

# Tapia woodlands

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## Introduction

Tapia woodlands (*bois de tapia*), named after the dominant tapia tree that is uniquely found in this vegetation type (*Uapaca bojeri*, Phyllanthaceae; see Ralimanana, p. xx), are a type of vegetation, also referred to as sclerophyllous woodland (Ganzhorn et al. 2018), found in the highlands of central and southwestern Madagascar (Figure 1A). These woodlands are a form of savanna, differentiated floristically from the scattered forest patches found in riparian areas and upland hollows in same region (Solofondranohatra et al. 2018) Humbert (1965) classified the tapia woodlands as part of the Western Slopes sector of the Central Domain vegetation region; Cornet and Guillaumet (1976) labeled the woodlands an anthropogenic formation within the ‘subhumid’ vegetation stage (Lowry et al. 1997). This chapter surveys tapia woodlands, looking at their characteristics, origins, their use by humans, and their management, especially by fire.

## Tapia woodlands

Tapia woodlands are found in several small clusters around the Central Highlands (Figure 2). The four major zones include: Imamo, near Arivonimamo and Miarinarivo; the Col des Tapis between Ambositra and Antsirabe; Itremo, west of Ambatofinandrahana; and Isalo. They cover approximately 1319 km<sup>2</sup> (Moat and Smith 2007). Areas of tapia woodland are now included within three protected areas: Itremo, Ibity, and Isalo. These represent ca. 30% of the total remaining area of this vegetation type. Itremo and Ibity are both new protected areas (Goodman et al. 2018) and much of the tapia woodland within these sites is included in zones of sustainable use (*Zones d’Utilisation Durable* or ZUD) so that local people can continue to use the benefits traditionally derived from this vegetation.

Tapia woodlands are found at elevations ranging from 800 m to 1800 m, in the bioclimate class « sH1e » of Cornet (1974) defined as sub-humid with a distinct dry season of seven months from May to October, albeit attenuated by occasional winter clouds and drizzle. Precipitation ranges from 1000 to 1500 mm per year and the mean annual temperature is from 17 to 22°C. Worldwide such climates are associated with fire-prone ecosystems (Hoffman et al. 2012) since there is sufficient rain to allow highly combustible C4 grasses to grow abundantly but also a marked dry season that allows them to burn, and the tapia woodland is no exception. Edaphic factors also determine tapia woodland distribution; most are found on nutrient-poor rocky soils underlain by granites and gneisses.

Tapia woodlands are also known as mid-elevation sclerophyllous forests or western slopes sclerophyllous forests of the *Sarcolaenaceae-Uapaca bojeri* series (DEF 1996; Lowry et al. 1997). Most of the tree species found in this habitat are similarly shaped, with tortuous trunks, low branches and dull, dark green fleshy or leathery leaves; maximum trunk diameters typically attain 40 cm, while the maximum height is between 8 to 12 m (Alvarado 2014) (Figure 3A). The canopy of tapia woodland is more or less open (hence, following White (1983), the use of the term ‘woodland’ rather than ‘forest’ to describe this vegetation) with a shrub layer and a well-developed ground layer of grasses and forbs (Figure 1B).

As far as floristic composition, ecological surveys at the Col des Tapis, Ibity, and Itremo woodlands found, respectively: 15, 12, and 11 tree species; 34, 21, and 7 shrubs or non-herbaceous woody species; and \*, 87, and 66 herbaceous species (\*not recorded in Col des Tapis). The surveys were based on 30 (Ibity) and 21 (Itremo) plots of 1600 m<sup>2</sup> (Alvarado et al. 2014) and on a dozen plots of 500 m<sup>2</sup> at Col des Tapis (Kull et al. 2005).. Tapia woodland is remarkable among ‘natural’ woody vegetation types of Madagascar in that the canopy is dominated by one tree species, *U. bojeri*. For example, in the tapia woodland at the Col de Tapis, Ibity, and Itremo this species represents 88%, 92.8%, and 78.7% of canopy trees Kull 2002; Alvarado et al. 2014). The shrub layer includes several species of *Sarcolaenaceae* (*Leptolaena*, *Schizolaena*, and *Xerochlamys*), several *Erica* species, as well as *Vaccinium secundiflorum*, *Aphloia theiformis*, and *Ateropeia densiflora*; while the ground layer includes numerous species of *Poaceae*, *Cyperaceae*, *Asteraceae*, *Lamiaceae*, and *Orchidaceae* - all species being characteristic of grassland, rather than of degraded forest (Solofondranohatra et al. 2018). The species at these study sites, except for recently introduced *Pinus* spp. and *Eucalyptus* spp., are all native to Madagascar, and many of the species are either regional or local endemics.

Sharing the landscape with tapia woodlands are vast areas of grassland and shrubland (sometimes dotted with more or less isolated *U. bojeri*) and small areas of moist evergreen forest. This forest formation is restricted to valley bottoms, where they are better watered and sheltered from wild fires, and are sometimes also found on steep south-facing, and therefore shady, slopes. The tapia woodland and the neighboring evergreen forest share almost no plant species (Solofondranohatra et al. 2018). There is an abrupt transition between these relatively inflammable forests (where light-loving and highly combustible C4 grasses are absent due to the dense canopy) and the surrounding flammable grassland including tapia woodland.

## Origin of Tapia Woodlands

The extent to which tapia woodlands are natural or derived under anthropogenic pressures, especially fire, is uncertain. Analysis of lake sediment cores (Burney 1987) originating from a landscape that now includes tapia woodland shows that immediately prior to the time of presumed human settlement within this landscape, estimated in this study to be between 1500 to 2000 BP, wildfires were present in the landscape and the vegetation included grassland, scrubland, and woodland and/or closed-canopy forest. These cores also show that around the time of human colonization here there was an increase in fire frequency, a decrease in trees, and an increase in grasses and forbs. Pollen of *Uapaca* is present in the cores prior to human settlement but not abundantly so, and it is also uncertain whether this pollen originated from *U. bojeri* or a different forest-dwelling species in this genus.

The presence today of a species-diverse grassland flora constituting the ground layer in tapia woodland, overwhelmingly dominated by native plants and including many locally endemic species, supports the notion that this flora is not recently derived (Bond et al. 2008). However, as reported in woodlands elsewhere (e.g. Lawton 1978; Chidumayo 1989) it is probable that the increased fire frequency and especially the increased frequency of unseasonal fires, lead to a reduction in canopy cover and the loss of tree species that are less resilient and resistant to burning than the currently dominant *U. bojeri* (Gade 1985; Rakotondrasoa et al. 2012; Alvarado et al. 2014). Manzi (2019) reports that a similar process has led to the *Bismarkia nobilis* dominated grassland in western Madagascar.

Certainly *U. bojeri* possesses the attributes of a fire-adapted grassland tree, as opposed to a forest tree, as described by Hoffman et al. (2009). These attributes include: seeds whose germination and growth is favored in sparse grassland (such as after burning) and by direct sun exposure; young plants that that accumulate protective bark (Figure 3B rapidly enabling survival and re-sprouting after top-kill due to burning; leathery leaves that resist burning; and, should burning occur, the ability for new shoots to penetrate through the bark to replace burnt stems (so called epicormic spouting, Figure 3C) (Kuhnholz-Lordat 1938; Koechlin et al. 1974; Rakotoarivelo 1993; Rasoafaranaivo 2005).

Apart from *U. bojeri*, other species occurring in tapia woodland have at least some tolerance to fire and Rasoafaranaivo (2005) showed that burning in the wild did not increase mortality of mature plants compared to unburnt plants of any of a sample of 10 tapia woodland species. Rasoafaranaivo (2005) also showed that that burnt individuals of most of these species were able to recover their pre-fire condition quite rapidly although, for some, flowering and fruiting were reduced in the season post burning compared to unburnt plants. However, Alvarado et al. (2012) found that high temperature, such as might be caused by fire, did not stimulate germination for any of six tapia woodland species and also reported that burning kills a large proportion of seedlings of four woody plants typical of tapia woodland, including *U. bojeri*, especially when the plants are small.

It is thus likely that today's tapia woodland is to some degree structurally and floristically different from its form prior to human settlement. Its fauna too is almost certainly different. The pre-human version of this vegetation provided habitat to a much wider diversity of large animals than today. For example, giant tortoises, now extinct, were certainly present and perhaps abundant in this landscape (Goodman and Jungers 2014; see Godfrey et al., p. xx). The cause of extinction of such animals is still hotly debated but probably is at least partly due to hunting by human colonizers (Crowley 2010). Currently the fleshy palatable fruits of *U. bojeri* are undispersed, except by humans, and presumably the past fauna would have included one or more seed dispersers for this plant. Furthermore, some of the lost fauna would have been herbivores and their loss may have caused an accumulation of grassy biomass leading to more frequent and more intense fires (Crowley 2010).

### **Economy and Subsistence**

People living near tapia woodlands gain revenue and subsistence resources from tapia woodland products, including marketable fruit, wild silk, and firewood. Tapia leaves are the preferred fodder for *landibe*, an endemic silkworm (*Borocera madagascariensis* Lepidoptera: Lasiocampidae). *Landibe* produce cocoons twice a year, November-December and May-June. Production varies immensely from year to year in both quantity and location. Villagers painstakingly gather cocoons from tree branches, leaves, and grass tufts. The chrysalis is eaten, and the empty cocoons are cooked, spun, and woven into silk fabrics. Much *landibe* silk is used to produce ritual burial shrouds, *lambamena*, for funerals and reburial ceremonies (*famadihana*) throughout the Central Highlands (Gade 1985; Kull 2002) and for a variety of scarfs and shawls that are sold locally and to tourists.

This silk-based economy has been important for several centuries, serving as a source of government revenue through royalties and concessions in both pre-colonial and colonial times. Beginning in the 1940s, the government established silk cooperatives; collection and commercialization was limited to members, and guards watched for illegal harvesting. These cooperatives dissolved in the 1960s following independence. Currently, local governments exercise little, if any, control over silk harvesting and commerce.

The November-December silk harvest provides crucial cash income during the meager months before the rice harvest. In the Col des Tapia region, two-thirds of households collect *landibe*, one-third earn cash income from the harvest, and one in five women is involved in spinning and weaving. In 1998, 200 female *landibe* cocoons sold for 100-150 MGA or \$0.10-0.15, and a finished 2 x 2 m *lambamena* for between 30,000 and 60,000 MGA (\$30-60) in Antananarivo (Kull 2002; Kull et al. 2005). In the latter 20<sup>th</sup> century the availability of cheap, long-lasting synthetic cloths dented the *lambamena* economy (Razafintsalama and Gautschi 1999, however, new products using this material, such as scarfs, have been developed for sale to tourists. These items are dyed using locally-collected plants - some also originating from the tapia woodland.

*Uapaca bojeri* produces large quantities of an edible fruit, *voan'tapia*; trade in this fruit has for many centuries provided income to communities living near the woodlands. The fruit is a small (2-3 cm diameter) round drupe, green to yellow on the tree and brown when ripe. As only fallen fruit are ripe, a strong taboo (*fady*) prohibits plucking fruit from the branches. In the Col des Tapia region, nine out of 10 households collect fruit; two-thirds earn cash income from the sale of fruit to urban consumers. In 1998, villagers earned 80 to 240 MGA per *katinina* basket, about 4 kg or 700 cm<sup>3</sup>, which translates to about \$0.02 to 0.06/kg. During the harvest, the Col des Tapia woodlands daily produce approximately 4 kg of fruit per hectare, an overall annual production of 600 to 1500 tons for the 50 km<sup>2</sup> zone. The fruit harvest, from mid-September to December, boosts family income at a critical time, allowing people to hire rice-transplanting labor and buy agricultural inputs such as seeds, manure, or fertilizer (Kull 2002; Kull et al. 2005).

Tapia woodlands provide other resources to the local subsistence economy. First, most villagers rely on the trees for woodfuel. Second, the woodlands host seven varieties of edible mushrooms. Most families collect mushrooms; some sell them locally and to regional markets. Third, many woodland species have medicinal value (Tables 1 and 2). Fourth, three mammals within the group of spiny tenrecs (subfamily Tenrecinae), *Echinops telfairi* (only near the Isalo tapia area), *Setifer setosus*, and *Tenrec ecaudatus*, are occasionally hunted in and around these woodlands. Fifth, woodland insects, such as *saraoa* caterpillars (*Antherina suraka* Lepidoptera: Saturniidae) and *landibe* chrysalises, are collected, consumed, and sometimes sold, forming an important part of hungry-season protein intake (Gade 1985). Finally, the berries of several plants growing within the tapia woodland are edible and provide snacks. The tapia forest thus serves as a source of dietary supplements, especially during the hungry period before the rice harvest (Ramamonjisoa 1995).

The woodlands supply an average of 6.5 % of the cash income of Col des Tapia households (Kull et al. 2005). However, dependence upon woodlands for cash income varies from zero to 40%. Large poor families tend to be more dependent than others on the woodlands for cash and subsistence (Razafintsalama and Gautschi 1999; Kull 2002).

### **Management and Protection**

The structure and flora of today's tapia woodlands is certainly, but to an unknown extent, the result of anthropogenic influences. These may be indirect and caused coincidentally but may also be caused by direct management interventions to favor revenue-generating forest products such as: imposing a fire regime that is beneficial to the useful and fire-adapted *Uapaca bojeri*; selective cutting; and protecting the woodlands (Kull 2002).

Most lightning strikes occur in the wet season and typically at this time the resultant fires will burn only small areas since the grassland vegetation is moist and the fires extinguished by rain, however relatively rare strikes occurring at the transition between the dry and wet season may be intense and burn large areas (Ramos-Neto and Pivello 2000, Platt et al. 2015). Humans have modified this natural regime and now tapia woodlands burn more frequently, normally during the dry season, but presumably less intensely since less fuel is available. In an 18 km<sup>2</sup> part of the Col

des Tapia region, 37 % of woodlands burned during 1998, a heavy fire year (Kull 2004) and on Ibity Massif between 2000 to 2017 some tapia woodlands burnt every two years (Ramahefamanana et al. 2019).

Even under these fire regimes the edges of tapia woodland are remarkably stable, at least over the last century (Kull 2002; Ramahefamanana et al. 2019) (Figures 4A and 4B). However, there is also evidence that the anthropogenic fire regime, while having little impact on mature trees of *U. bojeri*, may prevent their regeneration since small plants may be unable to escape the called ‘fire trap’ in which they repeatedly burnt to the ground and re-sprout leaving intermediate size classes relatively impoverished (Alvarado et al. 2012). For example, on the Ibity Massif, on average in three 0.16 ha plots established in tapia woodland that had burnt at least 6 times between 2000 and 2017, there were just 21 stems of tree species (mainly *U. bojeri*) in the stem diameter class >1 to 5 cm; 13 in the class >5 to 10 cm, yet 34 in the diameter class >10 cm.

Tapia woodland is often associated with rocky terrain (Guillaumet et al. 1972-73) perhaps because fire burns unevenly in such areas allowing some young plants to escape the fire-trap and grow sufficiently tall to avoid top-kill by future fires. Birkinshaw and Andriamihajarivo (2007) reported a positive correlation between species richness of woody plants in tapia woodland and the rockiness of the habitat and explained this relationship as being the result of the rocks attenuating the impact of the fire and creating a patchy burn. Thus while those wishing to nurture tapia woodland will want to maintain fire they also need to consider the appropriate fire frequency and the appropriate timing of fires to enable regeneration – early dry season fires, when grasses are still quite moist, are less intense and the burn is patchier. Protected area managers of grassland ecosystems, including tapia woodland, wishing to encourage species diversity will likely seek to promote a mosaic of different fire regimes across the site that will favor regeneration of different species and not just *U. bojeri*.

Fire also plays a role in increasing silk production. Light understory fires during or after the rainy season (January to May) control predatory ant populations and stimulate re-sprouting of grass and young tapia leaves favored by *landibe*. In addition, burning plays a role in the production of firewood, by creating dead and downed wood that villagers were by tradition allowed to collect, and also in providing rejuvenated pasture for grazing cattle. Collection of firewood and pasturing cattle is allowed in the *Zone de Utilisation Durable* (ZUD or Zone of Sustainable Use) of some New Protected Areas.

The Malagasy also significantly shape the woodland by selective cutting. Since nine out of 10 trees are *U. bojeri*, this tree contributes significantly to local woodfuel use. However, people gathering woodfuel are more aggressive in cutting trees other than *Uapaca*, like *Leptolaena* spp. and *Sarcolaena eriophora*, thus favoring the dominance of *U. bojeri*. In addition, long-established practices of woodfuel collection emphasize dead, downed, and sick branches, and may have a pruning effect, removing inefficient lower branches, reducing the danger of crown fires, and perhaps increasing fruit and branch production (Kull 2002).

Overharvesting of firewood can degrade woodlands. However, a comparison of firewood use with forest growth in the Col des Tapia region suggests, tentatively, that firewood collection

at its current level is sustainable (Kull 2002). Population growth may increase local demand for firewood, yet may not degrade tapia woodlands due to protective rules (below) and increased reliance on alternatives such as introduced pine and eucalyptus (three-fifths of households in the Col des Tapia region grow these trees). Increased urban demand has been shown to cause massive, private investment in fast-growing pine and eucalyptus woodlots in some areas; while increased localized demand is met from a mix of sources including native trees, introduced species (pine, eucalyptus, and mimosa), and trimmings from hedges and fruit trees.

Finally, tapia woodlands benefit from protection by local traditions and government rules. The woodlands have long been managed as community resources under formal state ownership. Since the French colonial period, successive laws have formally given adjacent communities traditional use rights. In all areas, the woodlands are guarded by local traditions, more or less rigorously applied, including restrictions on cutting live trees, on plucking fruit from trees, on breaking large branches to access the spiny *landibe*, or on outsiders commercially exploiting forest products. On top of local rules, the colonial and post-colonial Forest Service placed strict restrictions on forest cutting and burning. Enforcement during the colonial period was stricter than it is now, and there have been episodes when indiscriminate cutting led to tree loss. In the 1970s and 1980s, damage was done to Col des Tapia woodlands as people cut and burned tapia trees to make *laro*, ashes used in soap and tobacco factories. In several instances, entire stands were devastated for charcoal production. However, drastic violations can result in government prosecution or citizen protests, as was the case in a conflict over a mining concession near Arivonimamo in 2016. . Around the Ibity Massif, prior to the designation of the site as a NPA, some 50 families survived periods of hardship by converting woody trees found in tapia woodland, rarely including *U. bojeri*, into charcoal for sale. Fortunately, the ability of these cut tree species to re-sprout, as an adaptation against burning, means that the vegetation is quite resilient even to this treatment.

Legislation in 1996 and 1997 opened the way to officially decentralize the management of state-owned renewable natural resources, such as tapia woodlands, to adjacent communities. While under these rules there is no actual transfer of title from the State to the community; limited use rights are transferred to a local users group. However, such contracts have proven highly legalistic and, without NGO-support and strong interest alignment (Horning 2018), have lead to mediocre outcomes and only small livelihood benefits (Freudenberger 2010; Rasolofoson et al. 2017). Moreover, structural issues like legal prohibitions on burning, means that this legislation is not well adapted to traditional management of tapia woodlands (Razafintsalama and Gautschi 1999; Kull 2004).

Probably the most important immediate threat to tapia woodlands is neither cutting nor fire, but invasion by exotic species. Spontaneous colonization occurs from private and village woodlots, consisting particularly of pine (*Pinus khasya* and *P. patula*) in the Col des Tapia region (see Table 1) and *Eucalyptus* spp. in the Imamo area. According to villagers and local foresters, pines and eucalypts may damage tapia woodlands by shading out the heliophilic woodland species, modifying fire regimes, and changing soil characteristics; additional research is urgent.

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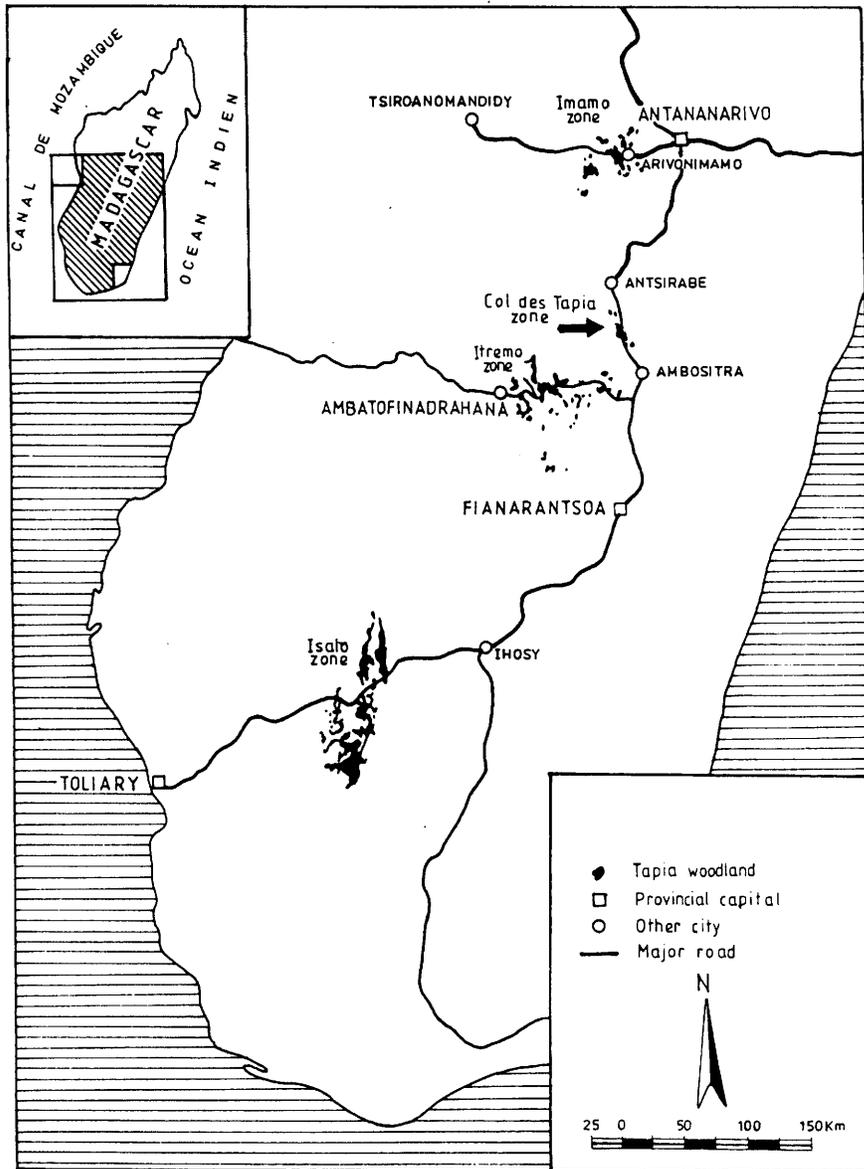
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**Figure 1. A)** Typical hillside in the Col des Tapia zone between Antsirabe and Ambositra. Valley-bottoms are cultivated with rice, lower hill-slopes host tapia woodlands, and ridges include rare crop fields and open grassland used as pasture. (Photograph by C. Kull.) **B)** Tapia woodland on the Ibity Massif showing open canopy and grass dominated ground layer. (Photograph by Chris Birkinshaw.)



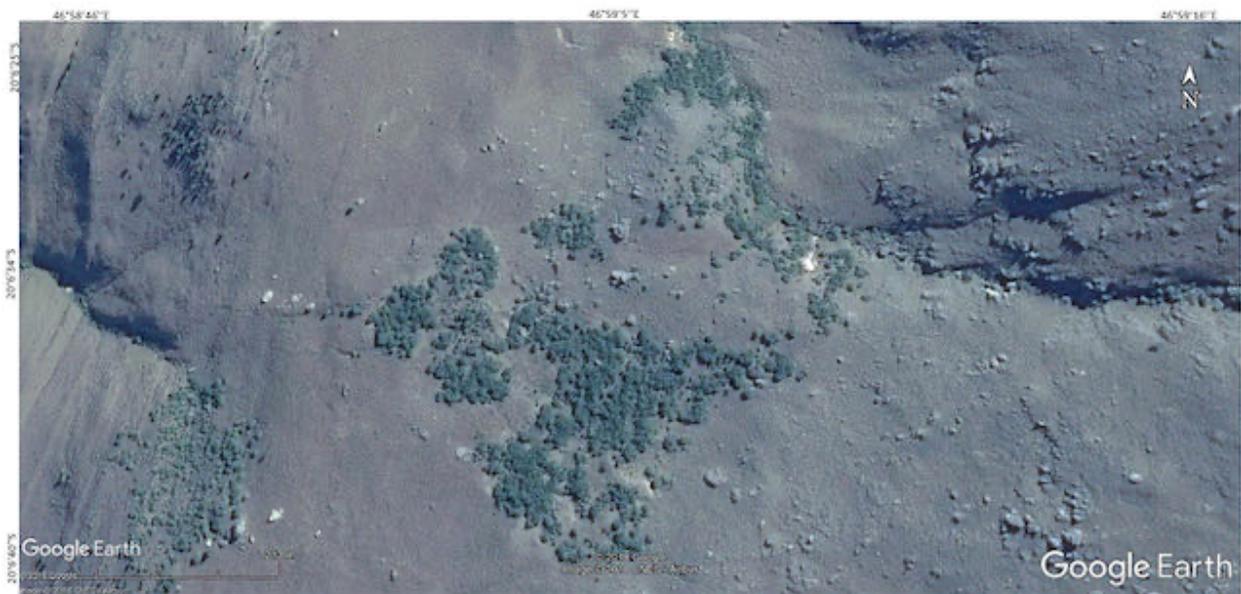
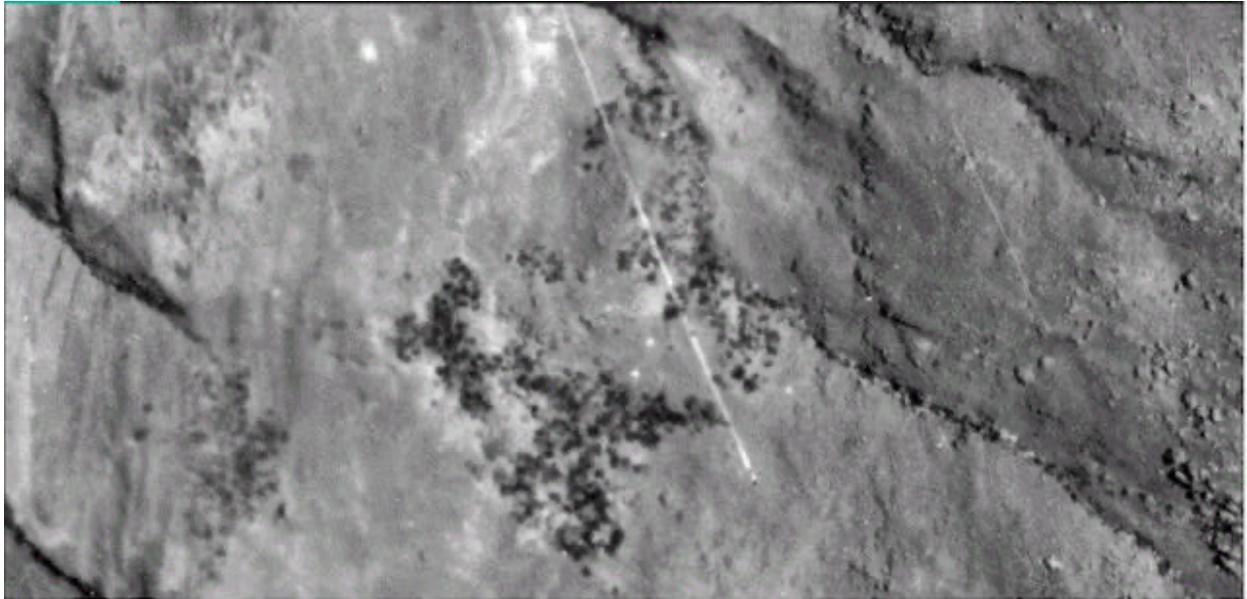
**Figure 2.** Locations of *tapia* woodland zones in Madagascar. Based on FTM 1:500,000 series maps.



**Figure 3.** **A)** Tree of *Uapaca bojeri*. (Photograph by Chris Birkinshaw.); **B)** Thick protective bark of *Uapaca bojeri*. (Photograph by Chris Birkinshaw.); **C)** Stem of *Uapaca bojeri* showing epicormics shooting after burning. (Photograph by Chris Birkinshaw.)



**Figure 4.** **A)** An area of tapia woodland on the Ibity Massif in 1949 (aerial photo from Foibe Tao-Tsaritan'i Madagasikara); **B)** same area of woodland in 2016 showing little change in cover despite being in a zone that burns every 2 or 3 years (image from Google Earth).



**Table 1.** Tree species found in Col des Tapia woodlands and their local uses. “Dominance” represents percentage of trees encountered in a dozen survey plots of 500 m<sup>2</sup> with dbh > 5 cm. Non-native plants are preceded with an asterisk (\*). Data based on Kull (2002).

Genus, species (family)	Local name	Dominance	Uses
<i>Uapaca bojeri</i> (Phyllanthaceae)	<i>tapia</i>	88.3	edible fruit, woodfuel, silkworm fodder, medicine (stomach, heart)
<i>Sarcolaena eriophora</i> (Sarcolaenaceae)	<i>voandrozana</i>	4.9	woodfuel, charcoal, small edible fruit
* <i>Pinus patula/khasya</i> (Pinaceae)	<i>kesika</i>	3.7	construction, woodfuel
<i>Leptolaena</i> spp. (Sarcolaenaceae)	<i>fotona</i>	1.4	woodfuel, charcoal, small edible fruit
<i>Trema</i> spp. (Cannabaceae)	<i>andrarezina</i> ( <i>tsivakimbaratra</i> )	0.34	commercialized ashes
<i>Xerochlamys bojeriana</i> (Sarcolaenaceae)	<i>hatsikana</i> ( <i>katsikana</i> )	0.34	woodfuel, roots used to flavor rum, tannins, medicine (sick pigs)
unidentified	<i>ndretsimora</i> ( <i>andriatsimora</i> )	0.2	antivenom for scorpions, medicine (diarrhea)
unidentified	<i>fanazana</i>	0.2	tea, medicine (stomach, paranoia)
<i>Agauria salicifolia</i> (Ericaceae)	<i>angavodiana</i>	0.18	medicine (cuts/bleeding)
<i>Neocussonia bojeri</i> (Araliaceae)	<i>tsingila</i>	0.15	medicine (stomach, last resort, cuts/bleeding)
<i>Vaccinium emirnense</i> (Ericaceae)	<i>voaramontsina</i>	0.15	woodfuel, fruit edible, tasty
<i>Aphloia theaeformis</i> (Aphloiaceae)	<i>voafotsy</i>	-	popular tea
<i>Baronia taratana</i> (Anacardiaceae)	<i>taratana</i>	-	medicine (stomach, last resort)
<i>Tambourissa</i> spp. (Monimiaceae)	<i>ambora</i>	-	medicine (teeth)

**Table 2.** Understory species found in Col des Tapia woodlands. Data based on Kull (2002).

<b>Genus, species (family)</b>	<b>Local name</b>	<b>Uses</b>
<i>Aloe</i> spp. (Asphodelaceae)	<i>vahona</i>	medicine (stomach, cuts/bleeding)
? <i>Asteropeia densiflora</i> (Asteropeiaceae)	<i>fandambana</i>	woodfuel
<i>Brachylaena ramiflora</i> (Asteraceae)	<i>hazotokana</i>	medicine (broad usage)
<i>Carissa edulis</i> (Apocynaceae)	<i>voahangitanety</i>	-
<i>Cassia mimosoides</i> (Caesalpinaceae)	<i>kelimanendilanitra</i>	medicine; ceremonial (ward off hail)
<i>Caucalis melanantha</i> (Apiaceae)	<i>kisetroka</i>	medicine (headaches, cold, blurred vision)
<i>Dombeya greveana</i> (Malvaceae)	<i>ambiaty/ombiaty</i>	burn to make commercial ashes
? <i>Dracaena reflexa</i> (Asparagaceae)	<i>ravoanjo/ranjo/raivoanjo</i>	for toilet training dogs (by rubbing leaves on the ground to deter dog from using that location)
? <i>Embelia</i> spp. (Myrsinaceae)	<i>tateradela</i>	medicine (for children, for cuts)
<i>Erica</i> spp. (Ericaceae)	<i>anjavidy</i>	woodfuel, medicine (cough)
<i>Helichrysum rusillonii</i> (Asteraceae)	<i>ahibalala</i>	medicine (stomach, cough, fever, last resort)
? <i>Helichrysum</i> spp.	<i>tsetsatsetsa</i>	-
<i>Maesa lanceolata</i> (Myrsinaceae)	<i>rafy</i>	small sweet edible fruit, medicine (teeth, chest pain)
<i>Plectronia</i> spp. (Rubiaceae)	<i>fatsikahidambo</i>	medicine (paranoia)
<i>Psiadia altissima</i> (Asteraceae)	<i>dingadingana</i>	-
<i>Psorospermum</i> spp (Clusiaceae)	<i>tambitsy</i>	medicine (general)
<i>Pterocaulon decurrens</i> (Asteraceae)	<i>ariandro</i>	-
<i>Radamaea montana</i> (Scrophulariaceae)	<i>tambarasaha</i>	woodfuel, cosmetic
<i>Rubus apetalus</i> (Rosaceae)	<i>rohifotsy</i>	medicine (anti-venom, heart, cuts)
<i>Senecio faugasiodes</i> (Asteraceae)	<i>hanidraisoa, koboï-boy</i>	medicine (cracks in feet, <i>fery</i> )
<i>Solanum</i> spp. (Solanaceae)	<i>sevalahy</i>	-
<i>Tetradenia fructicosa</i> (Labiaceae)	<i>bororohana</i>	medicine (paranoia)
<i>Vernonia glutinosa</i> (Asteraceae)	<i>ramanjoko</i>	medicine (fever)
<i>Vernonia</i> spp.	<i>kijejalahy</i>	medicine (sexually transmitted diseases, fever, stomach, general)
Unidentified vine	<i>vahy famonololo</i>	used to tie things, medicine (paranoia)
unidentified	<i>arivoniraviny</i>	wood for craft-making
unidentified	<i>fano</i>	-
unidentified	<i>hazomiarotena</i>	-
unidentified	<i>(keli)boloana</i>	medicine (fever, last resort)
unidentified	<i>kiripika</i>	-
unidentified	<i>reniomy</i>	medicine (for cattle illness)
unidentified	<i>voamasonomy</i>	medicine (constipation)
unidentified	<i>voatainosy</i>	woodfuel, tiny edible fruit, flavors rum
unidentified	<i>voatsitakazaza</i>	tiny edible fruit