UTS UNIVERSITY OF TECHNOLOGY SYDNEY

Biodiversity and ecological function in an age of biotic redistribution

by Erick Lundgren

Thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

under the supervision of Daniel Ramp and Arian Wallach

University of Technology Sydney
Faculty of Science

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Certificate of Original Authorship

I, Erick Joseph Lundgren, declare that this thesis is submitted in fulfilment of the requirements of the award of Doctor of Philosophy, in the School of Life Sciences, Science 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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List of Papers and Statement of Author Contribution

This thesis is a compilation of chapters and 4 published/publishable manuscripts. Each paper is formatted for their destination journals, except for referencing styles which were standardized throughout.

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and relativist scenario) affected prioritization simulations both by removing species (if delisted) and by changing priority weighting (see text).

Thesis Abstract

The human-assisted dispersal of species through introductions is a form of anthropogenic change that has received significant attention in conservation biology research and in conservation policy. Until recently, introduced biodiversity has been considered by most to be synonymous with anthropogenic harm. However, the empirical premises supporting this have been criticized as evidence has falsified or qualified the claims about introduced species as biodiversity threats and as the underlying normative value of *nativism* has come increasingly into focus. This thesis asks how suspending the value of nativism might alter how we understand biodiversity change, the ecology of introduced species, and conservation policy. This thesis focuses primarily on introduced herbivores, a globally endangered functional group that has experienced significant human-caused declines since prehistoric extinctions in the Late Pleistocene.

I begin by analyzing how the twin anthropogenic forces of extinction and introduction have shaped herbivore functional diversity since the Late Pleistocene, finding that introduced herbivores restore many lost ecological functions and make assemblages more similar to the pre-extinction past than native ones. I then describe ecosystem engineering by introduced equids, who dig wells to groundwater in desert drainages. In doing so, introduced equids restore a capacity to buffer desert water availability and facilitate plant and animal communities. While introduced herbivores are functionally similar to extinct species and can have facilitative relationships with native species, little is known about whether the small-bodied predators that survived the Late

Pleistocene extinctions can influence them. In Chapter 4, I report on a trophic cascade driven by cougar (*Puma concolor*) predation on wild donkeys (*Equus africanus* asinus) which significantly altered their behavior and their effects on desert wetlands.

Finally, I synthesize this work by asking to what extent broadening our value systems changes conservation priorities. I empirically test several value scenarios, including *nativism* and more inclusive alternatives, by conducting spatial prioritization simulations to find optimal solutions to protect threatened species. I find that while the scale of global endangerment overshadows the scale of introductions, including introduced species as biodiversity provides new opportunities to prevent extinctions and shifts conservation priority into overlooked landscapes.

Like any applied scientific discipline, conservation biology is comprised of both normative values and empirical facts. It is, however, imperative that conservation biology interrogate its values as robustly as its facts. This thesis suggests that expanding conservation values offers new understandings of ecological change, reveals unseen ecological relationships, and provides new solutions to prevent global extinctions.