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# ENVIRONMENTAL CASE STUDIES



**SOUTH PACIFIC REGIONAL ENVIRONMENT PROGRAMME (SPREP)**

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**South Pacific Study 2**

## WALLIS AND FUTUNA: MAN AGAINST THE FOREST

The settlement of the islands of the tropical Pacific began from the west several thousand years before our era.

In the small volcanic islands of the central Pacific, men found a more diversified environment, as regards altitude, soil quality, and surface water resources, than in the coral islands.

Human settlement was detrimental to the natural vegetation which was gradually replaced by a range of introduced plants grown by various techniques.

### The perils of shifting cultivation

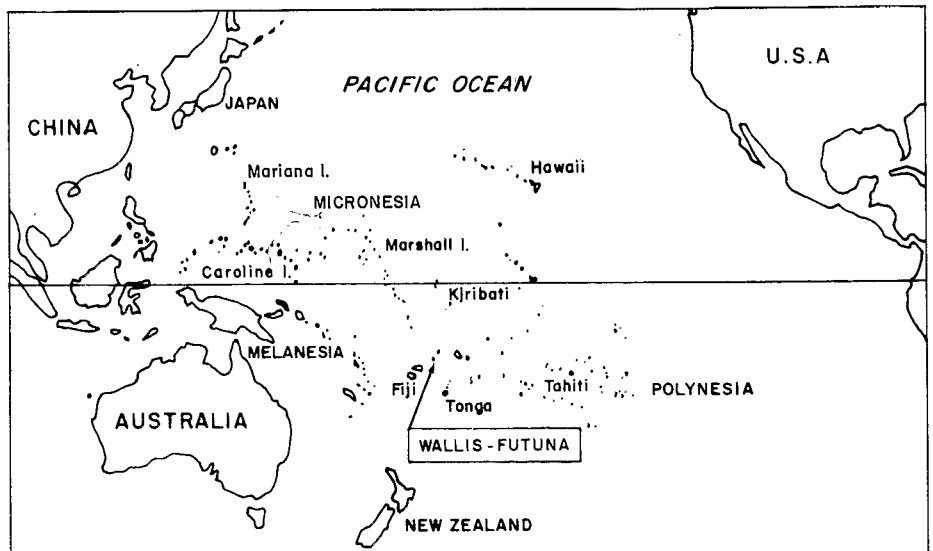
The simplest of these techniques is seasonal cropping in forest areas where the natural vegetation has been cut down and burnt. Every few years, a new area of forest is cleared and the old plot abandoned. Felling and burning destroy some species for good. A secondary forest may form, provided the area is left fallow long enough for trees to reach a reasonable height.

However if the intervals between successive cropping on the same plot are too short, only the hardiest, most prolific and least demanding species can survive, as depletion of the plant cover is associated with depletion of the soil which becomes poorer and poorer in organic matter. An increasingly inadequate cover soon causes the soil to fall victim to erosion during heavy rains. The surface horizons, containing nutrients that are easily assimilated by plants, are washed away. Only a few, very undemanding plant species, such as ferns, can henceforth subsist. Most tree species, as well as the food plants traditionally grown in the Pacific cannot grow at all on this poor type of soil.

Whenever the population increases in an island environment with limited resources, the fallow periods allowed in the shifting subsistence agriculture that is practised, tend to become shorter and shorter. The natural forest is endangered even though it constitutes a vital asset, on account of the protection it affords the soil, the accumulation of surface waters it permits, the reserve of timber and valuable plants with various uses it represents and the wildlife it can shelter.

Protection of the forest is all the more important in the Pacific islands as their population increases rapidly.

A survey of the state of the natural vegetation in three adjacent islands of the central Pacific — Wallis (Uvea), Futuna, and Alofi — will serve to demonstrate the vulnerability of forests and the need for forest conservation.

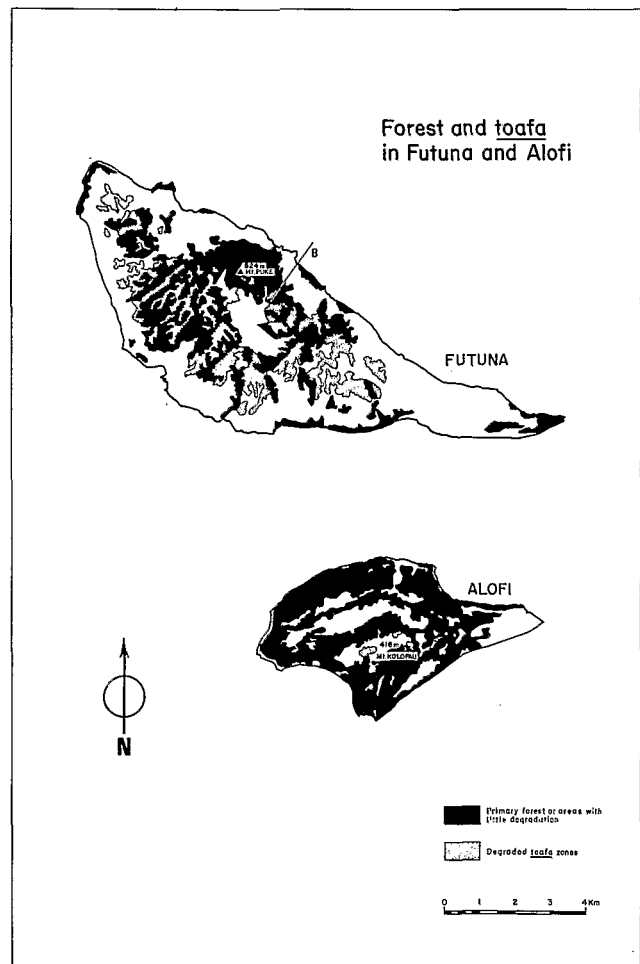
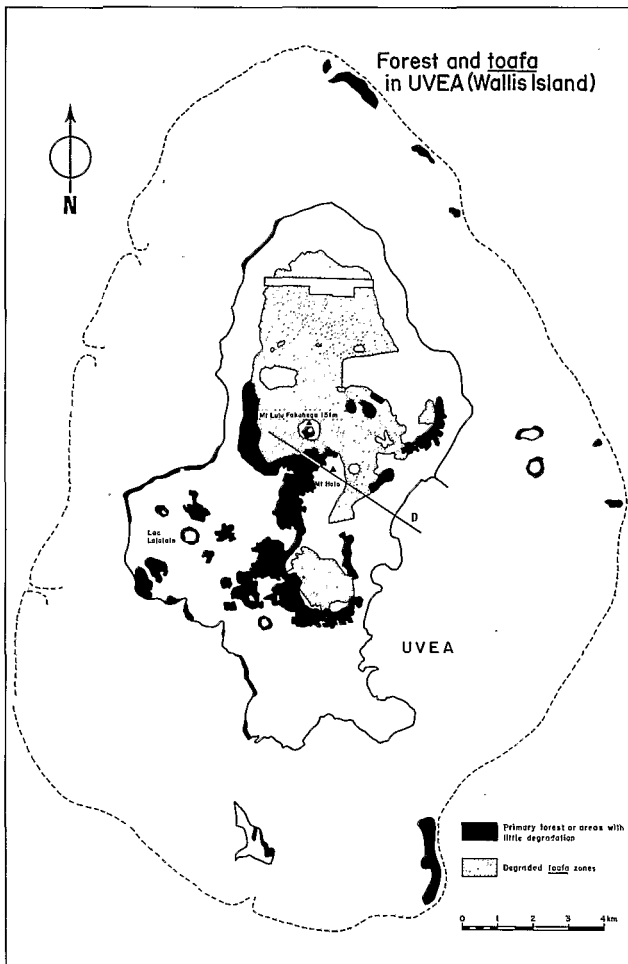


### Overall environmental conditions

On an area of 210 km<sup>2</sup>, these islands at present contain about 13,000 people.

Uvea is a low island where basaltic volcanism of the Hawaiian type, active until quite recent times, has given rise to an unobtrusive relief (maximum altitude 145 m). Futuna and Alofi, 250 km away, are by contrast mountainous islands with maximum altitudes

over 500 m and 400 m. They have no barrier reef and are the result of a tertiary, much more ancient, volcanic activity. The steep slopes of Futuna are interrupted by a series of uplifted coral tiers also evident on Alofi. Neither Uvea, which has lakes of volcanic origin and springs along the coast, nor Alofi have any permanent streams, unlike Futuna where many little creeks flow down the hills in deep gorges.



The three islands have a moderate average rainfall with, from time to time, the addition of very heavy rains caused by cyclonic depressions. This does not exclude a certain irregularity in successive years and prolonged droughts. Average annual rainfall is over 2,500 mm in Futuna, and over 3,000 mm in Uvea.

The Uvea population is concentrated on the east and south coasts. In Futuna, the west and south coast are the most densely populated. Alofi was inhabited until around 1840. It no longer has any permanent communities, although crops are grown there by the inhabitants of the eastern part of Futuna.

#### Vegetation and soils

The people of Wallis and Futuna have combined traditional subsistence farming and cash cropping. The former involves the production of taros and yams on dry ground, as well as wet-land taros cultivated on ridges inland from the Uvea coast, and in terraced flooded gardens at the mouth of streams in Futuna. The latter was based exclusively on the coconut and was started at the initiative of the missionaries and traders.

Copra production ceased in the early 70s. While the irrigated taro plantations, which are permanent, are a way of intensifying subsistence farming, dry-land crops continue to be grown according to the ancient technique of shifting agriculture based on burning off the natural vegetation.

When these islands were first settled, the natural vegetation appears to have consisted largely of forest, today in great jeopardy. Still used to supply timber for building, it has also been under constant attack to make room for crops. The harmful effects of systematic and localised clearing of the vegetation have been further aggravated by bushfires occurring during the dry season. In the entire low-altitude zone that is permanently settled,

the primary vegetation has been radically modified by pre and post European plant introductions and the large-scale extension of coconut groves. In Uvea, the establishment of two air fields and a network of roads during World War II worsened the damage described by Burrows in 1937. Now only patches of forest remain, on roughly 15% of the total land area of the island (Morat, Veillon, Hoff — 1983) in the southern central and western region. Everywhere else, the forest has been replaced by gardens, fallow

areas carrying a secondary bush, and especially, in the northern half of the island, by very poor lands on which only ferns, pandanus and a few shrubs grow: this is the **toafa**, or desert.

In Futuna, which is believed to have been settled earlier than Uvea, the primary forest receded to the upper parts of the hills and into almost inaccessible gorges. It still covers some 30% of the island's total area, but an extensive area on the central plateau bears only the very poor **toafa**-type vegetation, while the steep outer slopes running down to the coast are cleared and given over to dry-land crops grown under often quite difficult conditions.

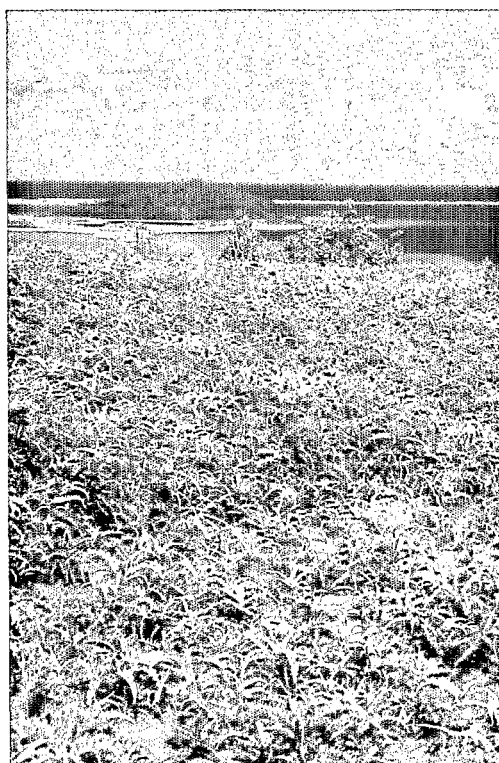
On Alofi, 70% of the total area (35 km<sup>2</sup>) is still covered with primary forest. Despite the predominance of the forest, the degraded **toafa** vegetation also exists in a few places of the central part.

With present farming practices, the erosion hazard is naturally much greater in Futuna, and to a lesser extent on Alofi, than in Uvea, on account of their respective relief.

In this last island, agriculture could take over virtually the whole land area on account of its low altitude and slight slopes, whereas in the other two the relief limits the area suitable for cropping. Not only the geomorphological structure, but also the soil distribution pattern is more contrasted than in Uvea, with, in particular, formation of red soils on the uplifted coral tiers.

Five major soil types, identifiable by the horizons (or successive layers) composing them, have been found to occur in these three islands:

- red **toafa** soils; usually quite deep in Uvea and of variable depth, depending on the slope, in Futuna and Alofi,
- red soil under forest,



*The Toafa on Uvea (Wallis-Island).*

- shallow soils containing a lot of coarse material,
- poorly developed brown soils with a lot of coarse material,
- poorly developed alluvial soils on coral and shelly sand.

### Land utilisation for agriculture

Land utilisation, like all land problems, is governed entirely by customary procedures. Some forest areas are, in theory, protected by customary restrictions (**vao tapu**). In the Uvea districts, utilisation of the primary forest is subject to the control of the customary authority, but damage seems to have worsened in the past 20 years, particularly as a result of the extension of individual houses along the roads, which is directly related to the increase in motor vehicles, the extension of water supply and electricity networks, and the population growth in spite of immigration to New Caledonia. About 200 ha of forest are estimated to have been destroyed.

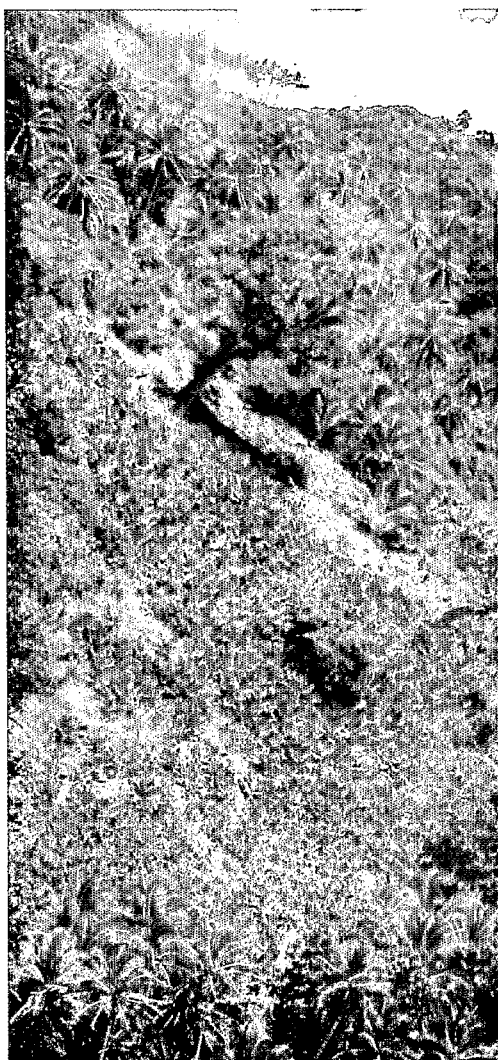
In Futuna, half of the areas actually under crop are given over to flooded taro crops. On the outer eastern slopes, dry-land crops are grown on forest clearings at gradients of over 100%. Hillside plots are replanted after fallows of 3 to 7 years. While small, localised land-slips do occur in fields, massive landslides are seldom seen. Certainly, bush-fires have caused (and are still causing) considerable damage to the Futuna forest, and to the Alofi and Uvea forests, despite the protection afforded by certain types of relief and the dampness in the high-lying regions. There are reports of repeated forest fires occurring during a dry spell about twenty years ago.

The Alofi forest appears to have been temporarily protected by the depopulation of the island, but is once again under attack nowadays. The first missionaries report that Alofi, being coveted for its timber resources, was the main reason for the wars waged between the different districts of Futuna, at least in the period just prior to its desertion and a considerable depopulation of Futuna.

The agricultural patterns and the population distribution along the narrow coastal belt, described by missionaries some 150 years ago, at a time when the islands had lost a significant part of their population were however largely the same as they are today.

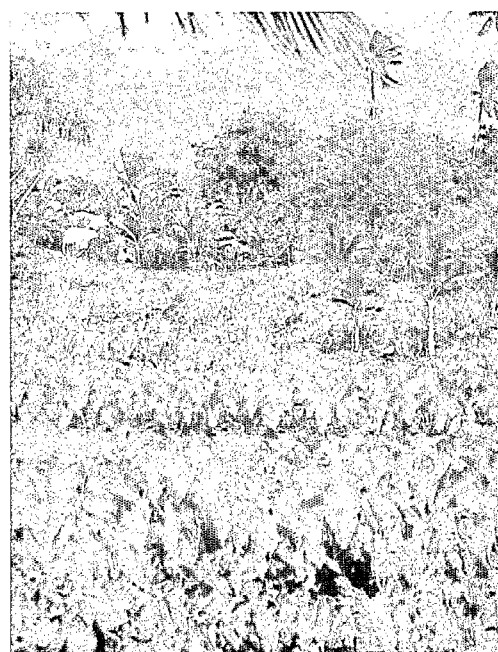
### The receding forest: facts and controversies

In the three islands, competition for land, has been attenuated by immigration to New Caledonia, despite the population increase. The new resources of the coconut groves led to the appearance of a cash economy. Money transfers from the emigrants have now replaced income from copra, and increased financial assistance is offsetting the effects of the economic slump. The food assistance provided from the end of the 19th Century by the French administration in times of acute food shortage, particularly after cyclones or droughts, as well as easier access to imported food products, caused the islanders to abandon traditional strategies against food scarcity such as keeping fermented paste of breadfruit preserved in pits, using starch made from the stem of the sago palm and of the tubers of a wild-growing plant, the Polynesian arrow-root **Tacca leontopetaloides** which used to be harvested after fires in the **toafa**.



Greater food security may also have resulted from the introduction of new plants. Cassava, which grows easily on any soil but damages it, is one of these plants. The starch it yields has replaced the **Tacca** starch previously used for glueing together strips of beaten bark for **tapa** making.

These changes in the lifestyle, may have brought about other kinds of changes in



Above: Clearings and cultivation on steep slopes. Futuna.

Bottom: Irrigated taro field in Uvea.

traditional patterns of behaviour with regard to the local vegetation. For instance, the superior efficiency of the new metal tools and neglect of plants such as **Tacca** — not to mention the effects of peaceful cohabitation between the communities, would have reduced fires and thus improved conservation. On the other hand, the population increase and the use of new plants such as cassava would have led to an increase in clearings to the detriment of the natural forest.

Actually, the borders of the **toafa**, at least on the island of Uvea at which we have aerial photographs taken at an interval of 40 years (1943 — 1982), have remained practically unchanged over this period. The reason for the stability of the clearly cut forest boundaries may lie in the nature of the soils. Kirch (1978) considers the barren area of the **toafa** to be largely due to agricultural over-exploitation having irreversibly degraded the original forest cover and the soils under it but this hypothesis still awaits a conclusive archaeological confirmation. The primary forest and the poorest vegetation where ferns are predominant can also be observed growing on the same red soils in the high parts of Futuna and, over a lesser area, in the centre of Alofi. On these two islands the difference of vegetation may have been enhanced by erosion on sloping land.

Recent analysis of the soils on either side of the **toafa** boundary (Beaudou — 1986) showed them to be almost perfectly identical in Uvea. In Futuna, a difference in organic matter and mineral content (e.g. in respect of nitrogen, calcium and magnesium) cannot be regarded as very significant, since it can well be due solely to the difference in soil cover. These findings bear out the hypothesis of the desert being man-made.

Reafforestation with pines accompanied by the development of a thick undergrowth, coconut plantations and trials with fodder crops have been successfully carried out in the Uvea **toafa** in the past twenty years. Afforestation has also recently been undertaken in the **toafa** area of Futuna, whose boundaries, as on Uvea, do not appear to have significantly changed, judging from aerial photographs taken at an interval of 16 years (1966-1982), despite accelerated rotation of dryland crops on the outer slopes.

Fires for the clearing of land were to some extent controlled, which seems to contrast with the systematic burning of the **toafa** during the dry season, still a common practice a few decades ago (Burrows — 1937) for the regeneration of the wild **tacca**. We can venture the hypothesis that this particular use of the "desert" was, for a time, a way of getting some benefit from land whose degradation had become irreversible without presuming anything about its original capabilities. Another hypothesis is that human action interrupted an uncompleted process of recolonisation by the forest. Repeated fires in these treeless areas would thus have frozen their boundaries at the time when conditions were again becoming favourable to forest growth, as the success of subsequent afforestation seems to prove.

The primary forest in Uvea can however be seen to have receded, on the aerial photographs taken 40 years apart. The 1943 photographs show the forest still dense and vigorous round the lakes of the south western quarter of the island, but replaced by perennial plantations in the area lying















The receding forest in Futuna.

between the coast and the central hills and plateaux, and elsewhere displaying all the forms of vegetation resulting from rotational burning, which, at the time, took place at intervals of between 5 and 20 years. Under normal conditions after 10 years, the vegetation changes from the low herbaceous and woody plants of the first regrowth to the shrubs and trees composing the secondary forest, two stages that the Uvea people clearly distinguish (Kirch — 1978). Clearing of land after bush fallows shorter than 10 years would therefore directly lead to the appearance of **toafa**-like zones. Since 1960, the population increase (50%) has resulted in shorter fallows, even though new lands were cleared for agriculture at the expense of the primary forest.

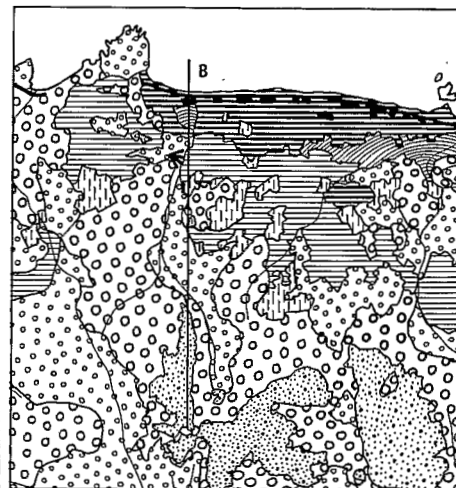
A recent case appears to have occurred in the **vao tapu** around Lake Lalolalo. Already badly damaged by the cyclone of 29 and 30 January 1966, the forest was ravaged by a fire occurring after several weeks of drought. The already sorely tried forest was further destroyed by clearing for the establishment of fields, which was authorised by the customary authorities in 1980 and the magnitude of which is clearly visible on the aerial photographs taken in 1982. These

**LEGEND**

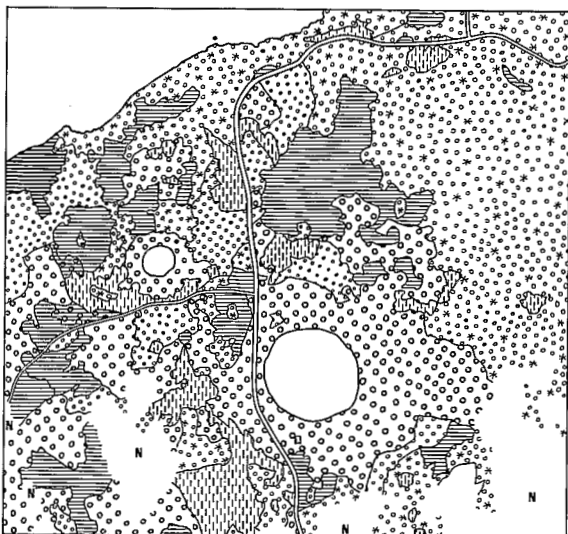
-  Forest, including coastal stands without any trace of crops
-  Secondary forest, more or less degraded
-  Secondary vegetation with coconut groves, Traces of clearings
-  "Toafa": Poor, shrubby vegetation. Ferns and pandanus predominant
-  Domestic and protected coastal plant species, with coconut trees predominant
-  Clearings, gardens and fallow land predominant (in existence for variable lengths of time)
-  Recent and current clearings and gardens
-  Taro plantations (on irrigated terraces in FUTUNA, on ridges in UVEA)
-  Traces of erosion, gullying
-  Housing area - isolated dwellings and buildings
-  Reforestation
-  Rubbish dump

1966

1982



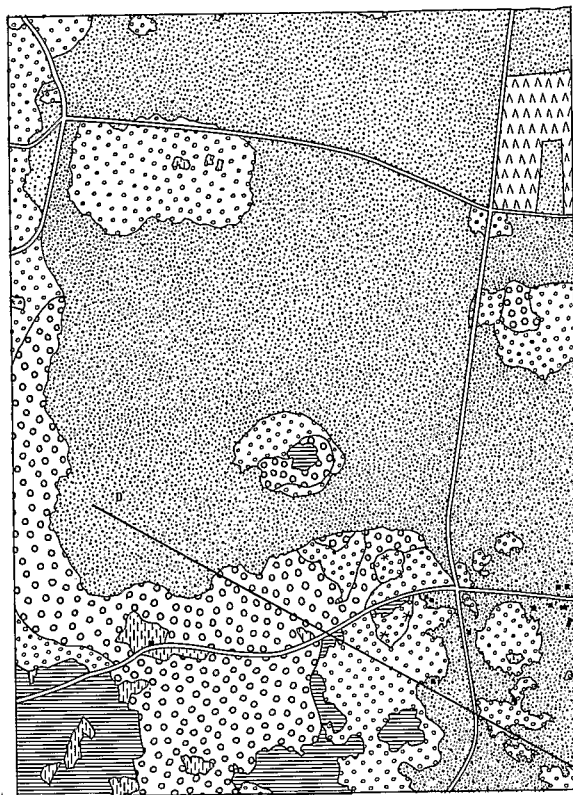
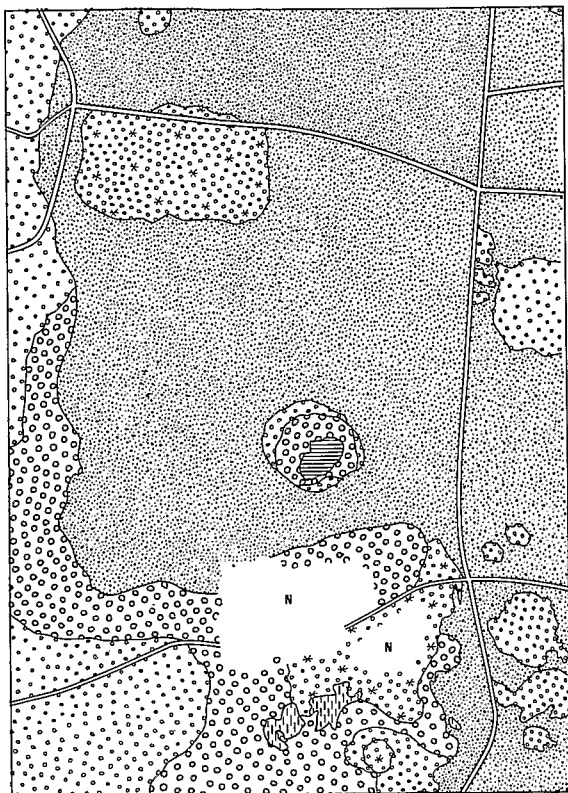
1943



1982



1943



1982

LEGEND FOR PROFILES B-D

COASTAL ZONE

- Housing
- Wall to keep pigs out of gardens
- Breadfruit
- Coconut
- Banana
- Sago
- Crops in gardens near houses
- Taro crops on irrigated terraces (FUTUNA)
- Taro crops on ridges in UVEA

HILLSIDES

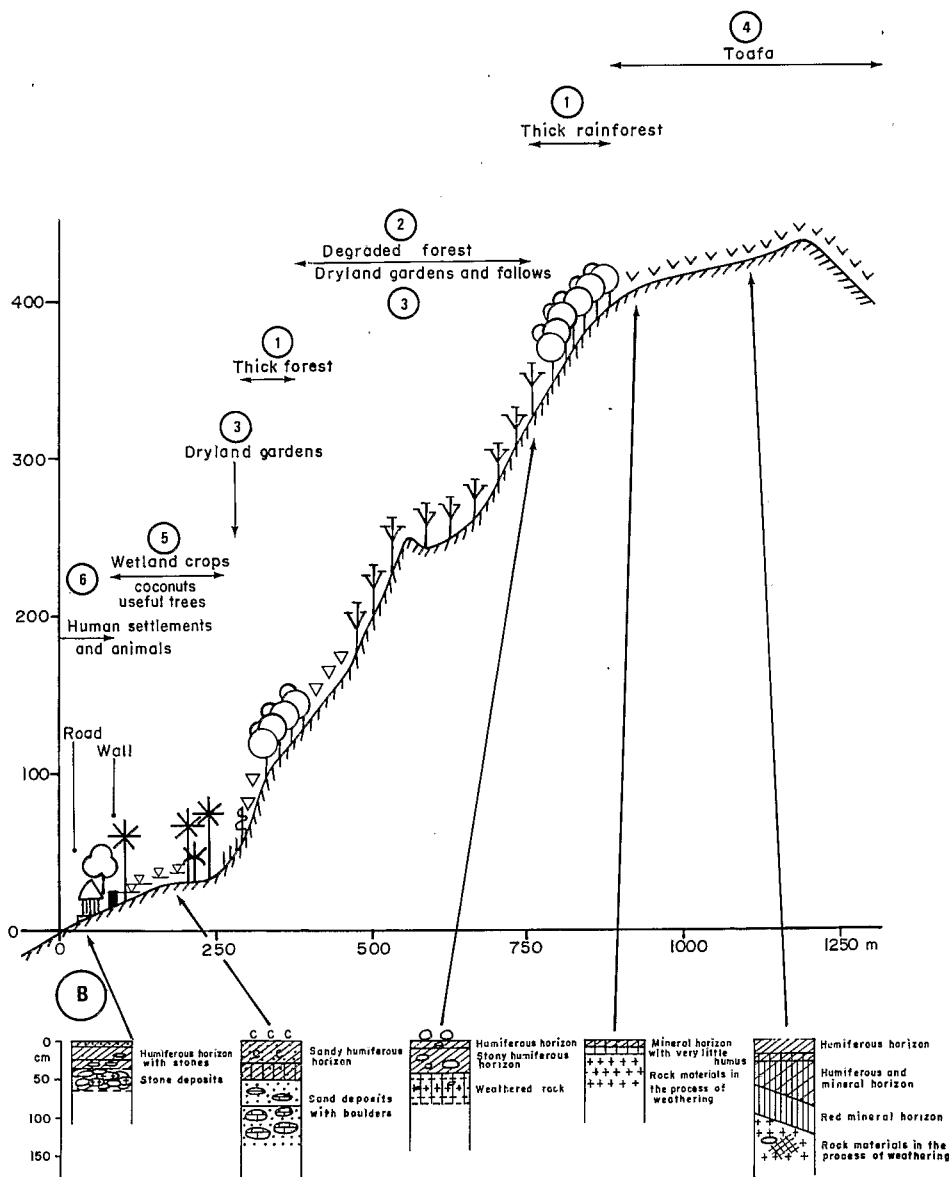
- Taro - kape } DRYLAND CROPS ON HILLSIDE
- Yams } FOREST CLEARINGS
- Gross-grown fallows
- More and less degraded secondary forest
- Thick rainforest
- Degraded, fern and pandanus-covered area (Toafa)

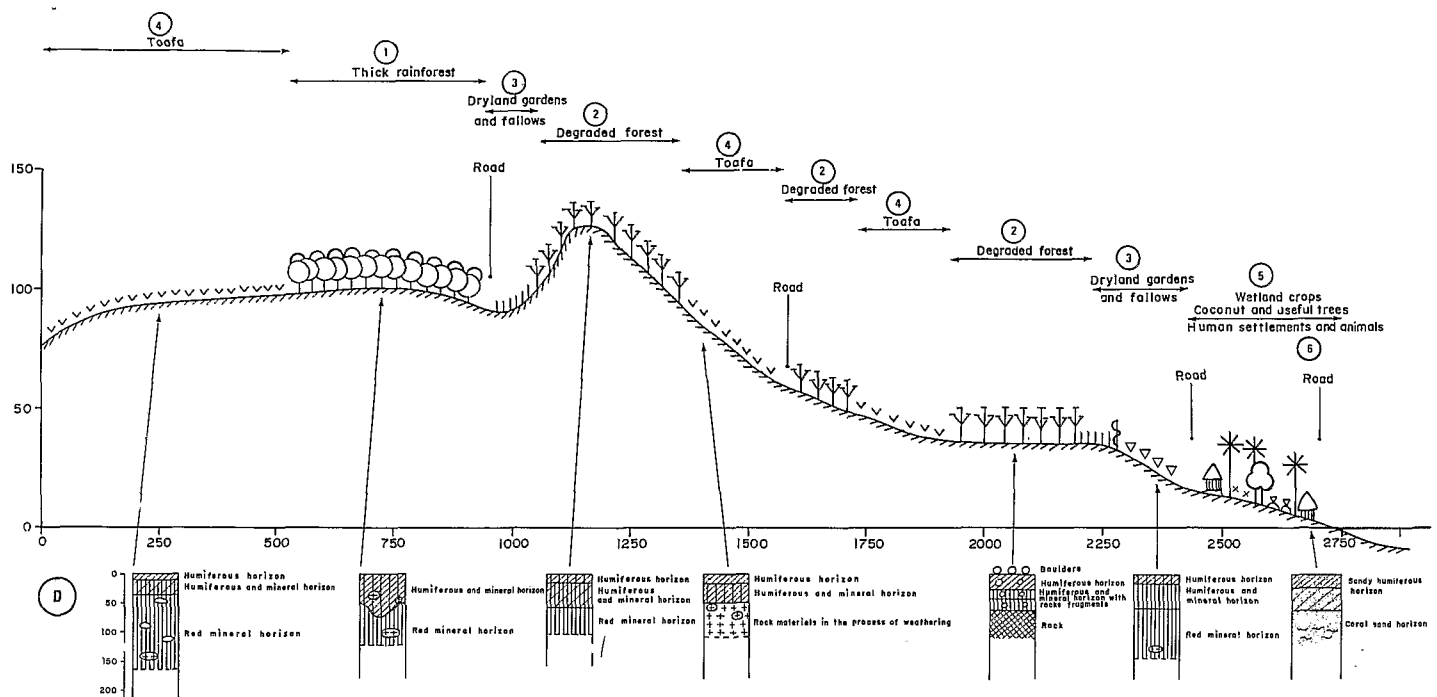
Profiles from provisional IGN maps (1985)

photographs reveal the current trend to clear more and more land for gardens in the west of the island, which have been largely deserted for over a century, mainly because the missions had established themselves on the east coast which has the advantage of getting the trade winds.

Over a third of the island of Uvea today appears unfit for cultivation maybe due to poorly controlled human activities the medium-term consequences of which (e.g. on the water resources), could prove very serious.

Whether the **toafa** zones in Futuna are the result of the action of man remains also to be proved. While large areas of primary forest have remained intact because of the difficult relief, the recent population increase (45% in the last 20 years) has resulted in more intensive cultivation on the flats and the steep outer slopes running down to the coastal belt.





An increase in the number of clearings is evident on the 1966 and 1982 aerial photographs, comparison of which also demonstrates the stability of the **toafa** boundaries.

Nowadays clearing is being carried out at the expense of what is left of the dense primary forest. Further shortening of the fallow period, which is already shorter than in Uvea, may in the near future give rise to serious erosion of the slopes.

In Alofi, the extension of clearings to meet the growing needs of the Futuna population calls for tough conservation measures to protect the primary forest.

#### From traditional strategies to active conservation measures

Whatever questions subsist as to the human influence, there can be no disputing the fact that man did, over a few thousand years, profoundly degrade a forest ecosystem that had no doubt taken 2 to 4 million years to develop. A comparison of the respective states of the three islands enables us to assess the relative magnitude of the damage done. This damage has, in some islands of the eastern Pacific (Huahine, Mangareva, Easter Island) led to complete elimination of the forest cover, and degraded zones comparable to the **toafa** exist under different names in most of the islands of the tropical Pacific.

In view of present trends, one may wonder about the significance of the coexistence in these islands of two different types of traditional agricultural practices. One is extensive, requires a lot of land and results in a squandering of natural resources, which runs counter to expanding needs of a growing population. The other is intensive, requires less land, and spares the biomass by mobilising, on the same ground, only the path taken by surface waters (Futuna) or spring waters (Uvea) as they flow down to sea level. Could this second type of land utilisation, which can be found in many other Pacific islands either in an active and living form or in a "fossilized" state (New Caledonia, Hawaii), possibly have been a response to other types of social organisation, different control techniques, different needs?

Was its adoption in Uvea a result of the extension of the **toafa**, and, in Futuna, a

result of downward migration of the population towards the coast? Might not this intensive type of agriculture, as it is still practised, despite some recent changes, be worth developing further? Is the shortening of fallows in the shifting mode of cultivation which is the first bad sign of intensification, always followed by deliberate development of irrigated agriculture? Does it not, on the contrary, jeopardise the latter by the damage it does to the environment? It is for archaeology, for anthropology and ethno-history to search for answers to these questions, in the traditional social systems of the islands.

It is clear, in the case of Wallis and Futuna, that the coexistence of a land tenure and utilisation system governed solely by traditional practices with needs created by the cash economy, and with the conditions of fast population growth not accompanied by new techniques ensuring parallel progress of production, has thrown many things dangerously out of balance.

Generalised use of fertilisers, to allow for more rapid rotations on limited land areas with less damage to the environment, adoption of crops requiring more work and less land, delimitation of forest reserves and control over tree felling, large-scale afforestation with useful tree species, control of population growth, a more reliable solution than immigration, might counteract present trends and safeguard the natural heritage for future generations.

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