CHAPTER

13

Picking Up The Pieces: Botanical Conservation on Degraded Oceanic Islands

MIKE MAUNDER
ALASTAIR CULHAM
and CLARE HANKAMER

"Tropical islands can provide a preview of the environmental situation that is likely to become more prevalent on the world's continents in the future. These islands typically have high population densities, exhibit highly fragmented landscapes, and have already experienced significant extinction events."

(McNeely *et al.* 1995)

"Most of the research about species extinction has been conducted on islands because islands are controlled environments and scientists can get drinks with little umbrellas in them there."

(O'Rourke 1994)

Historical debates about environmental degradation on oceanic islands acted as crucibles for the evolution of modern conservation thought (Grove 1995). These largely colonial debates recognized the link between forest loss and watershed decline and the possibility that habitat loss can result in species loss. Currently, oceanic islands are manifesting very high levels of extinction that demand urgent and innovative approaches to conservation. The paradigms established for continental areas, based primarily on the establishment of protected areas, are not sufficient to ensure the survival of the highly modified biotas and ecologies of many oceanic islands. On such islands the habitats prior to human colonization are largely destroyed, the original ecological processes lost or diverted, and the populations of endemic taxa severely reduced and fragmented. To salvage endemic species and their ecologies, habitat conservation needs to be matched with intensive species management and habitat restoration.

P. L. Fiedler et al. (eds.), *Conservation Biology*

ISLAND ENVIRONMENTS AND SPECIES LOSS

Oceanic island ecosystems have a unique evolutionary history as a result of their geographic isolation and small size (Mueller-Dombois 1981). As oceanic islands were formed, initial plant colonizers originated from continental floras. This colonization process resulted in patterns of taxonomic diversity quite different to those found on the source continents. Disharmonious island floras, differing in composition and proportion of plant families in comparison with the source area, share a number of characteristics (derived from Eliasson 1995):

(1) Adaptive radiation: An original founder taxon gives rise to a variety of species utilizing the available ecological niches on an island. The Asteraceae family is a classic example, e.g., *Argyranthemum* spp. in Macaronesia (Ortega, Jansen, and Santos-Guerra 1996) and the Hawaiian silversword alliance (Baldwin, Kyhos, and Dvorak 1990).

(2) Island woodiness: A number of well known plant families and genera exhibit a pattern of woodiness on islands not observed in continental areas, for instance, *Chenopodium* spp. (Chenopodiaceae) in Hawaii and Archipelago Juan Fernández.

(3) Loss of dispersability: Fruits of island species may show a reduced dispersal ability when compared with putative continental ancestors. For instance, endemic species of *Bidens* (Asteraceae) in Hawaii have reduced or no barbed awns associated with the epizoic dispersal characteristic of continental species.

(4) Changes in reproductive biology: The proportion of dioecious species seldom exceeds 3% on continental areas, but often exceeds 10% on island floras.

Patterns of colonization and radiation have resulted in rich floras, characteristically high in endemism, often derived from a limited number of founder taxa. These unique assemblages of plants on oceanic islands are threatened by a variety of human-induced factors. None of these are unique to islands but are most dramatically manifested on the vulnerable island floras. The introduction of exotic animals and plants by man is cited as the single most destructive force acting on Hawaiian ecosystems (Mueller-Dombois and Loope 1990; see chapters 11 and 12). Table 13.1 illustrates some of the major threats to the biodiversity of six oceanic islands/island archipelagos.

Historical Patterns of Habitat Modification and Species Loss

Island degradation is arguably as old as the human colonization of islands. Archaeological evidence suggests that European Mediterranean island ecosystems were dramatically altered by Neolithic settlers (Broodbank and Strasser 1991), although Schüle (1993) proposed that earlier devastation of these islands occurred as a result of colonizing ungulates (e.g., *Myotragus* and *Hippopotamus*) during the Pleistocene. Many Pacific islands were subject to profound environmental changes and high levels of avian extinctions following Polynesian colonization (Diamond 1986; Cuddihy and Stone 1990). One example, the Pacific island of Rapa Nui (Easter Island), underwent massive environmental degradation as long ago as 1200 to 800 B.P. (Flenley *et al.* 1991). In the Caribbean (Watts 1987), Atlantic islands (Grove 1995), and Mascarenes (Cheke 1987; Gade 1985), patterns of environmental degradation can be traced to European colonial administration