

Andringitra - A granite massif as a relict of GONDWANA with unique sub alpine forest/grassland ecotones

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Context

The Andringitra Massif's residual granite relief represents a visible testimony of Madagascar's geological past. During the Jurassic period until approximately 160 million years ago, Madagascar was part of the enormous super-continent GONDWANA. Since the slow southeastward drift away from mainland Africa towards its present position 120 million years ago and the break-off of India 80 million years ago, it evolved in isolation.

Man has inhabited Madagascar only since about 2000 years ago. The Andringitra Mountains were never permanently occupied but rather gained mystical and spiritual values and served as a refuge from feudal warfare for early settlers of the southern Madagascar highlands. According to village legend, the first people to venture into sub alpine elevations were cattle herders in search of healthy and productive pastures and more security from early cattle rustling. Since about 150 years ago, the sub alpine to alpine pastures of Andringitra upwards of about 1900 m have been included as integral parts of an intricate lowland-upland rotational grazing cycle. Stonewalls for cattle paddocks, rock shelters and burial sites are today vivid testimonies of this traditional form of transhumance. Thus, this ecosystem is not entirely natural, but represents a "sustainably disturbed" anthropogenic landscape.

Today, with natural population increase and additional pressures from in-migration, economic development, globalisation influences and liberalisation processes in rapid evolution, this form of traditional land use is in danger of getting into conflict with modern stakeholder interests such as conservation and tourism. As a consequence, the unique natural assets of the Andringitra Mountains are today co-managed by the national park service ANGAP and the local population.



Plate 23. "The balloon". Andringitra is said to have the most spectacular granite erosion formations in the world.
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Plate 24. A typical representative of the local "Betsileo" draped in a "Lambalandy", a traditional wild silk shawl, woven from cocoons of endemic silk worms *Borecera madagascariensis* or "Landibe". (© Peter Schachenmann)

Physiographical situation and climate

The Andringitra mountain range is located in south/central Madagascar. Its geographic position is approximately 100 km west from the Indian Ocean and a 120 km north of the Tropic of Capricorn (22°07'-22°21'S lat. and 46°02'-47°02' E long.). Being NW-SE aligned and having an elevational range between ~500 - 2600 m with numerous granite domes and peaks (Pic Boby 2658 m, Pic Bory 2630 m), it represents an orographic barrier between the humid and cooler oceanic flank in the east and a dry and hotter continental flank in the west. Seasonal climatic changes between summer and winter and temperature and humidity variations between day and night are brutal and the most extreme in Madagascar. The dry season during June to October coincides largely with the austral winter, where minimum temperatures at night may drop up to minus 16°C at summittal zones above 2500 m. Snow may fall occasionally and stay for a day or two down to around 2000 m. During November and December, before the monsoon season starts it gets very hot with prevailing winds from the west. Daily thunderstorms strike the summittal zones. Lightning frequently starts fires and precipitation remains very variable in space, duration and amount (from floods to droughts). During the monsoon season between December and April, the prevailing humid climate is from the oceanic east. Precipitation is variable but there is a steep gradient from the east- to the west slope of the mountain range (2000-->1000 mm), with only about half the amount of rain in the lee behind the granite arena. Throughout the year, except during September and October, the upper limit tree line on the eastern slope is exposed to daily cloud formation producing in parts the typical aspects of a cloud forest.

Box 14. A mountain poem by Gaston Bachelard

"...and so they started talking of the blue sky,
of murmuring seas, sweat airs and mountain highs,
as travellers, mingling from time to time
contempt and laughter for their native clime

...My pleasure still is to flow the stream, to walk
along the banks in the right direction, in the direction
of the flowing water, the water that leads life towards
the next village...."

Flora and fauna

Predominant factors shaping the vegetation are doubtless elevation and desiccation processes during the dry season. Daily temperature differences may be very marked, especially in some humid depressions. The "inselberg" character of the massif, combined with altitudinal zonation has led to high local endemism. Among the monocotyledons, of the 40% native to Madagascar, 7.7% are endemic to the Andringitra Mountains. Among the dicotyledonous, the corresponding proportions are 24% and 3.4%. Additionally, topographic variability, geomorphology, aspect, slope and exposure produce a high diversity of microclimates with their corresponding microhabitats with ericoid bush, sub alpine woodlands (Agauria,...) rich in lichen, dry and humid grasslands with a high diversity of Ericaceae, Asteraceae, Poaceae, peaty depressions and rocky outcrops rich in xerophytes. The sub alpine prairies are unique for geophytic Orchidaceae, of which over 30 species have been recorded so far.

Biodiversity assessments along altitudinal transects also confirmed an extraordinary corresponding faunal diversity. Among the reptiles, 80% are native to Madagascar of which 12% endemic to Andringitra. For amphibians, 11.4% of 52% native to Madagascar are endemic to Andringitra. 15 species of primates and insectivores were recorded, all endemic to Madagascar. And uniquely amongst the primates, a race of ring-tailed lemurs (*Lemur catta*) has adapted from their typical lowland forest habitats further to the southwest to this high mountain environment, colonizing a very special ecological niche of rock "desert" with succulent vegetation forms, moving up and down on the western flank according to season, temperature and availability of preferred food plants.

Box 15. The "pristine" environment a myth?

We learnt and scientifically proved that, contrary to conventional conservation wisdom, traditional land uses can be compatible with or may even be necessary for landscape- and biological diversity and functionality. After this discovery, the notion of a "pristine environment" appears a myth. The landscape keeps a memory of human "footprints" and conversely the cultural history of people is directly or indirectly entwined with the natural history of the land with its specific geo-morphology, climate, flora and fauna. Land users are automatically also land managers, therefore principally relationship managers, who continuously need to interpret physical, ecological, economic, social and political contexts and processes and adapt to, or manage interactions between nature and people over space and time in order to survive and thrive. Conservation objectives can therefore better be considered by inclusion rather than exclusion of people and by favouring a synergistic co-evolution of the transformation processes. Creative interaction and co-evolution grows and strengthens among equal partners having mutual respect for each others views, perceptions, logic,....

Historical context of land use

Remoteness, rugged terrain and rough climate never permitted permanent settlement and land use of the Andringitra Mountains. According to village legend, herders used fire as a tool to control ericoid bush, as well as expanding pastures into laurophyll mountain forests of Agauria. *This period can be described as the colonization phase.*

During botanical expeditions by the botanist Humbert in the early 1920's, the outstanding biodiversity value of the Andringitra mountain range was recognized and approx. 31'000 ha of the massif set aside as a Strict Nature Reserve in 1927 (Strict Nature Reserve 5) and legally ratified in 1966. After 1927 and up to political independence from the French colonial power in 1960, the reserve was patrolled and protected from unsustainable human impacts by forestry agents from the then powerful Water and Forest Service. Protection focused however more on forests than on montane grasslands, where cattle grazing continued to be tolerated on a moderate scale. During this period, natural fires from lightning and strategic anthropogenic fires set by pastoralists were controlled by human intervention within the reserve boundary as far as possible. *This period may be considered the conservation phase.*

After independence and until the early 1990's the Forestry Service lost influence, means and motivation to patrol the reserve and manage land use effectively. This resulted in a period of conflict, where the "owner" (the Water and Forest Service of the Government) had no means to control and the "user" (the local population) had no rights to continue to valorize the mountain pastures on a traditional basis, leading to haphazard and illicit use of mountain resources. *We may call this period the open access phase.*

The Andringitra National Park today

Effective in 1993, within the framework of the 1st Malagasy Environmental Action Plan, an Integrated Conservation and Development Project (ICDP) was mandated to develop a scientific base, tools and a legal framework for establishing and managing a new Andringitra National Park, finally decreed in 1998 as the 14th National Park in Madagascar. Under IUCN Cat. II protection status, the mandate for a park manager is one for conservation of unique natural resources and for visitor enjoyment in the form of sustainable ecotourism. As traditional resource access was somewhat curtailed (no grazing and fire), rapid ericoid bush encroachment led to more standing woody biomass with less herbaceous vegetation, out-shading geophytic orchids, while concurrently increasing the fire risk from highly inflammable fuel loads

(Ericaceae). Also, people/park conflicts flared up, leading to several protest fires within the park, damaging in particular the fragile montane forest ecosystem on the eastern ecotonal limit.

Strict protection being counterproductive in this context, we finally recognized, that traditional moderate land use and management of the sub alpine forest/grassland ecotones are necessary for shaping and maintaining (through grazing and fire) a mosaic of forest patches, ericoid bush and open grassland, combining unique biodiversity, important pasture values and aesthetic beauty for tourism.

For future sustainable multiple land use, using a holistic perspective for integrating and safeguarding these conservation-, pastoralist- and tourist objectives, a systemic approach and an integrative-, participative- and trans-disciplinary research and management methodology was developed. A negotiated tri-partite agreement between the park manager (ANGAP), the local population and the Water and Forest Service regulates current multiple stakeholder access and use. *The current period may therefore be called, the co-evolutionary management phase.*

How to visit the site

The Andringitra National Park and its immediate surroundings are well known today and have easy visitor access by road, off the Antananarivo -Tulear trunk road (RN7), either from Ambalavao town through the official northern gate of Namoly, where one finds the park headquarters, a magnificent interpretation centre, a well run ecolodge "TRANOGASY " and several campsites or, through the western access of the SAHANAMBO valley and TSARANORO, where two lodges (CAMP CATTa and TSARA CAMP) offer comfortable starting points for several days of mountain trekking. For VIP visitors or emergency evacuation the Andringitra massif may be accessible by small plane.

Box 16. The Andringitra ICDP: "Learning by doing" and adaptive management system

"Learning by doing" is an open ended and flexible process combining investigation, analysis, intuition, interpretation and "informed" trial and error and adaptation, copying nature in as much as the system permits to better tailor the approach to the context, the continuous elimination of failures and the rapid strengthening of successful options. For example, the scientists learnt from long standing observation, experiences, intuition, legends and taboos of local people and *vice versa*, interested villagers learnt to be excellent para-scientists, integrating their "soft" traditional knowledge in a database from "hard" sciences, at the same time learning to comprehend and even apply Cartesian logic and methodology of modern sciences; or in other case, adapted modern state legislation permitted integration of traditional "law" (Dina) for conflict resolution or third, different land-uses like e.g. pastoralism and tourism can be compatible with conservation needs. These components, segregated in the past, developed more and more synergy, creating a base for mutual understanding and reciprocal benefits from a matrix of multiple objectives and land-use systems.