# ASSESSMENT OF CURRENT CONDITION OF STEPPES IN CENTRAL ANATOLIA FOR CONSERVATION PURPOSES/ TURKEY

## DETAILED FINAL REPORT

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### BACKGROUND INFORMATION

Anatolian steppes originally covered two thirds of Turkey and are the richest terrestrial ecosystems of the country in terms of plant species, yet they are largely ignored in favor of forests, both in the protected area network and as a target by conservation organizations. Without such recognition, the general trend is to overgraze, convert into arable land or planted forests.

Steppes are one of the most damaged habitats in Turkey, due to agricultural conversion to arable land and overgrazing. However, the situation has started to change with land abandonment and reductions in livestock numbers. It is not known how those changes will affect the steppe ecosystem.

There has been no work on the conservation of steppe biodiversity in Turkey. One of the reasons is the lack of basic information and expertise to develop a grassland conservation strategy. There are no studies for understanding the ecology and current status of steppes, on the effect of past and current human use, and on developing conservation actions for biodiversity conservation in steppes.

Therefore, the aim is to start to fill the gaps by the proposed project in a 2 million ha mountainous region which is covered mostly by different types of steppe (see Map 1 below).

**Map 1:** Turkey map with study region shown in blue borders.

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**OBJECTIVES OF THE STUDY**

The study is research-based and aims to fill some information gaps and produce necessary technical data. The objectives are:

- ✓ to fill gaps of knowledge to understand ecology and current status of grasslands of the region
- ✓ to provide basic information on the interaction between the level of human use/disturbance and the health and integrity of steppe ecosystems
- ✓ to reveal the current condition of steppe ecosystems of the region
- ✓ to produce conservation guidelines for grasslands of the region, link plant communities with bird and butterfly communities, and provide information on their utility as surrogates

A landscape mosaic with cereal lands, orchards and steppes dominated by *Thymus, Convolvulus* and *Salvia* species.

**SUMMARY OF THE WORK**

**1.** Sampling sites were selected to collect data on plant, bird and butterflies chosen as surrogates of steppe diversity to reveal the current status. The selection was based on a stratified random design using environmental and census data with GIS.

**2.** The fieldwork:
**a.** Plant community data was collected on sampling sites for 20 days in peak season from 500 $m^2$ as percent coverage of plant species with >5% coverage in quadrats.
**b.** Breeding bird data was collected with 8 min. point counts on 14 days during the breeding period.
**c.** Butterfly data was collected in three different methods: general counts, fixed distance transect counts and additional recordings in peak season for 20 days.

**3.** Interviews were made with villagers close to sampling sites learn how people use steppes i.e. history of land use, type and numbers of livestock, extent of grazed land, changes in agricultural practices etc.

**4.** After all plant specimens were identified based on Flora of Turkey, all data were fed into multivariate community analysis to reveal common patterns of composition, distribution and main factors effective on current condition of steppes. The results are generalized to the region by using GIS tools.

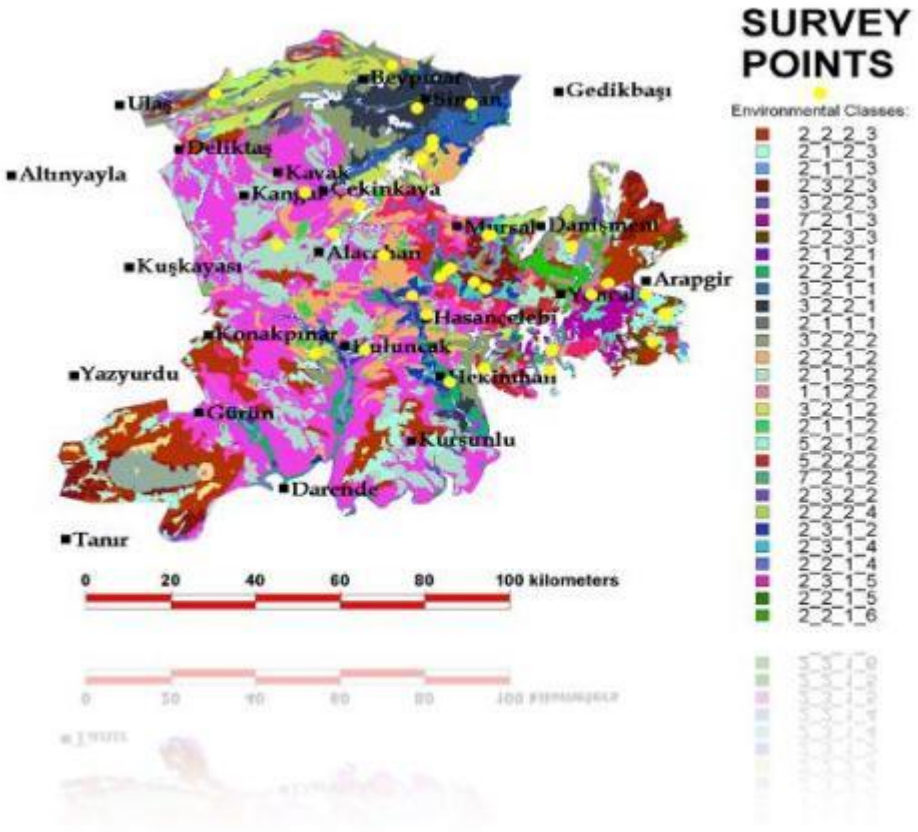
**5.** Conservation guidelines were produced for each threatened steppe community type. They provide rangeland and agricultural management measures for sustainable use.

**ACTIVITIES**

**1. Choosing the survey sites**

It was hypothesized that grassland biodiversity is affected mainly at the macro level by a few environmental factors. The strongest factors mentioned in literature are soil, bedrock, climate and elevation. Therefore at the regional level, sites with differing environmental conditions should be sampled enough with the correct sampling method.

The region was stratified into ecosections by combining main soil type, bedrock type, climate and elevation classes. The dryness index used was well correlated with the elevation since t was produced in consideration with elevation. Therefore I did not consider the elevation and combined classes of 4 main environmental variables to produce 5x3x3x6=90 different environmental classes. Some of the classes covered very small areas. Also some were covered by other vegetation types like agriculture and forest. So I filtered the results to reach sites that represented different environmental conditions, were considerably large and covered by steppes (see Map 2). Then I further evaluated the area in terms of logistics. Since the road network limits accessibility, fieldwork should be arranged based on the road network. Therefore, in the region I focused on the sites available with the road network. At the end, I identified 42 points to survey as well as 73 alternatives n case original selections cannot be reached. Those sites were concentrated along south of Zara, around Divriği and east of Darende-Zara direction.




**Map 2:** main ecosections of the region showing areas different in terms of main environmental variables and the survey points on them.

## 2. The Fieldwork

### a. Bird Fieldwork

- ✓ Bird fieldwork took place mainly between 17-24 June 2009 by Dr.Can BİLGİN and Soner ORUÇ. Additional fieldwork was carried out by Hilary and Geoff WELCH for 6 days in June-July 2010.
- ✓ Two experienced birdwatchers did 5'+3' point counts in two replicate points at least 100m distant from each other. Birds were recorded and counted as inside or outside a 50m diameter to indicate presence in homogeneous patch. Flyovers, juveniles and habitat use were recorded separately. Some habitat features that can be important for birds were noted.

Bird field team with a villager helping to move the car stuck in the mud

### b. Plant Community work

- ✓ Preliminary surveys took place in 2008 and 2009. The sampling took place in four periods depending on the altitude of the sites: 29-31 May 2010, 05-07 June 2010, 27 June-01 July 2010 and 11-18 July 2010. All were carried out by Didem AMBARLI.
- ✓ Two replicate points as in the bird fieldwork were sampled. The steppe of 50m. diameter was sampled with 10 random quadrats. The plants with more than 5% coverage were recorded and sampled. Later they were identified in the herbarium based on Flora of Turkey.
- ✓ Environmental elements (slope, aspect, soil color etc.) and presence of any woody plants were noted.

Didem, noting plant coverage data of a quadrat.

**b. Butterfly Fieldwork**

- ✓ Butterfly fieldwork took place at the same period with the plant surveys mostly by Süleyman Ekşioğlu.
- ✓ Dr. Evrim Karaçetin helped to develop the method and carried it out at 6 sites. Three methods were applied in the field: (i) general count around the replicate point, (ii) transect counts along the edges and diagonal of a square centering the replicate point, (iii) additional records obtained from refuges or after the standard count.
- ✓ Information on behavior and habitat use of the butterflies were noted as much as possible.

Süleyman starting the transect count.

**c. Interviews with villagers**

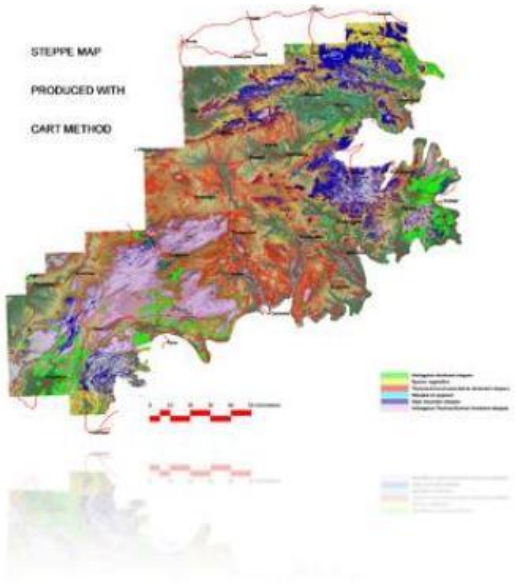
- ✓ The field teams did interviews whenever they could reach a person knowledgeable about the specific sites they are working on. They are mostly elderly villagers, the muhktar or shepherds. Interviews were made in about 20 sites. For sites quite distant from any settlements, if there was no shepherd around, no information was gathered. To fill that data gap the team will do another visit to the region in 2011.
- ✓ Specific questions were asked to the villagers: history of the site (forest, arable land or steppe history), type of use (type of farming, livestock race), degree of use (number of years, number of livestock), other economic value (collecting plants etc.
- ✓ The information is used to explain results of biodiversity data.

Didem talking to the villagers

©Hüseyin Ambarlı

**d. Analyses**

Analyses were done mostly with Two-way Indicator Species Analysis (TWINSPAN), Detrended Correspondence Analysis (DECORANA) and Canonical Correspondence Analysis (CCA) methods. Some mapping studies were done with TNT Mips, Arc GIS and GRASS softwares. The details will be given in the related PhD study.



## 3. Results

### a. Plant Communities

- ✓ In the end, 6-18 common plants were noted with an average richness of 11.74 species at a site. The commonest families were: Poaceae (*Festuca, Bromus* and *Stipa* sp.), Leguminosae (*Astragalus* sp.), and Lamiaceae (*Thymus* and *Salvia* sp.).
- ✓ Some endemic and threatened species were also recorded.
- ✓ When the sites were classified in terms of plant surrogates the following steppe types were identified:
  - Gypsum steppes with low number of species most of which are rare endemics: This steppe type has a quite pat region.
  - Halophile steppes of lowland plains: A very rare habitat type inhabiting halophile soils of central Anatolia. They are found in small closed watersheds, around salt lakes or depressions.
  - *Thymus-Convolvulus-Salvia* mountain steppes: They are dominated by forbs. They present a high diversity of plants. Such sites are found on the western part of the region. They occur in limestone, mid-elevation and moderate slope.

*Thymus spathulifolius*, an endangered endemic thyme ©Süleyman Ekşioğlu

  - *Astragalus-Thymus* mountain steppes: They are mainly originated as secondary vegetation after destruction of forests. One type is dominated by *Astragalus gummifer*. There are others dominated by *Thymus spyleus* and different *Astragalus* species. Usually *Phlomis* species are also common. They are common in mid-to high elevations. They are found predominantly on the eastern part of the region.
  - High mountain steppes: There are some different types. The screes are dominated by *Prangos* sp., *Festuca*, *Juniperus* spp. While those with more soil are covered with *Festuca*, Thymus, *Astragalus* and *Arenaria* sp.

- ✓ When sites are compared in terms of diversity of common plants, the results are surprising:
  - The richest sites are the ones that are either oaklands or juniper shrublands 60 or more years ago. Those lands are first deforested and then ploughed. They have not been sown for more than 30 years. During that period villagers used them as pasture and also collected *Astragalus* sp. to feed the livestock. Those activities now either declined or stopped. Continuous human use supported higher plant diversity since it enabled intermediate levels of disturbance on land. If the land was ploughed until recent years, then the plant diversity was found to be quite lower.

*Teucrium chamaedrys*, a common species of mid-elevation steppes ©Süleyman Ekşioğlu

- The second richest group of sites are the ones that were once forests, then deforested but not never ploughed since they had a very thin layer of soil. In most such sites bare rock patches can be seen. At some sites the reason is a steep slope but it is not valid for all. Heavy grazing in the past is the other important factor. It can lead to faster wind erosion.

- Saline and gypsum soils are poor in terms of number of common species since those sites are difficult to colonize. Only some specialised species can dominate the land and then only with low coverage. But we know that they host rare species although without high coverage.

- The poorest in terms of number of common plant species are high mountain steppes. They are dominated by a few plant species that are capable of high irradiation, cold weather etc.

Steppes rich in common plants

Steppes with shallow soils

Gypsum steppes

**b. Bird Communities**

- ✓ 61 species were recorded in 438 records. 90% of records inside 50m. belong to only 7 families. The families with the most records are larks (Alaludidae), buntings (Emberizidae), thrushes (Turdidae) and fncehs (Fringillidae). The commonest species are given below:
  - *Passer domesticus*
  - *Alauda arvensis*
  - *Emberiza melanocephala*
  - *Carduelis cannabina*
  - *Emberiza hortulana*
  - *Melanocorypha bimaculata*
  - *Oenanthe oenanthe*
  - *Miliaria calandra*

**Picture:** Bluethroat *Luscinia svecica* ©Soner Oruç

- ✓ The bird team did some interesting findings. They discovered probably the southernmost distribution of breeding Bluethroats. They also recorded Pale Rock Sparrow (*Petronia brachydactyla*) which was not known from the region before.

**Picture:** Pale rock sparrow *Petronia brachydactyla* ©Soner Oruç

- ✓ When the sites are analyzed in terms of bird data, the following results are obtained:
  - The main factor differentiating between steppes from bird diversity point of view is the human use. The bird fauna of natural (climatic) and modified (anthropogenic) steppes are different.
  - The presence of other habitat elements (arable, woodland, riverside vegetation) in proximity, thus creating a habitat mosaic, affects the species observed. However, the structure of the steppe affects species composition less than expected.

- ✓ The bird richness data give us a picture different than other species groups: The richest sites are the steppes either were forest in near past or are shrubby steppes. The second richest sites are the ones with an anthropogenic feature nearby like a village or an orchard. The third richest group includes sites with microhabitat features like streams. The poorest sites are the rocky steppes of plains, vast homogenous areas.

**Picture:** Chicks of a Calandra Lark *Melanocorypha calandra*

### c. Butterfly Communities

106 butterfly species were recorded with 870 records. Butterflies were recorded from all 5 families flying in Turkey. Most of them were from Nmyphalidae and Lycaenidae families. Most of the species were recorded less than 10 times which makes the analysis problematic.

As indicated in the summary report, a difficulty during the fieldwork is to catch the flight period of the same butterfly groups in all elevations i.e. sampling mid-period Lycenids and Nymphalids of arid regions. Because of annual changes in weather conditions, it was not always possible to estimate the right season for the butterflies. In some sites the vegetation was drier than expected so few butterflies were seen. This is reflected in the data collected. So I present below the main findings without trying to explain all the results, because difficulties may arise from possible bias during sampling.

When the steppes are analyzed based on butterfly data, the following results were obtained:

- The main environmental factor important for steppe butterflies is the elevation. The species of high mountains are quite different from mid or low elevations.
- The second factor is recent forest history. Presence of shrubs and forest underground flora affect butterfly communities in a certain extent.
- The arable land history is another important factor which affect the plant composition so the butterflies.

Steppe Ringlet *Proterebia afer*, a mountain butterfly

When we summarize the data in terms of butterfly richness the richest sites came out to be are the ones also rich in plants. The opposite is also valid. The high mountains although with distinctive butterfly fauna are not so rich general. Therefore the basic factors are similar. Especially land use is important. Refuge sites are also important to maintain a rich site throughout the season.

Mesopotamian Blue *Polyommatus dama* © Süleyman Ekşioğlu. It was thought to be extinct until rediscovered by the butterfly team on the way to RSG fieldwork

## d. Interviews

The results of the interviews are combined with field observations about the landscape and used in the explanations provided above. The locals provided quite interesting and useful data about plants and history of landscape. The main issues are:

- Most of the steppes of the region were heavily used before. Deforestation was followed by plowing for some years, then grazing and plant removal. Grazing can take place in steep elevation or on rocky surface without an agricultural history. But such land is either abandoned or most of activity has stopped for more than 30 years. The land was abandoned for economical and life-quality reasons. Consequently steppes are recovering. Some of the mid-elevation sites once had less than 10% coverage when heavily grazed but now have almost 90% coverage. Trees start to grow as an indication of absence of deforestation and grazing for about 30 years. The recovery takes more time on land with thin topsoil.

Over-grazed steppe

- Most of the land covered by steppes now was once woodland. Oak woodland or juniper shrubland were the main vegetation cover. Forest history goes more than 60 years since the oldest members of the village remember it barely. Sometimes it is claimed that the people do not remember the forest but they remember their grandfathers mentioning about it. The primary reasons for deforestation are

Steppe on hill tops were oak woodland more than 100 years ago

use of wood for heating, for house building or opening land for agriculture. Accidental forest fires or fires for hunting purposes are rare. Some of the lands once covered by woody vegetation were recovering. Land abandonment, decrease in grazing causes woody vegetation to reappear. But it is quite slow most of the time since topsoil is lost considerably through time. But in some places it can be fast. There are some sites managed only for charcoal production. If

Charcoal production

continuous destruction or grazing is not the case, those sites are recovering fast. The oak woodland is managed in rotation as coppice, with the oaks recovering in 10-20 years time. At those sites a woodland-grassland mosaic can be maintained which will be rich in plants and birds.

- Grazing levels decreased considerably in many places. Steppes once grazed by thousands of animals now feed a bunch of cattle. Sheep grazing stopped in many parts. The main reason is government policy about agriculture: the families can not sustain their livelihood from agriculture alone. So migration to urban centers took place. Although this helps heavily-used grasslands to recover, it disturbs the balance between diversity and human use. So the grasslands need to be monitored in the future to see the effects of land abandonment and decline in grazing.

- Most of the grasslands experienced removal of woody *Astragalus* species for years. The main purpose of it is to feed the livestock. A second reason is to use as a fuel for heating. However, *Astragalus* steppes have high recovery rates. A spiny *Astragalus* species like *A. plumosus* can grow 15 cm. in crown diameter within 5 years. So a land dominated by those species does not mean that it was like that for years or vice versa.

A villager digging to remove woody *Astragalus* sp.

**Conservation Recommendations**

- ✓ A protected area network should be set up to represent rich steppes of the region in national protected areas list which does not yet include steppes. Candidate sites with priority species are given in ANNEX I. Activities like mining, afforestation-reforestation should be carefully planned or avoided at such sites. In delineating the boundaries, elevation gradients, different bedrock types should be considered. To represent bird diversity of the region, a landscape mosaic should be targeted with steppes, arable lands and orchards. Special features like rock bodies and streams with riparian woody vegetation should be included. For butterflies, a recent and varying arable land history as well as forest history is important. Shrubby patches and nearby woody vegetation have added value. Also refuges and hilltopping sites should be included, too. Maintaining traditional farming practices is important. If that is not possible, a landscape mosaic with active but planned rural life should be targeted. Full recovery to woodland should be prevented to have both steppe and woody species.

Gypsum steppes as a target for conservation

*Gypsum steppes in the background as a target for conservation*

- ✓ Prevention of land abandonment is crucial for sustaining biodiversity of many steppe types since the diversity is linked with human use. Therefore, agri-environmental schemes should be developed for this need.
- ✓ Planned grazing is necessary in general, but it is vital for high mountain landscapes with high livestock numbers. It is also very important on sites with shallow soils. Heavy grazing together with wind erosion can cause irreversible damage on those sites.

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**ANNEX I**

**Priority Biodiversity Sites identified by a Regional Conservation planning Project**

Anatolian Diagonal Biodiversity Project is a regional conservation planning study managed by nature Conservation Centre. The project identified priority biodiversity sites for 8,5 million ha region covering also the study region for steppes. The sites identified by that project are indicated in the map. That project was also managed by the project leader of this RSG project. According to the results, there are 20 priority sites for conservation. Some are identified for rare plant conservation. All of those plants are endemics and only known from 1-2 sites. They live on gypsum or limestone *Thymus-Astragalus* steppes. There are many sites identified for rare butterflies which are linked mostly to steppes. The sites identified for birds or other species groups are not bound to steppes. Site-specific recommendations were developed. But the general principles for steppes are:

- ✓ Protection of a portion of highly vulnerable and rare gypsum steppes
- ✓ Planning of grazing activities: Promotion of it on most sites, decrease in few.
- ✓ Prevention of habitat destroying activities like mining is another important measure.