ATOLL RESEARCH BULLETIN

No. 277

EXCERPT

TAKAPOTO ATOLL, TUAMOTU ARCHIPELAGO: TERRESTRIAL VEGETATION AND FLORA

BY

M.-H. SACHET

ISSUED BY

THE SMITHSONIAN INSTITUTION

WASHINGTON, D.C., U.S.A.

DECEMBER 1983

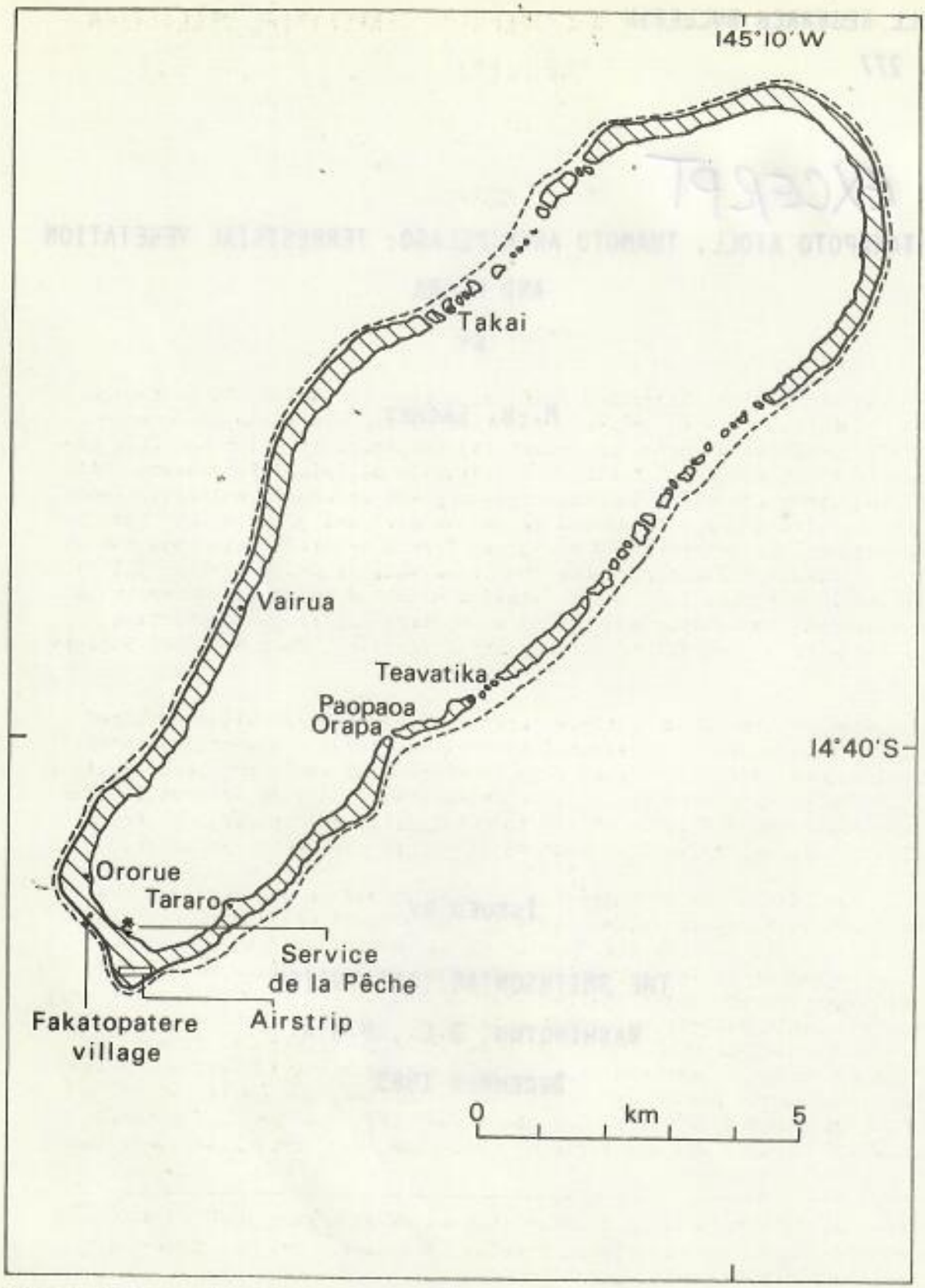

Fig. 1. Takapoto Atoll

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INTRODUCTION

The Man and the Biosphere (MAB) programme of UNESCO, first thought of in 1968, launched in 1970 and endorsed by the Stockholm Conference of 1972, includes a number of scientific projects, of which No. 7 is devoted to the Ecology and Rational Utilization of Island Ecosystems. All the programmes are to be interdisciplinary and intergovernmental. Among member countries which developed their own national plans within the framework of the separate MAB projects, France drafted a vigorous one in MAB 7 in French Polynesia, under the leadership of Dr. B. Salvat (1977). The French programme includes a detailed study of an atoll, Takapoto in the Tuamotus, and comparison of its ecosystems and their functioning with those of a high island already under scrutiny, Moorea in the Society Islands.

Teams of over 40 scientists representing many disciplines visited Takapoto over a period of several years (1974-1976). Several research organisations participated, in some cases bending their own study goals to fit the MAB-7 framework, so that an extensive body of information has become available and lends itself to integration and synthesis. Preliminary reports, as well as some final papers have been published.

I was already in SE Polynesia in 1974-75 and it was arranged that I would visit Takapoto in Dec. 1974 to study its flora and vegetation. The host institution was the Service de la Pêche, and I stayed in one of the bungalows of their Pearl Experiment Station. These were built on pilings over the quiet shallow lagoon, and linked by wooden walkways, forming a small attractive over-the-water village. I am very grateful to Philippe Siu, then of the Service de la Pêche, and to B. Salvat for this opportunity. Unfortunately I could not take the fullest advantage of it because the person in charge, Danny Carlson, was on leave. I could have learned much from her about the flora and its native names and uses. No boat was available at that time, so I could not visit the

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* Dept. of Botany, Smithsonian Institution, Washington, D. C. 20560. Antenne du Muséum et de l'Ecole Pratique des Hautes Etudes, Centre de l'Environnement, Moorea.

NE half of the atoll. My principal guide was Hurí Maire then schoolteacher in the village, and I remember with gratitude his friendly company and eagerness to inform, as well as that of other inhabitants I met. All Polynesians are passionately interested in plants and enjoy sharing their knowledge of them, and it is a pleasure to work with them.

GEOGRAPHY

The Tuamotu Archipelago, between 14° and 24° S and 134° and 149° W, is the largest group of atolls anywhere (about 75), and includes low islands of every size and shape. Some are tiny single motus with no lagoon, others are very large atolls with enormous lagoons, which may be very deep or shallow and cluttered with scattered reefs or coral pinnacles, widely opened to the ocean or closed or almost so. A few are somewhat elevated. Distances between the islands vary, but altogether the group creates a formidable obstacle to navigation, and sailing through the maze was considered very hazardous, hence the name Dangerous archipelago coined by Bougainville. Sailing vessels tried to avoid it as much as possible and quite a few, as well as modern ships with sophisticated navigational aids, finished their career on the reefs. The chain stretches in a general NW-SE direction and many of the atolls in the main alignment are so oriented. Others, along the NE edge of the group especially, are arranged at right angle, with their larger dimension SW-NE. Takapoto (14° 40' S, 145° 10" W) and its sister island Takaroa (King George's Islands) are so oriented as are the nearby pair of Manihi - Ahe.

Takapoto is an atoll, about 17 by 5.5 km, with a continuous reef and no real pass, the only communication with the ocean consisting of slight depressions of the reef surface devoid of land deposits but forming shallow channels called "hoa." The emerged land strip on the reef, about 40 km long, varies in width from 350 to 800 m at the SW point where the only village is located and where an airstrip has been established between it and the ocean-side reef. The reef flat is relatively narrow all around the atoll. The lagoon bottom slopes fairly regularly down to 40 m, with a few deeper basins (45 m). Many coral pinnacles rise from the bottom to varying heights, some almost breaking the surface of the water. The SW end of the lagoon is a conservation and research area for the Pearl Oyster Experiment Station.

The reef and especially the lagoon were studied in great detail by French biologists and oceanographers and their observations assembled by Salvat (1977) and in a special issue of the Journal de la Société des Océanistes, 1979. The geomorphology is described in some detail by Chevalier et al., 1979.

CLIMATE

The humid tropical oceanic climate of the Tuamotus, including Takapoto, varies little over the year. Atmospheric humidity is always high (80%) and temperatures are only slightly higher during the "summer"

(Nov.-April) and change little during the day (average 21° C). Atmospheric pressure, sunshine and cloud cover remain also relatively even except in stormy weather.

The NE trade winds predominate during most of the year, passing to the SE during the "winter" when stormier conditions may occur. The principal disturbances come with winds from the W and NW quadrant, with rain storms and high winds. Because the atolls rise so little above sea level, windstorms can bring very high and powerful waves and some land areas may be inundated and reef and beach sediments redistributed. Large blocks of coral torn from the undersea slopes of the reefs and thrown up on the reef flats are evidence of the power of such waves, and are especially noticeable on Takapoto along the NW reef near the several shallow "hoa."

Rainfall is the most seasonally variable factor in the climate. The "winter" season corresponds roughly to a dry season, and if the rains are slow in returning in November, a water shortage may occur. Water supplies have two main sources, ground water percolating through the porous substratum to the ground water lens and reached by shallow wells, and rain water collected from roofs into cisterns. Rain water collectors are not always maintained in good conditions, and wells, which are not habitually used nowadays for drinking or cooking, are often polluted or neglected, and do not suffice to replenish the supply.

Tsunamis generally do not affect atolls severely, except under very special conditions, because the wave, oscillating vertically, can pass an atoll with almost vertical submarine walls without breaking and releasing the enormous amount of water and energy it carries. Cyclonic storms and other violent storms, however, can be devastating in their effects on low islands which are not only vulnerable to high winds, but suffer great damage from flooding. The Tuamotus are generally said to be in a zone relatively free of cyclonic storms (cyclones, typhoons or hurricanes), but such are in fact frequent enough to need taking into account in planning construction and settlement.

Giovanelli (1940) and Teissier (1969) have published lists of tropical storms and hurricanes known to have affected French Polynesia and especially the Tuamotus (a tropical storm becomes a hurricane when the winds reach 65 knots = 120.5 km/h). The records go back to 1822 when the atoll of Anaa is known to have been devastated (Morenhout 1837, 1:365), as well as several neighboring atolls. Anaa was hit again in 1825. In Jan. and Sept. 1877, several storms caused important damage to various atolls including Manihi. The hurricane of 6-7 Feb. 1878 was extremely violent and 117 persons were killed in Kaukura.

The first well documented hurricane known to have hit Takapoto is that of Jan. 14-15, 1903. This terrific storm devastated a large number of atolls and 515 persons died, 377 of them at Hikueru where pearl divers and their families had assembled from other atolls for the diving season.

Another storm (March 23-25, 1905) caused extensive damages on Manihi and Takaroa. The hurricane of 6-8 Feb. 1906 was also a tremendous storm, causing immense damage in the Society Is. and Tuamotus, including Manihi and Takaroa, where the N.. coast was so pounded and flooded that there would have been many victims, except for the lucky fact that the population was on the other side of the atoll. Still, almost all the casualties (at least 121) occurred in the atolls. In those three great hurricanes (1878, 1903 and 1906) most of the damage was caused by the storm tides rather than directly by winds.

Teissier mentions only one more storm to hit the Tuamotus, in Jan. 1958. But there must have been others in pre-European times, and perhaps also since 1958, to reach Takapoto.

According to DeAngelis (1983:108) only 6 tropical storms formed east of 160° W between 1969 and Nov. 1982. But from Dec. 1982 (Lisa) through April 1983 (Veena), 6 formed in this region and affected French Polynesia, 4 of them some of the Tuamotus. Of these, Nisha/Orama (Feb. 20-28), Rewa/Reva (March 6-15) and Veena (Apr. 8-14) passed close to the Takapoto-Manihi area, the first demolishing buildings and other installations such as airstrips, defoliating and breaking coconut palms and other trees. Piling up sheets of coral shingle on shores and occasionally far into the land strip is probably the worst and most durable effect of these storms. Waves tear up large blocks of coral from reef fronts and throw them on reef flats, across "hoas" or, in some lagoons, on top of coral pinnacles. Small sandy islets can be built up or swept away, channels opened or closed. In the case of large lagoons, storm waves of sufficient height and energy may carry sheets of coral shingle onto lagoon shores. At Rangiroa, Orama and Rewa piled coral from the lagoon into both of the large and handsome villages.

Most trees and shrubs commonly native on atolls are relatively resistant to the effects of storms. Even Pisonia trees, with their shallow root systems, brittle wood and thin leaves, survive rather well. They leaf out quickly and branches of fallen trunks grow vertically and become new trunks of trees. Nothing can be done to save coconut palms that have been snapped or completely uprooted, and coconuts and copra crops are lost for some years even after the palms recover. Introduced trees and plants tend to be much more vulnerable than native species and are often killed. Breadfruit trees never thrive if underground water is too salty or if they are exposed to sea spray, and they are easily killed when villages or plantations are flooded with sea water, or hit with strong salt-laden winds.

In the 1983 series of hurricanes, aside from anxiety and fright, lack of food and more crucially water, one of the worst hardships the people had to endure especially on those atolls, including Takapoto, which were hit more than once, was lack of protection against the sun: buildings had been flattened, roofs swept away, trees defoliated and when clear weather returned, there was no shelter from heat and glare.

DISCOVERY AND EXPLORATION

Takapoto was probably discovered by Dutch navigators early in the 17th century, and in 1622 Roggeven lost a galley on its reef; the wreck was seen by Byron, Cook and other navigators; eventually (Moerenhout), only the guns could be observed; these guns were located anew by Danny Carlson and are described by Chazine (1977: 197-198). The two atolls, Takaroa and Takapoto, were named King George's Islands by Byron in 1765. During his second voyage Captain Cook (1961: 376-379) located them (April 17, 1774) and landed on the easternmost, called Teookea [Takaroa]. This is an important botanical landmark, as some of the Forsters' atoll plants are labelled Teoukea and represent some of the earliest collections from the Tuamotus. They found (1777, 2:41) "a scurvy-grass, which was common, and seemed to be very wholesome. The natives showed us that they bruised this plant, mixed it with shell-fish, and threw it into the sea..." to intoxicate fish. "The name which they give to this useful plant is e-Now [Lepidium piscidium Forst. = L. bidentatum Montin]. We likewise met with plenty of purslane, resembling the common sort, which the natives call e-Tooree." The Forsters described the natives, their huts and canoes, their dogs, tha clumps of bushes and trees, and the abundance of coconut palms. Incidentally, while sailing past many Tuamotu atolls, but especially at Takaroa, J. R. Forster described the process of soil formation and vegetation development (1983, 3:494-495), a view which he expanded in a more general account of atoll formation (1778, 2:148-159).

After this landing, Cook passed Takapoto (Oura, Taapouta), and then sailed on through the archipelago. Voyages became fairly frequent in the 19th century. Navigators who have published descriptions of Takapoto include Turnbull on the Margaret, Capt. Byers, in 1803, cited by Robineau (1977: 4), Kotzebue in 1816 and 1824, Moerenhout in 1830, Dumont d'Urville with l'Astrolabe and la Zélée in Sept. 1838, and Wilkes with the U. S. Exploring Expedition in 1839.

Moerenhout describes the atoll as follows:

"L'île de Taapouta n'a aucune ouverture par où la moindre embarcation puisse entrer dans son lac intérieur; mais comme la mer était belle, nous débarquâmes facilement sur le rescif, où je fus reçu par une vingtaine d'Indiens, qui m'accueillirent avec des démonstrations d'amitié, et me conduisirent à leurs maisons, toutes construites, comme dans l'île de la Chaine, à l'intérieur, sur le bord du lac. Là, ils me montrèrent une quantité de nacre qu'ils avaient entassée dans une de leurs habitations; .....

"Je ne voulus pas quitter cette île sans l'examiner un peu. Le sol en est assez étendu pour qu'on y puisse cultiver le taro, dont je trouvai des plants en divers endroits. Quoique le lac soit très-petit et déjà presque comblé, il ne s'y trouve que fort peu de cocotiers. Je présume qu'ils ont été détruits, dans cette île comme dans toutes les îles voisines, pendant les guerres de ses habitans avec les habitans d'Anaa. Elle possède, comme les autres, le fara (pandanus odoratissimus), et autres arbres propres à divers usages. Pendant notre promenade, les Indiens me parlèrent de canon."

Dumont d'Urville (1842, 4:53) passed "Tiokea" and "Oura" and wrote of the first (Takaroa) that it was low, well-wooded, with a lagoon and enormous clumps of coconut palms. He noted a large hut and many smaller ones and perhaps 50 inhabitants. Of Takapoto, also low, well wooded and with a lagoon, he remarked that it was well furnished with coconut palms, which must have become more numerous since Moerenhout's visit 8 years before.

The Wilkes Expedition (1845, 1:336), on the Vincennes, did not land at Takapoto but did at Manihi and Ahii on Sept. 6 and 7, 1839, and the Flying-Fish surveyed Takaroa and Takapoto a few days later. Charles Pickering, botanist and biogeographer, sailed with the Vincennes. In his Distribution of Plants ... (1876) he gives accounts of vegetation and plants for areas he visisted (this volume was never officially published, but some copies were assembled from printed stock). Pickering's method in describing floras consisted in listing the plants observed on the first island encountered in a particular group, and thereafter in referring to this list, according to his "geographical order of numbering," with a mention of additional or missing species for each island visited. Thus of Manihi he says (p. 232): "The vegetable growth, as far as examined by myself, proved entirely the same as on Taiara coral-island; but with less variety, nearly one-half of the species being absent. An additional species [a sedge] was however discovered by Mr. Brackenridge..." The plants these botanists collected are almost always labelled by island group only. They are preserved principally at the Gray Herbarium, Harvard, and in the U.S. National Herbarium. Many shells were collected on Manihi also.

Among the other great natural history expeditions, the Whitney South Sea Expedition did stop at Takapoto, Manihi, and nearby atolls to collect birds and a few plants, in Aug. 1922 and Feb.-March 1923. E. H. Quayle also examined and perhaps preserved corals and other reef animals, and algae.

VEGETATION

As with all (or most) atolls in regions of moderate to heavy rainfall, much of the landstrip of Takapoto was probably covered by forest before the arrival of human settlers. Areas with very thin or no soil may have had a scrub vegetation or even bunch-grass. With the coming of European man, much of the forest was destroyed and replaced by coconut groves or plantations.

During my stay of only 5-1/2 working days (Dec. 12-18), I was able to visit only the S half of Takapoto, from Takai to Orapa and Teavatika. Most of the time was spent exploring on foot and collecting around the village and airstrip, and between Vairua and Tararo and a little beyond. Two trips by car, walking back on a track which follows the lagoon shore, led me to the hoas at both ends of the V-shaped South islet.

Woody vegetation

Along the West arm of the V, the geometrically planted coconut palms extend only part way from lagoon toward ocean in most places, probably because the ground is very rocky nearer the ocean shore; but along the lagoon, they frequently come almost to the shore, which is lined by a narrow very gently sloping beach.

On the ocean side, extends a strip of rather poor scrubby open forest, perhaps resembling what was there in pre-human times and including Guettarda speciosa, Pandanus tectorius, Tournefortia argentea, and Pipturus argenteus, with a shrub layer of Timonius polygamus, Scaevola sericea var. tuamotuensis and Suriana maritima, and a ground cover of grasses, Heliotropium anomalum and Euphorbia near E. atoto. The shrubs scattered under the forest become dominant as an irregular hedge as the ocean shore is approached. Where the soil is sandier or of fine gravel, Suriana maritima is common, frequently parasitized, often covered, by tangles of orange to greenish strings of Cassytha filiformis, a leafless parasite. On bare limestone, reef or island conglomerate, or where this is only thinly covered with sand, the vegetation is a dense, tough scrub or scrub-forest of Pemphis acidula, which is seldom seen except in such habitats. It can reach a height of 3 or more meters. Suriana and Pemphis have a very similar habit, and seem to replace each other as the substratum varies from limestone sand to rock. These two plants are much in demand, especially Pemphis (mikimiki), as bunches of their tangled branches and twigs are cut or uprooted and used in the lagoon as collectors for pearl-oyster larvae ready to become attached (spat) (Reed, 1973, Robineau, 1978). Occasionally, the lagoon shore is formed by island conglomerate (called papa in the Tuamotus) with or without a sand cover, and Pemphis forms small clumps of wiry shrubs; elsewhere Suriana (u'u) is found scattered on the sand.

Approaching the hoas at Takai, the coconut plantation thins out and the trees look sickly, yellowish, giving way to scrub of low Timonius polygamus with scattered rather chlorotic Tournefortia bushes. The ground is very rocky with a layer of papa emerging from under the islet at the edges of the hoas. On such bare conglomerate, which also forms flat islands above the level of the rocky hoas, Pemphis is usually the only plant to be found.

Near Vairua, about 8 km NW of the village, inside the coconut plantation, groves of tall Pisonia grandis rise above the nearby palms. Contrary to what has been assumed in descriptions of Takapoto and other atolls, Pisonia does not occur where there is deep rock soil. It is the other way round: This tree, which can reach enormous size, is exceptional in the tropics in producing an acid, peat-like or mor-like raw humus, forming a layer on the coral sand and gravel floor of the forest. Locally these trees are a favored roosting and nesting place for white-capped noddies (Anous tenuirostris), red-footed boobies (Sula rubripes) and fairy terns (Gygis alba). Where abundant white excrement from these fish-eating birds accumulates on the litter of leaves and the humus layer and is washed down through it by rain, a hard-pan of phosphatized coral

limestone is likely to form beneath the humus. Such formation of Jemo soil, first described from the Marshall Islands (Fosberg 1954), was observed at Vairua.

I was told that the Pisonia groves at Vairua had been left as a sort of bird reserve, since noddies were eaten, but whether this information was correct, and whether the groves survive I do not know.

Under the tall dense Pisonia trees, the dark somewhat spongy soil is bare of vegetation but around them, where the shade is less, occur larger Guettarda and Tournefortia, smaller trees of Pipturus argenteus, sprouts of Morinda citrifolia, and other scattered trees. Tall clumps of gray Achyranthes velutina fill a sunny clearing. The ground cover here includes Polypodium, Boerhavia tetrandra, Laportea ruderalis and where the shade is less dense, Lepidium, Digitaria and locally Hedyotis romanzoffiensis.

The coconut plantation itself is very neat or "clean", which means that brush and ground cover are regularly cut or burned. This practice is intended to make it easier to collect nuts at harvest time, and to discourage rats. However, it also results in impoverishing the ground of part of its meager organic matter supply, and in impeding soil formation. The shrub or small tree layer which keeps sprouting from cut plants includes Guettarda speciosa, Calophyllum inophyllum, Morinda citrifolia, Timonius polygamus and, when the canopy is not too dense, some Suriana. On the ground are Triumfetta procumbens, Polypodium scolopendria (also on palm boles), Lepidium bidentatum, Lepturus repens and other grasses, Portulaca johnii and, especially on bases of coconut trees, Psilotum nudum. Nervilia aragoana, a very small ground orchid with a single plicate deciduous leaf, replaced at the flowering season by raceme of small flowers is quite rare. Tufts of a rather coarse grass, Digitaria stenotaphrodes, are distributed here and there.

Where the sandy ground slopes toward the lagoon occur taller trees of Guettarda, Calophyllum and other species.

Along the East arm of the V, on the other side of the village, the coconut plantation seemed rather poorer, except for an experimental plot of a dwarf coconut variety of a beautiful orange color not far past the airstrip. At Tararo, the sandy lagoon shore was lined with Suriana shrubs, and locally with Sesbania coccinea, a shrub or small tree with feathery paripinnate leaves, sweet-pea size orange and red flowers and long thin hanging pods (kofai). Whether they survived increased construction and effects of storms is problematical.

Beyond Tararo, the coconut plantation was locally interrupted by fields of coral blocks and boulders which appeared to be ancient hoas completely filled in by masses of coral shingle possibly carried in and deposited by storm waves. Such boulder fields are entirely covered by a pure scrub of tangled Timonius polygamus about 2 m high and practically impenetrable, the long arching woody branches of the shrubs being intertwined into a very dense, scratchy thicket. It is the most unpleasant

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type of vegetation because even only a short distance into it, the total lack of air circulation makes the heat and humidity appear much worse than anywhere else in the atoll.

Herbaceous vegetation

In former times, taro (Colocasia esculenta) was cultivated in Takapoto and all other inhabited atolls of the Tuamotus. This involved a tremendous amount of very hard work, because pits or winding trenches had to be dug down to the water table (1 to 1.8 m down), often through a layer of conglomerate (papa). From all accounts, the taro tubers produced in such pits were small and of poor quality. Other food plants were most probably grown with the taro. At present all such cultivation has been abandoned in Takapoto, as in most if not all of the Tuamotus. The trenches or "maite" can still be recognized in the form of ditches more or less filled in (Chazine, 1977). Near the village, near the Service de la Peche buildings, a low muddy area locally with open water, was filled with sedges and gelatinous mats of blue-green algae drying to a crust. Dense thickets of Hibiscus tiliaceus line this marsh. Other small depressions occur locally in the coconut plantation and the village.

Village vegetation

The population of Takapoto is now concentrated in a village (Fakatopatere), very open and attractive as are those I saw on other atolls, Mataiva, Tikehau and Rangiroa. Roadways of white compacted sand or gravel separate large holdings with scattered buildings. Everything gives an impression of care and neatness, the white or pastel colors of fences and structures, the flowering shrubs very bright and cheerful. At the time of my visit there were not many actively cultivated gardens, much of the village vegetation consisting of an herbaceous cover with scattered shrubs and trees, both useful and ornamental, such as oleanders of many colors planted along fences or walk, crotons and Acalypha varieties, bright red Ixora sp., Russelia equisetiformis forming cascading bushes with scarlet flowers, Plumeria rubra (frangipani, tipanie) of many shades, Delonix regia (flamboyant) and Adenanthera pavonina as isolated specimens. Fruit trees included Muntingia calabura planted along the road to the airstrip, papayas, citrus fruit, a few large Eugenia cuminii, some breadfruit trees including an enormous one shading the main store and the street along it, many large Terminalia catappa and especially Pometia pinnata or kava, the fruit of which are so much prized by both adults and children that they seldom have a chance to ripen and fruit-bearing branches are broken off repeatedly giving the trees a strange shape.

The herbaceous cover includes grasses, sedges, weedy Euphorbia spp. and many other species.

Of the more actively cultivated gardens, one included a small patch of taro plants carefully kept wet and weed-free, cuttings of Plumeria

obtusa recently brought from Tahiti, and other relatively uncommon plants. Another garden had a hedge of Acalypha with colorful foliage, and of Cryptostegia grandiflora vines covered with rose-mauve flowers, as well as a cactus-like Euphorbia which served as support for drying small children's clothes. This garden also included a fine Zoysia lawn, and all sorts of potted plants arranged on the ground, on the house steps, or hanging in trees.

On the ocean side, the village ends with a wharf where whaleboats load and unload passengers and supplies across the reef while ships wait outside the line of breakers. There were copra sheds, an old lighthouse and a grove of large old trees including the only large Thespesia populnea seen. Nearby a garden enclosed with chicken wire included some vegetables such as "chou chinois", Brassica pekinensis and vines of watermelon bearing fruit (pastèque). These may have been growing in soil brought from Tahiti or the Marquesas.

As described above (p. 6), the repeated blows of hurricanes in the first months of 1983 brought considerable devastation to Takapoto. The buildings of the Service de la Pêche over the lagoon were wiped out, the airstrip piled up with coral gravel and boulders, many houses and other structures lost their roofs or were flattened, debris of all sorts scattered in the yards and gardens, including roofs, overturned cisterns, boats and worst of all sheets of coral shingle. The attractive and colorful village was a pitiful sight immediately afterwards. This type of damage is very quickly and industriously cleared up, as well as broken or uprooted shrubs and trees. Generally, the remaining vegetation leafs out rapidly, but it takes a long time for the surviving palms or fruit trees to bear again, and some years before newly planted replacements can develop and fruit and coconut crops become available again.

MARINE FLORA AND VEGETATION

The role of algae in the fabric and ecology of Takapoto atoll is discussed and illustrated in several papers (Chevalier et al., Chevalier & Denizot (1979), but no enumeration of algae or list of collections is included anywhere except for the phytoplancton (Ricard et al., 1979).

FAUNA

Rivière (1979) paints a picture of the five main Takapoto biotopes placing the elements of the fauna within each and indicating their relationships to the landscape and substrata and among themselves (food chains, public health). A check-list of species collected in the Tuamotus is appended

Some elements of the marine fauna, especially corals, are mentioned and their role briefly described in other papers of the special issue edited by Salvat (1979). Lagoon invertebrates and especially molluscs, are discussed by Richard et al., and the fish fauna by Bagnis et al.

SYSTEMATIC LIST OF LAND PLANTS

Because I stopped several times at the Manihi airport in 1974-75, and had seen herbarium specimens from that atoll, I have included records of Manihi plants in the list below.

In size and orientation Manihi (14°26'S, 146°04'W) is very like Takapoto, 71 km away. However, Manihi has many more reef openings, including a pass deep enough for ships, at the SW tip of the atoll. Near it a deep concrete basin holds fish alive until ready to ship or use. The village, on the E side of the pass is very different from the Takapoto village, and most others in the Tuamotus, in that the buildings are much closer together, with small enclosed gardens. It looks more like a small city. But as elsewhere, everything is white-washed, bright and very neat. The 1983 hurricanes, unfortunately, demolished the village, and caused much damage to installations and vegetation.

The airstrip is on a separate motu, reached by boat through coral shoals and fish traps. This motu consists almost entirely of a large ridge of coral fragments, and pioneer shore vegetation extends all the way from ocean to lagoon at least in the vicinity of the airstrip. Some ornamentals had been planted near the "airport."

I have included English and other common names of plants when known. Those marked (P = Paumotu) or (T = Tahitian) were given to me by Huri Maire originally from Takaroa. The names for the Manihi plants are from the specimen labels of W. T. and C. C. Brooks who made an extensive collection of plants there in 1967, not all of which I was able to examine.

All my collections are deposited in the U. S. National Herbarium (US), with duplicates for the Bishop Museum (BISH) and the Paris Museum.

BRYOPHYTA

Brachymenium melanothecium (C. Mill.) Jacq.

Bright green moss, fairly common on ground in coconut plantation.
Vairua, Sachet 2060 (US).

Calymperes tuamotuense Bartram

Manihi, Bartram 1933 p. 6, citing Whitney Exped. 1929.

PSILOTACEAE

Psilotum nudum (L.) Beauv.

Broom-like green or orange tufts of prismatic, dichotomously branching stems bearing large yellow or orange spore-cases on side of terminal branchlets.
Area around first cistern, Sachet 2021 (US). Quayle 1953 (BISH).
Occasional on bases of coconut trees and on coral sand in shaded interior.
Manihi, Quayle 1914; 1922 (BISH).

POLYPODIACEAE

Asplenium nidus L. Birds-nest fern

Nest-like light-green rosettes of ascending broadly lance-shaped undivided fronds, the fertile ones having a zone of pinnately arranged parallel, crowded, linear fruiting sori on the under sides.
Vairua, Sachet 2063 (US). Whitney Exped. 1956 (BISH).
On ground and bases of coconut trees in shaded interior of plantation.
Manihi, Whitney Exped. 1919 (BISH).

Nephrolepis hirsutula (Forst. f.) Presl

Short erect stems above ground, slender cord-like runners which bear the roots, and with erect or ascending fronds with many pinnately arranged pinnae or leaflets that bear kidney-shaped spore-dots or sori on under surfaces; pinnae shed when old, leaving stiff persistent rachis.
Village, Sachet 2077 (US).
Planted in yards and gardens, very common, probably spreading.

Village, Sachet 2075 (US).
Occasional in weedy areas.

*Emilia fosbergii Nicolson

Slender succulent-stemmed sparsely branched herb, thinly pilose, leaves thin, slightly glaucous, basal larger, somewhat lobed, terminal lobe larger, cauline alternate, narrowly oblong, toothed, sagittate at base; heads of flowers few, involucre cylindric or narrowed toward summit, of a single series of linear bracts coherent by their overlapping margins; flowers brick-red, exceeding the involucre, achenes prismatic, 5-sides, angles microscopically grooved, with hairs in grooves, pappus of many white capillary hairs. This plant has commonly been called E. javanica.
Village, Sachet 2048 (US).
Common in weedy yard.

*Emilia sonchifolia (L.) DC. ex Wight var. javanica (N. Burm.) Mattf.

Slender, succulent-stemmed sparsely branched herb, thinly pilose, leaves thin, glaucous, basal leaves larger, lyrately lobed, terminal lobe larger, cauline leaves shallowly lyrate, involucres narrowly cylindric, of one series of linear bracts, flowers very slender, purple or lilac, subequal with involucre; achenes prismatic, 5-sided, angles grooved, pappus of many white fine capillary hairs.
Village, Sachet 2049 (US).
Rare in weedy yard.

*Emilia sp.

Diseased plants.
Village, Sachet 2050 (US).
Local in weedy yard with E. fosbergii.

*Synedrella nodiflora (L.) Gaertn.

Erect herb with opposite branching and opposite ovate serrate leaves, heads cylindric, sessile, axillary, involucre of few narrow oblong bracts, flowers few, several yellow rays, a few yellowish disk flowers, achenes of two sorts, ray achenes elliptic, strongly margined, margins toothed, two pappus spines rather erect.
Village, Sachet 2046 (US).
Common weed.

*Vernonia cinerea (L.) Less. var. parviflora (Bl.) DC.
Little Iron-weed.

Slender erect herb, sparsely branched, leaves alternate, elliptic to obovate, basal ones larger; heads discoid, small, about 5 mm long, in corymbiform clusters, involucres of several series of closely imbricate bracts, flower purple, pappus white, capillary.
Area just behind Sevice de la Pêche, Sachet 2027 (US). Whitney Exped. 1923 (BISH).
Common weed.

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Fig. 1. Channel (hoa) across reef, coconut grove in background, germinating coconuts in foreground.

Fig. 2. Coconut plantation with split nuts piled up to dry enough to loosen meat for copra. Vairua area, lagoon side.

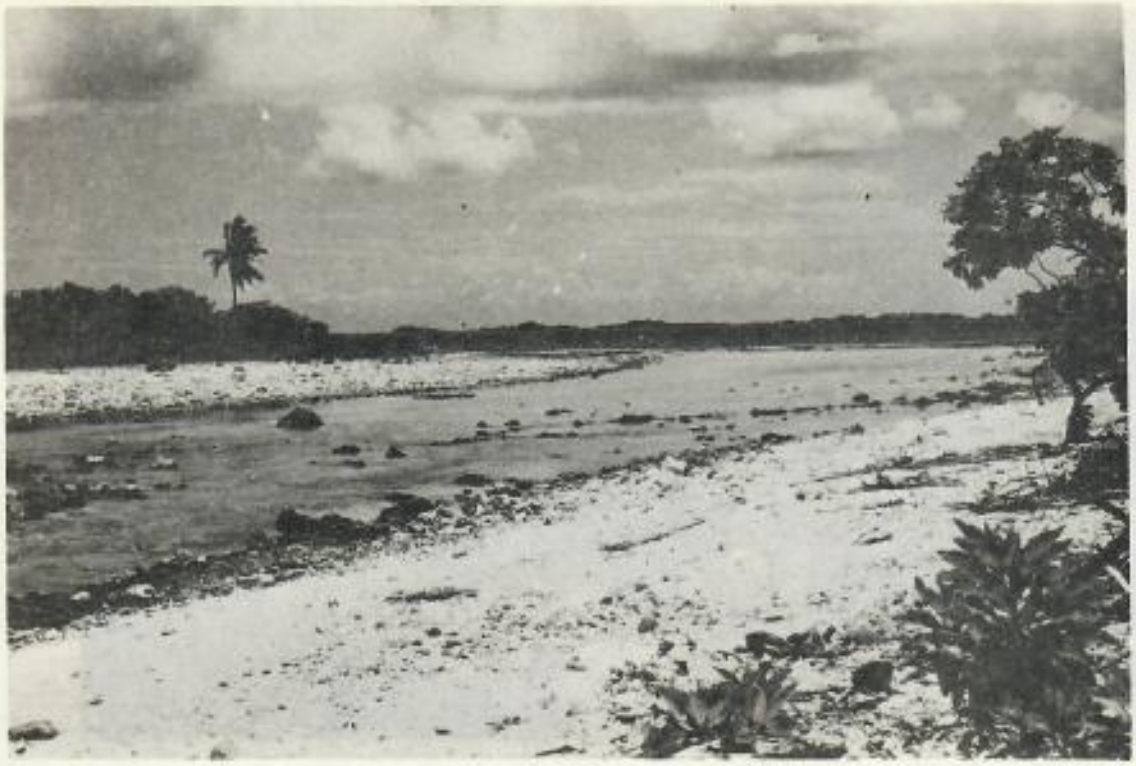

Fig. 3. Shallow channel (hoa) through land-strip, Takai area. Tournefortia argentea tree on right.

Fig. 4. Almost dry, "non-functional" hoa, Tournefortia scrub forest at top of shore opposite.

Fig. 5. Timonius polygamus scrub, very tangled, with emergent Tournefortia tree, Takapoto Atoll.

Fig. 6. Prostrate Scaevola sericea var. tuamotuensis, Manihi Atoll, near airstrip. Nov. 1974.

Fig. 7. Tournefortia argentea, budding inflorescence, Manihi Atoll, near airstrip

Fig. 8. Tournefortia, flowering inflorescence, Manihi, both photos Feb. 1975.

Figs. 9-10. Fairy tern, Gygis alba, in Pisonia grandis tree, Takapoto Atoll, Vairua.

Nos. 273–281 December 1983

ATOLL RESEARCH BULLETIN

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