

7. Summary

During a work period of nearly nine months in the area of Northern Jordan (from August to October 1990, from August to October 1991, from March to June 1992) investigations were carried out on the degradation of soil and vegetation.

The aims of this study are:

- * to get a better understanding of the processes which have caused degradation of soils and vegetation in Northern Jordan.
- * to investigate the influence of different land use systems on the location.
- * to look for degradation indicators (in vegetation and soil).
- * to support decision makers, regional planners as well as the forestry (agronomy) authorities and to help organizations for the conservation of nature in avoiding the spread of degradation processes and developing a land use system adapted to natural conditions.

The investigation of vegetation relevés was carried out with a modification scale according to the method of **BRAUN-BLANQUET** (e.g. in **WILMANN** 1984). Based on 307 plant-sociological relevés different land use systems in the area studied were recorded, amongst these woods, grazing forests, pastures, shrub and dwarf shrub communities (Batha) and weeds on formerly cultivated land or completely degraded agricultural land.

In addition to the floristic records 18 soil profiles were dug. 145 soil samples were examined for important soil parameters, e.g. pH (KCl and H₂O), electrical conductivity, particle size distribution, calcium (CaCO₃), carbon, nitrogen and organic matter contents and C/N ratio.

Moreover, the interpretation of 172 questionnaires (with 70 questions each - see 9.1 in the appendix) from the different areas of study provided important socio-economic information

about the situation of the resident rural population (farmers and herders).

The area studied comprises about 15 000 km² (see fig. 3.1), the altitude varies from 200 m above sea level (Zarqa valley) to more than 1 100 m above sea level (Jabal Al-midḥaliyyah, 1 100 m above sea level, Jabal Ishtafena, 1 115 m above sea level, both in Ajlun District). It comprises the western mountain ranges of Northern Jordan (Al-midḥaliyyah, Al-mushrefeh, Ishtafena, Sakib, Al-muṭawaq and Umm-mikman), where the climates range from subhumid (in Ishtafena, Ajlun District) to arid in the desert fringes of Al-ḥallabat and Al-mafraq) from west to east.

The various land use systems were recorded and investigated under geological, geomorphological, pedological, climatic and floristic aspects. It should be particularly emphasized that two thirds of the Jordanian population are concentrated in the studied area. Among other things the existing serious problems caused by the current intensive use of soil and vegetation cover can be derived from this fact.

Important results of the socio-economic investigations are:

1. The farmers in the studied area practice very intense cultivation without a rotation system using few chemical or organic fertilizers.
2. Illegal encroachment by herders on protected natural range land (Ṣurra and Al-khnaṣri protected area) has increased. The protected areas are well suited objects of study for the refugial importance; they are imperative for the regeneration of the autochthonic adopted vegetation.
3. The amount of waste water in the Zarqa river has increased due to the high population density of the cities Amman and Az-zarqá. This has led to a lack of drinking water.

7. Summary

Important results of the land use investigations are:

1. The method of deep ploughing, which is used today, persistently destroys the natural vegetation, particularly in the North-East of the area studied.
2. The destruction of terraces in the mountains increases, particularly on very steep slopes, resulting in the loss of soil due to strong soil erosion (see photo No. 26).
3. Large area invasions in potato, tomato and tobacco cultivations by the weeds *Orobanche schultzei* and *O. cernua* provoke large problems. They are difficult to control and lead to serious yield losses, which result socio-economically in the decrease of income.

Important results of the soil investigations are:

1. Increase in soil salt in the area of Al-ḥallabat because of the misuse of irrigation systems.
2. Loss of carbon and nitrogen in the upper soil in the area of the Zarga river because of the intense cultivation without a rotation system and with only little use of fertilizers.
3. Increase of soil erosion by water (short-term strong rainfall) and wind (see photo No. 26).

Important results of the vegetation investigations are:

1. Forest and pasture land regions have declined, as well as the average vegetation cover in the area studied (see vegetation tables 18, 21, 23 and fig. 5.18, 5.19, 5.27, 5.36).
2. The native tall-growing more or less closed oak woods (*Quercus calliprinos* and *Quercus ithaburensis*) are being replaced by short growing shrub communities (maquis and Batha) and short growing xeromorphic dwarf-shrub communities. In open steppe halophyte vegetation is being replaced by *Tamarix jordanis*, *Chenopodium* spp. and others (see fig. 6.1 and tab. 26).
3. In the dry regions of Al-ḥallabat and Al-mafrag the livestock pushes back previous palatable species, e.g. *Artemisia sieberi* (syn.: *A. herba-alba*), *Salsola vermiculata*, *Atriplex halimus*

- and others. Because of the overgrazing caused by the enormous density of livestock, the indicator plants (invaders) like *Anabasis syriaca*, *A. articulata*, *A. setifera*, *Peganum harmala*, *Chenopodium murale* and others are promoted.
4. Because of the high amount of salt in the upper soil the halophytes, e.g. *Chenopodium spec. div.*, *Anabasis spec. div.*, *Tamarix jordanis*, *Sonchus maritimus*, *Peganum harmala* and others, spread far in the above mentioned areas. Thus, at present, a change in the vegetation becomes obvious.
 5. By uprooting underground parts of the plants as well as by breaking and deep ploughing long-existing resources of medical plants in the regions of Ishtafena, Dībīn and Jalād, like *Salvia fruticosa*, *Majorana syriaca*, *Achillea santolina*, *Ephedra alta*, *Marticaire aurea*, *Mentha longifolia* and others have been permanently destroyed.

Vegetation, soil and socio-economic investigations indicate several current problems: as a consequence of vegetation degradation, including floristic depletion, and soil degradation by erosion, nutrient depletion and salt increase a fast progressing impoverishment of the rural population can be seen. The immediate action of the Jordanian government, particularly of the Ministry of Agriculture (Forestry and Soil Department, Department of Range Management) is very urgent.