

Galápagos Botanical Management Provides Perspectives for Hawaii

By Clifford W. Smith, Charles D. Stone, and Lloyd L. Loope

The biota of the Galápagos Archipelago, like that of Hawaii and many other oceanic island groups, is becoming increasingly threatened by aggressive introduced plants and animals. The threats to endemic tortoises and iguanas have been relatively well publicized; active management programs have been undertaken, with notable success, to assure survival of reptile populations of certain islands. In contrast, threats to survival of endemic plants have received relatively little attention, perhaps partly as a result of the absence of showy species and superlative examples of adaptive radiation (i.e. groups such as the Hawaiian tarweeds and lobelioids). It is becoming clear that unless feral ungulates and alien plants in the Galápagos are managed aggressively, the rich botanical resources of this renowned national park and World Heritage Site will be severely damaged in the long run.

A "Workshop on Botanical Research and Management in Galápagos" was held April 11-20, 1987, at the Charles Darwin Research Station on Isla Santa Cruz, Galápagos. The workshop, sponsored by the Charles Darwin Research Station (CDRS), the Galápagos National Park Service (GNPS), and the Catholic University of Ecuador in Quito, was an attempt to develop a framework for preventing any further decline of the Galápagos flora. Financial support for the meeting was provided by the MacArthur Foundation; a proceedings volume will be published by Missouri Botanical Garden. The workshop was attended by 95 registrants, of whom about 60 were Ecuadorians. Five of us were from Hawaii, 15 others from U.S. institutions, and the rest were primarily European. Two New Zealanders, one from Japan, and one from South Africa also participated. Efficient simultaneous Spanish/

English translation (the first ever at a conference in the Galápagos) allowed for effective communication.

The problems facing the Galápagos are essentially the same as in other oceanic island groups. Some of the recommendations developed from the workshop included renewed emphasis on fundraising and education inside and outside the Galápagos; increased monitoring and research and better use and protection of the data generated; improved control of tourism and alien importations; more emphasis on both inventories and long-term studies; focus on relatively important ecological areas, particularly on uninhabited islands that are most intact; *in situ* protection of the biota through removal of alien influences and exclusion by fencing; and *ex situ* conservation through expansion of both Galápagos and external programs.

Priorities identified for alien species research included identifying plants to be controlled by herbicides and increasing research on various chemicals to control them; management of weeds and introduced animals on uninhabited islands; mapping of weeds; and biocontrol introductions. Use of outside expertise for alien animal and plant control was recommended. The international community, particularly USNPS, could also be involved in more systematic training of GNPS personnel in principles and practices of conservation biology. The information generated at the meeting will be used to plan for a better future and to seek further funding for conservation biology in the Galápagos.

The Galápagos National Park itself and the institutions involved in its protection are impressive by any standards. The national park was established in 1959 and expanded in 1968 to include 96 percent of the land area of the archipelago or 2,960 square miles.

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In 1986, the Ecuadorian government declared an additional 31,000 square miles a Marine Resources Reserve. The national park staff (GNPS), funded by the Ecuadorian government, now numbers about 30 employees. CDRS, established in 1959 under the auspices of UNESCO and funded internationally, has about 50 staff members as well as numerous visiting researchers and students. The function of the CDRS is research, both basic and applied, whereas GNPS is responsible for management. The greatest single problem appears to be lack of adequate funding for the GNPS, quite understandable in view of the difficult economic situation in Ecuador, but no less debilitating as a bottleneck hampering park management. The severity of logistic difficulties in the Galápagos is difficult for most North Americans even to imagine. Nevertheless, an outstanding literature relevant to conservation biology in island ecosystems has resulted from research carried out by CDRS. The relatively high quality of the accumulating data base is suggested by a recently published volume (Robinson and del Pino 1985) on effects of the 1982-83 El Niño event on the Galápagos biota.

Those of us from the Hawaiian Islands were, of course, fascinated with the Galápagos microcosm of evolution in isolation, the striking vulnerability of the biota to environmental alterations by man and his introductions, and the obvious parallels with the Hawaiian situation. We were able to contribute significantly to discussions identifying the problems as well as research and resource management needs. The threat to the Galápagos flora is less immediate than the parallel problem in Hawaii due to the more recent human occupation and substantially lower population. Nevertheless, many of the same pressures for further development and environmental deterioration are present, e.g. a marginal agricultural industry looking for alternatives, uncontrolled importation of plants.

We have taken advantage of our visit to publish comparative papers elsewhere (Stone *et al.* in press, Loope *et al.* in press). More importantly, our dedication to strengthening research and management in oceanic island ecosystems has been reinforced and enriched by the opportunity to obtain a close look at the situation in "Darwin's Islands."

The unique possibilities for obtaining detailed understanding of evolutionary processes through ecological research on islands is well illustrated by work on the Galápagos finches (Lack 1947, Grant 1986). Numerous other Galápagos studies complement the noteworthy body of literature on evolutionary biology from Hawaii (recently reviewed in an entire issue of *Trends in Ecology and Evolution*, July 1987,

Vol. 2, No. 7). These tiny archipelagoes with their fascinating and highly endangered plants and animals require and deserve much more concerted and better-funded conservation research and management efforts than they are getting. Neither can continue to serve as important evolutionary laboratories for the future without positive human intervention on their behalf.

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