The IUCN Red List of Ecosystems
Scope: Sub-global
Language: English

Tapia Forest, Madagascar

Assessment by: Moat, J., & Bachman, S.

Overall risk category **EN**

NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENDANGERED	COLLAPSED
NE	DD	LC	NT	VU	EN	CR	CO

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Ecosystem Description

Tapia Forest is recognised as a major vegetation type in the Atlas of the Vegetation of Madagascar (Rabehevitra and Rakotoarisoa 2007). It is a stratified, evergreen forest with a low (8 - 12 m) semi-continuous tree canopy, an understorey of ericoid shrubs, frequent lianas but few epiphytes, and a moderate to rich herbaceous component dominated by grasses (Rabehevitra and Rakotoarisoa 2007). The most characteristic specie is Uapaca bojeri (Tapia). Tapia Forest typically occurs at 500-1,800 m elevation above sea level on dissected terrain, within sub-humid to sub-arid climates (Cornet 1974) on the western and central parts of the main plateau of Madagascar. Fire is a key element in the distribution and diversity of Tapia Forest, influencing both survival and regeneration of its component species (Rabehevitra and Rakotoarisoa 2007). Charcoal manufacture, firewood, timber collecting, grazing and change in fire regime are the major threats for this ecosystem.

Classification

IUCN Habitats Classification Scheme

- 1. Forest
  - 1.5. Forest - Subtropical/tropical dry

IUCN Global Typology

- Terrestrial
  - T1. Tropical-subtropical forests
    - T1.2 Tropical-subtropical dry forests and scrubs

Distribution

Tapia Forest occurs on the western and central parts of the main plateau of Madagascar. Substantial stands of Tapia Forest occur in the south and in Isalo National Park. Smaller patches occur around Ambatofinandrahana and surrounding areas (central Madagascar west of Fianarantsoa) and Morarano (north-east of Antananarivo).

System

Terrestrial

Biogeographic Realm

Afrotropical

Countries

Madagascar

Geographic Region

South Madagascar/Center Madagascar

Characteristic Native Biota

Tapia Forest is a forest comprising an evergreen canopy of 10-12 m, with an understorey of ericoid shrubs. Lianas are frequent, but epiphytes are few. The herbaceous layer is dominated by grasses (Rabehevitra and Rakotoarisoa 2007). Tapia Forest is floristically diverse compared to its surrounding vegetation of denuded grassland and wooded grasslands of the high plateaux. The plants are mostly sclerophyllous, hairy or heliophilous. The tree bark in this type is frequently thick, and resistant to fire. Common canopy families are Cunoniaceae, Anacardiaceae, Rubiaceae, Ericaceae, Sarcolaenaceae and Asteraceae, while two endemic plant families (Sarcolaenaceae and Asteropeiaceae). Poaceae and Asteraceae dominate the herbaceous stratum with Pachypodium rossulatum occurring frequently on rock outcrops. Three mammals occurring within Tapia Forests are known to be hunted: Echinops telfairi, Setifer setuosus and Tenrec ecaudatus (Kull 2003a). Insects occurring within this ecosystem include landibe (Borocera cajani) or wild silk moth (Razafimanantsoa et al. 2012).

Taxa

Agarista spp., *Asteropeia labatii*, *Borocera cajani*, *Echinops telfairi*, *Pachypodium rossulatum*, *Pentachlaena latifolia*, *Sarcolaena oblongifolia*, *Schizolaena microphylla*, *Setifer setuosus*, *Tenrec ecaudatus*, *Uapaca bojeri*, *Weinmannia spp*

Abiotic Features

Tapia Forest typically occurs at 500-1,800 meters elevation above sea level on dissected terrain. Soil characteristics are likely to determine the distribution of the ecosystem (Kull 2003, 2004). The forest is on eroded ruiniform sanstone, where acidity tends to be high. Tapia Forest occurs within sub-humid to sub-arid climates (Cornet 1974), although the average annual rainfall ranges from 900 mm up to 1,400 mm with 80–90 rainy days (Gade 1985). Tapia Forest tends to occupy rain shadow microclimates, where rainfall is lower and temperatures are higher than the surrounding areas. Following the Köppen-Geiger scheme Tapia Forest occurs typically in the tropical savanna to humid subtropical climate.

Biotic Processes

Fire is highly influential in the distribution and diversity of Tapia Forest, influencing both survival and regeneration of its component species (Rabehevitra and Rakotoarisoa 2007), this has both positive and negative aspects. Other key factors that determine the distribution of Tapia are not clear, although soil factors are likely to have an influence, as Tapia Forest is often found on nutrient-poor rocky soils. Humans also influence the dynamics of Tapia Forest, with burning practices likely to have involved significant modification of the system over the 1500 years of human occupation. Tapia (Uapaca bojeri) is an endemic species valued for its edible fruit which is high in Vitamin C, also the bark is used in Malagasy folk medicine to relieve diarrhea (Gade 1985). These uses may influence the dispersal of seeds. This species is highly prized because it hosts silk worms and thereby supports village-based silk industries. Tapia usually resprouts from roots and stumps, but can also regenerate through rhizomes and via seed dispersal (Kull 2003).

Threatening Processes

Tapia Forest occurs throughout Madagascar’s plateau areas, which has ensured its exposure to multiple human pressures including charcoal manufacture, firewood and timber collecting, grazing and change in fire regime (Rabehevitra and Rakotoarisoa 2007). Tapia Forest is used for charcoal production in several Madagascar regions. Although it is not ideal for charcoal production due to its slow growth and low energy output, the human pressure and lack of any alternatives have dramatically increased the charcoal production from Tapia since the 1970’s. Individual Tapia trees have the ability to regenerate vegetatively when burnt. Kull (2003, 2004) argues that Tapia Forest owes its existence to fire, and he rebuffs the assertion that the woodlands are reducing with repeated burning. However, if fires are too frequent, they limit regeneration and species diversity of the herb layer can become very low. Non-native species such as Pinus sp. and Eucalyptus sp. can encroach on Tapia Forest and may affect soil characteristics, flammability and shade. Further work is needed to understand the extent of this disturbance (Kull 2003).

Collapse

Tapia Forest will collapse when its mapped distribution declines to zero.

Ecosystem Risk Assessment

Assessment Protocol	IUCN Red List of Ecosystems Category and Criteria	Last Assessed
IUCN RLE v2.0	Endangered A3	2013

Justification

The Tapia Forest global assessment classified it as Endangered. Limited data exists to quantify the current and future rates of decline in area of distribution of Tapia Forest. However, the increase in human population and activity since 1750 was assumed to have caused that most (though not all) of the decline in the distribution of Tapia Forest. The decline in distribution since 1750 was therefore assumed to be within the bounds of 70% to 90%. Thus, Tapia Forest was classified as Endangered under subcriterion A3.

Criterion A EN

Summary

The increase in human population and activity since 1750 was assumed to have caused that most (though not all) of the decline in the distribution of Tapia Forest. Allowing for a small amount of over-prediction and deforestation prior to 1750, and given qualitative evidence of ongoing declines from the 1990s to present, the decline in distribution since 1750 was therefore assumed to be within the bounds of 70% to 90%. Tapia Forest was thus assessed as Endangered under sub-criterion A3.

Risk Category EN

Subcriterion	Category	Justification
A1	DD	Limited data exists to quantify the current rate of decline in area of distribution of Tapia Forest, as this ecosystem is not well respresented in some country-wide mapping of the region. Moat and Smith (2007) use Harper et al. (2007) to show the general trend for the main vegetation types of Madagascar, they quote a 43% reduction in Tapia Forest for a 25 year period from 1975 to 2000. However, vegetation types that occur characteristically in small patches (of which Tapia is included) are problematic to classify (Moat and Smith 2007), and the same areas were often classified very differently due to differences in classification and mapping methods. Inspection of the data of Harper et al. (2007) shows that very little of the Tapia was mapped in initial prospections in 1975, probably because this vegetation can be sparser and occurs in smaller patches compared to the dry and humid forest vegetation types, which were the main vegetation types in that study. The estimates of decline in distribution based on a comparison of mapping from different sources are thus too uncertain to use for assessment of sub-criterion A1. Further work is needed to clarify the recent changes in Tapia Forest extent. As a result, the ecosystem is assessed as Data Deficient under sub-criterion A1. **Key Indicators in detail** Evidence of Continuing Decline: Stable or Increasing Evidence of Threatening Processes: No
A2a	DD	Proposed increases in number and area of protected areas (SAPM 2011) may eventually limit the ongoing decline in distribution of Tapia Forest if management of these reserves is able to eliminate exploitative activities such as wood harvesting and charcoal production. However, present rates of decline are poorly known, and therefore there is limited data to drive any analysis of projected declines. Modelling responses to climate change could provide appropriate data for this criterion but until that is carried out, the rating under sub-criterion A2a should be classified as Data Deficient.

Key Indicators in detail

Evidence of Continuing Decline: Stable or Increasing
Evidence of Threatening Processes: No

A2b DD

As subcriterion A2a, and present rates of decline are poorly known, and therefore there is limited data to drive any analysis of projected declines. Therefore, Tapia Forest are Data Deficient under sub-criterion A2b.

Key Indicators in detail

Evidence of Continuing Decline: Stable or Increasing
Evidence of Threatening Processes: No

A3 EN

The current distribution of Tapia Forest is most likely a remnant of a larger and more diverse forest (Kull 2003, 2004) transformed since the arrival of humans some 1500 years ago. The increase in human population and activity since 1750 was assumed to have caused that most (though not all) of the decline in the distribution of Tapia Forest. Allowing for a small amount of over-prediction and deforestation prior to 1750, and given qualitative evidence of ongoing declines from the 1990s to present, the decline in distribution since 1750 was therefore assumed to be within the bounds of 70% to 90%. Tapia Forest was thus assessed as Endangered under sub-criterion A3.

Key Indicators in detail

Evidence of Continuing Decline: Decreasing
Evidence of Threatening Processes: Yes

Indicator Variable: Change in distribution

Extent (%): 88.15

Mapped distribution
Year: 1750
Mapped distribution (km2): 26,200-13,900
Year: 1996
Mapped distribution (km2): 2,600
Year: 2007
Mapped distribution (km2): 1,319

Criterion B VU

Summary

Tapia Forest is often highly fragmented and sparse within the landscape. The minimun convex polygon enclosin all occurrences as mapped in 2000 (Moat and Smith 2007), has an area of 47,485 km2. Ongoing human pressures and plausible climate change scenarios suggest that the ecosystem is undergoing a continuing decline in distribution. Although threats are ongoing, they are not likely to rapidly affect the ecosystem. Thus, the ecosystem is classified as Vulnerable considering restricted extent of occurrence (sub-criterion B1aii,b).

Risk Category VU

Subcriterion	Category	Justification
B1	VU	The minimum convex polygon enclosing all occurrences as mapped in 2000 (Moat and Smith 2007), has an area of 47,485 km2. Ongoing human pressures and plausible climate change scenarios suggest that the ecosystem is undergoing a continuing decline in distribution. Also it has been observed that the ecosystem exhibits less biodiversity (and therefore decline in quality) in areas of frequent fires, especially those areas not formally protected or not safeguarded by local human populations. Therefore, the status of the ecosystem under sub-criterion B1aii,b is Vulnerable.

Key Indicators in detail

Evidence of Continuing Decline: Decreasing
Evidence of Threatening Processes: Yes

Indicator Variable: EOO

Mapped distribution
Year: 2000
Mapped distribution (km2): 47,485

B2 LC

Spatial analysis revealed that 108 10 x 10 km cells were occupied with Tapia Forest, of which 73 had over 1% level of occupancy. This estimate of Area of Occupancy is beyond the 50 grid cells threshold for Vulnerable, and hence Tapia Forest was assigned a status of Least Concern under sub-criterion B2.

Key Indicators in detail

Evidence of Continuing Decline: Decreasing
Evidence of Threatening Processes: Yes

Indicator Variable: AOO

Mapped distribution
Year: 2000
Mapped distribution (10x10-km grid cells): 73

B3 LC

Too little is known about the spatial patterns of threatening processes to estimate the number of locations. Although threats are ongoing, they are not likely to rapidly affect the ecosystem. Hence the second requirement of sub-criterion B3 (increased vulnerability to threats) is therefore unlikely to be met. The status of the ecosystem under sub-criterion B3 is therefore Least Concern.

Key Indicators in detail

Evidence of Continuing Decline: Decreasing
Evidence of Threatening Processes: Yes

Criterion C DD

Summary

Tapia Forest is too poorly studied to estimate the extent and magnitude of degradation in abiotic components within the ecosystem. The status of the ecosystem is therefore Data Deficient under criterion C.

Risk Category DD

Subcriterion	Category	Justification
C1	DD	No data has been collected to assess changes in abiotic variables affecting the ecosystem in the past 50 years.
C2a	DD	No data has been collected to assess changes in abiotic variables affecting the ecosystem in the next 50 years.
C2b		No data has been collected to assess changes in abiotic variables affecting the ecosystem in a 50-year window.

Key Indicators in detail

Evidence of Threatening Processes: No

Key Indicators in detail

Evidence of Threatening Processes: No

DD

Key Indicators in detail

Evidence of Threatening Processes: No

C3 DD

No data has been collected to assess changes in abiotic variables affecting the ecosystem since 1750.

Key Indicators in detail

Evidence of Threatening Processes: No

Criterion D DD

Summary

Tapia Forest is too poorly studied to estimate the extent and magnitude of degradation in biotic processes and interactions within the ecosystem. The status of the ecosystem is therefore Data Deficient under criterion D.

Risk Category DD

Subcriterion	Category	Justification
D1	DD	No data has been collected to assess degradation in biotic processes and interactions within the ecosystem in the past 50 years.
D2a	DD	No data has been collected to assess degradation in biotic processes and interactions within the ecosystem in the next 50 years.
D2b	DD	No data has been collected to assess degradation in biotic processes and interactions within the ecosystem in a 50-year window.
D3	DD	No data has been collected to assess degradation in biotic processes and interactions within the ecosystem since 1750.

Key Indicators in detail

Evidence of Threatening Processes: No

Criterion E DD

Summary

No quantitative analysis has been carried out to assess the risk of ecosystem collapse for Tapia Forest.

Risk Category DD

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