



— Special Issue —

Island Plant Biology: Celebrating Carlquist's Legacy

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Introduction to the Special Issue: Advances in island plant biology since Sherwin Carlquist's *Island Biology*

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Forty years ago, Sherwin Carlquist's seminal book *Island Biology* proposed a series of hypotheses that have since guided considerable research in island biology. This Special Issue focuses on new developments in five areas of island biology: island biogeography, systematics and evolution, plant–animal interactions, global change, and conservation.

Kim R. McConkey and Donald R. Drake

Low redundancy in seed dispersal within an island frugivore community

AoB PLANTS (2015) 7: plv088 doi:10.1093/aobpla/plv088



Flying foxes (large fruit bats) play a vital function in dispersing seeds within a Pacific archipelago. More than 75% of plant species eaten by flying foxes, and that had large fruits, were not dispersed effectively by any other animal.

Even when plant species had alternative dispersers, these frugivores were often unable to compensate for flying foxes when their role was limited by low numbers. The low functional redundancy within this island system may be characteristic of other island communities which typically have very low species diversity.

Luís Silva, Elisabete Furtado Dias, Julie Sardos, Eduardo Brito Azevedo, Hanno Schaefer, and Mónica Moura

Towards a more holistic research approach to plant conservation: the case of rare plants on oceanic islands

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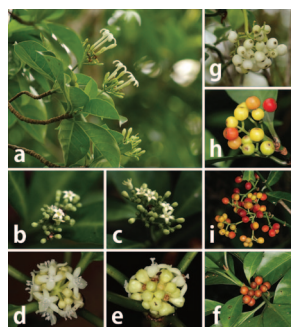
Research dedicated to rare endemic plants is usually focused on one particular aspect. However, holistic studies, addressing several key issues, might be more useful, supporting management programs

while unravelling basic knowledge about ecological and population level processes. In this paper a more comprehensive approach to research is proposed, encompassing: phylogenetics/systematics, pollination biology and seed dispersal, propagation, population genetics, species distribution models, threats and monitoring. The authors applied this research approach to *Veronica dabneyi*, an endangered chamaephyte endemic to the Azores, showing how it could support more effective recovery plans.

Kenta Watanabe and Takashi Sugawara

Is heterostyly rare on oceanic islands?

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While many studies of reproductive systems targeting island plants have focused on the occurrence and evolution of dioecism, only a handful of studies have investigated the occurrence of heterostyly on oceanic islands. In this paper, the authors review reproductive studies of heterostyly on oceanic islands, with special emphasis

on the heterostylous genus *Psychotria* as a model system. They conclude that careful examination of correlations between breeding systems and geographical/historical conditions are needed to understand the general patterns of heterostyly on islands.

Dennis M. Hansen

Non-native megaherbivores: the case for novel function to manage plant invasions on islands

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Author Dennis Hansen proposes that in specific ecosystems, introductions of carefully vetted, non-native species could provide a net conservation benefit. On many islands, non-native species are increasingly used as ecological replacements for extinct native species, reinstating a

herbivory regime that largely benefits the native flora. Based on these efforts, he suggests introductions of non-native megaherbivores to islands that are threatened by invasive plants, but which never harbored native megaherbivores, as a conservation management tool. He argues that large and giant tortoises are ideal candidates and that, as an easily-regulated adaptive management tool, this proposal represents an innovative, hypothesis-driven approach to island conservation.

Pablo Vargas, Yurena Arjona, Manuel Nogales, and Ruben H. Heleno

Long-distance dispersal to oceanic islands: success of plants with multiple diaspore specializations

AoB PLANTS (2015) 7: plv073 doi:10.1093/aobpla/plv073



After more than 180 million years of evolution, angiosperms have acquired multiple fruit and seed types. Oceanic islands offer an ideal framework to test the advantage of bearing multiple

sets of diaspore traits by a single species using its geographic distribution. Contrast analyses between the floras of Europe (Portugal) and Azores revealed a meager advantage for species with two sets of diaspores vs. one set or none. A general trend of a higher number of islands colonized by species with a single set and two sets than by species with no traits related to long-distance dispersal (unspecialized) was found.

Koji Takayama, Patricio López-Sepúlveda, Josef Greimler, Daniel J. Crawford, Patricio Peñailillo, Marcelo Baeza, Eduardo Ruiz, Gudrun Kohl, Karin Tremetsberger, Alejandro Gatica, Luis Letelier, Patricio Novoa, Johannes Novak, and Tod F. Stuessy

Genetic consequences of cladogenetic vs. anagenetic speciation in endemic plants of oceanic islands

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This paper presents the first comparison of the genetic consequences of two different types of speciation in plants of an oceanic island. Using two different DNA methods, genetic data were obtained from more than 4000 plants from the two major islands of the Juan Fernández Archipelago (Chile). Results show that

some immigrant populations undergo major splitting events and harbor limited genetic diversity within each evolving line. In contrast, other immigrant populations establish and enlarge, but never split, hence accumulating higher levels of genetic diversity.

Inger Greve Alsos, Dorothee Ehrlich, Pernille Bronken Eidesen, Heidi Solstad, Kristine Bakke Westergaard, Peter Schönswetter, Andreas Tribsch, Siri Birkeland, Reidar Elven, and Christian Brochmann

Long-distance plant dispersal to North Atlantic islands: colonization routes and founder effect

AoB PLANTS (2015) 7: plv036 doi:10.1093/aobpla/plv036



This study provides new knowledge of two processes that are important for plant adaptation in a changing environment: 1) long-distance dispersal patterns, and 2) genetic founder effect on islands. Although the theoretical

framework for the genetic founder effect on islands was proposed in 1973, Alsos et al. are the first to quantify it in relation to island size, dispersal distance, and plant traits. In addition, their genetic results are mainly coherent with post-glacial colonization rather than *in situ* glacial survival, and should therefore bring a final end to the 140-year-long glacial survival–*tabula rasa* debate among northern biologists.

Paul G. Wolf, Carol A. Rowe, Joshua P. Der, Martin P. Schilling, Clayton J. Visger, and John Thomson

Origins and diversity of a cosmopolitan fern genus on an island archipelago

AoB PLANTS (2015) 7: plv118 doi: 10.1093/aobpla/plv118



Isolated oceanic islands are characterized by patterns of biological diversity different from those on continents. In this study, nucleotide sequences from chloroplast and nuclear genes were used to

examine the origins and diversity of the cosmopolitan fern genus *Pteridium* on the Galapagos Islands. The authors found evidence for multiple origins of the widespread allotetraploid *P. caudatum*. They also show that the Galapagos Islands are home to *P. caudatum* as well as diploid *P. esculentum* subsp. *arachnoideum* and possible hybrids between the two. Haplotype diversity indicates that *Pteridium* has colonized the islands multiple times and probably from diverse mainland sources.

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Janice M. Lord

Patterns in floral traits and plant breeding systems on Southern Ocean Islands

AoB PLANTS (2015) 7: plv095 doi:10.1093/aobpla/plv095



Little is known about floral biology in the Southern Ocean region (45°–55°S), despite the World Heritage status of some areas. Typical pollinators are rare on these cold, remote islands, yet some plants have showy flowers, suggesting insect pollination, or separate sexed flowers requiring cross-pollination.

This study analyzes data for 321 species on 11 Southern Ocean island groups. Separate sexed flowers are common compared with other high latitude islands, but a reliance on biotic pollination may limit species distributions. Given the vulnerability and uniqueness of these floras, a greater effort needs to be made to understand their reproductive ecology.

Janet M. Wilmschurst, Matt S. McGlone, and Chris S. M. Turney

Long-term ecology resolves the timing, region of origin and process of establishment for a disputed alien tree

AoB PLANTS (2015) 7: plv104 doi:10.1093/aobpla/plv104



Alien plants are a pervasive environmental problem, particularly on islands where they can rapidly transform unique indigenous ecosystems. However, it is often difficult to

determine with confidence if a species is native or alien, especially if establishment occurred before historical records. This can present a management challenge: for example, should such taxa be eradicated or left alone until their region of origin and status is clarified? In this paper the authors show how combining palaeoecological and historical records can help resolve such dilemmas, using as a case study the tree daisy *Olearia lyallii* on the remote New Zealand subantarctic Auckland Islands.

Philippe Birnbaum, Thomas Ibanez, Robin Pouteau, Hervé Vandrot, Vanessa Hequet, Elodie Blanchard, and Tanguy Jaffré

Environmental correlates for tree occurrences, species distribution and richness on a high-elevation tropical island

AoB PLANTS (2015) 7: plv075 doi:10.1093/aobpla/plv075

This article focuses on the distribution of trees on a high-elevation tropical island of the New Caledonian archipelago. The aim was to determine how the variety of environments occurring on this island (in terms of elevation, rainfall, substrate and vegetation types) shapes the distribution of tree

species. The authors analyzed the distribution of 702 native rainforest species through approximately 40,000 occurrence records and GIS environmental layers. Results showed that species exhibit high environmental tolerance while their distribution is spatially highly aggregated. They concluded that tree species distribution in New Caledonia is shaped by dispersal limitation rather than by environmental specialization.

Liba Pejchar

Introduced birds incompletely replace seed dispersal by a native frugivore

AoB PLANTS (2015) 7: plv072 doi:10.1093/aobpla/plv072

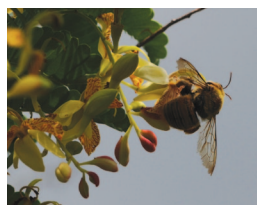


In an era of widespread extinction and invasion, understanding the functional role of native and introduced birds in ecological processes is increasingly important. This study compared seed rain in the presence and absence of Hawaii's last abundant native frugivore, and found that introduced birds were an imperfect substitute. In the absence of the native bird, seed rain

was less frequent, less species rich, and biased towards smaller seeded plants. To maintain diverse island plant communities, conservation strategies in Hawaii should focus on restoring functional populations of native dispersers, rather than relying on introduced species to fill this role.

Anna Traveset, Susana Chamorro, Jens M. Olesen, and Ruben Heleno Space, time and aliens: charting the dynamic structure of Galápagos pollination networks

AoB PLANTS (2015) 7: plv068 doi:10.1093/aobpla/plv068



Alien species can severely disrupt the structure, function and stability of native communities. Traveset and colleagues evaluated the structure of pollination networks in the three main habitats and in the two seasons on the two most

disturbed Galápagos Islands, and investigated how such structure is influenced by invasive plants. Alien plants integrate easily into the communities, but show low impact on overall network structure, except for an increase in network selectiveness. The highly invaded and low diversity humid zone showed the highest nestedness and the lowest modularity. Both pollinators and plants were more generalized during the hot season, when most plants were flowering and networks became more nested.

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Maria M. Romeiras, Filipa Monteiro, M. Cristina Duarte, Hanno Schaefer, and Mark Carine

Patterns of genetic diversity in three plant lineages endemic to the Cape Verde Islands

AoB PLANTS (2015) 7: plv051 doi:10.1093/aobpla/plv051

In an effort to better understand the evolution of the vascular plant flora of the Cape Verde Islands (Macaronesian Region), this study provides an updated checklist for the endemic vascular plants of the Cape Verde Islands and compares patterns of genetic diversity within three endemic plant lineages. The detected levels of genetic differentiation between islands indicate the existence of overlooked (cryptic) taxa in all three lineages, in the genus *Umbilicus* possibly at species level. These findings indicate that plant diversity in Cape Verde is higher than previously thought and highlights the need for additional studies.

E. M. Wandrag, A. E. Dunham, R. H. Miller, and H. S. Rogers

Vertebrate seed dispersers maintain the composition of tropical forest seedbanks

AoB PLANTS (2015) 7: plv130 doi: 10.1093/aobpla/plv130



Seed dispersal is considered a key mechanism through which the structure and function of forests is maintained. Testing this can be difficult because the large scale over which dispersal operates makes it difficult to examine in a meaningful

way. Using the near complete loss of native vertebrate seed dispersers from the island of Guam the authors examine the importance of seed dispersal for maintaining forest seedbanks. They find that seed dispersers have a strong influence on the species composition of seedbanks. Without seed dispersers, seedbanks no longer serve to increase the species pool for tree regeneration following disturbance.

Christopher N. Kaiser-Bunbury and Nico Blüthgen

Integrating network ecology with applied conservation: a synthesis and guide to implementation

AoB PLANTS (2015) 7: plv076 doi:10.1093/aobpla/plv076

Ecological networks are a useful tool to study the complexity of biotic interactions at a community level. The authors introduce a framework for network analysis to be harnessed to advance biodiversity conservation by using plant–pollinator networks and islands as model systems. Conservation practitioners

require indicators to assess management effectiveness and validate overall conservation goals. They propose the use of several network metrics that indicate human-induced changes to plant–pollinator communities, and illustrate an implementation pathway to successfully embed a network approach in biodiversity conservation. They also list potential obstacles to the framework, highlight the shortfall in experimental network data, and discuss solutions.

Aarón González-Castro, Suann Yang, Manuel Nogales, and Tomás A. Carlo

Relative importance of phenotypic trait matching and species' abundances in determining plant–avian seed dispersal interactions in a small insular community

AoB PLANTS (2015) 7: plv017 doi:10.1093/aobpla/plv017

In this paper the authors take advantage of the simplicity of an insular community to evaluate the relative importance of species' phenotypic traits and species' abundance in determining fruit–avian disperser interactions, at both network and pairwise interaction levels. The authors innovatively include fruit nutrient compounds in fruit–avian network analyses. Although the best way to predict plant–avian interactions was based on both phenotypic traits and species abundance, the most important factor to explain these mutualistic interactions was fruit–beak size overlap, followed by species abundance and fruit nutrient compounds. This work will encourage further studies to look for similar patterns in more species-rich communities.

Aaron B. Shiels and Donald R. Drake

Barriers to seed and seedling survival of once-common Hawaiian palms: the role of invasive rats and ungulates

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Loulu palms (*Pritchardia* spp.) once dominated many lowland ecosystems in Hawaii, and non-native rats (*Rattus* spp.), ungulates (e.g., pigs *Sus scrofa*), and humans have been proposed as major causes of their decline. Using field and captive feeding trials, the authors experimentally determined the vulnerability of seeds and seedlings of two species of *Pritchardia*. Their findings are consistent with the hypothesis generated from palaeoecological studies indicating that introduced rats may have assisted in the demise of native insular palm forests. Future conservation efforts involving *Pritchardia* should prioritize the reduction of rat predation on the plant recruitment stages preceding seedling establishment.