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Island tales and beyond

Messages from Islands – A Global Biodiversity Tour, by Ilkka Hanski, 2016

The University of Chicago Press, 272 pp., ISBN: 9780226406305

One of the most repeated mantras in ecology is that islands are natural laboratories for understanding biodiversity. And this is correct; there is no question about the value of the knowledge obtained from centuries of island research, from the voyages of Charles Darwin and Alfred Wallace to islands that are immortalised in evolutionary theory, to Robert MacArthur and Edward O. Wilson's revolutionary Equilibrium Theory of Island Biogeography (ETIB; MacArthur and Wilson 1963, 1967), among many other naturalists and researchers that have focussed on these small, isolated, pieces of land. Interest in islands has continued (e.g. Warren et al. 2015, Santos et al. 2016, Patiño et al. 2017), probably associated with the increasing availability of data on species distributions, ecology, and evolutionary history, merged with current knowledge of islands' past and present geological characteristics.

Ilkka Hanski's *Messages from Islands: A Global Biodiversity Tour* reinforces this general view of islands as story tellers of the natural (and unnatural) world that surrounds us. Using six different islands, each represented by a chapter, this book takes the reader through topics from describing biodiversity, how it is generated, and why it is important, to changes through time, and how mankind has caused many of these. This is done through a narrative that is based on the late Ilkka Hanski's personal and research experiences, and his own opinion on some controversial topics, giving this book an autobiographic flavour.

The book begins with Borneo and Hanski's research on this island's dung beetle communities during his years as a PhD student. In this first chapter, we are introduced to the terms *species*, *habitat* and *ecosystem* in a simple and straightforward way. There is also an account of how much biodiversity is thought to exist, and how it has changed during the past millions of years through

bursts of speciation and extinction, leading to the current distribution of diversity (e.g. the latitudinal diversity gradient). Hanski also critically assesses the negative impact of mankind's actions on biodiversity, a recurrent theme throughout the book.

The second chapter builds on the processes that generate biodiversity. Speciation is explained using the Galápagos finches as an example of natural selection. Another of Hanski's long term projects was devoted to the diversity of dung beetles in Madagascar, here used as an example of an adaptive radiation. Coevolution can generate biodiversity, for example through the evolutionary arms race that occurs between plants and insect herbivores, and pollinators. In both cases, the appearance of key innovations in some taxa has allowed an increase in speciation rates. The effects of evolution can be seen at very small temporal scales. In under 10 years, beak morphology and body size of Galápagos finches changed considerably after an extreme climatic event, which caused a change in the direction of natural selection (Grant and Grant 2014).

The third chapter explores the notion that biodiversity is not static and can change through time. Hanski's recurrent visits to Haminanluoto, a 2-ha island in the eastern part of the Gulf of Finland, and his observations of its bird community since his childhood, together with his PhD research on British dung beetles, introduce the reader to the pattern of species turnover, i.e. the maintenance of species richness of a particular region despite changes in the identity of the species present. Changes in biodiversity can include species characteristics such as body size. Overall, animal size has been increasing through evolutionary time, a pattern known as Cope's rule (Alroy 1998). However, this tendency has been changing since the appearance of our own species, an event

that culminated with the decline of the Pleistocene megafauna and continues today. Climate is also an important determinant of change in species distributions. In the present scenario of human-induced climatic change, species are left with three options: move to other suitable areas, adapt to current conditions (at the individual or population level), or go extinct. Different taxa are given as examples of these different outcomes, but many studies estimate the imminent extinction of an alarming percentage of species if no action is taken (e.g. Thomas et al. 2004).

Chapter four explores species movements. The blowflies of La Gomera Island (Canary Islands, Spain) exemplify the taxon cycle described by Edward O. Wilson that links habitat selection and degree of ecological specialisation (Wilson 1961). Species can be moved intentionally or unintentionally by humans, and islands are highly vulnerable to alien species. Indeed, native species might be displaced by these newcomers, probably due to a lower competitive ability. Conservationists are aware of this threat and have developed lists of the most invasive species, some of which already occur on islands. Human-induced dispersal has led to homogenisation of floras and faunas, in which generalist species tend to thrive and specialist species become more vulnerable to extinction. However, some alien species were introduced by humans for a particular well-justified purpose (e.g. introduction of dung beetles in Australia, for decomposing cattle dung and, consequently, to control bush and buffalo fly populations). In an attempt to save some species from extinction, conservationists are debating species translocations, as these might allow spread of populations in fragmented landscapes, or avoid inbreeding in small populations.

The next chapter covers habitat loss and fragmentation, a topic that has been highly influenced by island theory, particularly by the ETIB. Briefly, this theory predicts that the number of species on an island depends on the immigration and extinction rates, which in turn depend on the islands' isolation and area, respectively. These principles were applied to fragmented landscapes, influencing conservation theory and metapopula-

tion research (i.e. a set of populations that occur in a network of habitat patches), a topic to which Hanski devoted many years of his scientific career. This chapter is represented by the Åland Islands in Finland, and summarizes Hanski's own research with metapopulations of the *Glanville* fritillary butterfly that inhabits this archipelago. It also discusses extinction thresholds, their connection with habitat loss and fragmentation, and extinction debt, finishing with Hanski's proposition of the third-of-third rule, that each country should designate a third of its territory as conservation landscapes distributed evenly across space, and then protect a third of such landscapes.

The sixth and final chapter explains why biodiversity should be maintained. Hanski was involved in a long term study on the cyclical dynamics of lemming populations and their associated predators in Greenland, and uses this research to introduce community and population stability and explain how these can be affected by climate change. Many other studies indicate that biodiversity is a necessary feature for achieving higher levels of productivity and for maintaining ecosystem functioning and stability in the long term. Conservation and land management practices therefore need to be designed so to maintain and promote biodiversity. The book ends with an alarming message regarding our planet's future, as the present lack of action for reverting the increasing trend of biodiversity loss is putting all of Earth's life in danger, including ourselves.

Those particularly interested in island research might be misled by the book's title. The main focus is not islands; instead it gives the reader a general description of biodiversity using a style suited to the general public, while also providing many examples of the classical and modern research that has helped us understand how our planet works. The book can be a bit repetitive in some sections, as the author covers the same topic in different chapters, but this, of course, is also a reflection of how everything is intertwined in nature. This book is not adequate for those looking for a deep conceptual review of Hanski's research or a textbook about biodiversity. However, I still highly recommend it for a sci-

entific audience, as well as to readers interested in popular science, because it sums up in an engaging manner a lifetime of research by one of the most influential ecologists of the past three decades, demonstrating how each little piece of evidence can contribute to an overall picture of how our planet functions.

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