints of the realities of sites and their digital representative datasets. It focuses on the specific documents of field enquiry within a studio context and their implications, rather than the resulting design outcomes. It is possible both to harness the full technological capabilities of UAV platforms, while applying and transforming the data into a format as simple and linked to site as Saussure's Cyanometer.

Coastal Sites

Australian coastal tributaries that switch from fresh to brackish and then to saline water, or a site that experiences flux from sub-zero temperatures to drought and bushfires within months, best exemplify these extremes. Consider varied applications where a line is traced through the fieldwork within separate sites along the New South Wales coast: Tallow Beach and Rosedale, each sites of design research in 2020. Each was coordinated in close collaboration with Dr Penny Allan, and the research focused specifically on the site-based approach, data collection, the author's manipulation techniques, and how these are best exemplified in varied approaches of the resulting studio work. The specifics of each approach, and the relationship to data, were elaborated through the data and design documents created in this exchange. They began with the role of the field leader, or coordinator, deploying students onsite with specific foci, based on geographical taxonomies, rather than thematic groups. Therefore, the pragmatic landscape transect, especially in linear coastal sites, is both an ideal starting frame and neutral constant between sites.

The illusory nature of a comprehensive or complete image of site is well transferred to students through the analogy of the early exploration of Australia. Pictured (Figure 19.1, left) is the drawing of the expedition through the Western Australian desert by Dempster, Clarkson and Harper. The image shows a thin transect of the Western Australian desert, illustrating a short visual distance from the path travelled; on second glance it is entirely written in German, published 12 months after the original expedition, to great international scrutiny. The arduous journey was of great interest around the world, due in no small part to the extreme and alien landscape conditions. Such maps of desert exploration are directly analogous to modern UAV flights over a site. They give the illusion of overview, but document only a thin sliver or transect of the terrain over which they pass, with restricted operation, countless occlusions from vegetation and structures, each constrained by the realities of fuel, weather extremes, and the tyranny of the distance.

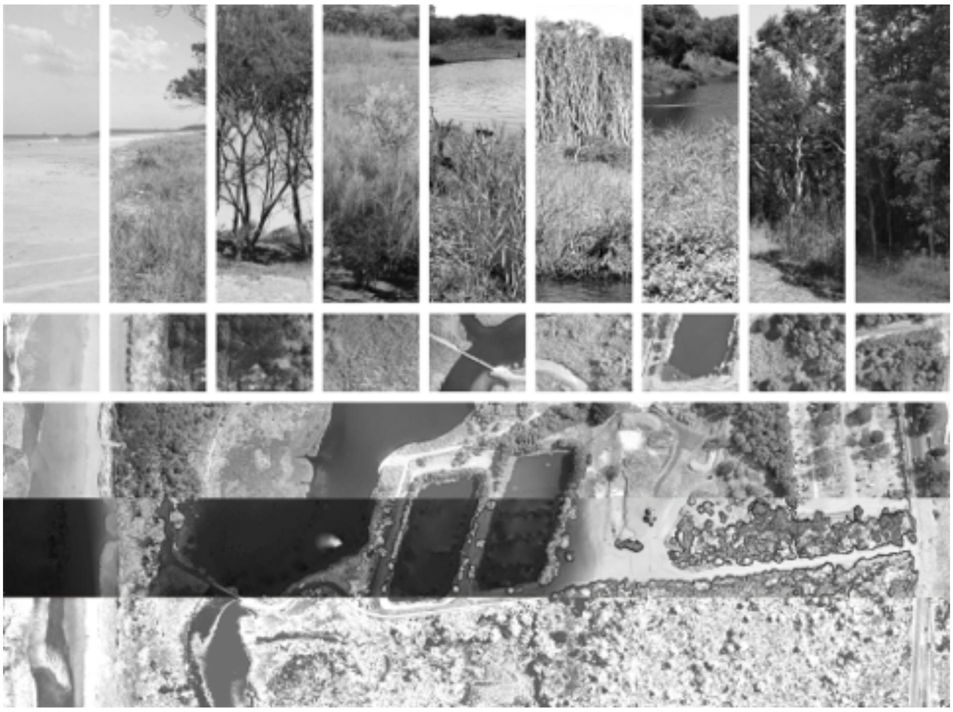

Figure 19.2: Tallows section analysis & survey outputs (Above: Jeremy Chivas, Bellow: Author)

The images to the right, taken on site on Tallow beach, New South Wales, give the impression of overview yet have a similar, limited scope; the closer they come to overview, the lower the resolution, the paradox of scale. The transect attempts to document the transition of beach to dunes, ICOLL (Intermittently Closed and Open Lakes and Lagoons) system, and dense coastal vegetation. Extensively mined for silica and other minerals in the 1940s, the dunes were entirely reconstructed. This has resulted in a complex system of care and conversion as invasive species are gradually culled and local vegetation replanted. The area is managed principally by the local Arakwal indigenous authority, in partnership with the Shire of Byron; this section illustrates several zones of care and jurisdiction, from Shire and New South Wales fisheries, to Arakwal National Park.

The illustrated transect demonstrates various modes of working onsite, from conventional, yet standardized transverse photographs of the dune system, to a UAV based photogrammetry scan, and calculation of the vegetation index (NVDI) and plant health from the infrared spectrum. The combination of these techniques can be extrapolated ex situ to determine species type, distribution, densities, and health. When combined with the local bore water readings for depth and salinity of the water table and Tallow Creek, a detailed and nuanced image can be generated of both the ecologies and factors contributing to gradual transformation of the dune system and the interventions into its water system. The same bore water data and drilling information accessed on this site has been extrapolated by the authorities to construct one of the world's largest seamless 3D geological models, stretching over the entirety of New South Wales. The model had been reconstructed from elementary physical data sources such as historical bore water drill sites, whether monitoring, agricultural, residential, or exploratory, and the Tallow site was later documented at the territorial scale (Melsom 2020).

Figure 19.3: Rosedale dune fluctuations - geometries of wind and gusts (Nathan Galluzzo)

The resulting in situ/ex situ extrapolation of data and site phenomena, above and below the ground, facilitate a view of the site with literal 'depth.' The resulting design research works to represent in one document the complex ecological processes and practices of care over the site, integrating exclusive interview and photographic documentation from local dune care archives. It extrapolates the role of anthropic maintenance and intervention required for some time in the future, as the dunes gradually retreat due to storm surge events of increasing frequency and severity.

The grain of information in such documents relies on a synthesis of UAV survey data, detailed analysis and extrapolation of the species identification and distribution, and careful reconstruction of local microclimatic response and techniques of cultural intervention. Such systems, going through massive shifts through the seasons of sand movement, cycles of deposition and erosion, vegetal flux and dense human use, require iterative cycles of in situ and ex situ analysis to map, understand, and project the future cultures of care necessary to balance the various factors testing these sites.

The second coastal site of focus is Rosedale, New South Wales, the site of the 2020 New Year's Eve fire event that devastated the community and the landscape. The design studio, run with Penny Allan, was a complex confluence of approaches, with detailed reconstruction of the event, and developing various approaches of living with fire (Allan 2020). The projects elaborated here demonstrate a specific reaction to in situ data, collected in March of 2020, and painstaking ex situ reconstruction, projection, and simulation.

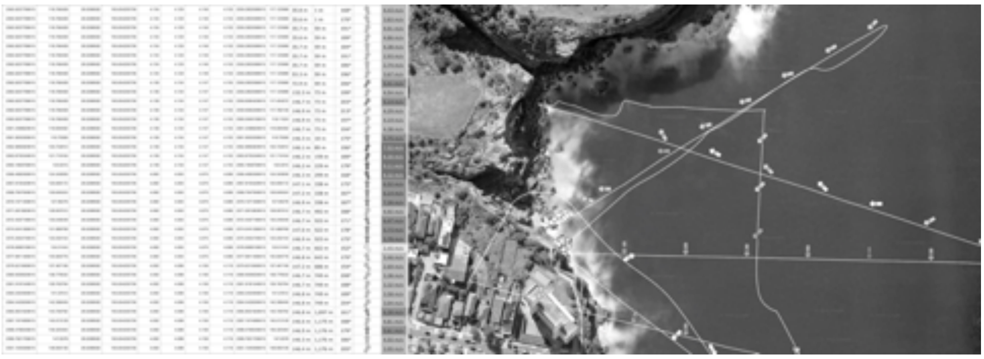

Figure 19.4: Wind data extracted from UAV sensor fluctuations off the New South Wales coast (Author)

The exceptional circumstances of the 2020 studio environment meant repeated visits to the site were not possible, increasing reliance on data collected during the first site visit. The projects took full advantage of the high-resolution aerial LIDAR point cloud data from the New South Wales government, and a UAV photogrammetry scan of the site, post fire event.

Enquiry into UAV data need not end with directly recorded data. The log files of the UAV itself can become a mine of data, as fluctuations in the motors of the UAV can be dissected later to reveal the air currents buffeting the forces acting upon it. This reveals the region's characteristic wind speeds, directions, and micro fluctuations, as well as microclimatic influences, whether obstacles, vegetation, or shifts in air pressure. An excellent example is vertical winds. These are characteristically difficult to map, given the dominance of the European concept of cardinal directions, and the ability of UAV stabilization systems to automatically compensate and effectively render such effects invisible. Especially noticeable in steep alpine terrains and along the stark coastal geologies of New South Wales, the dissection of the UAV's constant struggle to resist uncontrolled movement plainly maps these otherwise invisible forces. Elaborating these local effects to students has the potential to heighten their awareness of local microclimatic differences, and broaden their awareness of site beyond the visual spectrum.

Drones should best be thought of as sensory rather than flying visual platforms. All the sensors designed to automate and streamline their function also act upon and log the platform's resistance to the forces affecting it. The nature of this friction or resistance within its environment is analogous to the manner in which ships charted their speed through the counting of knots on rope, the relevant physical processes need only be harnessed and their metrics translated. It is however possible to reconnect and even amplify these lost signals, and create entirely new datasets and site legibility.

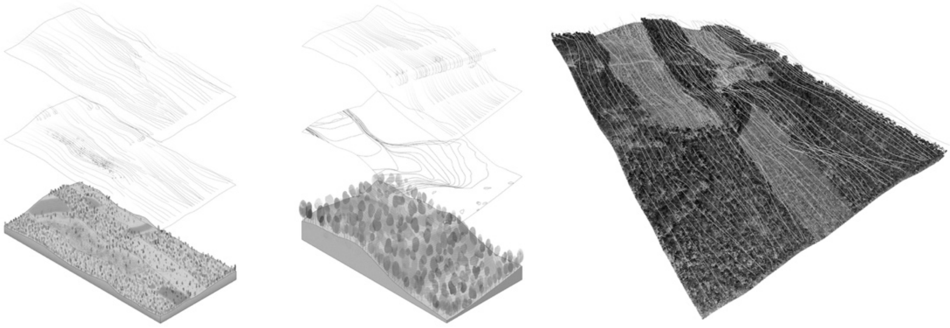

Figure 19.6: Rosedale wind movements (Freya Cameron)

The larger-scale schematic mapping of wind movements directly influenced an investigation into the relationship of fire spread rate, intensity, and ember creation. Working directly with a former Rural Fire Service specialist, high resolution canopy data was manipulated to generate alternate land management and forestry practices, a mosaic of canopy territorial canopy textures that directly influence and incorporate the relationship of terrain slope, orientation, and wind.

The point cloud colour is codified according to colour based on exposed ground, after a technique developed in collaboration with Luis Fraguada at the National University of Singapore. In this application, soil erosion and degradation are among the most substantive issues facing the landscape. As documented in the report on the 2019-20 fire season, perhaps the most worrying impact on biodiversity is the destruction and loss of topsoil due to the extent and intensity of the fires and following erosion (DPIE New South Wales 2020).

Detailed reconstruction of housing sites from point cloud data lead to a project focused on the archeology of fire, in which previous ruins become elements within the construction of communal habitation assemblages (Figure 19.6). It was only through comparing point cloud datasets that the true impact of the fires could be read in the landscape. When masked for anthropic elements, and combined with spectrum analysis techniques, the difference in biological diversity can be read in the imagery. The resulting reconfiguration of the site can be seen to mediate lost canopy density within construction elements, the ground plane opened for revegetation, habitat, and recontextualization of the ruined fragments.

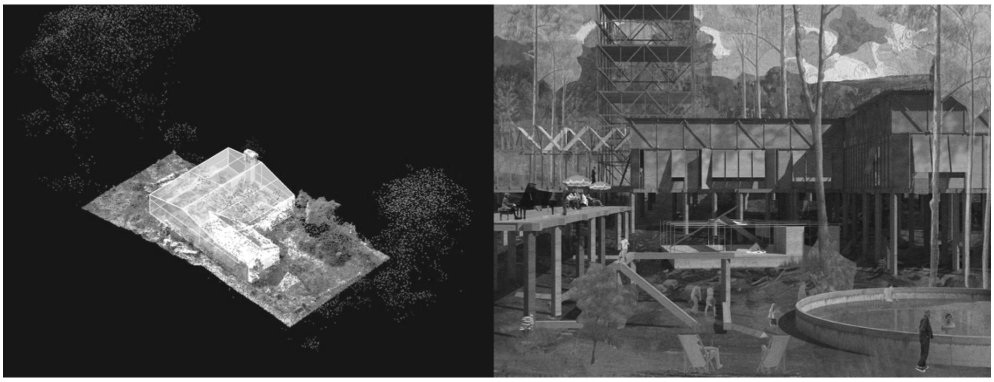

Figure 19.6: Rosedale pointcloud fragments - destruction & reconstruction (William McRoberts)

The current research into the extent of fire damage, and rate of recovery, brings the research full circle to geometries of site colour and texture, with 3D stratification of the colour spectrum. Photographs taken from

Rosedale in areas affected and avoiding damage were dissected for their spectrum and histograms, and turned into geometries of colour distribution and abundance.

Despite the often intense colour apparent in epicormic shooting and regrowth, the comparative lack of diversity of colour hues is perhaps the largest indicator of unbalanced recovery in this landscape. The events are often a chance for non-endemic species to spread into the space vacated by fire. The resulting selective 3D colour profiles of the drone imagery reveal loss of spectra, limited diversity of the epicormic shoots, and exposure of soil tones and open ground. The volume of 3D colour profiles, and their comparison and overlay, reveals which areas of the spectrum are missing, and can be isolated to specific species and ground cover.

Combining NDVI imagery spectrum data with the vegetal colour range, as with the Tallow site scans, allows the potential for more accurate dissection of species, vegetation health, and coverage on the ground. Through this process, and when combined with extra-visual data, new metrics of health, range of variation, dryness, plant stress, and diversity can be measured. Specific biotopes and plant communities can be isolated within dense vegetation with this method. The stark contrasts of these environments lend themselves well to developing tools and methods. Even for the most banal of sites we can perhaps envision a tool to best encapsulate that landscape – the Sandometer of the Tallow Dunes, or the Carbonometer of specific stands of species affected by fire, and their underlying soils – to understand the extent and intensity of damage and recovery strategies.

Site data published this year from the alpine forests of Switzerland confirm this shift, with forests recently prone to drought and explosions in insect numbers (Brändli 2020). Published as part of the same study that outlines site equipment and methods applied by LANDSKIP in the field, the document reinforces the rapid change in the environment, both in empirical data and in the visible spectrum as measured both through data analysis and on foot, painstakingly measuring the distribution and abundance of Switzerland's forest substance. Similar to the data contained in Davidson's 1954 "Bioclimatic Zones of Australia," a constantly shifting image of ecology has replaced the stable models proposed with such confidence earlier in the twentieth century. These accelerating shifts amplify the importance of site-based work and incremental observation.

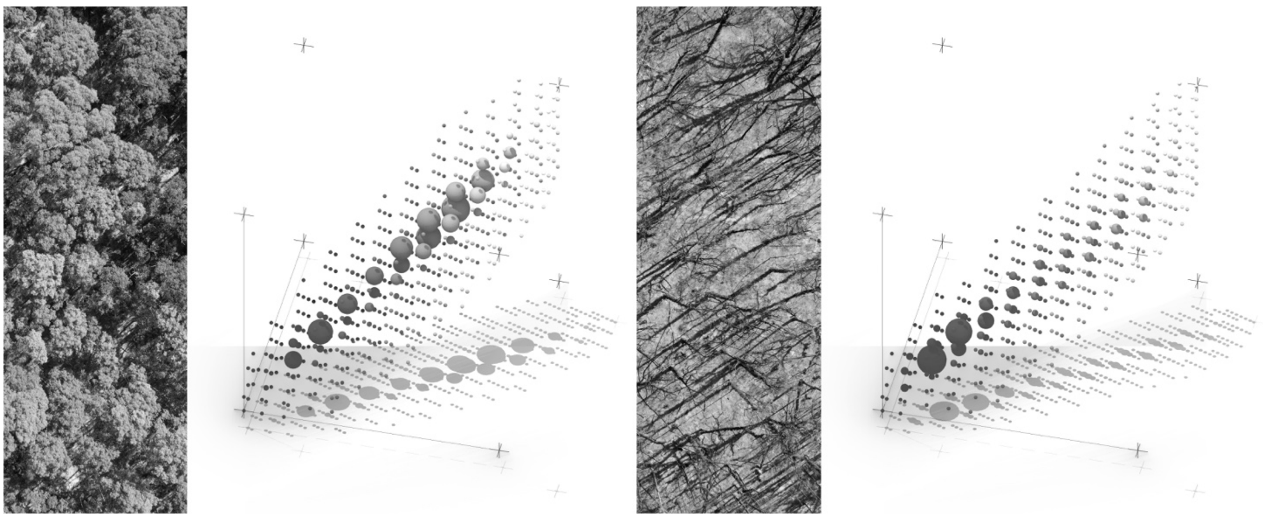

Figure: 19.7: Pre and post-fire spatial colour profiles (Author)

Rather than treating this change as pathology, there is a chance to work in a constructive manner with knowledge of shifts in these landscape sites, strengthening emerging synergies of habitation and ecology. With increasing variability in climate, weather, and the environment, the world is shifting to a mode of constant observation, of difference and measured abnormality. Even as ecologies shift, the abundance and distribution of all ecological material will be in a state of constant flux, and the relationship between historical data and onsite observation and data generation even more essential. Rather than empirical numerical data, perhaps the visual and textural, and shifts in densities and movement, hold the key to understanding, and working within, the shifting parameters of the site.

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