

4.1.2 Geology, Topography and Soils

Yemen and the whole Arabian Peninsula are part of the Nubian-Arabic shield. During pre-cambrium it was folded, what produced metamorphic shists and gneisses. Several granite intrusions date from that episode, but Bura' is a Tertiary one. The massive sedimentation at the end of the Paleozoic (Jurassic, Cretaceous) went parallel with intense volcanic activities. The Red Sea is part of the rift valley that stretches from East-Africa through the Afar depression and the Red Sea to the Jordan Valley. It was formed in between the old Tertiary and the Miocene. This NNW-SSE oriented rift system is joined by the WSW-ENE rift of the Gulf of Aden.

Socotra has been isolated from the African shield in the Mesozoic before the mammals started to develop.

Yemen is classified into five main zones: the Coast (*Tihama*), the Foothills, the Escarpment ("Serrat"), the Highlands and the Eastern Desert (seen from South Yemen it would be the Northern). The Escarpment is again divided into Lower, Middle and Higher Escarpment, the Highlands into Northern (Saada), Central (Sana'a) and Southern (the two basins of Ibb and Taiz). Moreover there are several islands, the biggest ones being Socotra in the Gulf of Aden, Kamaran and Hanish in the Red Sea.

Soils have not been extensively studied for this work, as the focus was set on the human use of the environment. [A very thorough study on soils is available in: R. Straub (1986).] During the inventory studies (1988-1990) the difficulty to express a fundamental term, the soil depth, had to be overcome by an integrative value: "ecological site quality". This value integrated available soil, water, micromorphology (natural water-catchments) for a multiple regression on tree height at Jebel Lawz. The trees there grow on very shallow soils. Sometimes only a few cm deep, sometimes without any layer of soil at all. Roots are just penetrating cracks of the bedrock, several meters deep. It is difficult in Yemen to find soils that can be properly described as horizontal strata, as the horizons are rarely undisturbed. Often there are just patches and pockets of this "stuff". The "scientific definitions" of Fitzpatrick 1980 [In Straub p. 62:] fit here quite well: "*Soil is the space-time continuum forming the upper part of the earth's crust*". Or by Bridges in slightly less scientific terms [Bridges (1970) p. 6:] "***Soil is the stuff in which plants grow.***"

The reasons are manifold. Most soils are either colluvial, alluvial, aeolic or anthropogenic. Wind and water erosion don't leave time for the development of horizons. Soils under agricultural use are submitted to several disturbing influences: grazing and compaction, wood cutting and sealing by rains, irrigation and, as they are considered a commodity, "soils are transported to water" [Varisco (1982) p. 364:] for the establishment of terraces.

Moreover, in few cases only the vegetation cover and biotic activity is sufficient to produce a mentionable humus content. For leaching, the downward transport of humus and minerals from

the upper horizons, rainfall is not sufficient.

Infiltration is generally fast, but on compacted range (micro-catchments at Mahall al Harb e.g.) it was observed that 10cm water needed more than 3 ours for infiltration! An indication, that during the typically short thunderstorms large parts of the rainfall will form runoff - in spite of the generally high silt content. Yemen is quite lucky what concerns the porosity of its soils, as this prevents the upward movement of water by capillary forces, an effect leading to the salting up of irrigated soils in arid countries.

An average profile under a cover of shrubs or trees at Bura' looks like:

- A-horizon: well developed, but variable, with 2-20cm depth. There are well formed crumbs and a strong biological activity (snails). The skeletal content is larger than 80%. In other parts of Yemen the A-horizon is very little developed. The situation under the forest cover here at Bura' is better.
- B horizon is lacking.
- C-horizon consists of weathered granite, schists or volcanic rock.

B (if present) and C-horizons are , except on very well treated agricultural terraces, composed of more than 50% stones (skeletal). If the soil would cover the area more completely it might be called "Ranker" in our old European terminology.

The high density of snail shells is an outstanding feature. They just appear below 15 cm depth, what indicates that water rarely percolates deeper into the soil.

4.1.2.1 Erosion

Eger [Eger (1987): *Runoff Agriculture. A case study about the Yemeni Highlands*], who did a very extensive and valuable study on the Yemeni runoff irrigation, reported that 25% to 50% of the rainfall are flowing away as superficial runoff. As e.g. the most famous crop of Yemen, coffee, needs 600-800 mm per year, the need for additional irrigation by runoff or other methods can easily be estimated. At Jebel Bura' the rainfall (some 600mm) is almost sufficient to produce coffee without additional irrigation - except during dry years. On the drier Serrat and a bit more inland a relation of runoff areas to farmland of 2:1 might be sufficient. On the dry highlands, due to frost, no coffee can be grown at all. In general the needed relation is 3:1. On the highlands (Qa al Boun) even 5:1.

What does this have to do with erosion?

For maximum runoff generation the area should have a smooth, compact and sealed surface. That means without stones or plants. Eger makes only one mention on the removal of vegetation [ibid p. 211:] "*Women used to collect dry weeds (which are not grazed by animals) as burning material, thus keeping the rainwater harvesting are nearly free of any vegetation. Due to the introduction of gas and the need for the women to work actively in the more productive branches of agriculture, this runoff inducement process is not carried out any more, with the consequence that*

the runoff efficiency of these areas is decreasing."

Runoff clearing by fuelwood collection looks rather unintentional. While Eger collected an admiring load of information on runoff, he did not give any heed to erosion and environmental problems. And in spite of his claim that the runoff areas are neglected, the degradation of vegetation is proceeding quite rapidly. The side effect of that, soil erosion, is estimated as 60-200t/acre/y for a typical short and intense rainfall on silt-loam and silty clay-loam soils with a sparse vegetation cover. [ESMAP p. 40:] The fact that the silt freight of the runoff has a fertilizing effect, was not mentioned in those studies and looks not to be enhanced intentionally either.

Forest extensionists, on the other side, uses the argument that "Forests protect the soil from erosion" a bit too negligently. In a proposal on extension the author to criticised, that "very few forests are dense enough in Yemen to fulfill this function." [Herzog: Draft Proposal for a Mobile Extension and Tree Distribution Team. 30.7.1991.] As this is the kind of things you are expected not to say as a forestry engineer, I'm happily able to endorse this view with a quote from a World Bank report [ESMAP (Energy Sector Management Assistance Program. Rep 126/91.) p. 41 / 4.17]: "Although uncontrolled exploitation of the remaining woody biomass resources in Yemen will no doubt lead to increased soil erosion and the consequent downstream damage, afforestation alone will not significantly reduce the current high rates of soil erosion. In agricultural areas, the most effective method of controlling erosion is well-maintained terracing and any policies which encourage terrace agriculture will be more effective than woodland management or afforestation in reducing erosion in farmed areas. However, terrace maintenance could involve agroforestry practices, particularly tree planting along terrace walls to bind the soil at the terrace edges. In non-agricultural areas improved rangeland management, particularly livestock management, will likewise be more effective than afforestation in arresting soil erosion." uba

4.2 The Natural Environmental Factors

4.2.1 Vegetation

4.2.1.1 History of Botanical Explorations

The earliest botanical information on Yemen was collected by the Danish expedition 1761-1767 [Hansen (1964): *Arabia Felix: Danish Expedition of 1761-1767*. London.]. Forskal, who had died at Ibb, had described many Yemeni specimens for the first time. His results were published in 1775 by the only survivor of the expedition, C. Niebuhr. Several French (Descaigne 1834, Monod 1867, Boissier 1887, Defflers 1894-95/1889), British (Carter 1851), German, Italian and other botanists (Schweinfurth 1867/1884/1891/1912, Botta 1880/1938) had collected plants in Yemen in the following 19th century. Due to the colony of Aden the twentieth century was dominated by the British (Blatter 1919, Gilliland 1952, Kerfoot 1961/66/75/84, Hepper 1969/76/77/79, Wood 1975/81/82/85, Meikle 1978). But still there were some substantial German contributions, especially what concerns plant geography of Africa and North Yemen (Vierhapper 1907-10, Engler 1908-29, Schwarz 1934-39, Burret-Wissmann 1943, Wissmann 1943/72, Müller-Hohenstein(Hubeishi) 1984, Deil 1986-87). Others: Lavranos 1966, Scholte 1988/91. For Socotra the main information available has been collected by: Balfour 1881/88, Schweinfurth 1884, Forbes 1903, Vierhapper 1907, Engler 1908, Botting 1958, Boxhall 1966, Radcliffe Smith 1971, Popov 1957, Kokwaro 1980, Guarino-Miller-Bazara-Obadi 1990, Miller 1990.

4.2.1.2 The Present Situation

In spite of this long history of botanical excursions, there is so far no handy key for the identification of many of Yemen's plants. For practitioners as forestry engineers and technicians it is quite a shame, if one is not able to identify the trees one should care for. What would be needed for that purpose is not a detailed botanical description, but a handy key for a quick first identification, with pictures and/or drawings of leaves, bark, fruits and habitus - not only flowers! In short, a popular, modern flora. The booklet of Hubeishi/Müller-Hohenstein (1984) is helpful for a start, but with some 120 tables, including grasses, herbs and shrubs, clearly not sufficient for the identification of woody species. The large flora of Schwarz is only descriptive. The biggest shame in the botanical history of Yemen is the destiny of J.R.I. Wood's flora, that is on Routledge, Kegan & Paul's publishing list since 1983(!). [From where it has obviously disappeared in the meantime! (tel. information 22 january 1998)].

In the meantime Antony Miller is working hard on his own flora of Southern Arabia. As he concentrates on Oman, Socotra and Houf, a lot of information on the northern Yemen that Wood had collected might get lost. At any rate the flora of Miller will only be published end of the century. So for the time being, I had to use the information that was available and composed an Iconography [Herzog, M: *The Woody Plant Species. Iconography of Yemen*

(centered on *Jebel Bura'*). FAO Sana'a, Jan. 1993]. (Deil had done the same - but never made his work available.)

A regional overview on the floristic provinces represented in Arabia shows, that the floras of Sudan, Arabia and Ethiopia cover a large part of it:

Uniregional:		in %:
Euro-Siberian	0.3	0.3
Mediterranean	2.8	2.8
Irano-Turanian	5.8	5.8
Saharo-Arabian	14.0	14.0
Sudanian	43.6	43.6
Pluriregional:		
Euro-Siberian / Mediterranean		0.1
Irano-Turanian		1.5
Euro-Siberian/Irano-Turanian		0.2
Mediterranean/Irano-Turanian		5.2
Mediterranean/Saharo-Arabian		1.1
Irano-Turanian/ "		2.0
Sudano/Saharo-Arabian		2.9
Borealo-Tropico & Borealo-Subtropico		4.0
Tropico & Tropico-Subtropico		15.2

The floras used for this iconography were mainly:

Egypt	Taeckholm 1974
Ethiopia	Hunde 1982 Hamza 1990
Sudan	Chevallier 1939, Chiovenda 1939, Glover 1947,
Somalia	Heming 1961/66 Dale-Greenway 1961
Kenia	Fitzgerald-Foster 1955/57/57, Hedberg 1957,
East Africa /	Pichi-Sermolli 1957, Hemming 1961/66,
Red Sea	Kerfoot 1961/66/75/84, Knapp 1968, Lebrun 1977/79, Kassas 1979,
	Knapp 1973, Oliver 1868-1934, Pichi-Sermolly 1957, Ross 1979
Africa	Mandaville 1973/79, Migahid 1978, Hillcoat 1980, Collenette 1985, Koenig 1987
Saudi Arabia	Zohary 1973/80
Near and Middle East	

What concerns endemics, Arabia in general has about 17 %. The bulk of them Erithreo-Arabian growing on the south-western and south-eastern mountains, what means Yemen and Asir. The areas of

the highest diversity are those around Taiz. The highest endemism is found on Socotra with 32%!

The history of herbaria and botanical gardens depicts a critical perspective of institutions in Yemen. The largest plant collections of Yemeni plants might be in Edinburg (*Miller*), Kew (*Wood*) and Bayreuth (*Deil*). The university of Sana'a has some (not very well organised) herbarium. The Southern Upland Rural Development Project (*Khuleidi*) as well. Important collections of Socotra and Houf plants can be found at Al Kod with Bazara'a. The "National Herbarium", initialized by the Dutch "*Range and Lifestock Improvement Project*" in the late eighties, has been transferred to the AREA (*Agricultural Research and Extension Authority*) at Dhamar. Its actual shape is rather doubtful. Herbarium activities at the GD Forest and Range, Natural Forests Section, have been given up after 1990. Additional to the problems with identification, no local counterpart showed the slightest interest in that matter.

As frustrating is the experience with the "botanical garden". The establishment of such has been tried during the first phase of the Forest Development Project (1985-88). No activities followed. A small arboretum established at the GDFR by the author in 1989/90, showing humid (ditch) and dry (hillocks) niches, has been removed by the brute force of a bulldozer. The opinion of that counterpart being: "*This (nature) we have it, we want modern*". With "modern" some Versailles-style park was meant.

The last approach was undertaken with the section of the "*Yemen Environmental Protection Society*" at Bajil. They were very interested in establishing a nature-park and arboretum and were ready to supply land and water. This approach is still open for two reasons. A) the planning of the basic needs should be done by the Yemenis, and B) the funding should be organised by the author. Anyhow (sounds like a foul excuse, but:) more ideal would be an arboretum or botanical garden at Taiz or Ibb, as it has sufficient rain and an intermediate climate. One potential area is at the Chinese garden of Taiz, where Khulaidi has started some activities. Sana'a being too cold. Due to the high altitude (2200m) it would only be possible to grow the tropical alpine species. Bajil on the other hand is very hot, so the species from the highlands, even from the escarpment, would not grow well.

4.2.1.3 Phaenological Observations 1989-1993:

It was proposed to collect phaenological observations countrywide, with the participation of regional project's forestry sectors and the forestry project's staff. The result was, once more close to zero. Only the natural forests section has been collecting data. The data are so not sufficient to draw some finer conclusions, as e.g. the dependence of flowering period on the rainfall.

The general picture is, that the plants flower all over the year, an observation conform with the low and nonperiodic chan-

ges of tropical weather. It is a bit astonishing that this is valuable as well for the highland species, as *Acacia gerardii*. The lack of pods (f: fruits) observed in the table below is misleading. It is due to the fact that acacias bear pods all the year round, and it is difficult to assign them to a specific year. The fact of simultaneous bearing of fruits and flowers is observed as well for *Cordia*, *Ziziphus* and especially for *Terminalia*.

Phaenological Observations between 1990 and 1993:

Species:

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A A A A A A A A A A B B C C C C D D D G L P P P S T T Z Z
c c c c c c c c d n a a a a o o i o o r e a a r c a e i i
a a a a a a a a e i l r l r m r c b d e p n r o h r r z z
c c c c c c c c c n s a l o i m d r e o w t d k s i c m i i
i i i i i i i i i i o n e t s i i o r n i a a i o n h i p p
a a a a a a a a a u t i r r s p a s a e a d n n p u o n h h
                m e t i o a h t a e u s i s n a u u
a c e g h m o t s e a p o a a g s n s o s a l s s
s y h e a e e o o s i e r b c l v p i n m n i
a a r r m l r r b t b s d a y h a i . a o i s o t a s m
k n e a u l f t e r a i u s i b s d a p l h p a
  o n r l i o i s i e s p l s s s r c p o . l u b i c
  p b d o f t l u s g p r i p i a o y r a e s r n r
  h e i s e a i m u y i o s . n c s r a c o a o
  y r i a r s l t n c i i a o t . c w - n
  l g a c i o e c n t i a n c a
  l i u a s r a e e s m i h t
  a a s c a a r c s p i r a
  n a e h i h i
  a a n . m o s .
                a r .
  
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jan  b  b                f  f  b                f  bf
feb  b  b      b                b                bf
mar   b b      b      b      b      b      b                b f
apr
may  b      b  b                b  b      b      b  b
jun   b b                b  f                f
jul  b  b b b b                b  b b      b                f f
aug  b  b b      b b b b                b  b b      b                bf bf
sep
oct   b      b f f      b      bf                f f
nov  b  b  b      b                f                f
dec  b  b b      b b  f      b                b  f      f
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b: blossoms
 f: fruits
 bf: blossoms and fruits

Comments on institutional problems - the low importance given to

data in Yemen makes live of an empiricist difficult. For future studies some more systematic observations should be done, filling the tables for all species, to know effectively what is blossoming and what is not. It should be done regularly, at least once, better twice a month. And it should be done by local observers!

From the seed collection at Bura' it became clear as well, that it is difficult to find seeds during the rainy period - but as well in prolonged dry periods. So the relation of flowering to rainfall might not only be of scientific interest but is as well of importance for seed collection.

The dependence of seed weight on available water can easily be seen in irrigated plantations or comparing Junipers on terraces and dry slopes.

4.2.2 Phytosociological Indications for Degradation

The result of a small analysis (4 plots in Wadi Busal) in analogy to Jebel Laws (s. chapter 1.1) shows the influence of human and animals in relation to the distance from the village, here *Al Shatt*:

plot	dominant species	no of species
1	Olea	8
2	Grewia	5
3	Grewia	4
4	Anisotes	4

Above point 1, on almost inaccessible slopes, even some large *Commiphoras* survived; in the higher wadi itself some remnants of riparian forests. At Wadi Rigaf we found in those plots 9 to 11 species. The increasing impoverishment in species is quite clear from plot 1 to 4. The change in species itself indicates the selective cutting of the stem forming woody species. In the measured plots only shrubs are left, *Olea* being the largest one. Generally the degradation process goes through the following steps. First the trunk forming trees as *Acacia mellifera* and *A. asak* are being replaced by the umbrella shaped *Acacia tortilis*. The further degeneration leads through *Acacia oerfota* and *A. ehrenbergiana* stands to some remnants of *Grewia*. The final stage (before the pure *hammada*) is a wasteland with only unpalatable *Anisotes* and *Euphorbias*. *Grewia* may survive as long, as the grazing pressure is not too high. When all the wood has been collected and every edible plant grazed, just the poisonous *Anisotes* and *Adenium* are left.

A list of plants serving as "Bioindicators of Desertification" has been established by Müller-Hohenstein [in Rappenhöner 1989, p. 164-170]: *Boscia senegalensis*, *Adenium obesum*, *Scadoxus multiflorus*, *Anisotes trisulcus*, *Aloe menachensis*, *Crinum yemense*, *Calotropis procera*. Especially thorny, and therefore

surviving, are *Euphorbia amak*, *Caralluma quadrangularis*, *Blepharis ciliaris* and *Cenchrus ciliaris*.

For forestry purposes the classical phytosociological inventory has to be completed for information allowing a biomass estimate. [This kind of inventory has not been used further by the author, as P. Scholte (DHV) worked 2 years at Bura', has all the data and promised a publication ... 1990!]

4.2.2.1 Changes in Land-use at Jebel Bura' between 1973 and 1987

	area 1973	area 1987	change in km ²	change in %
dense forest	2.26	3.55	1.29	+ 8.4
open forest	0.31	3.22	2.91	+ 19
dense scrub	1.62	(wood- land) 6.05	- 2.28	- 15
open land with trees and scrubs	6.71			
agriculture	0.28	0.7	0.42	+ 2.7
open land	3.64	1.76	- 1.88	- 12.3
shadow	0.46	0	- 0.46	- 3
total area	15.28	15.28	9.24	60.4

In opposition to Monsch's table [Table 12: *Changes of land-use at Jebel Bura between 1973 and 1987*. In Monsch, 1994], the forest inventory of Herzog (1990) delimited an area of 304 ha. 128 ha out of that consisted in degraded *Acacia* stands and *Phoenix* bushland. So the area of interest for forestry in the table above is only the category of "dense forest", here 3.55 ha in 1987.

Legend:

+: increased forest cover or area

m: decreased " "

1: Ali Hanish's farm

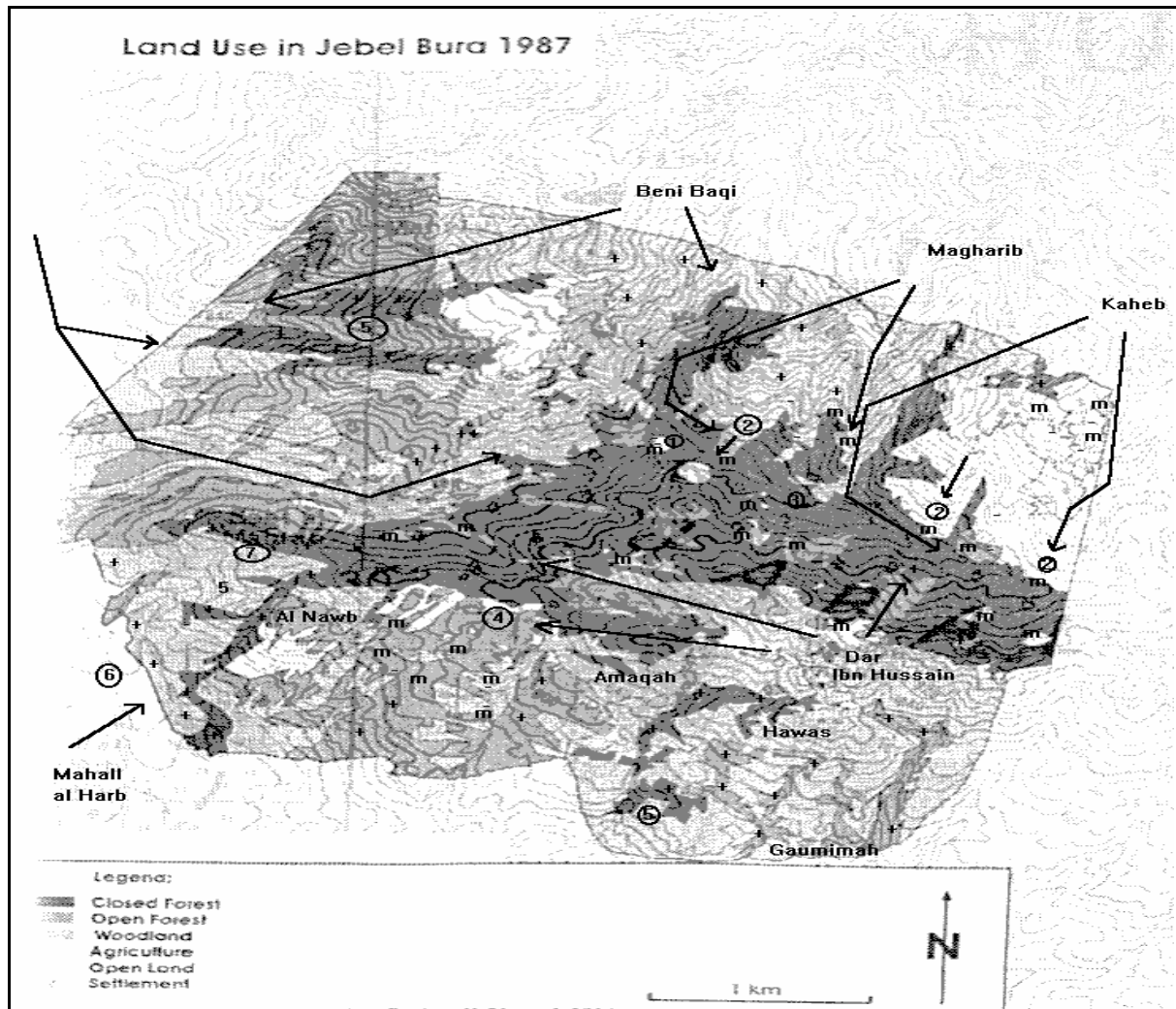
2: wood collectors of Magharib

3: Al Wadi (Begeli)

4: Dar Ibn Hussain & Hawas (Begeli)

5: Beni Baqi, in Wadi Busal

6: Mahall al Harb



Interpretative Problems:

Monsch wonders how he arrived at 15.28 km² for the study area, covered by the 1987 aerial photos (1:20,000), while Millington and Saadallah used the same material and studied 24.14 km². That is most probably due to the fact that Millington, Saadallah and Herzog used the average scale of 1:20,000 for planimetry, while Monsch used corrected orthophotos. So his measurements are more reliable what concerns the area.

In what concerns vegetation, Monsch found rather an increase, while Millington claimed that 52% of the area changed from higher to lower density and 8.23 % had been converted to agriculture. Two rather contradictory results! - The reason is twofold.

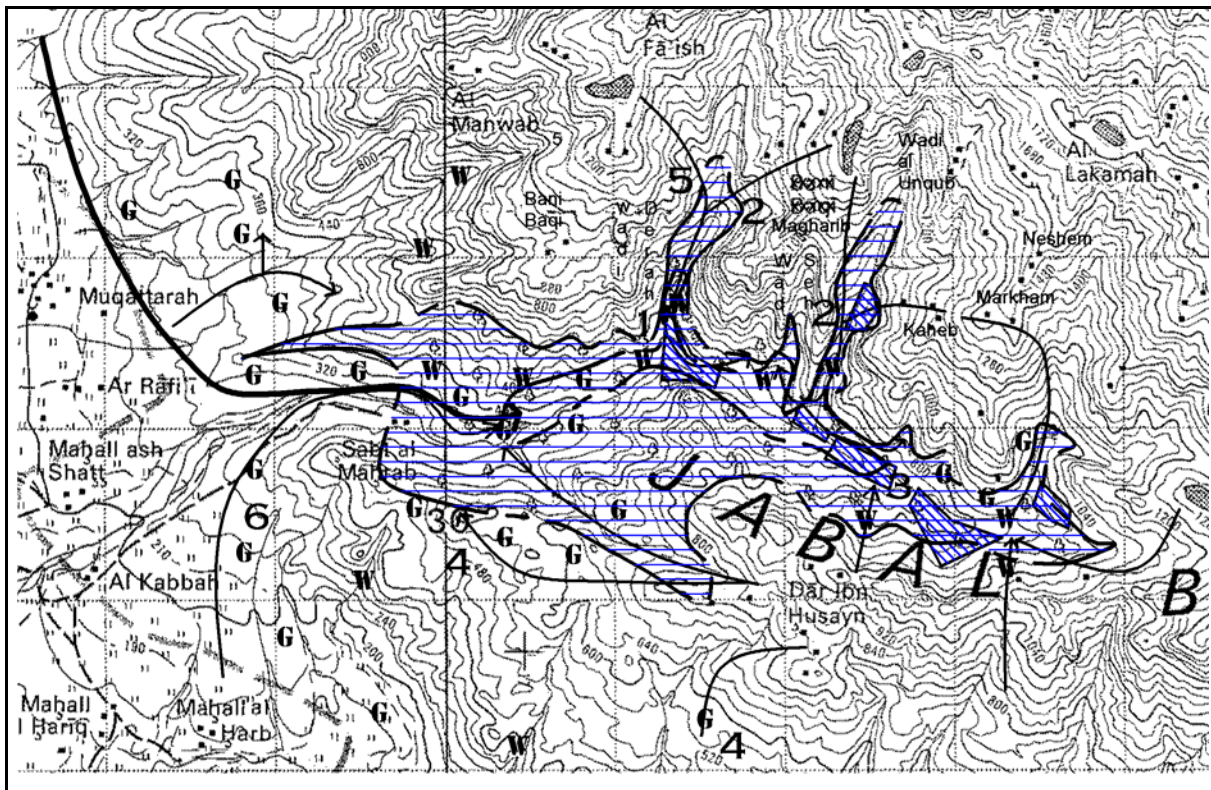
Millington definitely overestimated the decrease in density, due to the fact, that the 1973 pictures have been made when the sun was standing very low (early morning in this case. Late evening or winter would produce the same effect) - what can be seen from the long shadows under the peaks. All trees, especially those on the southern slopes, show long shadows, what virtually enhances the density. The 1987 picture shows no shadows, the sun is

standing high up. The forest looks more flat and bare. Now - If we look at the changes between 1973 and 1986, it peeks out, that "the increase (+) happened" in the wadis of the southern and western slopes (5) and on the higher areas north. Those steep gorges south have only rarely been used, but what was impressive was their lush aspect in years of good rain, what leads to the suspicion, that 1987 might have been a year of strong rains. The general trend shows exactly the opposite (s. following table)! But - the three exceptional stations are no 1 (east of Bura'), no 6 (at the foot of Jebel Bura') and no 9 (NW of Bura'). So we may guess that in opposition to the trend 1987 was a good year for that area with lush vegetation. Anyhow, in terms of biomass those differences are of clearly minor importance, as the degraded Acacia and the Phenix strata just represent an average biomass of $0.25\text{m}^2/\text{ha}$. So 300 ha of open forest more or less would only make a difference of some 75m^3 of wood.

no	Station	rainf. 87	rainf. aver.	%
1	Al Amir	580	554	<u>104.69</u>
2	El Haima	285	311	91.64
3	Al Dabira	146	247	59.11
4	Al Fowara	164	293	55.97
5	Mah. Sham.	300	471	63.69
6	Sukhna	593	492	<u>120.53</u>
7	El Hamal	363	419	86.63
8	Maghraba	513	627	81.82
9	Deir Zinka	400	357	<u>112.04</u>
10	Al Khalifa	na	551	na
11	Hudeidah	51	136	37.50
12	Wa'allan	164	271	60.52
13	Waqir	307	351	87.46

4.2.2.1.1 Historical and Qualitative Assessment

That forests are disappearing is a well known fact - even for the Yemenis. That something should and can be done against it is an other matter. The locals are still quite optimistic that Allah is going to send rain and restore the forests, one day ... Jebel Bura's forest was mentioned in literature for the first time at about 1870 in Burri's: "*Arabia Infelix or the Turks in Yemen.*" It must have been an impressive site already that time to deserve the attention of the author. At the waqf office of Hudeidah (s. chapter 4.4.6 on the *Waqf Begeli*) only one old man new something about a forest at Bura, "*the forest of Begeli*" (Al



Grazing (G), wood collection (W) and origin of users in Wadi Rigaf at Jebel Bura'. (Grid 1km). The numbers refer to the following paragraphs.

Khabat al Begeli). The members of the YEPS ("Yemen Environmental Protection Society"), while visiting the forest with us in spring 1993, claimed that "the forests at Milhan are much better than this one". But they had to admit to be speaking about the situation as it was 20 years ago! In those past twenty years many forests have gone! Jebel Bura's Wadi Rigaf is actually the only forest of this type on the Arabian Peninsula! Similar areas in the adjoining Jebel Reima, south of Haidya, have been cleared in spring 1992 (it was secondary valley forest on private land). The wadi forests at Jebel Milhan have been cleared to a large extent already between 1988 and 1990.

The very rapid destruction process could be monitored at Wadi al Aswad. Only since some twenty years settlements have been (illegally: s. *Waqf Begeli*) established. On the 1973 aerial photos there is absolutely nothing to be seen. The hamlets of Suq as Sabt and Hazz ash Shumah did neither show any settlements nor agricultural use, what proofs that those must have been established between 1973 and 1979. Clearing was done rapidly and is still ongoing, in those flat areas mainly by bulldozer. The returnees cleared substantial areas in 1991 and afterwards. While there is a growing awareness on the problem of disappearing woodlands, and clearing is not very appreciated by the people, it still looks to be a current and uncontrollable procedure. And that is true for most parts of Yemen. North of Bura, Wadi Siham, reported as "the Green Yemen" in the 30-th, has nowadays not more to show than some poor *Commiphora-Acacia* stands.

The changes in forest cover and area could not be interpreted by Monsch who had to rely mainly on the analysis of air-photos. Only from the field work the patchy situation of increasing (secondary, mainly *Phoenix caespitosa*) and decreasing forests can be understood. Moreover, the intensity and impact of change from 1973 to 1986 was definitely minor to what happened in the aftermath of the Gulf War. For this we have to rely on qualitative field-observations. The major destructive influences on that forest will be discussed shortly.

1 Ali Hanish's farm:

Ali Hanish and his brother Khamisi, from the village of Magharib, started farming in this area at about 1985. On the 1973 photo nothing is visible. During our first visits in 1988-89 Ali still admitted, that the land belongs to the government and that he had (illicitly) cleared a piece. In 1990 when we had the first quarrels with him, he claimed that the land had been used by his grandfather already and belongs to him. A claim that might be supported by the old terrace wall of giant stones, bordering the wadi below his farm.

Anyhow, during november 1990 he had cleared a quarter ha at the south-western corner of his farm, established a charcoal pit and cleared another quarter ha at the eastern edge by fire ("*But what did you do!!!*" - "*I put some dry banana leaves in the forest and burned it*"). Whereafter our patience was a bit reduced and he had to spend some weeks in prison.

The relation between Khamisi and us was rather queer, for western understanding. We often slept on the roof of his house, when the rain surprised us, even inside his house. Sometimes six people on ten square meters!). Moreover, he keeps two guns in his house, one of them an old type of a Russian submachine gun, mafia stile, with a drum-shaped magazine. In spite of the fact, that he had to spend quite some time in prison because of us, the relation with him always stayed quite "social". That is surely something difficult to understand for "Westerners", who discriminate "unfriendly" people much faster and ultimately - than any Arab. It would be difficult to imagine let's say a Swiss that has been put into prison because of our interventions, inviting us for a cup of tea! But here the understanding was rather that we do our job, what means to protect the forest - while Ali does his job, what is to run a farm. The problems and conflicts that arose out of this constellation are considered as rather "technical" - not social!

Anyhow, the process of clearing continued. In February 1991 the area burned the year before was enlarged - and Ali even complained about the people coming up from the Tihama to cut trees. Beginning of march an other relative of Khamisi had cleared about half a hectare west of the farm and constructed a new shed under an overhanging stone. This area was later on used for the establishment of the guard's house. During the construction period (dec. 1992 to august 1993) the vegetation cover of this central area, close to the house was being heavily reduced. Khamisi had established a store and the place developed into a kind of market.

2 The Wood Collectors of Magharib

[First a remark about the map. *Bani Baqi* is indicated on the wrong place. It is the village one slope westward. The village titled Beni Baqi on the map is Magharib.]

The woodcutting women of Magharib had a substantial impact on the forest, what could be heard and seen during the fieldwork, and what can be seen even on the aerial photos. The disappeared forest on the western slope of Wadi al Unqub (north of Al Wadi) and Wadi Seh (between Wadi al Unqub and Wadi Derah, north of Khamisi 1) is their work as well.

3: Al Wadi - the hamlet of the Begelis

The biggest shock I got during the six years work in Yemen happened the 13th (well ...) of February 1991. We had the intention to visit the sheikh of Qaryat Jaylan and after the visit of Khamisi we moved up the road. From Al Wadi to the east the people had cleared the whole valley (some shocking photoreport is available). The land they won consists of almost pure rock. But there was no other reply to our questions, than "WE MAKE ALL THIS AGRICULTURE"! At the upper part of the valley the situation was even much worse. The whole valley, from the bottom up to the village had been cleared from vegetation. On the eastern part terraces were already established. The people told us, "THERE ARE PEOPLE BACK FROM SAUDI. WE MAKE ALL OF IT FRUIT TREES". Fruit trees anyhow won't grow here, because there is no water for irrigation. But the local opinion was: "ALLAH GIVES US RAIN AND WE PLANT" [from: Bura Report 13.2.1991:].

Allah was not so merciful (*rahmanul*. s. chapter 4.6). The rains failed for the following two years. The pollarded and lopped trees (*Ficus*) started reshooting. *Phoenix caespitosa* and a multitude of shrubs reconquered the area.

In the same time the lower part of Wadi Higan (= Wadi Unqub) has been cleared for sorghum. The terracing has been done only very superficially. The farmer claims, that he only cut thorns and shrubs. Any ownership of the government (or awqaf) is heavily (and rightly) contested by the children. This area definitely belongs to Lakamah and Kaheb.

4: Dar Ibn Hussain & Hawas - the homestead of the Begelis

In 1991, in addition to the above mentioned areas, there were many activities on the southern slopes (*Kusai*) in those years. Between 1988 and 1994 the increase of settlements in this area was astounding. Instead of Dar ibn Hussain, the only village indicated on the map of 1980, there are now five villages, what explains some of the decrease. Still, some traditional tree-farming models have been preserved. Especially there are the *Terminalia brownii* stands at Hawas and Amlaqah that are carefully protected as village forests. The same is true for the area south of Sabt al Maghreb, where *Terminalia* woodlots above (S) the village are well kept.

5: Beni Baqi in Wadi Busal

This is one of the villages that sees its forests in Wadi Bussal disappearing and would like to protect them - especially from the intruders from the Tihama. Still, the observation of the actual use of the woodlands around Al Manwab showed [Bura report 30.7.1991:] that even after the district director had issued a decree that limited wood collection to dry wood and shrubs, many areas have been burned and a lot of cutting was under way. During the visit we observed that a pole had been removed at Al Manwab itself, besides the cistern. As the acceptance for the restrictive decree had been discussed just before and had been answered positively, the question was put forward again. The answer was, that the tree had to be cut, because "*there are snakes under the roots*". An answer as well heard at Hazz ash Shumah. The unlucky fact, mentioned already in the inventory of 1990, that just the poles are collected, while lots of dead wood and branches are left, could be observed here again.

6: Mahall al Harb

Mahall al Harb, the village of Ali Harb, existed before 1973. In the eighties the family moved to Saudi Arabia for work and only returned after 1990. The whole increase was secondary bushland - and has disappeared again in the meantime, as the farmland was reestablished. Additional to the reestablished farmland, more areas at the entrance to Wadi Rigaf have been cleared. On top of the alluvial fan as well as along the wadi.

Tihama in general and some remarks on the use of decrees and prisons:

The impact of Tihama woodcutters is "chronical" and historically documented (s. chapter 5.4.6 "*Waqf Begeli*"). Many woodcutters have been reported to us by Khamisi (s. up, no 1)) as well as by Idris. Idris is the mamoon of Hazz ash Shumah. One of the most active and interested leaders met in Yemen. In spite of his social engagement and his assistance to the poor, he run into some troubles with his own people. In summer 1992 he had to spend some three weeks in the prison at Ruqub, because in the district governors opinion he did not control wood cutting strictly enough. During the time in prison, a villager stole his radio because "*he is with the people who want to protect the forest*". (*Life can be hard, isn't it?!*)

Being sent to the prison in Yemen does not bear much of a social stigma. The first time I noticed that was winter 1988 on Jebel Reimah. In the morning at around seven some singing could be heard from the nearby village. I asked our host if this was the school. He replied, "*no, the prison*". - "*They seem to be quite happy?*" - "*Oh, you know, almost everybody happens to go there once in a while.*" And as anywhere in the world it does have only a minor influence on the later behavior of the inmates. One of the biggest wood thieves at Bura is M.D. from Deir al Uragh. He

has been warned, fined, imprisoned for many times, run away for as many times and looks to be one of the more difficult cases! The people of Al Uragh have been at loggerheads with the Begelis for ages, but they know and tell that the forest of Wadi Rigaf has been protected for a long time.

4.2.2.2 The Overuse of the Range

**SCIENCE IS NOT SETTING VALUES.
SCIENCE IS NOT MOTIVATING ACTION.
SCIENCE ANALYSES AND DESCRIBES PROBLEMS!**

As the first part of the book has been dedicated to the question what science is, what it is not and what it should be we won't start here again. But if sciences or scientist adapt their findings to idols (*idola tribus* in this case, s. chapter 2.3.3.1: Topics), then science is nothing but useless (or a hobby at best), useless even for awareness raising. Many scientists working in developing countries bring along their idealistic view of "*indigenous people, living in harmony with nature.*" Even facts they collected and analysed themselves can not convince them, that the harmony has gone. Range research in Yemen delivered some blatant examples: "*Contrary to popular belief, we think that large, although certainly not all, parts of the Yemen are at present not being overgrazed. If the grazing pressure is reduced the standing biomass will increase.*" ["*The State of the Rangelands in Yemen.*" Reply to a remark in "*The Vegetation of the Rep of Yemen.*" Yemen Update Summer/Fall 1993. #33, p. 23:]

While it is logical and not really worth while mentioning that the biomass will increase if not harvested, the term "overuse" needs a more precise definition. Let's check on what base the rangelands of Yemen might be declared not overgrazed - and what results the DHV exerts found themselves:

The yearly cycle of range use:

september - december:	animals live on sorghum stubble
december - spring rain:	" supplement needed
march - april:	" range and fallow
may-june:	" spring crops harvest
july-august:	" range (rainfall period)

25-40% of the fodder comes from the range. Shrubs are generally less preferred and only grazed after the availability of grasses and forbs decreased. This situation is quite common all over Yemen. Where the agricultural sector is dominant, there is a high interrelation between range and the agricultural fields. When the crops start sprouting, they are quite sensitive to grazing and will be well protected. The goats and sheep are led to the rangelands. When the main crop, sorghum, reaches a certain height, some grazing is tolerated or the lower leaves are collected by hand and fed to the animals. During and after harvest the stalks and dry leaves make up the bulk of the fodder. So there is a natural rotation - depending on rainfall, the related farm productivity and the potential supply of supplementary fodder.

Even in areas without agricultural activities (besides herding),

as Socotra, there is some natural rotation, due to the sporadic and very local rainfalls, as well to the very strong winds during the summer monsoon.

It is easily understandable that grazing changes the floristic composition of the range. On the protected range the vegetation cover was 1.5-2 times higher than on the common rangelands. Even on Socotra, where some traditional range rotation and protection principles seem still to work, at least in the mountain areas (Miller/Morris), large difference between protected plots (palm plantations) and the surroundings can be seen. Serjeant [Serjeant: pers. comm. 31.1.1993:] mentioned a fenced plot, established in Colonel Bousted's time, that produced an astonishing vegetation cover in comparison with the desert-like surroundings.

The livestock project compared protected with unprotected rangeland. The latter showed the following changes:

	decrease in plant species	increase	invaders
perennial grasses	11	-	-
	1	2	2
annuals	3	-	-
	5	1	1 [RLIP Com. No 20:]
forbs			
dwarf shrubs			

The increase of annuals and the disappearance of perennials is a very clear sign of degradation, as not only the plant cover, but as well the here indicated loss of diversity is a good criteria for the grazing (and others as woodcutting!) impact on range: 20 species disappeared, 6 increased.

It can only be added, that the disappearance of trees and shrubs, is surely not to be ascribed to grazing alone, but mainly to (fire-)wood collection. The tender seedlings can't escape the teeth of the hungry grazers! So a combined effort of wood collectors and seedling eating animals prevents the regeneration of shrubs and trees. Two plants have to be mentioned here especially, as typical elements of the area. Anisotes trisulcus is an endemic plant of the Eritreo-Arabian realm. It produces beautiful orange-coloured flowers - but is neither rare in Yemen nor of much use. Its not grazed and so clearly a sign of over-grazing.

Adenium obesum (Bottle Tree) is a typical plant of the Serrat. It keeps the landscape beautiful, even if all edible and 'browsable' plants are gone. It has beautiful pink flowers - but is poisonous and has wood as soft as a sponge.

The Opuntias that are thriving around villages in the escarpment and the highlands are a bit more useful, while not indigenous. (They have been introduced by the Turks). They are browsed by animals (poor creatures, its not the spineless variety!) and

produce the delicious cactus figs (*tin shawqi* = thorny fig).

Generally we might agree with Hugh Scott (1942:52), who wondered, why the Romans had called Yemen

ARABIA FELIX instead of **ARABIA SPINOSA**.