

Vanishing forests and sustainable development of an arid island

Soqotra (Yemen): an example



BY GIUSEPPE ORLANDO AND BRUNO MIES

Located at the eastern entrance of the Gulf of Aden, the Soqotra archipelago lies between latitudes 12°06' N and 12°42' N and longitudes 52°04' E and 54°32' E. It consists of the main island Soqotra (3,549 Km²), three smaller islands, Abd al-Kuri (162 Km²) and "The Brothers", Samhah (45 Km²) and Darsa (10 Km²) and two rocks, Cal Farun and Hertha. Abd al-Kuri, the westernmost of the archipelago, lies at only 100 Km from Cape Guardafui, in Somalia. Soqotra itself lies at about 240 Km East off the Horn of Africa and at some 300 km from Ras Fartaq, on the Arabian mainland. The whole archipelago politically belongs to the Republic of Yemen. Like the Seychelles and Madagascar, they are continental islands, which formed part of the southern continent Gondwana until the late Cretaceous. Since then, as a result of the long isolation, a high degree of endemism characterises the flora and fauna of the whole archipelago, and particularly of the largest island, Soqotra, a "hot spot" of the world biological diversity.

Since the Tertiary Period, the archipelago maintained a warm and arid climate which is substantiated by the conservation of relict species and a high endemism rate. The flora of the island includes about 850 species (Mies 1994, 1998, Miller & Bazara'a, 1998), of which 273 (32%) species and 8 infraspecific taxa are believed to be endemic. There are 10 endemic genera, being 8 of them monotypic and thus don't represent significant examples of insular evolution, which has probably taken place within the genera *Heliotropium* (11 endemic species), *Boswellia* (at least 7 endemic species), and *Helichrysum* (9 endemic species).

Soqotra is not only a floristic sanctuary but an entire, and an up-to-now, conserved ecosystem representing a model for the Horn of Africa and East African Region at the whole, as the island had a natural vegetation cover and a self-sufficient pastoral society.

In recent years, zoological research in the archipelago has produced a wealth of results which also underline the global importance of the faunistic diversity of the island and its surrounding coastal and marine areas.

Why are desertification and phytodiversity interconnected? Habitats are fragmented and populations decrease to island-like areas of occurrence in regions which are subject to increased aridification. As evolution processes, the isolation of taxa and a genetical drift can increase biodiversity due to a higher ambient adaptation pressure (Stebbins 1952). On the other hand, loss of habitats and



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isolation of populations from each other may be followed by a decrease in biodiversity as the genetic drift causes a loss of potential genetic diversity in isolated populations. At least, those populations start with a reduced potential into the necessary adaptation to differing environmental conditions (Boyce 1992, Menges 1992, Ellstrand & Elam 1993). Concluding that, an anthropogenic desertification affects or depletes biodiversity and the ecosystem. Many factors are interconnected and still not understood; therefore, an interdisciplinary approach was formulated under the Yemeni-German BIOTA project “Biodiversity and Ecology of palaeoafrikan refugial areas in Southern Arabia and on Soqatra Island”.

This study is the result of a ten years’ period of vegetation observation on Soqatra Island and its recent trends since 1993 (Mies & Beyhl 1999, Mies 2001), showing that an increased and obvious usage of wood and pasture began intensively in 1998, which substituted the traditional and sustainable economies. Traditional use of Soqotran natural resources may be called “sustainable”, as there was no observable decrease in quantities and densities of vegetation covers and hence, the potential for complete regrowth has been preserved. A deforestation would result in desertification, an irreversible change of natural environments which depletes the livelihood of man and his livestock as well as potential husbandry and forestry (Beyhl & Mies 1998).

People, Development and Sustainable Island Management

Soqatra was described by Kossmat (1907) as one of the most isolated places on earth, and this was true until a few years ago, as the island was accessible only by boat or little aeroplanes, and the strong monsoon winds cut communication with the mainland for several months in summer. The opening of the island to the world, due to the attractivity of an offshore drilling survey in 1996 and to a project to conserve the biodiversity since 1998 and thanks to the new airport inaugurated in 1999, marked a crucial turning point for the fragile ecosystems of the archipelago.

The first scientific expeditions to the archipelago date at the end of the 19th century. After that period, not many surveys and have been made by western scientists. The most important of them was the Middle East Command Expedition in the spring 1967. After the withdrawal of the British from Yemen in 1967 Soqatra remained virtually closed to foreigners and further scientific exploration. Research started again in 1982, when the geographical and biological departments of the University of Aden sent a scientific mission to Soqatra.

In 1985 the island botanist Quentin Cronk visited Soqatra and found that although there were still large herds of livestock and extensive wood-cutting, the environment was largely unspoilt. He said: “Having seen the degradation overgrazing can cause, I was staggered to come across a place which was in all probability substantially the same now as 1000 years ago.”

The low population density and the subsistence economy of the inhabitants caused little impact on the environment. Thanks to this, many areas are still well conserved. The central granitic peaks, valleys such as Wadi Ayhaft, and several coastal areas are all interesting biotopes characterised by a high floristic and faunistic diversity.

People traditionally practise rotational grazing. Live trees and shrubs are rarely felled and camels are periodically banned from the hyper-arid west of the island, preserving the island’s fragile equilibrium. A network of tribal councils strictly enforce these rules.

Most of the traditional population on the island of Soqatra subsist on livestock and the collection of natural products. The farmers gained their income from meat and milk production by their goat, sheep and cattle livestock, and collected natural resins of dragon’s blood, incense, myrrh, and *Aloe* sap which actually have lost their economical



Southeastern plain of Hadibu at the entrance of the Aduno valley in 1996 (top) and 2002 (bottom). Although the two photographs have been taken in different times of the year, erosion and reduction of the vegetation coverage are evident. (Photos by Bruno Mies)



benefits for them as Yemeni markets absorb more and more of similar but cheaper products from India, Southeast Asia or Somalia. At the same time, increasing aridity observed over the last 30 years in East Africa and Arabia seemed to take place - with all consequences on man and nature - and has further reduced the benefits of natural resources, grazing lands and productive forest especially.

Natural population growth at more than 3% per year and a strong immigration from the mainland leave their own imprint on land use changes. Traditional grazing and tree-based economy is forced to exploit fragile land for food production, to shorten traditional non-use or fallow periods, and to overgraze marginal rangelands and forests. Subsequent decline in natural productivity, short-term loss of top soil, wind and water erosion, and desertification have reached alarming proportions. The gap widens between growing demand for food and forage and declining regional carrying capacity.

At the same time, rural and urban population growth and the associated demand for wood as fuel for domestic consumption have induced uncontrolled deforestation and widespread destruction of the semiarid forest biome, the *Croton socotranus* bushland and mixed forests with *Commiphora* and *Boswellia* trees. In the absence of available oil and gas resources affordable to the local income - fuelwood supplies for the main villages and cities are becoming critically constrained. Woodlands in the hinterland are cleared at rapidly grow-

ing distances from the city. Current prices for fuelwood are soaring, making this vital resource more and more unaffordable especially for the poor, the majority of the population. As the situation on mainland Yemen is generally as bad as such, the ecosystems of the island of Soqatra were depleted since 1996 increasingly and a drastic change is obvious towards desertification.

An economic and social dimension is then added to an already bleak ecological imbalance as a result of deforestation - a process leading to:

- rapid soil loss,
 - irreversible exposure of stone plaster or impenetrable soil crusts,
 - increasing surface runoff on the plateaux,
 - gullying and loss of usable land on the glacis,
 - sedimentation and flooding on the bottomlands,
 - regional groundwater depression
- to mention just a few responses of the ecosystem.

Since 1994, the examinations of vegetation on the island done before and in the continuing field studies show large and expanding circles of barren land around the centres of population. Such man-made 'desert islands' can neither be reclaimed in the time-span of a human life nor in terms of available financial resources.

Bushland and forests of remote plains, inland valleys and highlands were relatively intact and conserved from excessive use (fuel wood, house-building) because motor vehicles could not reach them. Before, wood had been cut down to that extent which covered the daily own needs for cooking and

building. Improving the infrastructure led to better tracks and situation has changed with more traffic. The inhabitants of the inner areas are now able to cut more wood and to earn more income from the villages because of transportation facilities by four wheel drive and all terrain vehicles.

The following figures may simply illustrate the current and appearing fuelwood crisis of Soqatra (Mies 2001): population of the main village of Hadibu in 1989 was less than 1000 heads; forests within walking distance from the village outskirts could provide sufficient fuelwood for domestic consumption. The total area of the Hadibu plain contributes 2% (89.4 km²) to the surface of the island. The 1999 population of Hadibu was estimated four-fold at 4000 heads: forests at 5 to 12 km distance were supplying appr. 1200 tons of fuelwood each year - a stack of wood over 5.7 km long and 1 m high. The whole population of the island consists of 80.000 people at present who should use a stack of a length of 114 km, even longer than the island itself from East to West. At current rates of wood consumption (300 kg/head/annum) and population increase by natural population growth and a drastic migration, the remaining forests of Soqatra and their productive environments will have disappeared by twenty years.

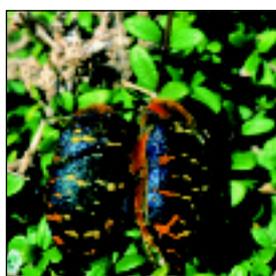
A culturally acceptable national intervention plan must resolve the fuelwood crisis and save and keep productive the remaining forests - one of the only relict forests spots Yemen has. Forests are not independent and isolated land cover units and must be viewed and protected as the stabilising component within the context of traditionally complex land use systems.



Croton socotranus collected for firewood near Qalansyia.

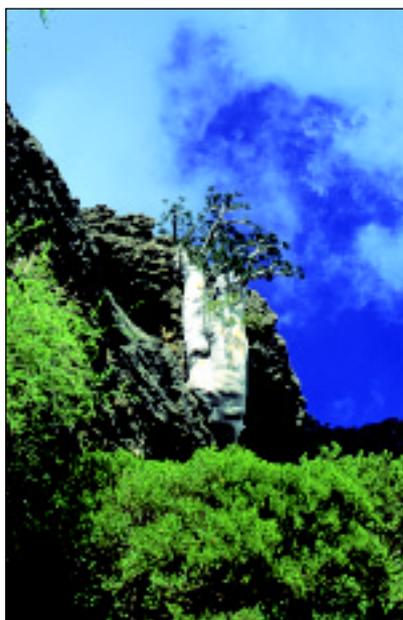
Common evaluation is that “poor man’s energy crisis” gained and kept its momentum because basic and applied research have ignored the interrelated ecological, economic and socio-cultural realities - the latter of which meaning “traditional” - of tree-based rural and pastoral economies. Broad based research is needed to interpret the role of forests in the hinterlands of Yemen and Soqotra as a component of both an urban and a rural ecological and economic system.

Although the island has recently been declared a UNESCO Biosphere Reserve, the international research community has barely begun to be aware of the issue of land surface and social change involved: Locally on the island, the mentioned project has focussed on protecting park areas and conserving key species. Regionally



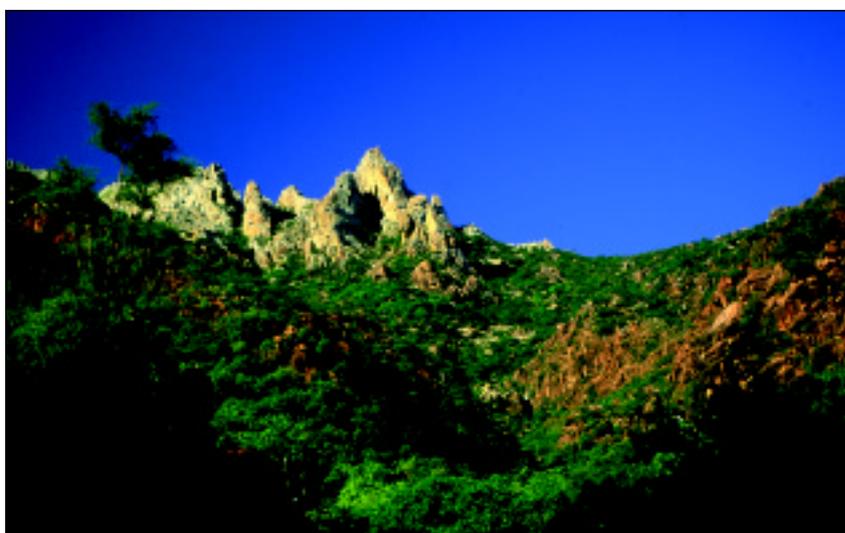
and on the continent-wide scale, major funding is trying to model shrinking zonal forests or grasslands and other parameters of desertification via remote satellite sensing, mainly in relation to global change and meteorological drought, to inappropriate colonial and postcolonial land use and related feedback mechanisms for global models.

Only exceptional studies have dealt with field surveys in the arid Subtropics in order to evaluate the ecologically balanced use of woodlands in pre-colonial times and with the theoretical basis to inventory and monitor renewable resources. Those rare ones have really assessed possibilities to increase the human-ecological carrying capacity of semiarid lands by means of agroforestry or nature protection (AGNEW & WARREN 1996, HALWAGY & al. 1995). The actual state of vegetation on Soqotra still offers a unique chance to have these original pre-colonial data available yet. Studies of forests and their ecology are a possible solution to the environmental and energy difficulties facing semiarid Africa-Arabia. Social perception of and response to deforestation within the broader context of drought and desertification are poorly understood – and at least on Soqotra and at the Horn of Africa.



To our (foreign) concern, a continuation of BIOTA-alike projects in Yemen appears would be worthwhile to:

- 1) Survey and assess spatial and temporal change of forest resources, patterns of fuelwood production, marketing and consumption,
- 2) Analyse bio-physical land surface changes as a result of deforestation in declared observation spots,
- 3) Determine the response of the tree- and livestock-based rural system to the general environmental degradation following large-scale deforestation, and
- 4) Deliver all those data harvested and appropriately translated to the local and traditional decision makers.



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