

Natural Vegetation of Seyhan River Basin

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1. Introduction

Sustainable and rational use of natural resources is only possible by ecologically based planning. Degradation of nature in Turkey leads the loss of important habitats, endemic and unique plant cover where the vegetation is a perfect indicator that showing us the transformation on nature caused mostly by anthropogenic and sometimes by natural phenomena such as climate change.

Changes on both land use patterns and consequently on vegetation will help us to make accurate presumption for the future and particularly restoration of degraded areas. Furthermore that information will be used in indication of typical vegetation, landscapes, biotopes and habitats as well as negative effects and protection of natural remnants

In this research Natural Vegetation of Seyhan River Basin was examined within the framework of international project “Impact of Climate Change on Agricultural System” carried out under the cooperation of Tubitak (The Scientific and Research Council of Turkey) and Japanese-RHIN (Research Institute for Humanity and Nature). In investigating the effects of global warming on natural plant cover “exemplifying parcels” that selected for the studies on flora and vegetation will be an useful tool to run a regular assessment and analysis and evaluations within the project will be also first coming data sets in monitoring.

2. Research Area and Method

General situation of research area is given in Figure 1 where Seyhan River Basin starts with

Çukurova delta an important coastal ecosystem on ecological bases extends to the Çukurova plain flats with 150 meters reaches 3000 meters and above in Taurus Mountains.

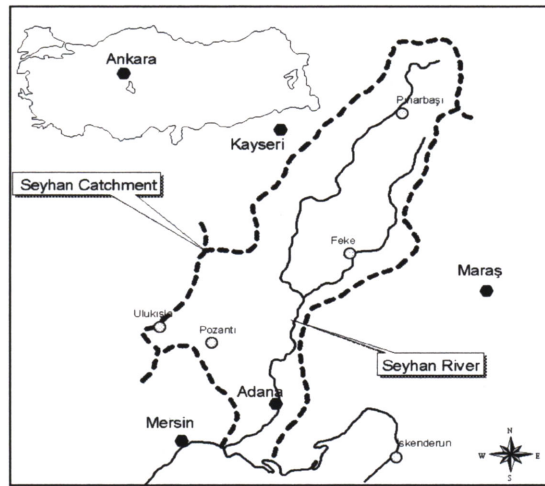


Figure 1. General Situation of Research Area

Examination of Natural vegetation of Seyhan River Basin on the floristic and vegetation viewpoint is aimed in this study as well as assessing and analysing the relationship between plants and growing conditions

Relatively to select “Exemplifying Parcels” that representing the whole basin natural plant formation maps for the basin were produced both from previous literatures and field work on the first hand and pre-classification of natural plant cover formations for Seyhan River Basin was outlined. Taking the size of the research area into consideration it was decided to choose transects that able widespread sampling in order to carry out an effective fieldwork. For this aim using Landsat 7 ETM satellite images dated 2002 simple classification of the basin was realised and compared with the plant formation map and consequently three

transects that covering all the plant formations in the basin came out as alternatives.

To decided only one transect amongst three; these transects were examined in the field where natural plant formations that best representing plant diversity and characteristics supported by the satellite images were greatly regarded. Moreover accessibility was taken as a most important criteria presuming that the exemplifying parcels that selected on these transect will be analysed three times a year.

As a result of both field examinations and taking the entire criterion that fallowed, Transect 1 was chosen as most suitable one. Giving priority to high mountain parts of the basin because the climate conditions become severe in early autumn exemplifying parcels were indicated on the selected transect as covering all the plant formation types.

After completing detailed pre-examination of plant formations total number of 32 20x20 meters in size and total number of 20 100x100 meters in size "Constant Monitoring Parcels" in four different points which are Kükürt Basin, Kaledağ, Keçi Castle and Katran Cavity were selected.

Selected parcels on four-above mentioned localities will be analysed at least two times a years with additional two times checking during two years. Furthermore in order to bring out soil characters, soil samples were taken from each parcels which have been examined through chemical and physical features.

3. Natural Vegetation of Seyhan River Basin

Upper parts of Seyhan river basin situate in Irano-Turanian Phtogeographic Region while lower parts down to Mediterranean coasts locate within the Mediterranean Phtogeographic Region. Seyhan River Basin covers below given plan associations on the "Natural Vegetation" viewpoint;

- South Anatolia Mediterranean Plant Association
- South Anatolia Cedar-Fir Mountain Forests
- Sub-alpine and Alpine Region Plant Associations (Altan, 2000; Louis,1939 and Walter,1956).

Intensive agricultural activities have been carried out on the lowland of the watershed while macchia cover is typical on the sloppy hills which parts used to be covered by thick oaks forest (*Quercus infectoria*) according to previous records. Various

vegetation types of sand dunes, both fresh water marshes-meadows and salt marshes-meadows, dune slacks biotopes and halophytes largely expand on the coastal parts.

In Figure 2 vegetation and land use changes are given in an example transect taken from sea level up to upper parts of Seyhan River Basin. Here vegetation starts with *Abies cilicica*-*Cedrus libani* forests in alpine zone fallowed by *Abies cilicica*, *Cedrus libani* and deciduous mix forests and fast changes especially on southern slopes are observed.

3.1. South Anatolia Mediterranean Plant Association

Most characterising species that expanding from sea level up to 1200-1300 meters in the Taurus Mountains is calabrian pine "*Pinus brutia*" which becomes progressively more dominant moving from 100 meters up to "Taurus Transition Areas". On the parts where the plant growing conditions become relatively better mostly primer macchia are most common.

Dominant woody species within this association are; *Quercus coccifera*, *Phillyrea latifolia*, *Myrtus communis*, *Arbutus andrachne*, *Erica manipuliflora*, *Cercis siliquastrum*, *Pistacia lentiscus*, *Pistacia terebinthus*. Secunder macchia becomes more apparent where callabrian pine forest and primer macchia were degraded by anthropogenic effects (Altan, 2000) in which *Erica manipuliflora*, *Cistus creticus*, *Cistus salviifolius*, *Calycotome villosa*, *Myrtus communis*, *Lithodora hispidula* are more leading woody species.

3.2. South Anatolia Cedar-Fir Mountain Forests

After 1000 meters elevation calabrian pine forests mix with junipers and after 1300 meters two main juniper species of *Juniperus oxycedrus* and *Juniperus excelsa* become more dominant which parts described as "Cedar-Fir Forests Plant Association of South Anatolia" where junipers first combine with cedar (*Cedrus libani*) and on the upper parts particularly after 1500 meters compact forests of solid fir (*Abies cilicica*) are found (Kızıldağ). On the more humid parts up to 1000 meters *Pinus brutia* is more dominant and mix with *Styrax officinalis* where typical example is seen in Kaledağ.

After 950 meters in Kaledağ *Juniperus oxycedrus*, *Juniperus drupaceae* and *Cedrus libani* conjoin the *Pinus brutia*-*Styrax officinalis* association. Between 1100-1200 meters *Juniperus oxycedrus* and *Juniperus drupaceae* become more dominant accompanied by the deciduous species of *Ostrya carpinifolia*, *Quercus cerris*, *Quercus pubescens*, *Acer negundo* which led by fir (*Abies cilicica*) after 1200 meters. Fir composes compact forest particularly on the northern locations where soil quality and conditions are better and humidity level is high with steep slopes.

Cedar and fir are the two species that display the sub-forest border which should be normally at 2400 meters declined down to 2000-2200 meters as a result of anthropogenic effects. Plant associations of alpine region are found on the higher elevations.

On the upper parts of the basin especially on the valley with less rainfall and rain regions Austrian pine and also (*Pinus nigra*) forests are common as in Kükürt Valley. Austrian pine forests can reach up to 2000 meters where they found in solid forest around 1850 meters and mix with *Juniperus oxycedrus* and occasionally with *Cedrus libani*. These areas are very steep with usually south and south-east slopes. Western and lower parts of Aladağlar are rather steppe character as west of Karanfil Mountain, Çamaradı, Ecemiş Brook and Payamdere have steppe vegetation in the Seyhan River Basin. It is named species-rich steppe of *Stipa-Bromus tomentollus*-*Festuca sulcata* if these areas are not highly degraded but it become dominant by tarragon (*Artemisia frabans*) after heavy grazing having poor nutrition for plant life.

According to Walter (1956) tarragon (*Artemisia*) has a semi-desert region character and it is how quickly this species becomes dominant after heavy grazing. Particularly on the areas where main ground rock is closer to the surface cushion formed xerophytes of Prickly-thrift (*Acantholimon*), milkvetch (*Astragalus*), sainfoin (*Onobrychis*), Labiatea species and dwarf yarrow (*Achillea*) are found. Some variations on the vegetation become apparent on these steppes depend on the soil conditions, type of the material, slope, wind and aridity (Altan, 2000).

3. 2. 1. Montane and Oreal Zone

Montane and orreal zones are composed of

different plant associations. "Evergreen pine forests" that tolerating cold are the plant associations that characterise montane and orreal zone in Aladağlar. However depend on climate change on the mountain species, cover density, and composition differentiate greatly where cold tolerating pine forest are mostly found in the south-east slopes.

Montane zone is more comprise of *Pinus nigra* ssp. *pallasiana* and *Juniperus exelca* species and they form sub-forest border at 2200-2400 meters. On the other hand *Cedrus libani* and *Abies cilicica* are dominating in orreal zone where many deciduous tree species such *Acer platanoides*, *Carpinus orientalis*, *Ostrya carpinifolia*, *Populus tremula*, *Quercus pseudo-cerris* ve *Sorbus torminalis* are also exist.

The number of above-given species starts to change due to rising aridity on the north-west directions where biodiversity is decreasing. Moving mostly on the northern parts, northernmost distribution of pine forest is found in Emli Geçidi, east of Çamaradı (Spreitzer, 1959; Skkichtel ve Ark, 1965; Kürschner 1982; Kürschner, 1984) which is the xerophytes Abietum cilicicae with relict character.

Pine forests are common on the southern pebbly slopes which are dominated sometimes by *Abies cilicica* as well as *Quercus libani* (Kürschner, 1982) As an indicator of former forests deciduous and mix bush cover that tolerating cold is still exists in almost all valleys most typically in bush formation in Üçkapı Mountain which is found on the steep hills and upright slopes between 1600 and 2200 meters.

Evergreen formation is usually formed by *Juniperus exelca*, *J. oxycedrus*, *Quercus pubescens* ssp. *anatolica* and *Rammus libanotica* while deciduous bushes are around riversides and sediment heaps around them which dominated by *Berberis crataegina* and *Acer monspessulenum*

Mix formation of xerophytes dwarf bushes and cushion form species become prevalent as seconder vegetation after heavy degradation of forests and bush formations that used to grow on 2000-2200 meters lying on flat transition areas in Aladağlar and crystallised hilltops on the west Üçkapı Mountain. Particularly heavy grazing areas with high erosion are characterised by *Artemisia*-steppe with cushion formed xerophytes.

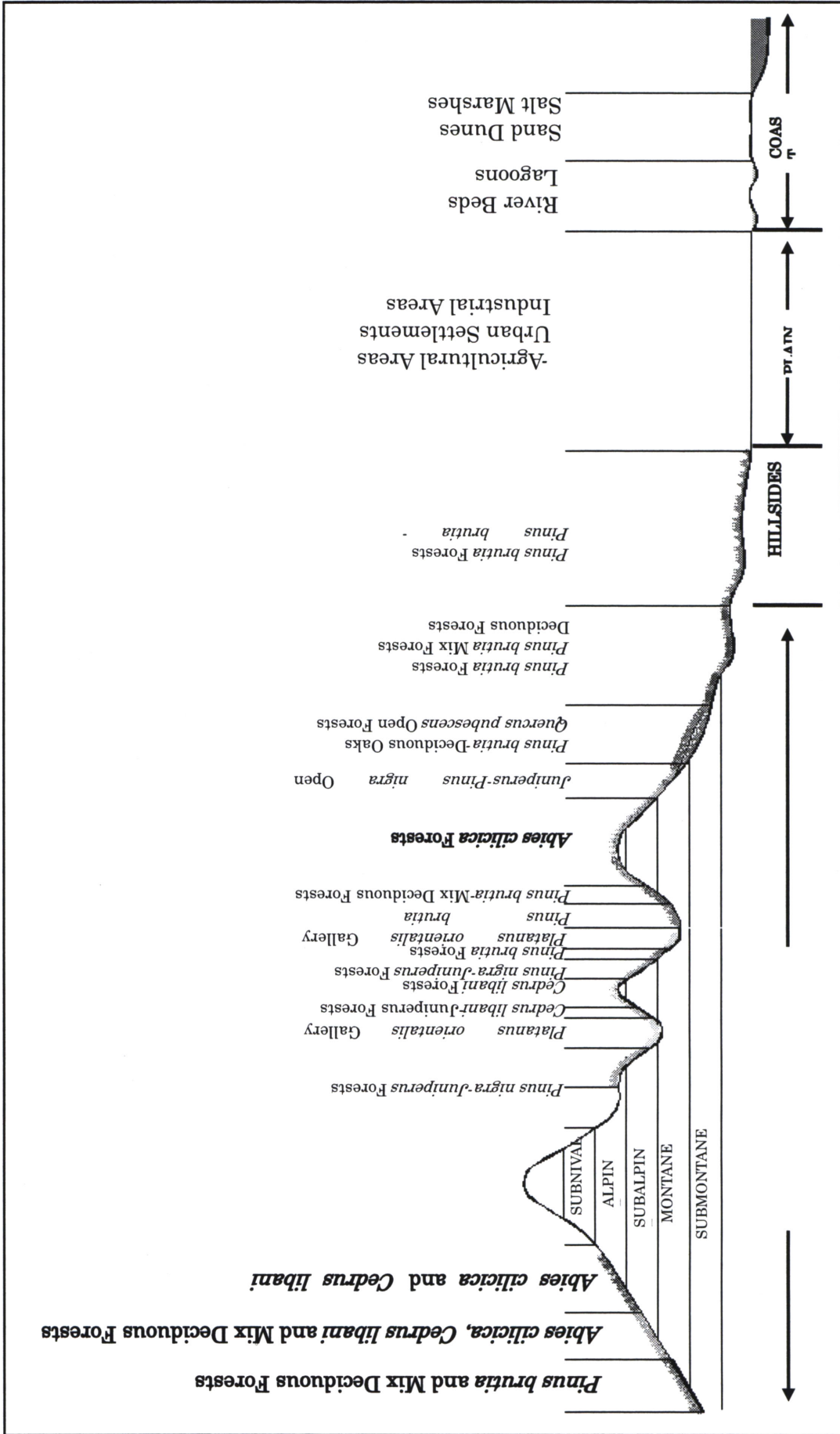


Figure 2. An Example Transect for the Vegetation and Landuse Changes in Seyhan River Basin

3. 3. Sub-alpine and Alpine Zone

Sub-alpine and alpine zones in Aladağlar comprise of plant formations as xerophytes (small bushes, cushion formed thorny plant formation, herb cover, plant cover on oreol rocky heaps, oreol rocky plant cover), mesophytes (perennial herbs, perennial alpine plants and geophytes) and hydrophytes (stream sides, springs and their environs, marshlands rich of perennial plants, plant cover on and around melted snow) (Kürschner, 1982).

There are two plant associations that dominate the sub-alpine small bushes in Aladağlar; *Genista albida* and endemic *Ononis sessilifolia* association. This zone started to cover large areas towards oreol zone due to degradation of forests. As a result of heavy grazing the number of cushion formed thorny plants increased which become remarkably dominant.

Floristic combination that occurs in sub-alpine zone as follows;

- <i>Genista alba globosum</i>	-	<i>Marrubium</i>
- <i>Acantholimon venustum brachypteris</i>	-	<i>Astragalus</i>
- <i>Onobrychis cornuta argyrophyllum</i>	-	<i>Alyssum</i>
- <i>Alyssum aurantiacum eriophyllum</i>	-	<i>Astragalus</i>
- <i>Astragalus hirsutus tauricolus</i>	-	<i>Astragalus</i>
- <i>Bromus tomentollus gnaphalodes</i>	-	<i>Cerastium</i>
- <i>Crepis armena</i>	-	<i>Festuca anatolica</i>
- <i>Galium cilicicum</i>	-	<i>Minuartia leucocephala</i>
- <i>Onosma armenium</i>	-	<i>Salvia frigida</i>
- <i>Silene supina ssp. Pruinosa</i>		

Sub-alpine herb cover largely grows on the pebble heaps in oreol zone and is represented by four associations; *Festuca anatolica*, *Bromus tomentellus*, *Poa bulbosa*, *Koeleria cristata* (Kürschner, 1982). This plant cover is found in limestone and dolomites massifs Seslerion association which is typical in all parts of mid Taurus (Sckichtel ve Stern, 1963; Sckichtel et al., 1965). Floristic structure of this herb cover is almost the same as small bushes and cushion formed thorny plant cover apart from being dominated by *Poaceae* family.

Potentilla speciosa association common in east Mediterranean that tolerate heat is found on very steep and limestone riffs in sub-alpine zone reaching sometimes even up to montane zone and leaves its place to *Saxifraga kotschyi* association an Irano-Turanean element in alpine and sub-alpine zones. According to Quezel (1973)

Saxifraga kotschyi – *Aethionema glaucescens* association appears as a third association here and found with *Ophalodes luciliae* ssp. *cilicica* association which grows caves formed by ice and water erosion in sub-alpine zone.

Species that represent plant cover on rocky slopes in high mountains are; *Omphalodes luciliae* ssp. *cilicica*, *Gnaphalium leucopilinum*, *Anchonium elichrysifolium*, *Potentilla speciosa* var. *speciosa*, *Valeriana sisymbriifolia*, *Sedum hispanicum*, *Saxifraga kotschyi*, *Tanacetum kotschyi*,

Arabis caucasica ssp. *brevifolia*, *Cerastium cerastioides*, *Saxifraga exarata* and *Veronica caespitose* are found on high elevations above 3500 meters where stone and pebble heaps cover large surfaces particularly on rock heaps and steep limestone walls. Cushion formed *Draba acaulis* with attractive yellow flowers is the one that can grow on highest elevation in Taurus Mountains.

Appearance of plant cover in Narpız Boğazi (2600 meters) is historically interesting dominated by *Achemilla ellenbergiana*, *Polygonum bistorta* ssp. *Carneum*, and *Swertia longifolia*. It is very remarkable to see a perfect example of plant distribution from north to south in Pleistocene time. Many plants species of Euro-Siberian and Euxin flora elements have moved to mountainous part of Mediterranean and some disappeared after competing with Irano-Turanean elements with increasing temperatures.

This plant association is a perfect example of the distribution of plants from north to south in Pleistocene time. Many plants species of Euro-Siberian and Euxin flora elements have moved to mountainous part of Mediterranean and some disappeared after competing with Irano-Turanean elements with increasing temperatures. However some “relict” samples rarely remain in limited locations as in Narpız Boğazi.

4. Conclusion and Further Studies

These are preliminary results of our studies and number of 95 taxis in selected 4 different localities was determined during the field works so far while identification of some species has been continuing

Comparative studies on satellite images of Landsat 5 TM dated 1985 and Landsat 7 ETM dated 2002 have been still continuing so that it would be possible to make some presumptions for the last 20-25 years in terms of to predict likely effects of climate change on natural vegetation. On the parallel of the field works, socio-economic studies have also been started under a programme in the rural settlements that situate within the basin to asses anthropogenic effects on plant

cover and to determine the way that local people use the natural resources

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