

## Living on coral reef atolls – Human induced vegetation changes

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### Natural vegetation

A coral cay, on an atoll, is rarely more than four meters above the high water line. It is always exposed to seawater spray and is occasionally inundated by seawater during storms. Plants that tolerate such conditions are few.

Rainwater rapidly infiltrates porous carbonate soil on coral reef islands and stays underground as a freshwater/brackish water lens because of the density differences of the two bodies of water, combined with hydrostatic pressure. This water is the 'water of life' for land dwelling organisms.

The plants that settle on the atoll through long distance dispersal are distributed in zones because of their differential tolerance to salinity, wind resistance, and geographical features of the ground, soil texture, and humus distribution. This article discusses plant life on a coral reef atoll, not in Japan but in the Cook Islands, to exemplify changes that may have taken place on atolls throughout the Pacific. Plants are generally distributed in concentric circles (Fig. 1).

### Agroforestry

The plant landscape of an atoll changes remarkably after human settlement. When prehistoric Polynesians moved into the Pacific, they brought with them seeds and saplings of many plants, including taro, praca, and banana roots, breadfruit and coco trees, *Pandanus*, sugarcane, and other useful architectural timbers. Not all plants adjusted to the harsh atoll environment. Most introduced plants were of continental origin, and were unconditioned to high sodium, high pH, and low iron concen-

trations, as found on atolls. Therefore, humans implemented special protection and management strategies. At least 25 species, almost half of the 52 vascular plant species confirmed on Pukapuka Atoll, are introduced species. This shows how carefully humans worked at changing the vegetation.

People understood the micro-habits of the atoll, and cultivated plants accordingly. Residents dug up the central portion of the island, where the underground water layer was the thickest, built Taro paddy fields, and established concentrated production areas in the center. For example, breadfruit depends on underground water and is relatively intolerant to sea spray. Therefore, as in the natural situation, introduced plants are distributed in concentric circles (Fig. 1).

One of the largest features on the atoll is a sustainable agroforestry – namely coco, which tolerates a wide range of environmental conditions. Together with an active modification of the geographical features and a change in the landscaping, to fully utilize the underground water, people have elaborately managed 'useful' trees, and have attempted to protect the local wildlife – which includes many species of seabirds, sea turtles, and coconut crabs.

Having developed a system where land use and area is maximized, with highly seasonal yet productive crops, as has enabled relatively large populations of humans to dwell on Pacific atolls. The spectacle of today's atoll, where coco forests often cover the entire island, began after copra became an important monetary crop.

### Copra and the canned food economy

A big change in atoll vegetation in the Pacific Ocean appeared after copra became an important industry. There was probably a gradual shift in land use and labor toward copra production, which led, eventually, to copra monoculture. The expansion of coco forests led to loss of other plant species, particularly beach vegetation that people had planted to protect the coastline and prevent erosion.

### Decline of the copra economy

In the 1980s, the price of copra declined and transportation costs increased. As a result, copra production declined and the ill-maintained coco forests often became overcrowded. The high tree densities put further strains on the limited resources, which in turn resulted in reduced coconut (fruit) production. The collapse of the copra industry has led to poor forest management. Young people, who in the past were actively involved in the copra industry searched for opportunities elsewhere, often leaving the atoll. Alternative income sources involve, remittance from workers that have left the atoll, international aid, and, or, support from an old suzerain. Authorities, or bureaucrats, engaged in aid generation have often replaced traditional leaders. Agroforestry management has become difficult because of the change in human population structure, progressive depopulation, and a change in the social politics. As a result the vegetation on many Pacific atolls is devastated. The plants that were carefully protected and managed for sustenance have withered, and diversity has been lost. Furthermore, the information and knowledge on agroforestry, accumulated and exchanged through culture over time, has been lost. The changes in vegetation, loss

of diversity, and loss of coastlines, have changed in tandem with a loss of native languages.

(Partly rewritten from Chikamori (2001). Refer to the text for details.)

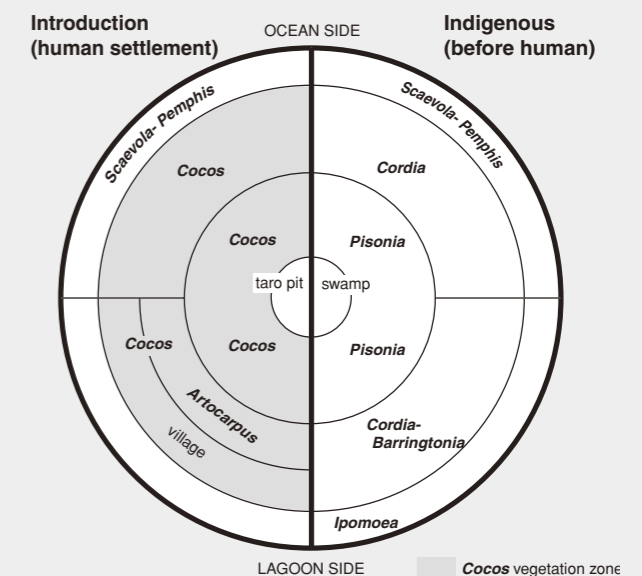


Fig. 1. Pattern of the vegetation distribution of a cay of Pukapuka Atoll. The upper portion of the figure represents the open sea, and the lower portion represents the lagoon. The horizontal axis shows the passage of time. The right portion shows the natural vegetation before human settlement, and the left portion shows present vegetation, artificially modified by human settlement. The half tones show the growing range of coco.