

JUAN FERNANDEZ ISLANDS

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The Juan Fernandez Islands are located in a warm temperate region of the far southeastern Pacific Ocean and consist of three large volcanic islands that harbor a flora of remarkably high endemism (about 67%). Historic human-induced changes to the island environments and their isolation from a continental landmass have contributed to degradation of the island biota, which is rapidly becoming one of the most threatened in the world.

GEOLOGY

The Juan Fernandez archipelago is made up of three large volcanic islands—Isla Robinson Crusoe (or Masatierra; 33°37' S, 78°51' W; area 47.9 km²; elevation 915 m), Isla Alejandro Selkirk (or Masafuara; 33°45' S, 80°45' W; area 49.7 km²; elevation 1380m), and Isla Santa Clara (33°41' S, 79°00' W; area 2.2 km², elevation 374 m)—and several small rocky islets that lie between 570 and 720 km west of the Chilean coast. Currently the islands are administered by the Chilean government and are inhabited by around 600 residents based in the present village of San Juan Bautista on Isla Robinson Crusoe and whose livelihoods are derived primarily from fishing (lobsters), tourism, and cattle.

The islands are volcanic in origin, forming over a hotspot that underlies the eastward drifting Nazca plate. These isolated volcanic islands range in age from around 4 to 1 million years old, with the oldest, Isla Robinson Crusoe, having a very rugged and deeply dissected topography compared to the younger Isla Alejandro Selkirk. The islands lie within the northern margins of the subantarctic region of the South Pacific Ocean and are under the influence of major ocean currents: the subantarctic Chile-Peru Current (Humboldt Current) and the subtropical Peru Oceanic Countercurrent. The climate data available for Isla Robinson Crusoe Island records a warm temperate climate with a wet winter and dry summer, a mean annual rainfall of around 1000 mm, and a mean annual temperature of 15.2 °C at sea level. The higher Isla Alejandro Selkirk, 187 km to the west, generates abundant orographic rain, primarily from southwesterly and southeasterly winds, in addition to precipitation delivered from the western storm track. The high altitudes are considered

to be almost perpetually cloud covered, which along with occasional frosts and snow falls, contribute to the existence of a climatic forest limit at an elevation of around 700–750 m.

BIOGEOGRAPHY

The Juan Fernandez Islands have a very limited fauna, with no native mammals, reptiles, or amphibians. Around 30 landbird and seabird species breed on the islands. The islands have three endemic bird species, the most striking being the picaflor or Juan Fernandez firecrown, *Sephanoides fernandensis* (Fig. 1), the only endemic hummingbird known on oceanic islands. The present vegetation of the islands is well known with a total of 383 species of flowering plants, which includes 104 endemic, 52 native, and 227 introduced species. There are 51 species of ferns. Table



FIGURE 1 (A) The Juan Fernandez firecrown, *Sephanoides fernandensis*, is an endemic hummingbird on Isla Robinson Crusoe, seen here feeding on the nectar of *Dendroseris littoralis*. (B) *Robinsonia gayana*, an endemic Asteraceae on exposed southern cliff face, Robinson Crusoe Island.

TABLE 1
Diversity of Species on the Juan Fernandez Islands

	Endemic		Native		Introduced		Totals	
	Total	% before 1574	Total	% before 1574	Total	% after 1574	before 1574	after 1574
Flowering plants	104	67	52	33	227	59	156	383
Dicotyledons	90	58	29	19	195	50	119	314
Monocotyledons	14	9	23	14	32	8	37	69
Ferns (pteridophytes)	17	33	34	66	0	0	51	51
Mosses and liverworts	38	24	119	76	0	0	157	157
Terrestrial birds	3	42	4	58	7	50	7	14
Insects	440	72	170	28	77	11	687	687

1 shows the composition and origin of the flora with the pre-1574 flora consisting of around 67% endemic species. The origin of these plants is dominantly from the southern South American mainland (55%), with smaller proportions being widespread and derived from the Neotropics, Pacific, Australia, and New Zealand. The distinctive rosette-like trees, shrubs and herbs within the Asteraceae (five endemic genera including 26 endemic species derived predominantly from the Americas) have diversified most dramatically on the islands and occupy a wide range of habitats from lowland forest to alpine areas (Fig. 1B). Other genera that have numerous endemic species include *Gunnera*, *Peperomia*, *Wahlenbergia*, *Chenopodium*, and *Eryngium*.

The remaining forest cover on the islands falls into a subtropical montane rainforest classification that is dominated by trees of *Myrceugenia*, *Drimys*, and *Fagara*. The endemic palm species *Juania australis* forms an occasional emergent. At higher elevation, dwarf trees, shrubs (*Ugni*, *Pernettya*, and *Escallonia*), and tree ferns (*Blechnum* and *Dicksonia*) become dominant. Above the climatic tree line on Isla Alejandro Selkirk, the “alpine tundra” is distinguished by cushion plants (*Abrotanella*). In all these vegetation zones, invasive species have taken hold, mainly in the lowlands, resulting in more than 70% of endemic species being classified as threatened under IUCN threatened-species criteria.

Insects are also very diverse and have evolved extensive adaptations to island ecosystems. This is reflected in the high percentage of endemics (~70%), which is comparable to endemism within the flowering plants of the Juan Fernandez Islands. The majority of these species are derived from southern Chile, with some Pacific and Indo-Malaysian elements present.

DISCOVERY AND EXPLORATION

The Juan Fernandez Islands were discovered in 1574, and a small colony of Spanish and South American Indians

was established in 1591–1596. They introduced goats and pigs, cut firewood, grew vegetables, and caught and dried fish for the Spanish colonies in Chile. Short-lived settlement of the islands characterized much of the seventeenth and eighteenth centuries, which included groups of castaways or deserters inhabiting the islands for brief periods as British and Spanish interests competed for control. The most famous of these was marooned in 1704, when Alexander Selkirk took voluntary leave of Dampier’s squadron and remained ashore for four and a half years—with his experiences later becoming the basis of Daniel Defoe’s allegorical romance *Robinson Crusoe*. In 1749 the Spanish Viceroy ordered the formal colonization and protection of the Juan Fernandez Islands, with the construction of a substantial fort in Cumberland Bay and the arrival of 62 soldiers, 171 colonists, and 22 convicts, together with cows, sheep, mules, pigs, and poultry. By the 1790s, the settlement, essentially a penal colony, consisted of about 300 people, although this was abandoned by 1817. Permanent settlement began in 1877, and the islands were declared a Chilean national park in 1935; UNESCO declared the park a world biosphere reserve in 1977. As of 1976, the Chilean national park service, CONAF, has delivered administrative and environmental protection services to the islands.

CONSERVATION AND FUTURE CHALLENGES

Despite a relatively short history of permanent human settlement dating back only 130 years, the island flora and fauna are threatened by changes brought about by human activity including over-exploitation of forest and animal resources (e.g., indigenous sandalwood, *Santalum fernandezianum*, probably extinct since the beginning of the twentieth century, and earlier devastation of fur seal and elephant seal colonies—with 3 million skins being taken from Isla Alejandro Selkirk alone during 1797–1804), soil erosion, fire, introduced vascular plants (around 227

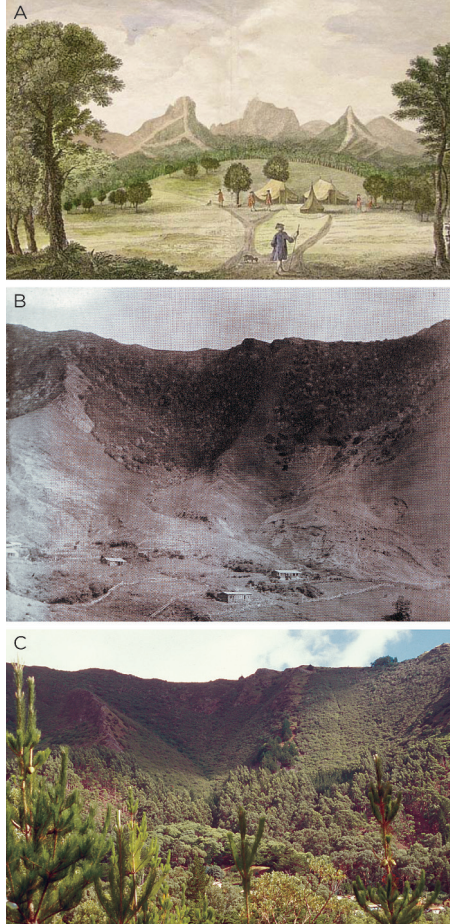


FIGURE 2 Comparison of landscape images in Cumberland Bay, Isla Robinson Crusoe by (A) George Anson, 1740; (B) Carl Skottsberg, 1918; (C) Simon Haberle, 2000. Notice the replacement of natural forest vegetation by degraded grassland and introduced tree species, including *Pinus* sp., *Eucalyptus* sp., *Aristotelia chilensis*, and *Ugni molinae*.

invasive species known in 1998), and introduced animals including cattle, goats, and the European rabbit. Descriptions of the islands by explorers such as George Anson dating to the mid-eighteenth century suggest that the lowland valleys were forested. Scientific exploration of the islands has been extensive with the work of the Swedish naturalist Carl Skottsberg in the early twentieth century providing a remarkable account of island environments

at this time, suggesting that the vegetation became much more degraded after the mid-eighteenth century under the influence of increased human activity. Extensive botanical surveys and photographic comparisons spanning the twentieth century (Fig. 2) show that this process is ongoing and that the rapid invasion of exotic species will need to be halted if threatened and rare species are to survive to the end of the twenty-first century.

Since the islands were discovered in AD 1574 by the explorer Juan Fernandez, the conversion of natural vegetation into pastures, the occurrence of extensive fires, and the introduction of alien plant and animal species have had a profound impact on the composition and extent of natural biotic communities. Only one extinction has so far been observed (*Santalum fernandezianum*), but population sizes of many endemics have become small, with some having less than 25 known individuals left. Continued conservation efforts by CONAF, local residents, and international interests have the potential to ensure the ongoing preservation of this remarkable island environment.

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FURTHER READING

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