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Degrading Land: An Environmental History Perspective of the Cape Verde Islands

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SUMMARY

This paper discusses changes in land and vegetation cover and natural resources of the Cape Verde Islands since their colonisation. This isolated group of islands in mid-Atlantic was first colonised by the Portuguese around 1460. The paper discusses both physical and human causes of land-cover changes, including changes in climate, land-use, land tenure, economic, political and social systems.

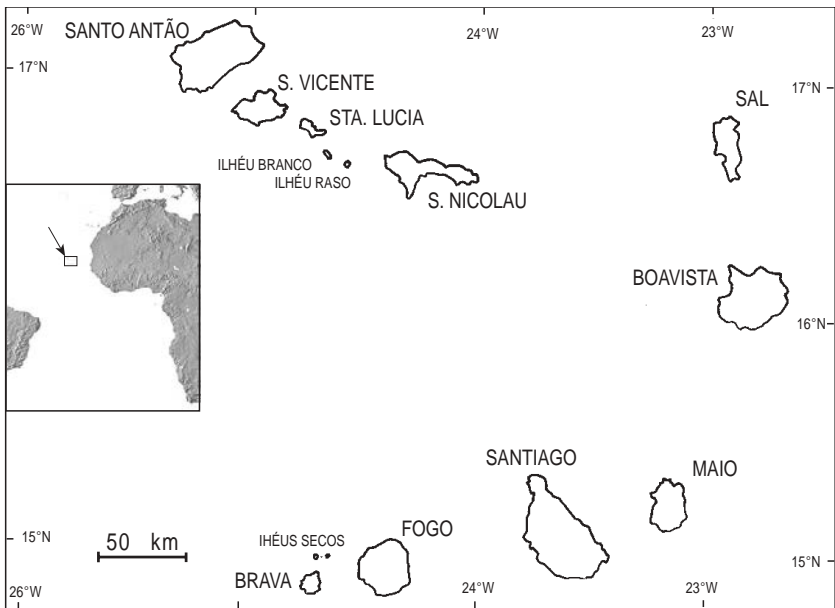
The actual consequences of the first centuries of European colonisation of the Cape Verde Islands were very different from the idealised view of tropical islands as Gardens of Eden that was current in Europe during the early colonial period. The sources discussed in this paper provide evidence of catastrophic degradation of the land and vegetation of these islands: from a dry but 'well-wooded' savanna with 'great quantity of grass', and 'streamlets of water' at the time of colonisation to a near desert landscape today, especially at the lower altitudes. A major cause of this degradation, perhaps indirect but still decisive, may have been a political and economic system that permitted an appallingly shortsighted exploitation of the land. The major direct mechanism of this process was probably overexploitation of the vegetation-cover by people and their goats.

Despite the evidence for human causes behind this ecological disaster, the possibility cannot be excluded that there has also been a change in climate purely due to physical causes. If, however, the first colonisers had been conscious of the fragility of the ecosystem they came to occupy, these islands could still have profited from the advantages of a dry savanna with trees and a continuous grass cover, as do the Bermudas, which have remained a 'terrestrial paradise' thanks to the protection of the cedar forests since their first settlement in 1622. The reason why the 'fortunate' islands of Cape Verde should be reafforested thus becomes evident.

Human beings frequently have a good perception of the symptoms of environmental degradation, but they rarely perceive the causes of such changes.

In particular, they do not see themselves as agents in relation to nature. Instead they attribute environmental degradation either to God, destiny, etc., or to more earthly powers, which results in resignation relative to environmental problems.

Compared to the length of human life most environmental changes, e.g. land degradation and climatic changes, are slow processes, noticeable only over decades. This may explain why it is difficult for humans to comprehend the causal mechanisms behind such changes. It may be crucial to understand these human perceptual processes if the human causes of environmental degradation are to be countered.



Source: de Albuquerque & Santos, 1991

MAP 1. The Cape Verde Islands

INTRODUCTION

A commonly held point of view is that changes in land-cover, often leading to land degradation and desertification, are results of processes which are only or mainly human induced. Others are equally convinced that the causes are either non-anthropogenic physical processes or climatic changes due to changes in the

THE CAPE VERDE ISLANDS

solar system. The real causes of land degradation are surely more complex, involving both anthropogenic and non-anthropogenic factors. Recent research has underlined their complexity and interrelated character (e.g. Gaud, 1992). A holistic and multi-disciplinary approach is necessary to understand these processes, which have often been oversimplified, and to elucidate the mechanisms contributing to such natural disasters, which happen slowly but are the more lasting, often everlasting (Blaikie & Brookfield, 1987; GeoJournal, 1993; Lindskog & Tengberg, 1994).

This paper addresses the topic of what changes have taken place in the land, vegetation and natural resources of the Cape Verde Islands since their colonisation. These isolated islands in mid-Atlantic were first colonised by the Portuguese around 1460. Nine of the ten islands are inhabited today, with a population of around 350,000. In the paper, both physical and human causes of land-cover changes are discussed, including changes in climate, land-use and land tenure.

SOME NOTES ON THE EVOLUTION OF THE VEGETATION COVER OF TROPICAL ISLANDS

A comparison of the evolution of vegetation and natural resources on the Cape Verde Islands with that of other tropical islands may help to provide a better insight into the direct and indirect causes behind land-cover changes.

Firstly, such an attempt should be put into the context of European expansion and colonisation of other continents from the 15th century onwards. Several faraway islands in the oceans such as the Azores, Madeiras, Ascension, St Helena, Mauritius, Réunion and the islands in the West Indies, which were hitherto uncolonised or inhabited by people with weak or no links to the rest of the earth, then suddenly became attractive as sources of fresh water, food and (when steamers came into use) sometimes also fuel. Further, before the days of radio and radar, such islands were important landmarks when traversing the oceans. Thus, their size was often grossly exaggerated in the minds of mariners and in the cartography of the 16th and 17th centuries (Duncan, 1972, p. 2-3).

Secondly, at the end of the Middle Ages, ideas of the earthly paradise 'shifted in the European imagination from a location in the distant past to a geographical site in the present' (Duncan, 1993, p. 48). From the 15th century onwards, with the discovery of continents and islands hitherto unknown to Europeans, the search for this paradise entered a new era.

...the task of locating Eden and re-evaluating nature had already begun to be served by the appropriation of the newly discovered and colonised tropical islands as paradises. This role was reinforced by the establishment of the earliest colonial botanical gardens on these islands and one on mainland 'Eden', the Cape of Good Hope. (Grove, 1995, p. 5)

It is not possible here to deal fully with the views of and attitudes towards the different Atlantic islands at various periods in Europe, Africa and the Americas, but merely to remark that already in 1492, a legend on the globe of Martin Behaim reads: 'Cape Verde Islands or Insula fortunata' (Crone, 1937), i. e. the Cape Verde Islands were seen as the Fortunate islands, see also Davidson (1989). This attribute has also been given to other Atlantic islands: Crosby observes that the Romans knew of the Canaries and possibly also the Madeiras and the Azores and gave them the name the Fortunate Isles (Crosby, 1986, p. 70-103).

Roberts notes that:

Extinction rates were highest on island ecosystems, especially on those few which remained uninhabited prior to European contact. ... Once that isolation is broken and competition introduced in the form of pigs or rats carried on board ship, native island biotas are ill-adapted for survival, and many species become as dead as the dodo. The consequences of abrupt external impact are well illustrated by the sub-tropical Atlantic Islands of the Madeiras. (Roberts, 1989, p. 157)

These islands had been uninhabited before their discovery and colonisation by the Portuguese in the 14th century. The nearly entire cover of 'great trees' gave the islands the name Madeira, meaning timber. However, to the colonisers the trees were an impediment and 'it was therefore first of all necessary ... to set fire to them. By this means they razed a great part of the forest' (*ibid.*).

St Helena was first discovered by European colonisers in 1502, when Alexander Beatson recorded that 'its interior was one entire forest' (Beatson, 1816; quoted in Grove, 1995, p. 96). However, soon 'after 1700 fears began to be expressed about the likely risks of drought on St Helena. This was directly due to observations that clearly demonstrated the effects of deforestation on the regularity of stream flow on the island' (Grove, 1995, p. 108).

Concerning the impact of island colonisation, Barrow concluded that:

Throughout the literature on island degradation, the introduction of goats, pigs and, to a lesser extent, cattle are cited as the cause of problems. Saint Helena has lost most of its, once extensive, woodland; the blame has been levelled at goats released in 1513. (Barrow, 1991, p. 138)

BACKGROUND

The Cape Verde Islands may be an illuminating example of the causal relationships between the physical system and the political and economic system and their impact upon the vegetation cover, erosion rates and land degradation. The archipelago is today severely degraded, if not in places already a desert, especially the lower parts.

Three captains, Antonio da Noli, Diogo Gomes and Aluise da Cadamosto, claim to have discovered some of the previously uninhabited¹ Cape Verde

THE CAPE VERDE ISLANDS

Islands between 1456 and 1460. One of them, Cadamosto, noted that the largest island, Santiago, 'appeared well-wooded' and that his sailors discovered the mouth of a river, where they replenished their fresh water supply (Crone, 1937; Verrier, 1994). According to G. R. Crone, this journey took place in May 1456, i.e. at the end of the dry season.² In a similar vein, Diego Gomes, whose journey probably took place in 1458 or 1459, recounted that

...on the shore we found many strange birds and stream-lets of fresh water. ... There were also an abundance of figs, but they do not grow on the trees in the same manner as in our parts, for our figs grow near the leaf, but these all over the bark from the foot of the tree to the top. These trees grow in great numbers, and there was great quantity of grass there. (Crone, 1937)

Many recent visitors and development workers on these islands, and also authors of scientific articles (e.g. Spaak, 1990), are convinced that these islands were always very degraded, in a state near desert. Spaak supports his argument by a quotation from the journal *Univers*, which in 1848 noted that the Cape Verde Islands suffered from two calamities: lack of water and lack of trees. He concludes that the evidence from this article published in 1848 'seems to refute the hypothesis according to which these islands, given their name, in a recent past should have been verdant, only the incompetence of the inhabitants being responsible for the drought nowadays observed' (op. cit., pp. 50-51).

If the conclusions drawn by Spaak are correct, there would not have been any major evolution of the vegetation system of these islands during the nearly 400 years of human settlement from 1460 to 1848. Did Cadamosto, Gomes and others in fact only try to 'sell' these islands to prospective settlers, therefore exaggerating the natural resources of the islands in order to attract more Portuguese settlers? It was just a few decades earlier that the Portuguese had colonised Madeira and the Azores.

Regarding the origin and the meaning of the name of the Cape Verde islands, a source more reliable than that of 1848 might be an anonymous Portuguese traveller who passed the islands on his way from Lisbon to São Tomé Island around 1545 and noted that the name stems from 'a promontory of Africa now bearing the same name' (Sauvageot, 1961, p. 127). He was referring to the promontory on which is situated Dakar, the administrative centre for the French expansion into West Africa and today the capital of Senegal. This promontory is still today, despite its semi-desert state, called 'Cape Vert', green cape. William Dampier who visited the islands in 1683 wrote that 'they lie several Degrees off from Cape Verd³ in Africk, whence they receive that Appellation' (Dampier, 1937, p. 56). Another explorer, Robert Challe, who came to Santiago in March 1690, remarked that they are called the Cape Verde Islands 'because they are at the same latitude as the cape which is in Africa' (Challe, 1721, p. 129). It seems clear that the Cape Verde islands received their name due to their position off Cape Verde on the African mainland rather than because of their own verdure.

In fact, approximately 10 years before the publication of the article quoted by Spaak, Charles Darwin provided clear evidence of the precarious situation on the Cape Verde islands. On his first landing there in January 1832 after the departure from Devonport in England, he noted ‘an utterly sterile land’ on Santiago with the neighbourhood of Porto Praia wearing ‘a desolate aspect’ and having scarcely a single green leaf over wide tracts. On the other hand he wrote that at the time of discovery of Santiago, ‘the immediate neighbourhood of Porto Praya was clothed with trees, the reckless destruction of which has caused here, as at St. Helena, and at some of the Canary islands, almost entire sterility’ (Darwin, 1860, pp. 1-2).

Apart from his own studies during the two-week stay on Santiago (he did not visit the other islands), Darwin also based his opinion on the work of other scientists such as Dr. E. Dieffenbach. Dieffenbach edited the German translation of Darwin’s Journal, in the editor’s notes of which he wrote:

The island St Jago is in the interior mountainous and fertile. Also the immediate surroundings of Porto Praya were not always so deserted and infertile as today. Only through the ruthless destruction of the forests, with which the first explorers found the island covered, has the collection of humidity, and thereby the source of the growth of the vegetation, been destroyed. A similar procedure has reduced to a minimum the original vegetation of St Helena and the wonderful forests of the lava mountains of the Canary Islands [...] San [sic] Jago resembles a desert; however, as already has been noted, it has a fertile and mountainous interior. (Dieffenbach, 1844, p. 301)

A few decades after Darwin’s visit, Elisée Reclus wrote that the flora of the Cape Verde Islands had not been studied with the same care as that of the other archipelagos of the Atlantic Ocean (Reclus, 1887, p. 141).

The botanist Auguste Chevalier, who visited the islands in 1934, noted that the observations made by Cadamosto well suited the islands of Boa Vista and Santiago. Chevalier did not find it surprising that Cadamosto had found Santiago covered with trees, as he still found natural forests in some parts of the island, e.g. *Faidherbia albida* and *Ficus gnaphalocarpa* (Chevalier, 1935, p. 757). In fact, Chevalier asks: ‘Was it the devastation of the original vegetation and the propagation of the herds which caused the droughts which in turn resulted in famine?’ (op. cit., p. 758).

HISTORICAL EVIDENCE

How reliable are the works of Cadamosto and Diego Gomes? According to Crone (1937, p. xxi-xxiv), Cadamosto made two journeys to the West African coast, one in 1455, the other, during which he came to the Cape Verde Islands, in 1456. Crone writes that the work of Cadamosto

is the first original account to have survived of a voyage into the regions opened up

THE CAPE VERDE ISLANDS

by European enterprise at the dawn of modern overseas expansion, and reflects the spirit of open-minded enquiry characteristic of the new age. The fabulous and the sensational have no place in the story he has to tell. His outlook was singularly comprehensive, and he was evidently at pains to collect and co-ordinate information from many sources. That his work remained for a considerable period one of the primary authorities on western Africa is testimony to its thoroughness. (op. cit., p. xxiv)

Regarding the narrative of Diego Gomes, Crone makes the remark that it

has come down in an unsatisfactory state, which is accounted for by the fact that it was taken down by Martin Behaim from an oral statement by Gomes many years after the events with which it deals ... and was apparently taken down by Behaim in 1482. It is not, therefore, to be wondered at that it displays considerable confusion. (ibid.)

It is thus difficult to invalidate the reports of these two explorers without further evidence against their veracity.

But if, on the other hand, it is true that at the time of colonisation the islands had a more abundant vegetation cover, are those reports false which note that they were dry, e.g. Duarte Pacheco Pereira around 1506-1508? (Pereira, 1892; Pereira, 1956.) And if it is the case that their vegetation cover was once more abundant, what were the causes of its disappearance? Were the reasons climatological or human? Or perhaps a combination of both? If there were human causes behind such a degradation, which groups of people contributed to it and through what mechanisms?

Apart from evidence of changes of vegetation cover, soils and water that may be provided by reports on other tropical islands, further evidence exists related directly to the Cape Verde Islands.

In 1735, Atkins remarked about Cape Verde peninsula where Dakar is found: 'The Land about the Cape appears the Height of that at Deal in Kent; woody, a white even Sand along Shore' (Atkins, 1735, p. 32). So, if this now urbanised desert was once wooded, and if Diego Gomes around 1460 not far away on this peninsula could find 'an extensive plain full of grass, and more than five thousand animals called in the negro language "myongas"' and '... five elephants come out of a small river sheltered with trees' (Crone, 1937, p. 92), it seems far from surprising that Cadamosto wrote about the Cape Verde Islands in May 1456:

Then, sailing along the coast of one of them,⁴ which appeared well-wooded, we discovered the mouth of a river issuing from it. Judging that there the water would be good, we anchored to replenish our supplies. (op. cit., pp. 64-65)

After the discovery of the Cape Verde Islands some time between 1456 and 1459, they were probably colonised 'by da Noli, perhaps in conjunction with Gomes, in 1459 or thereabouts' (op. cit., p. xlii). Trading in slaves was a major activity from the earliest years. 'It began illegally ... and was eventually

authorised expressly under Royal Warrant of 1472' (Carreira, 1982, p. 5), i. e. only 10-15 years after the first settlements on the islands. Human settlement was during the first century concentrated on Santiago. Brasio has estimated that in 1513, about 50 years after the colonisation of the islands, there were 100 to 150

Year	Population	Growth/year (%)	Population density (persons/km ²)
1580	9940		2.5
		0.5	
1650	13980		3.5
		0.7	
1720	23130		6
		3.1	
1774	50639		13
		-	
1775	28368		7
		2.6	
1800	56050		14
		0.6	
1807	58401		15
		1.7	
1831	88368		22
		-15.0	
1834	55833		14
		2.2	
1844	69700		17
		1.5	
1861	89310		22
		2.8	
1864	97009		24
		-9.0	
1867	67517		17
		3.0	
1871	76053		19
		5.9	
1874	90710		23
		2.3	
1878	99311		25
		2.2	
1885	115461		29
		2.0	
1890	127390		32
		3.3	
1900	147424		37
1992	350000		87

Source: Population and growth rates compiled by Patterson (1988), based on an inventory of numerous sources.

TABLE 1. Estimated population of the Cape Verde Islands and annual growth rates

THE CAPE VERDE ISLANDS

inhabitants in the main settlement, Ribeira Grande. The number of inhabitants in the two captaincies on Santiago had reached 1200 by 1549, 12,000 by 1572 and 15,700 by 1582 (Brasio, cited in Carreira, 1982, p. 6). Patterson has put together numerous sources and has summarised these, what he believes 'to be reasonable estimates for the total population of the islands' (Patterson, 1988, p. 293), see Table 1. It should be noted that the degree of reliability and 'credibility' varies a lot (*ibid.*). As the first modern census was conducted only in 1878, information before that date should be treated with care, but still gives an indication of the evolution of the number of inhabitants (see p.280 below).

Baltasar Barreira, a catholic missionary, wrote in 1606 concerning Santiago Island: 'It is mountainous and covered with hills which are bare of vegetation, so that seen from the sea it appears arid and infertile. But those who travel across it find it quite the contrary, for so many streams and springs emerge from these hills that they make the island very green and fertile'. He also noted much cultivation 'throughout, and especially in the valleys' of fruits, coconuts and dates and that there were 'large cotton plantations, which are very profitable' (Barreira, 1989, p. 2).

Carreira notes that the 'way in which the resources of the archipelago were distributed greatly influenced the development of society. It unquestionably worked towards the impoverishment of the great masses of the settled population in favour of the Crown, and of a small fraction of the rural bourgeoisie. ... The Crown lacked financial resources and was not interested in investment for development' (Carreira, 1982, p. 7). And 'maladministration of land in Santiago (one of the causes of emigration) derives from this first period of settlement' (*op. cit.*, p. 5). Could it be that the maladministration of land was the main cause of its degradation which in turn was one of the causes of emigration?

The *morgadio* land tenure system of the Cape Verde islands gave a few individual families

...the right to the land in perpetuity through the male line. This system, although theoretically laying down duties for the landowner, effectively allowed him (it was, by definition, never 'her') to extract whatever he might from his holdings with no reciprocal duties to the people who lived upon them. He could not sell the land and, therefore, when it became unproductive, might simply lose interest. This led to the most extraordinary maladministration with appalling effects for the slaves and peasants... The *morgadio* system prohibited the passing on of land holdings to anyone but the eldest son and, of course, forbade the sale of the holdings. (Foy, 1988, p. 11)

This appalling social situation with a majority of the population being landless created a tradition of rebellion against the landlords in the Cape Verde Islands (*ibid.*). It seems likely that one of the main causes of the disastrous evolution of the Cape Verdean ecosystem was the *morgadio* land tenure system.

From the first years of colonisation in the 15th century, goats as well as donkeys, rabbits and other animals were left on the islands, including the

uninhabited ones, without anyone worrying about the consequences for the future. Duarte Pacheco Pereira remarked around 1506-1508 that each year a large quantity of skins from goats and cattle were sent to Portugal from Santiago as well as from other islands (Pereira, 1892; Pereira, 1956). Valentim Fernandes noted, also at the beginning of the 16th century, the rapid colonisation of the islands by goats rather than people (da Costa, 1939), while the anonymous traveller who visited the islands around 1545 wrote that 'the goats give birth to 3 or 4 kids at a time, and that happens every 4 months' (Sauvageot, 1961, p. 127). Walter Wren writes that when Captain George Fenner visited the islands Boa Vista, Maio, Santiago, Fogo and Brava in 1566, he observed that the latter island had 'good Store of Goats, and many Trees; but not above three or four Persons dwelling in it' (Wren, 1745, p. 189). On Boa Vista, he 'found twelve Portuguese. In all the island, there were not above thirty persons'. Further, he noted that the rent of the island to be paid to the Portuguese government was 'at one hundred Ducats a Year; which rent is raised out of Goat Skins only: For if they may be credited, forty thousand of those Skins have been sent from hence to Portugal in one Year' (op. cit., p. 188). Thus already during the first century of colonisation, four independent sources note the importance of the goats to the economy of the islands. As Shaw concludes, it thus seems well-established that the goats 'indubitably contributed to a process of environmental degradation' (Shaw, 1991, p. xv).

If 40,000 goats were killed in one year on Boa Vista, the number of goats must have been considerably more before slaughter. Given that the size of Boa Vista is 620 km², this would give a density of at least one goat per hectare. Today there are around 3,500 inhabitants on Boa Vista. With not more than 30 persons on Boa Vista around 1566, it is probable that the goats, as agents of human economic activities, caused considerably more damage than direct human activities such as tree-felling for construction, for fire-wood, for sugar refineries and distilleries etc, although the effects of tree-felling were still probably not negligible.

Although estimates of the size of population before 1878 are most uncertain (Patterson, 1988), a population of less than 20,000 or 5 persons per km² at the end of the 17th century (Table 1), more than 200 years after colonisation, cannot be considered remarkably high. Patterson concludes that while population growth was slow before the 18th century, average growth rates increased in the 18th and 19th centuries, but with massive mortality reducing the population by a third or more in the 1770s, 1830s and 1860s. Densities reached 14 persons per km² around 1800 and 37 around 1900. During the first centuries of colonisation, there was probably 'more rapid increase in the 16th century and stagnation in the 17th century' (op cit, p. 298).

Further evidence regarding the impact of goats is given by Froger, writing 150 to 200 years after the accounts of Pereira, Fernandes and Fenner. He was a member of the French expedition 'de Gennes', who lay at anchor at São Vicente in September 1695. Froger found the island uninhabited apart from some 20 Portuguese from S. Nicolau who had been there for the past two years making

THE CAPE VERDE ISLANDS

hides from goats, which were found in abundance. The goats were hunted by specially trained dogs, each of which could kill and retrieve 12 to 15 goats per night (Froger, 1699, p. 52).

Additional observations a few years later are provided by captain George Roberts who was stranded on the Cape Verde Islands from 1721 to 1725 during a journey to Virginia. While visiting St John island (today called Brava) in 1722 he noted that:

... he was daily in Danger of being killed by the Stones that tumbled from the Mountains early and late in the Mornings and Evenings. This, as the Blacks said, was occasioned by the wild Goats going to their Caves on the Edge of the Mountain, whose Foot was at the Top of the Rock, under which they were: For the Land, says the Author, rises something like the Pyramids of Egypt. (Roberts, 1745, p. 622, column 2)

[the mountain] was so steep, he could proceed no farther; and one of them, searching about for the best Way, broke off a prodigious Piece of a Rock, which was very near sweeping down some of them in its Way, and the Noise and Dust frightened them all so, that they were about descending. (ibid.)

... the Rocks were more crumbly, ... occasioned, he supposes, by the Scorching of the Sun, which, as it were, calcined and made them more friable, and apt to break; whereas in the Night they seemed to attract from the Air a Kind of Gluten, which cemented and rendered them more firm. (ibid.)

[one of the blacks] was unfortunately killed very near him by a Piece of a Rock, which falling down, smashed him all to Pieces (op. cit., p. 623, column 1).

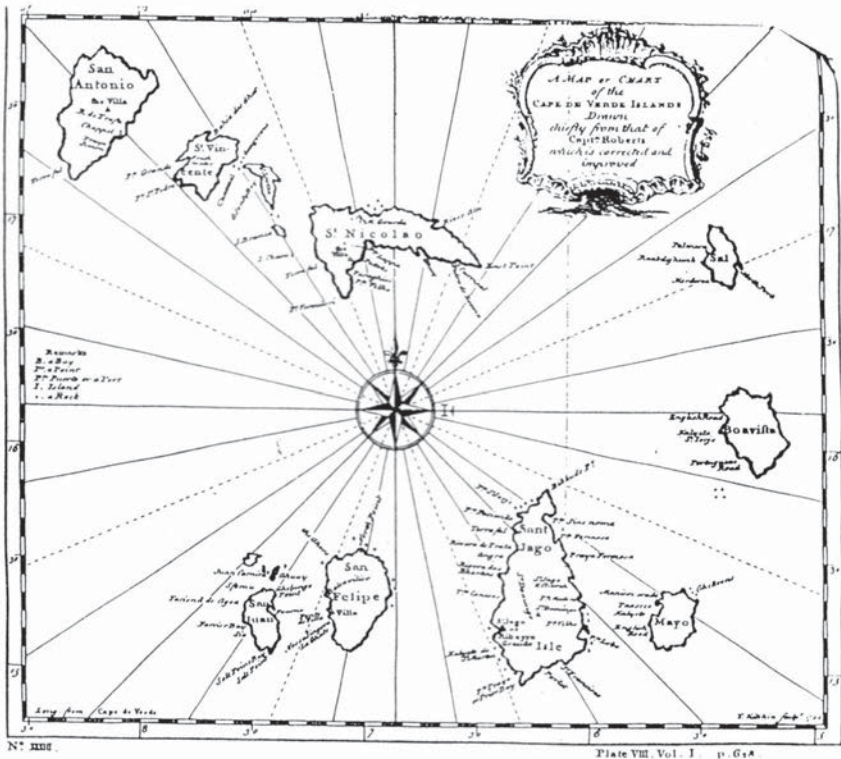
These passages suggest the detrimental effects of the introduction of goats on these volcanic islands with very steep slopes and a fragile ecosystem. Overgrazing by goats apparently led to destabilisation of the steep slopes. In contrast to cattle, goats graze right down to the roots, leading to the almost complete disappearance of the protecting herbaceous layer. This means that the ground becomes more exposed to water and wind erosion, which in areas with steep slopes (as are large parts of the Cape Verde Islands) tends to accelerate mass movements such as rocks falling down the mountains. The combination of increased erosion rates and of mass movements owing to the degradation of the vegetation cover apparently had disastrous effects on the islands.

While the goats have had a very strong degrading impact upon this fragile ecosystem, they have always been of key importance in the diet of the population and often constitute to the landless peasants their sole form of 'wealth'. 'Families remain very attached to their goats as an insurance against dispossession' (Foy, 1988, p. 8). What an insurance! It is true that the possession of goats made a certain contribution to the household economy in the short run, e.g. milk, meat, wool and fur etc. But the long term eroding impact upon the only basis for survival of the islands, i.e. soils, water and vegetation, does not seem to have been

generally conceived. Or if it was, people had no means to escape out of this trap. People's perception of their means of survival was strongly related to one of the principal causes of the disaster. It is likely that from the early days of colonisation, the economy of this archipelago provided no way out of the vicious circle of the poverty-degradation trap other than emigration.

Other human activities such as cutting wood for construction, for sugar refineries, for cooking and heating have certainly had a degrading impact upon these islands. In 1832 Darwin remarked during a tour of the interior of Santiago that the 'children, completely naked, and looking very wretched, were carrying bundles of firewood half as big as their own bodies' (Darwin, 1860, p. 4). Do Amaral has made a major study of the history and geography of Santiago and notes that the population has devastated the forests in order to get firewood and material for construction, quite apart from the effects of animals, especially goats (do Amaral, 1964).

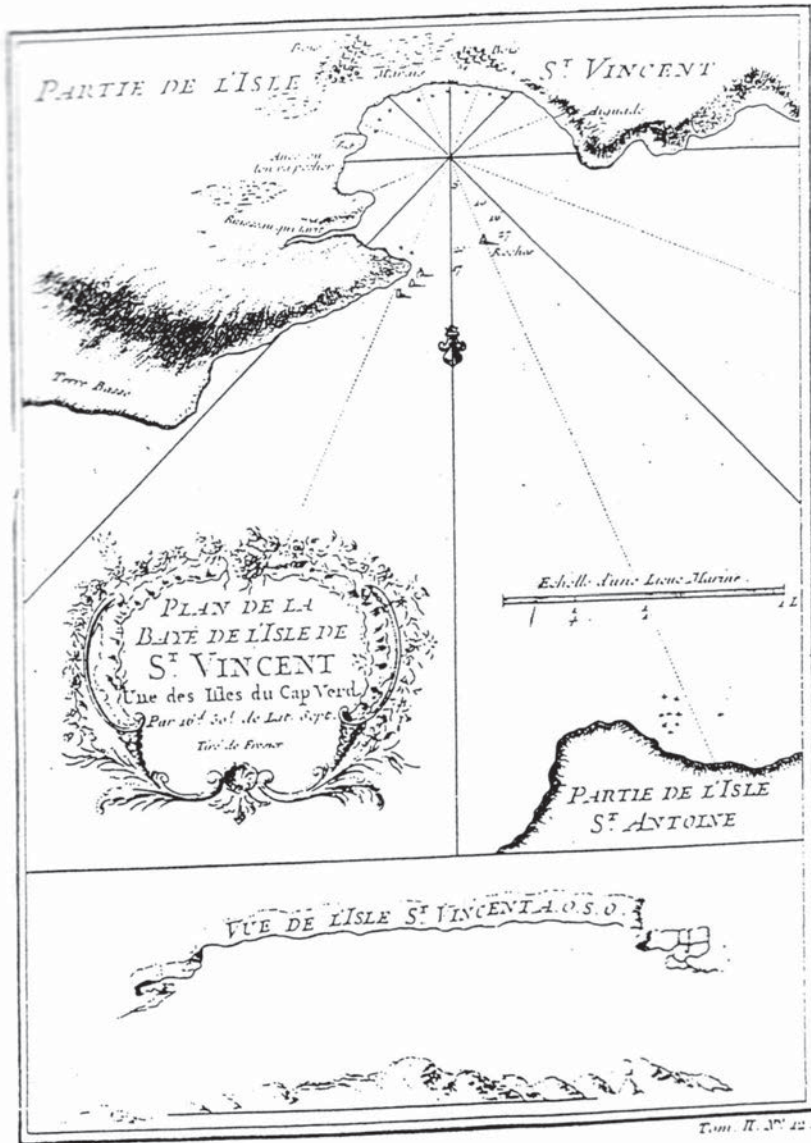
Maps provide further evidence, e. g. that of Roberts (Map 2), which indicates 'fresh water' at the bay where Mindelo, the second biggest town on São Vicente



MAP 2. Chart of the Cape Verde Islands drawn chiefly from that of Captain Roberts (Roberts, 1745)

THE CAPE VERDE ISLANDS

island, is found (Roberts, 1745, Plate VIII, Vol I, p. 628). On another map over the same island by an unknown author two areas of wood, a marsh and 'a stream which dries up' are indicated, (Map 3). It was on this island that Froger (1699)



MAP 3. Plan of the bay of São Vicente Island (18th Century)

noted the activities of the 20 Portuguese preparing goat hides (see above). Sao Vicente Island is today the driest of all the islands, without any fresh water, which at the beginning of this century was brought from Santo Antão Island. However, because of the size of Mindelo, the second largest urban agglomerations of the Cape Verde Islands, a desalination plant was constructed in 1981.

Colombani et al. (1984, pp. 298-9) have calculated the erosion during two days of heavy rain in the river basin of Riviera Brava à Vila on São Nicolau in 1981. On the 2nd and the 13th September, average rainfalls of 56 mm and 128 mm were recorded, with specific erosion of 33.6 and 81.5 ton/ha respectively. Thus there was an erosion of 115.1 ton/ha in the space of a fortnight, which, with an average density of 1.3, gives a specific erosion of 8.8 mm, entirely discharged into the sea. Nearly double the discharge was observed on the 26th and 27th September 1978, after an average rainfall of 240 mm, although this is not so well documented.

With nearly a centimetre of the most valuable top soil of the entire surface of this river basin washed away within a fortnight in 1981, the quantities which have passed into the sea during the 500 years since colonisation must be considerable. Rainfall statistics are available for Praia from 1875. Comparing the first 30 year period with the most recent, the mean for the first is 293 mm per annum, whereas for the most recent 30 year period it is 170 mm, a reduction of 42%.

It is not difficult to imagine the horrific struggle the Cape Verdean people have fought during the five centuries since colonisation, once the natural ecosystem of the precolonial times was destroyed and the islands were turned into a virtual death-trap. Large parts of the soils and the vegetation were washed away into the sea with every rain or blown away by the wind during the 9 or 10 months dry season, thereby reducing the capacity of the land to infiltrate rainfall into the soils. The collapse of the ecosystem is likely to have been the main reason why half the population perished in a single year, around 1770, over a third in 1830 (Foy, 1988, p. 12; Patterson, 1988), and possibly as much as two thirds on Fogo in 1834 (Chevalier, 1935, p. 758). It is likely that the destruction of the ecosystem on the Cape Verde Islands was rather early, probably during the first two or three centuries. Later generations had no choice but to reap the bitter fruits of colonisation.

AMILCAR CABRAL ON SOIL EROSION

Already in the 1840s, Lopes de Lima argued that unless trees were planted, attempts to promote agricultural development would probably fail (Lopes de Lima, 1844). Thus, the 'connection between ground cover, crises and hunger was recognised early on' by colonial administrators, who one after another made reports urging afforestation, as they 'were aware that human activity had introduced and/or intensified processes which were accelerating and exacerbat-

ing desertification and a decrease in precipitation' (Bigman, p. 83). At the end of four years of drought in the 1940s, Amílcar Cabral⁵ published some articles in the journal *Cabo Verde: Boletim de Propaganda e Informação*, one with the title: 'Some thoughts on the rains' (Cabral, 1949) and four entitled: 'In defence of the land' (Cabral, 1949-50). Cabral, who was then still an agronomy student, discusses the causes of soil erosion and its role in relation to the disastrous evolution of agriculture on the islands. He points out that the removal of the plant cover made the soils vulnerable to the immense erosion observed. There are in these scientific articles a hint of Cabral's future political mission: he indicates that the political will necessary to carry out the soil and water conservation works to stem this disastrous process must come from the Cape Verdeans themselves, not from the colonial power (see also Shaw, 1991). It is noteworthy that despite all pressure upon the Portuguese colonial government, the first soil conservation programmes were only introduced during the last 10 out of 500 years of colonial rule (dos Santos Pereira, 1966).

Could it be that this ecological disaster, largely unknown to the outside world, fostered Cabral to rebel against the Portuguese colonial government? Perhaps the process of creating a political movement to overthrow the colonial government was to some extent facilitated by Cabral's background as a soil scientist.

CONCLUSIONS

The actual consequences of the first centuries of European colonisation of the Cape Verde Islands were very different from the view of tropical islands as Gardens of Eden that was current in Europe during the early colonial period. Instead, the impact upon these islands was a catastrophic degradation of land, vegetation and natural resources: from a dry but 'well-wooded' savanna with 'great quantity of grass', with 'streamlets of water' where the first explorers could replenish their fresh water supply, to a near desert landscape, especially at the lower altitudes. The principal cause of the disaster is likely to have been a political and economic system which permitted an appallingly shortsighted exploitation of the islands' resources through maladministration of the land and immediate extraction of economic profits. The principal mechanism through which this process operated was probably overexploitation of the vegetation cover, to which overgrazing by goats was an important direct causal factor.

It should be noted that with volcanic soils, very steep slopes and an extremely irregular distribution of precipitation (probably equally so at the time of colonisation), the islands would in any case have been a very fragile ecosystem, and therefore easy to disturb by a political and economic system which did not assure protection of the land and its vegetation. However it would be premature to conclude, in answer to Chevalier's question (see p.276 above), that all

degradation on these islands is related to human causes. It cannot be excluded that during the 500 years since colonisation there may also have been an independent evolution of the climate towards drier conditions purely due to physical causes related to such factors as changes in the atmospheric circulation and sea surface temperatures in the Atlantic (Folland et al., 1986).

If, however, the first colonisers had been conscious of the fragility of the ecosystem they came to occupy, large parts of these islands could still have enjoyed the advantages of a dry savanna with trees and continuous grass cover, as do still parts of Niger and Mali, also in areas with only 200 mm of annual rainfall. Chevalier compares the evolution of the Cape Verde Islands with that of the Bermudas, where all trees were protected from the first colonisation of these islands in the 17th century, giving it the attribute of a 'jewel, a terrestrial paradise' (Chevalier, 1935, p. 865). So the answer to Spaak's (1990) question, why the 'fortunate islands'⁶ of Cape Verde should be reafforested, becomes evident. Such an afforestation should take into account the potentialities of the dry lowlands as well as the tropical montane cloud forests (Doumenge et al., 1993) investigating, for example, the fountain tree as a source for the collection of drinking water (Gioda et al., 1993).

Human perception and knowledge of the evolution of natural resources like soils, plant cover and water resources is often neglected in research on the environment (Lindskog & Tengberg, 1994). Human beings often have a very good perception of the evolution of the physical conditions, like rainfall and winds, as well as of the physical symptoms of the degradation of their environment. However, human beings seem to be much less aware of the possible human causes of the degradation, i.e. they do not properly understand that human activities may contribute to degradation. In a survey in the Oudalan province in Burkina Faso, an area in the Sahel region with an average rainfall during the last 30 years around 300-400 mm, only two out of fourteen persons questioned indicated the possibility of degradation due to human causes, whereas the other twelve either did not know the cause or attributed it to God. One of the two who indicated a human cause said it was due to a change of life style, the other related it to the disappearance of trees. People generally do not perceive themselves as agents in relation to nature but see God, Allah or destiny as the only dynamic force. Sometimes, more earthly powers like governments, politicians, or 'Brussels' (i.e. the European Community) are seen as the roots of the 'evil'. This results in resignation relative to environmental problems (Lindskog and Tengberg, 1994).

In relation to the length of human life, changes in natural resources which lead to land degradation are often rather slow processes. Human beings do not observe much evolution of these resources during their life-time, and over longer periods such evolution mostly remains completely unnoticed. This may explain why it is difficult for humans to understand the causal mechanisms behind such changes. At the same time it may be crucial to understand these perceptual

THE CAPE VERDE ISLANDS

processes in order to counteract the human causes of environmental degradation. This lack of understanding that natural resources, upon which so much of the future of a society rest, are dynamic and evolutionary may be one of the principal, though indirect, causes behind the severe land degradation evident in the Cape Verde Islands.

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¹ The possibility of human occupancy of these islands before the Portuguese colonisation remains uncertain. It has been proposed that either Arabs, Wolof or Serrer people may have arrived at the islands earlier, e. g. to exploit the salt deposits, but no firm evidence has been found. Chevalier (1935) noted the existence of megalithic dolmens as well as rock inscriptions, thought to be of Berber origin. However, Crone considers the character of the dolmens as doubtful and concludes that 'the inscriptions cannot be older than the end of the fifteenth century, and may be the work of slaves. There is no evidence therefore for a discovery of the islands before 1450' (Crone, 1937, p. xxxvi).

² The rainy season, though very irregular, lasts from July to October.

³ Cape Verd = Cabo Verde (Portuguese), Cape Verde (English) or Cap Vert (French) is the peninsula on which the present-day city of Dakar is located.

⁴ Called San Iacomo by Cadamosto, i. e. Santiago.

⁵ Amilcar Cabral was the leader of the revolution against the Portuguese colonial government in Guinea Bissau and the Cape Verde Islands.

⁶ On Martin Behaim's globe of 1492, a legend reads: 'Cape Verde Islands or Insula fortunata' (Crone, 1937). See also Davidson (1989).

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