

5.1 CONCLUSION

Already in the last century, attention was focused on the Amanus Mtn. by European botanists and vegetation scientists because of its 'well-known' geoelements of Euro-Siberian origin. Therefore many questions arose about the history of the macroclimate of this area and - dependent upon this question - about the history of vegetation.

Over a long period of time - from the phytogeographical point of view - there seemed to be no doubt about the 'relictic character' of the extrazonal vegetation. In accordance with this hypothesis, Euro-Siberian species penetrated from northern Anatolia southward to the Amanus Mtn. 'during the various climatic changes during pleistocene' times or perhaps immediately in post-glacial times because of pluvial conditions. As a migration or invading route, the mountainous 'Anatolian Diagonal' was supposed by DAVIS (1971). Due to holocene climatic changes to mediterranean (resp. arid) conditions, only favorable sites retained Euro-Siberian species within enclaves or smaller stations (e.g. Pos, SE-Toros) far away from their main phytochoria (ZOHARY 1971). For example, in the southwestern mediterranean coastal area of Anatolia, restricted occurrences of the endemic *Liquidambar orientalis* near Köyceğiz were assumed to be isolated tertiary relicts (KÜRSCHNER 1984). Convincing palynological arguments are lacking. It should be kept in mind, that the logical consequence of this hypothesis postulates very stable subtropical isolated site conditions over a period of at least 2.3 to 2.4 Mio. years (!) during several glaciation periods in the northern hemisphere.

The evaluation of existing investigation results - namely of serious palynological research - concerning the history of climate in the East-Mediterranean area and especially of Anatolia do not support the plausibility of several hypotheses and speculations regarding historical migration and invading dynamics of vegetation cited in several chapters of this work. Although convincing facts are missing for obvious reasons, the degree of probability decreases that only the holocene environmental change induced favorable site conditions resulting in 'secular successions' (long-term successions), or according to LEUSCHNER (1994) to changes of resource availabilities and requirements. In this context, the occupation and establishment by genetically predisposed Euro-Siberian geoelements of Euxinian provenance on sites with habitat factors very similar to Euxinian phytochoria on the western slopes of the Amanus Mtn. have to be seen as a logical consequence. Very unique site conditions in the research area correspond with singular site requirements of typical species of the research area proved by the method of canonical correspondence analysis (CCA).

In this context, necessary questions on possible allochorus and/or hemerochorus diaspore availabilities in the past are not sufficiently verifiable. However, examples from the past and present cited in this text show not supposed velocities of propagation and migratory rates after climatological and cultural induced fluctuations of habitats. In addition, it should be kept in mind, that hemerobic ecotopes as the result of human activity have been recorded for many Anatolian regions since early holocene, and the surmount of large distances by pre-historic Man is well known. With regard to the Amanus Mtn., the above mentioned circumstances are of special relevance. The very special macroclimatological mediterranean regime (!) of the coastal region of SE-Anatolia leads only in holocene times to altitudinal belts with habitat conditions comparable to warm-temperate to temperate vegetational zones (in the sense of WALTER, 1985, these are the zonoecotones IV/VI to V/VI with relations to V) which are exclusively favorable for Euro-Siberian geoelements of Euxinian provenance.

It is not surprising that cultivation-induced increasing changes of landscape coincide with changes of its vegetation on the western slopes of the Amanus Mtn. It is well known that the same can be reco-

gnized in climatologically and floristically comparable northern Balkan landscapes as well as in coastal mountains of the Euxinian-Pontic and Caucasian Black Sea region. For all described stands with their **individual and different site conditions**, it is true that the actual vegetation persists in an equilibrium between human intervention as a potentially disturbing factor and the genetically determined occupation and survival capacity of plant individuals. This means that floristical similarities do not necessarily lead to evidence of the same environmental parameters. As a consequence, similar floristical compositions have only limited value as ecological indicators and they are of restricted comparability. Nevertheless, on the basis of the proved actual climatological and pedological conditions of the investigated area of the Amanus Mtn., it can be assumed that after a long-term succession under ahermobic to oligohermobic conditions, the 'potentially-possible vegetation' (PPV) would be extremely different from the 'actual vegetation' (AV). Due to the climatic conditions, it seems to be indisputable that the narrow coastal strip as well as the hilly landscapes of the Dörtyöl region would not be occupied by evergreen macchie-formations. With its remarkable and changeable history of colonization and cultivation, the vegetation of the coastal area has without doubt been modified by man. The present day occurrence of typical mediterranean elements is therefore the result of secondary invasions and not an indicator of climate.

Motivations for research carried out in mountainous regions have very often been related to landscape changes and their affects on its vegetation induced by tourism (PRICE 1995). Similar aims led to the present 'Landscape Ecological Analysis in the Amanus Mtn.' which was focused on habitat conditions of remarkable extrazonal vegetation. The question concerning the endangerment and retreat of rare species and aspects of dynamic of unique vegetation types by man-made modifications of resources (e.g. arising by increasing settlement activities and tourism), was of great impetus. For the solution of landscape ecological problems focused on floristical and/or geobotanical questions, climatological and pedological investigations are indispensable. Due to the given financial, personal and temporal framework, only several of various questions could be investigated in this limited research project. Many questions arose during the field-work or the evaluation of the collected data. However, I hope that further investigations in the future will be able to profit from the ecological results of this work.

As it is well known in subtropical regions, it has also become evident in this project that plant-available water in soils is among the most important key resources during summertime, but only few investigations have carried out on evaluation of the water balance of soils and vegetation. Infiltration rates, surface run-off and evapotranspiration rates in relation to altitude, exposition, inclination and climate conditions are necessary data to understand the water regime of this fragile ecosystem. In addition, the significance of the variables 'landscape relief' in relation to 'global radiation', and cover values of vegetation for the distribution of different life-forms give some indication of necessary research regarding photosynthetically active solar-radiation in different vegetation layers. With this research, questions concerning vegetation dynamics after human interferences would be possible to answer. Not only faunistic research would be important and a necessary completion of the ecological complex analysis.

The most important unknown environmental variables are created by human impact itself. From the point of regional planning, reliable data concerning this complex of factors is absolutely necessary for effective environmental protection and the sustainable use of the numerous resources of the Amanus Mtn.

Retrospectively, some explanatory remarks are necessary regarding some concepts and the presented results:

Regarding some reflections on questions resulting from practical work, overdue changes of paradigmas give warning of the traditional appreciation of nature and natural conditions. In reality e.g. reliable answers to obvious questions of mainly forestry administrations or authorities for nature conservation concerning the so-called 'Potential Natural Vegetation' (PNV) are not possible (cf. ZERBE 1997). It is no secret that ahemerobic sites with the same or similar habitat factors functioning as areas of reference actually do not exist. Seemingly comparable sites with some similarities in the floristical composition of the vegetation are influenced by anthropogenic (unknown) factors and normally profound knowledge, especially about edaphic and climatic factors, is insufficient or lacking. With regard to the research area, no information is available about this landscape and its vegetation without human impact. In addition, it is absolutely not clear whether at any period in holocene times ahemerobic conditions prevailed in the Amanus Mtn. Consequently, any answer regarding 'PNV' would be unrealistic and would depend upon individual wishful thinking or on mere speculation.

Certainly the concept of a 'potentially-possible vegetation', introduced in Chapter 3.3.1.2, will provoke contradiction (maybe only for the time being and because of an apparent pleonasm). This concept is related only to a well defined habitat under consideration of the actual and possible site conditions. It includes therefore dynamical aspects of ecosystems with human beings as a part of nature and excludes the idea of (poly)climax (since equilibrium as an end-point of succession only controlled by climate is unattainable). This concept has intentionally been used in opposition to the speculative and idealistic philosophy of 'PNV'. The concept of a 'potentially-possible vegetation' (PPV) includes possible hemerobic influences in the past by pre-historic Man, in historical times, present and future and the permanent internal dynamic of ecosystems (cf. LEUSCHNER 1994). This concept is interested in possible developments in the future. It accepts the experimental fact of non-existing reference stands with ahemerobic site conditions.

Nevertheless, knowledge of probably comparable sites with similar floristic compositions, e.g. on the Balkan Peninsula or Pontus Mtn. of the Black Sea region, served only in a very restricted way to help in the understanding as indicators for possible vegetation dynamics in the Amanus Mtn.; one of the reasons being the fact that the importance of environmental variables of the compared landscapes has normally been unknown. The 'potentially-possible vegetation' (PPV) of the research area, presented in **Fig. 33-7 (Chapt. 3.3.1.2)** with its hypothetically vertical distribution after a long time of oligohemerobic conditions, is derived from the basis of actual climatological (and pedological) conditions in the sense of HORVAT (1954).

The climatological results have to be seen against the background of remarkable variations of yearly rainfall rates in this region. So far measurements over three to four years (the less so since in a mountainous area) are only corner-values which should function as orientation. In different chapters, the defectiveness of short-term measurements (a few hours to a few weeks) have been sufficiently explained. Years with very low yearly precipitation rates and extremely high rainfall events provided the most favorable conditions to carry out these investigations, mainly because of the measured possible soil water regime.

Regarding necessary approximation of 'yearly means' of rainfall (for different altitudes) on the basis of long-term measurement series (42 years) of the Dörtyol station, it has to be pointed out that clearly recognizable gradients of rainfall on the altitudinal gradient have been shown. In general it has to be emphasized that to a lesser amount yearly means are of importance for the characterization of sites. The more decisive features of relevance for habitat conditions are variabilities in climatologically dependent resources. This situation has been considered through introduction of the possible variation of the S-index (PE/M), resulting from yearly fluctuations of summer rainfall. As can be seen by the distribution of the oriental beech in soils derived from different limestones, only the shortage of water

during summer time (Juli to September) regulates the long-term survival conditions of different species involved in the vegetation complex.

A decisive perception (the most important result) of the research has to be repeated at this point: under the given circumstances of extremely high intensity of solar radiation (with remarkable altitudinal differences), even very small interventions with the effect of an increasing evaporation loss (e.g. understocked forest, coppicing), lead to vegetation changes in rapid succession. For example, coppice management leads to decisive changes of internal shading conditions in different vegetation layers. The higher evapotranspiration rates could possibly cause water shortages and the dying off of less dry-resistant hydro-unstable mesophytic species in the now unprotected undergrowth. Only the result of this frequently described process of desiccation - otherwise 'mediterraneanisation' - of habitats with now favorable conditions for mediterranean elements explains their advantage of colonization and their expansion. Under these conditions, 'successful' mediterranean 'invaders' are actually the most efficient users of resources required by anthropogenically modified site conditions.

Even under reduced cultivation intensity, one can only expect a long-term distribution of mesophytic Euxinian deciduous species and a slow retreat of mixed Euxine-Mediterranean vegetation types (this, however, could be a disadvantage for some people!, cf. NAVEH & WHITTAKER 1979). This means that the 'potentially-possible vegetation' (PPV) under oligohemerobic conditions as a result of secondary succession will be attained very slowly. In contrast, the habitats for Euxinian geoelements will of course shrink with increasing human impact, and the site conditions for Mediterranean elements will improve. The overexploitation of the beech forest by the forestry management itself above Topoktaş Yayla can be taken as a good example.

The most serious problem, however, will be in the expected deterioration of water availability. Under the described precipitation regime with extreme rain-fall events, erosion occurs rapidly where the vegetation has been degraded, especially in the higher mountainous belt. As it is well-known from other research in mountains (cf. PRICE 1995), dramatic changes in the water balance are the result of the above mentioned soil and vegetation destruction, leading to discontinuous water run-off. On the other hand, the industry and agriculture of the coastal region depend highly on continuous water supply. Although the coastal area has a highly developed irrigation system at its disposal, water shortages in summertime or floodings from autumn to spring will lead to difficulties of water supply or catastrophic erosion events such as arose probably already in byzantinian times.

Additional landscape ecological information is of existential interest for further regional planning for the western slopes of the Amanus Mtn. Due to the fertility of the coastal plain in the Dörtöl region, the population is increasing even more rapidly than in urban areas. The Amanus Mtn. between Osmaniye and Iskenderun is not only of outstanding importance for its water and wood supply, but increasingly for its recreation and touristical requirements.

It is essential therefore to include the research area of LÖKAT and the neighbouring regions in the international programm of 'In Situ Conservation' in Turkey, established in November 1996 (cf. KRUGMAN 1997). Immediate and sustainable resource management is required, to withstand the economical pressure and infrastructural development, both of which menace this unique landscape and vegetation. From the national and international point of view, this region is of tremendous interest for its phytogeographical and floristical importance. From the landscape ecologically point of view, the western slopes of the Amanus Mtn. - with their extrazonal vegetation - are of the most valuable areas in Turkey. A monitoring is urgently requested to establish a successful control by specialists of the Turkish Ministries of Agriculture and Rural Affairs, Forestry and Environment.