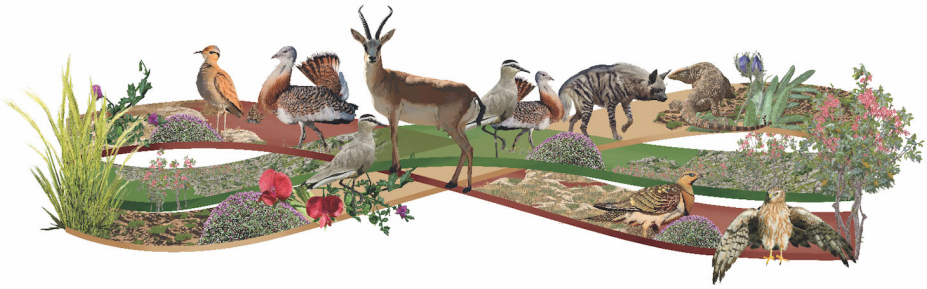
Food and Agriculture Organization of the United Nations



"Conservation and Sustainable Management of Turkey's Steppe Ecosystems Project"
GCP/TUR/061/GFF

KARACADAĞ STEPPES MONITORING PROGRAM

Karacadağ Steppes Monitoring Program was prepared by Doğa Koruma Merkezi (DKM; Nature Conservation Centre) within the scope of the Conservation and Sustainable Management of Turkey's Steppe Ecosystems Project which is carried out collaboratively by the Food and Agriculture Organization of the United Nations (FAO) and the Ministry of Agriculture and Forestry General Directorate of Nature Conservation and National Parks (GDNCNP), General Directorate of Plant Production (GDPP), and General Directorate of Forestry (GDF) with the financial support of the Global Environment Facility (GEF).

Prepared by:

Doğa Koruma Merkezi (DKM): Dr. Mustafa Durmuş, Yıldıray Lise, Dr. Uğur Zeydanlı, Dr. Tuba Bucak Onay, Dr. Semiha Demirbaş Çağlayan, Prof. Dr. Erhan Akça, Prof. Dr. Ömer Faruk Kaya, Prof. Dr. Şevket Ökten, Prof. Dr. Mehmet Zülfü Yıldız, Dr. Deniz Özüt, Dr. Mert Elverici, Ferdi Akarsu, Anadolu Meraları

The Food and Agriculture Organization of the United Nations (FAO): Dr. Nihan Yenilmez Arpa

The Ministry of Agriculture and Forestry General Directorate of Nature Conservation and National Parks (GDNCNP): Tuğba Usta, Dr. Burak Tatar, Serhat Erbaş, Fatih Köylüoğlu, Ömer Faruk Arslan, Ümit Bolat, Abdulsamet Haçat, Osman Uğur Akınç

Şanlıurfa 3rd Regional Directorate: Mehmet Gürkaynak, Reşet Ektiren, Ecrin Kapucu, Fecir Örnek

The Ministry of Agriculture and Forestry General Directorate of Plant Production (GDPP): Esra Esina

Şanlıurf Provincial Directorate of Agriculture and Forestry: Mehmet Gözoğlu, Aziz Aktacir

The Ministry of Agriculture and Forestry General Directorate of Forestry (GDF): Türkan Özdemir

Graphic Design: Tuğba Can
Translation and Editing: Senem Tuğ Aksöyek, Yıldıray Lise
Front Cover: Spectacled warbler *(Sylvia conspicillata)* Photo: Juan Lacruz
Back Cover: Buttercup *(Ranunculus bingoeldaghensis)* Photo: Ömer Faruk Kaya

Conservation and Sustainable Management of Turkey's Steppe Ecosystems Project
Karacadağ Steppes Monitoring Program

For Detailed Information:
The Food and Agriculture Organization of the United Nations
www.fao.org/turkey E-posta: fao-tr@fao.org
Republic of Turkey Ministry of Agriculture and Forestry
General Directorate of Nature Conservation and National Parks
https://www.tarimorman.gov.tr/DKMP
General Directorate of Plant Production
https://www.tarimorman.gov.tr/BUGEM
General Directorate of Forestry
https://www.ogm.gov.tr

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EXECUTIVE SUMMARY

Monitoring programs are one of the most important tools that enable nature conservation and sustainable management of natural resources. It increases the effectiveness of management mechanisms by periodically detecting the changes in monitoring indicators and taking necessary measures according to the trends of the changes. In recent years, monitoring programs have been handled with more holistic approaches, in which monitoring issues are associated with different components such as environmental, socio-economic, cultural, ecological, management effectiveness in line with the objectives and targets.

Monitoring is based on making reliable observations of how species, ecosystems and social issues change over time, naturally and as a result of human intervention, to detect, measure and evaluate results and change practices. And monitoring is defined as a cyclical process with 5 steps. This cycle begins with identifying the need for monitoring and ends with defining the purpose, developing the monitoring program, implementing implementation, and making evaluations, respectively.

Karacadağ Steppes Monitoring Program was prepared within the scope of the "Conservation and Sustainable Management of Turkey's Steppe Ecosystems Project" carried out by the Food and Agriculture Organization of the United Nations (FAO) and the Ministry of Agriculture and Forestry (MoAF), aiming to strengthen the conservation of Turkey's steppe ecosystems through effective management in protected areas and extending the conservation of steppe biodiversity in production landscapes.

Featured Wildlife Area (Bird) Karacadağ Honey Forest Photo: Mustafa Durmuş

Karacadağ Steppes are located on the border of Şanlıurfa-Diyarbakır-Mardin, 35 km east of Siverek town centre. Karacadağ, which is an extinct volcanic area, is covered in snow between December and March.

Indicative species of steppe ecosystems, which contain low and high mountain steppe species, and local endemic plant species that are only found in this region in the world occur in the area. This area, which is important in terms of biodiversity, is under intense human pressure due to excessive and incorrect grazing and the conversion of steppes into agricultural areas.

For these reasons, a viable and effective monitoring program is needed for the continuity of the steppe ecosystem and species in the area and for its sustainable use by the people of the region.

The main purpose of the Karacadağ Steppes Monitoring Program is to contribute to the evaluation of the data obtained by monitoring the pressures on the steppe ecosystem and the changes in threatened species and habitats, with a conservation-oriented approach, and to contribute to the sustainable use of natural resources.

Spectacled warbler (*Sylvia conspicillata*) Photo: Juan Emilio

The monitoring program developed for the Karacadağ Steppes includes environmental, biodiversity, socioeconomic and management effectiveness components and the 'Livestock and Grazing Monitoring Subprogram'.

In the monitoring program, the inventory data obtained from the "Conservation and Sustainable Management of Turkey's Steppe Ecosystems Project" and the experience gained from the Şanlıurfa Steppe Conservation Strategy and Action Plan studies, as well as the Monitoring issues determined for Şanlıurfa within the scope of the "National Biodiversity Inventory and Monitoring Project" carried out on a province basis throughout the country and coordinated by the Ministry of Agriculture and Forestry, General Directorate of Nature Conservation and National Parks were evaluated altogether. Thus, the project outputs were associated with the national monitoring program, and a biodiversity monitoring program was developed after a participatory process with the contributions of relevant stakeholders and experts.

In the process, separate sets of indicators for each of the four components and monitoring subprograms and appropriate monitoring methods for monitoring these indicators were defined, forms were prepared for data collection, analysis and evaluation, and all stages before the implementation phase were completed.

Indicators and monitoring implementation plans for the environmental monitoring component have been prepared based on the intersecting criteria of Climate, Land Degradation and Desertification and Biodiversity, which are used in the international arena and are especially the three conventions of the United Nations (UN).

The main criterion in the creation of the joint monitoring components of these contracts is that the feature to be monitored can measure the response of the ecosystem to sustainable uses or misuses in the fastest, most economical, and simplest way. In this context, environmental monitoring recommendations and justifications for Karacadağ Steppes on land use, climate and pollution are presented within the framework of the UN's land degradation neutrality (LDN) approach.

The inclusion of the socio-economic component in the monitoring program strengthened the monitoring program. Notably, monitoring the deep-rooted human-nature interaction from the past to present in the region and the changes caused by this interaction is as important as the monitoring of biodiversity and environmental factors. To monitor the socio-economic, socio-cultural structure of the society living in and around Karacadağ Steppes and the changes in the perceptions of the natural environment they live in, it is under the main headings of demography, socio-economic status, visitor management, tourism, and recreation - monitoring indicators have been determined and an implementation plan has been prepared.

The management effectiveness monitoring component is perhaps the component that will make the most important contribution to the conservation of the area. In this context, the success of the implementation of the management plan, the change in the scores obtained by using the management effectiveness evaluation tools (METT, EOH), the change in the number and capacity of the personnel, the change in the equipment and infrastructure investments were the subjects of monitoring.

The objectives of the management plans prepared for a certain period and the monitoring of the activities aimed to be implemented during this period and the evaluation of their effectiveness will provide more successful conditions for the management of the area with the new activities updated in the next plan period.

The biodiversity monitoring component has been prepared to include monitoring at species and ecosystem levels in line with the 'National Biodiversity Inventory and Monitoring Project'. For monitoring at the species level, 15 species (7 plant, 2 mammal, 2 bird, and 3 invertebrate species) were selected considering their endemism and threat status, being steppe-dependent, steppe indicator, or relatively easy-to-monitor widespread species: *Cicer echinospermum*, *Astragalus erythrotaenius*, *Hesperis hedgei*, *Lathyrus trachycarpus*, *Paracarium kurdistanicum*, *Crocus leichtlinii*, *Ranunculus bingoeldaghensis*, grey wolf (*Canis lupus*), Palestine mole-rat (*Nannospalax ehrenbergi*), spectacled warbler (*Sylvia conspicillata*), great bustard (*Otis tarda*), *Isophya sikorai*, *Saga ephippigera syriaca*, seven-spotted lady beetle (*Coccinella semptempunctata*).

Within the scope of ecosystem monitoring, 5 special areas were subject to monitoring, including 1 special wild animal area (bird), 2 special plant communities, 2 habitats rich in target species/areas where endemic plants are concentrated.

Livestock and grazing activities are one of the most important human activities associated with steppe ecosystems in the area, and for this reason, they have been evaluated separately under the monitoring subprogram.

The aim of the livestock and grazing monitoring subprogram is to establish a grazing planning approach in which grazing activity preserves (sustains) or even strengthens (restorative) the rangeland.

In this process, the grazing monitoring program is designed to shed light on the correctness of the decisions made and the planning made to the decision-makers. Within the scope of the program, long-term and short-term monitoring indicators were determined by using the "Ecological Outcome Verification" model, and a plan was prepared to evaluate the effects of grazing practices on rangeland productivity and steppe ecosystems.

Mardin crocus (*Crocus leichtlinii*) Photo: Nihan Yenilmez Arpa

For the monitoring program to be implemented effectively and the process to be managed effectively, it was decided to establish a monitoring program coordination board consisting of the representatives of the 3rd Regional Directorate of the Ministry of Agriculture and Forestry, Şanlıurfa Regional Directorate of Forestry and Şanlıurfa Provincial Directorate of Agriculture and Forestry, and to form a monitoring group by making a protocol with Harran University.

The established board and the monitoring group will carry out monitoring studies in coordination and will prepare an annual evaluation and a 3-year monitoring status report. As a result of the workshops and expert meetings held with the project partners, the monitoring program was divided into two separate implementation time periods, the first and the second period, for the effective implementation of the monitoring program. The first period covers the 1st and 3rd years of the implementation phase, and the second period covers the 4th and 9th years. The monitoring program will be updated with new data obtained as a result of the experience gained at the end of the first 3 years.

1. INTRODUCTION

Monitoring natural areas and phenomena is a core activity of biodiversity conservation and conservation biology and is considered to be among the essential tools for nature conservation on a global scale. Monitoring studies depend on reliable observations to identify, measure, evaluate and conclude how species, ecosystems and social issues have naturally changed over time as a result of intentional or unintentional human intervention.

MONITORING

is defined as "the collection and analysis of repeated observation findings or measurements to evaluate changes in condition and progress toward a management objective".

Camera trap

It is important to develop and implement monitoring concept suitable for conservation objectives to increase the effectiveness of nature conservation management and to obtain successful results. The purpose of the monitoring program is to reveal the changes in the monitoring object/subject (species or population, habitat, ecosystem, or process) over time and to take measures in line with the pursued objectives. The pursued objectives in a monitoring concept should be clearly stated and the program should have a monitoring methodology that can objectively measure the success or failure of conservation efforts. Monitoring studies should be able to identify the change and its causes. The relevant management unit should be prepared to eliminate the causes of unwanted changes in line with conservation goals.

For an effective monitoring program, sufficient financial resources should be allocated, teams should be formed, appropriate equipment should be in place, institutional capacity should be sufficient and expert support should be secured when necessary. Due to the high cost of long-term monitoring, sufficient technical and financial resources may not be secured, and this system may not be established. For this reason, it is important to develop low-cost and effective monitoring methods by determining the points that will form the basis of the monitoring plan such as monitoring level, subject, indicators, time, frequency, methodology and success criteria with involvement of practitioners and interest groups.

In short, the monitoring process starts with determining the need for monitoring and the objectives of the monitoring concept to be developed in line with this need. Then, by clarifying issues such as indicators, monitoring methodology and tools, team members, monitoring frequency and data management, the monitoring concept is shaped with state, pressure, and response components. The monitoring cycle is completed by implementing the program with field studies, analyzing, and interpreting the collected data and sharing the reports with the interest groups.

2. MONITORING CYCLE

The monitoring program developed for Karacadağ Steppes, represents a 5-step cyclical process that starts with the determination of the need and is followed by the definition of the purpose, development of the monitoring concept, implementation of the concept, and the evaluation (Figure 1).

The monitoring program was developed in a participatory manner with contributions from project stakeholders and experts using this cycle, and in line with the "Guidelines for Biodiversity Monitoring" and "Guidelines for Grazing and Livestock Monitoring" publications developed under Conservation and Sustainable Management of Turkey's Steppe Ecosystems Project".

Figure 1 Monitoring cycle and workflow diagram

3. MONITORING NEEDS, PURPOSE AND TARGETS

3.1. Monitoring Needs

Karacadağ Steppes host the low and high mountain steppe habitats, steppe indicator species and local endemic plant species. It is a nationally important biodiversity site which is under high human pressure of intensive grazing, and land use change of steppes into farmlands. Therefore, there is a need for a feasible and effective monitoring program for the continued existence of ecosystems and species in this site and their sustainable use by people in the region, and the monitoring program was prepared in line with this need.

3.2. Monitoring Purpose and Targets

Karacadağ Steppes are one of the representatives of Anatolian steppes, and hosts steppe indicator animal species like *Gazella marica* and *Otis tarda*. Main purpose of the monitoring program is to support the conservation of the steppe ecosystems and sustainable resource management in the site by monitoring environment, biodiversity, socio-economy, and the management effectiveness under one program.

☐ The monitoring program's targets are defined as:

- Systematically revealing the changes in the species that are the main values of the site, and changes in the steppe ecosystems.
- Monitoring the trend in the severity of threats on the steppe ecosystem and steppe species,
- Monitoring the socio-cultural and socio-economical changes of the local people, and the changes on their perceptions on nature and sustainable resource management.
- Determining the changes in the management effectiveness of the site
- Evaluating the effectiveness of conservation measures
- Monitoring the socio-economical changes of the local people having livestock, and the productivity, resistance, and performance of their herds
- Defining the grassland productivity in short and long terms.

4. MONITORING PROGRAM COMPONENTS AND INDICATORS

Care was taken to ensure that the identified monitoring indicators are suitable for the subject and the purpose of monitoring programs, are measurable and clear enough with economical field practices, ensure measurement of success of the monitoring program and help define the changes in the monitored element. The methods and tools proposed for monitoring these indicators are of good quality enough to ensure that the indicators can be evaluated per each objective of the monitoring programs.

Monitoring indicators are prepared tabularly (monitoring tables) in line with the national biodiversity monitoring database (Nuh'un Gemisi - Noah's Ark) monitoring tables with detailed information on the following topics:

☐ The monitoring topics:

- Monitoring Indicator
- Monitoring Level
- Monitoring Period and Frequency
- Monitoring Area
- Monitoring Method
- Monitoring Team/Expertise
- Target / Success Criteria

The monitoring programs have 4 components and a grazing and livestock monitoring sub-program for each site:

☐ The monitoring program components:

- Environment component
- Biodiversity component
- Socio-economic component
- Management effectiveness component

Bush cricket *(Saga ephippigera syriaca)* Photo:Mustafa Durmuş

Table 1. Monitoring program components, basic issues, indicators, and frequencies

Monitoring Component	Basic Issues	Indicators	Monitoring Frequency
Environment	Land use	Changes in soil carbon, net primary production, soil nutrition cycle, soil loss by wind erosion, and land use change,	Annual
	Climate change	Changes in measurements of temperature, precipitation, wind, etc.	Annual
	Pollution	Changes in agricultural pollution, changes in domestic and industrial wastewater pollution, changes in effects on water quality and water resources, changes in air pollution measurements	Monthly, annual
	Hydrology	Changes in water level, number of wells	Seasonal, annual

Table 1. Monitoring program components, basic issues, indicators, and frequencies

Monitoring Component	Basic Issues	Indicators	Monitoring Frequency
Biodiversity	Species level	Changes in population size	Seasonal, annual
	Ecosystem level	Changes in habitat area, species diversity, population abundance and density	Seasonal, annual
Socio-Economy	Demography	Changes in population, age and sex, social gender view, education level, marriage types, immigration rate, fertility rate, social and health insurance	Triennial
	Socio-Economy	Changes in income per person, expenditures for the soil, income from agriculture practices, ownership of farmland, decision making process, agriculture inputs and pesticide/herbicide,	Triennial
	Visitor management	Changes in number of visitors, pattern, visitor satisfaction, visitor pressure, visitor profile, change in their perceptions on nature conservation, cultural heritage	Annual
	Tourism and recreation	Changes in income from tourism activities, and people working in tourism business.	Triennial
	Illegal archeological excavations	Changes in the number of reporting by local people and the number of official reports.	Annual
	Poaching	The number of hunter training programs, the number of inspections and people caught during inspections	Annual
	Illegal collection pressure on plants and animals	Changes in the number of plant and animal collection permits and documents and the number of official reports.	Annual
Management Effectiveness	Implementation of the Management Plan	The success of the implementation of the activities and the success in the achievement of the objectives	Annual, Triennial
	Management effectiveness in protected areas	Change in the METT analysis total score; or comparing UNESCO EOH tool (12 tools) with the previous results	Triennial
	Number and capacity of staff	Changes in number of personnel, personnel capacity	Annual
	Equipment and infrastructure investments	Changes in equipment and infrastructure investment	Annual

The Grazing and Livestock Monitoring Sub-Programs have 3 components:

- Animal Husbandry and Economic Efficiency
- Health of Steppe Ecosystems
- Management Effectiveness

Table 2. Grazing and Livestock Monitoring Sub-Program components, basic issues, indicators, and frequencies

Monitoring Component	Basic Issues	Indicators	Monitoring Frequency
Animal Husbandry and Economic Efficiency	Economic status and life standards of the shepherds	Change in income from main products; change in the economic status and life standards of the shepherds	Annual
	Grassland productivity and effectiveness	Changes in animal number, types, size of the herd (mean value), and distribution in the pastures; changes in the grazing site and periods of the nomads; change in the size of grazing area	Annual
	Herd / animal Performance	Change in the mean value of weight of the one-year-old animal at the end of grazing season; change in the number of animals died; change in the rate of lamb death; change in total forage weight	Annual
Health of Steppe Ecosystems	Biodiversity	Change in the number of trees or shrubs (or woody plants); change in the rare or threatened species; change in the distribution of dominant (invasive) species.	Annual
	Biomass production effectiveness	Change in pasture plants functional groups (cereals, pulses, broad leaved); change in the multiyear herbaceous plants; Change in the ratio of bare soil / covered soil.	Annual
	Upper soil protection	Change in the severity of wind and water erosion	Annual
	Long term resistance of the ecosystem	Change in water infiltration and retention of soil; change in soil carbon or organic material; changes in soil biology	5 year
Management Effectiveness	Ownership and consistency of the plan	The success of the implementation of the grazing plan activities; changes in the number of legal violation official reports	Annual
	Capacity of planning and implementation of the plan	The success of the implementation of the grazing plan activities and the success in the achievement of the objectives; change in the technical capacity on developing grazing plans with vegetative recovery period; change in the evaluations made by the beneficiaries on the annual grazing	Annual, at the end of the annual grazing plan implementation

In the monitoring program, the environment component involves indicators that identify and monitor main threats to ecosystems and species (such as land use change, climate change). The biodiversity component covers indicators that show the status of the species and ecosystems. Whereas the socio-economic component set the basis for the indicators on population and livelihoods (such as demography, socio-economy, visitor management, tourism and recreation, livestock, and grazing). Lastly, the management effectiveness component includes indicators that define and monitor the management efforts in the protected areas (efficient management practices and measures, management of staff and resources, etc.).

Indicators are proposed for each monitoring component and the grazing and livestock monitoring sub-program. At least one monitoring method is proposed for each indicator. Depending on the properties of the indicator, two monitoring methods are proposed for a few indicators. These monitoring methods will be implemented by the proposed monitoring group.

Each indicator has a specific frequency of field sampling, such as monthly, seasonal, annual or triennial, depending on the properties of the indicator, and is aligned with subsequent analysis.

Under the guidance of "Noah's Ark National Biodiversity Database", the monitoring tables were prepared for each component and the grazing and livestock monitoring sub-program's components for the effective implementation of the monitoring program. These tables were finalized at 2 expert meetings, and finalized in consultation with GDNCNP, GDPP, GDF and FAO project team inputs via corresponding emails.

Pin-tailed sandgrouse *Pchillea formosa* Photo: İdris Ölmez

5. MONITORING METHODS

5.1. Monitoring Methods for Environment Component

The monitoring methods for environment component of Karacadağ Steppes Monitoring Program are given below.

Monitoring methods for change in soil carbon 	For monitoring the changes in soil carbon soil samples will be taken from 0-15 cm and 15-30 cm depth of different land covers. The total organic carbon and total nitrogen will be analyzed by organic carbon analyzer
Monitoring methods for change in net primary production 	For monitoring the changes in net primary production by GIS & remote sensing techniques for Normalized Difference Vegetation Index (NDVI) calculation can be used. NDVI is preferable for global vegetation monitoring since it helps to compensate for changes in lighting conditions, surface slope, exposure, and other external factors.
Monitoring methods for change in land cover / steppe usage 	The changes in net primary production will be monitored by GIS & remote sensing techniques will be used.
Monitoring methods for change in soil nutrition cycle 	The change in soil nutrition cycle will be monitored by taking soil samples and analyzing with soil kits on nitrogen, phosphorus, and potassium elements.
Monitoring methods for change in soil nutrition cycle 	The change in soil nutrition cycle will be monitored by taking soil samples and analyzing with soil kits on nitrogen, phosphorus, and potassium elements.

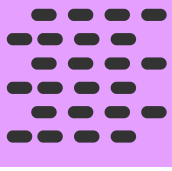
5.1.2. Monitoring Methods for Climate

Monitoring methods for change in the drought level 	The general situation for drought level will be assessed by using UNCCD drought toolbox (https://www.flooddroughtmonitor.com/home?ugredirect=true&ug=unccd) application and comparing with previous values. The drought indices can also be measured by using data of the nearest meteorological station. Monthly, seasonal, and agriculture yearly drought analyses can be done by using Standard Precipitation Indices (SPI) and Percentage of Normal Indices (PNI) methods.
Monitoring methods for change in annual precipitation, temperature 	Changes in annual precipitation, temperature and snow level will be assessed by gathering meteorological data from the nearest meteorological station and comparing the values of different years.

5.1.3. Monitoring Methods for Pollution

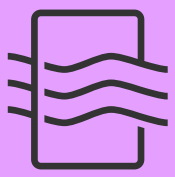
Monitoring methods for changes in usage of agriculture chemicals 	Changes in usage of agriculture chemicals will be monitored by using questionnaires with 20 farmers, and analysis of soil samples taken from the organic soil material sampling points.
Monitoring methods for changes in usage duration of tractors in ploughing 	Changes in usage duration of tractors in ploughing by using questionnaires with 20 farmers.
Monitoring methods for changes in pollutants in the rainwater 	Changes in pollutants in the rainwater will be monitored by collecting rainwater and analyzing with ion chromatography. Main pollutant cations (NH4, Na, K, Mg2 ve Ca2) and anions (Cl−, NO3− ve SO4-2) in rainwater (over 5 mm) with ion chromatography.

Monitoring methods for changes in pollutants in the desert dust



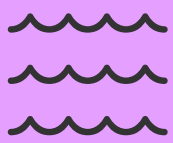
Changes in pollutants in the desert dust will be monitored by measuring the pollutants (heavy metals, nitrogen dioxide (NO_2^-) and sulphur dioxide (SO_2^-) in the desert dust.

Monitoring methods for change in industrial wastewater pollution



Change in industrial wastewater pollution will be monitored by gathering water samples from the wastewater discharge point and affected sites at each season. These samples will be analyzed in an accredited laboratory for comparing with previous years' analysis.

Monitoring Methods for Hydrology



Monitoring methods for change in the number of water wells: Change in the number of water wells will be monitored by field surveys and assessing the water well data of SUŞKİ.

5.2. Monitoring Methods for Biodiversity Component

The monitoring methods for biodiversity component of Karacadağ Steppes Monitoring Program are given below

5.2.1 Monitoring Methods for Species Monitoring

Monitoring Methods for Large Mammals 	For monitoring the changes in population size the monitoring method for Gray wolf (*Canis lupus*) is using camera traps and for monitoring the changes in habitat use the method is using GPS collars.
Monitoring Methods for Small Mammals 	For monitoring the changes in population size of *Nannospalax ehrenbergi* the main monitoring method is field survey with point count and mound count.
Monitoring Methods for Birds 	For monitoring the changes in population size of the bird species *Sylvia conspicillata* the transect count in the breeding season and point count in fall season is proposed. For Otis tarda the main monitoring method is point count.
Monitoring Methods for Invertebrates: 	For monitoring the changes in population size of the invertebrate species (*Isophya sikorai, Saga ephippigera syriaca,* and *Coccinella semptempunctata*) the main monitoring methods is transect counting.
Monitoring Methods for Flora 	For monitoring the changes in population size and habitat of *Astragalus erythrotaenius, Hesperis hedgei, Lathyrus trachycarpus, Paracaryum kurdistanicum, Cicer echinospermum, Crocus leichtlinii, and Ranunculus bingoeldaghensis* the main monitoring method is field surveys (counting number of individuals).

Selected Species For Monitoring

Cicer
Cicer echinospermum
Photo: Ömer Faruk Kaya

Milkvetch
Astragalus erythrotaenius
Photo: Ömer Faruk Kaya

Hesperis
Hesperis hedgei
Photo: Selçuk Ertekin

Bride pea
Lathyrus trachycarpus
Photo: Selçuk Ertekin

Paracaryum
Paracaryum kurdistanicum
Photo: Selçuk Ertekin

Crocus
Crocus leichtlinii
Photo: Nihan Yenilmez Arpa

Buttercup
(Ranunculus bingoeldaghensis)
Photo: Ömer Faruk Kaya

Grey wolf
(Canis lupus)
Photo: DKM Archive

Palestine mole-rat
(*Nannospalax ehrenbergi*)
Photo: Muhsin Çoğal

Spectacled warbler
(*Sylvia conspicillata*)
Photo: Wikimedia commons

Great bustard
(*Otis tarda*)
Photo: Ferenç Çeğledi

Bushcricket (endemic)
Isophya sikorai
Photo: Hasan Sevgili

Bushcricket
Saga ephippigera syriaca
Photo: Mustafa Durmuş

Seven-spotted lady beetle
(*Coccinella semptempunctata*)
Photo: Wikimedia commons

15 species (7 plant, 2 mammal, 2 bird, and 3 invertebrate species) were selected considering their endemism and threat status, being steppe-dependent, steppe indicator, or relatively easy-to-monitor widespread species:

- *Cicer echinospermum*,
- *Astragalus erythrotaenius*,
- *Hesperis hedgei,*
- *Lathyrus trachycarpus*,
- *Paracarium kurdistanicum*,
- *Crocus leichtlinii*,
- *Ranunculus bingoeldaghensis*,
- Grey wolf (*Canis lupus*),
- Palestine mole-rat (*Nannospalax ehrenbergi*),
- Spectacled warbler (*Sylvia conspicillata*),
- Great bustard (*Otis tarda*),
- *Isophya sikorai*,
- *Saga ephippigera syriaca*,
- Seven-spotted lady beetle (*Coccinella semptempunctata*).

5.2.2. Monitoring Methods for Ecosystem Monitoring

Monitoring Methods for Special Wildlife Areas

Special Wildlife Areas are defined for threatened animal species, flagship, and key species in the project site. At national biodiversity monitoring scheme these areas are monitored by using the species diversity and density as proxy for the ecosystem/habitat monitoring. For monitoring the change in bird species diversity and abundance in Karacadağ Honey Forest, point counting will be done.

Monitoring Methods for Special Plant Communities:

These are the areas that contain special plant communities (endemic plant associations/association enclaves, flooded forests, rich geophytic plant areas, special wetlands, peatlands, floating islands, etc.). For monitoring the change in Astragalus species population in Karacadağ Peak (Kollubaba Hill) the main monitoring method is field surveys (counting number of individuals). The habitat change in oak stands in Diyarbakır Road - Çelebi Village will be monitored by GIS & remote sensing techniques.

Habitats Rich in Indicator Species/ Areas Rich in Endemic Plants

These are areas where indicator/target species are heavily distributed.

For monitoring these sites, the main monitoring method is field surveys (counting number of individuals):

- Change in plant richness areas between Karabahçe and ski center (after
- 11 km) Change in plant richness by Simo River.

5.3. Monitoring Methods for Socio-Economy Component

The monitoring methods for socio-economy component of Karacadağ Steppes Monitoring Program are given below. As a result of the sampling analysis, it is proposed to make questionnaires by 380 local people living in and around Kızılkuyu Wildlife Reserve for the indicators under the socio-economy components. Number of people for each village was given as a table in the related section of the monitoring program. The questionnaire is given in the annex of the monitoring program.

5.3.1. Monitoring Methods for Demography

The monitoring for the below indicators will be carried out by questionnaires, interviews and, comparing statistical data in each 3-year interval:

☐ Demography indicators:

- Change in population, mean value of household
- Change in age and gender pattern
- Change in education level
- Change in social gender view
- Change in marriage types
- Change in migration rate
- Change in fertility rate and birth speed
- Change in social and health insurance

5.3.2. Monitoring Methods for Socio-economy

The monitoring for the below indicators will be carried out by questionnaires, interviews and, comparing statistical data in each 3-year interval:

☐ Socio-economy indicators:

- Change in agriculture practices and amount
- Change in household income
- Change in the expenditures for soil
- Change in the income from agriculture activities
- Change in the ownership of farmlands
- Change in the quality of decision-making processes
- Change in agriculture inputs and chemical usage

5.3.3. Monitoring Methods for Visitor Management

For the visitor management indicators, the questionnaire sampling size shall represent the 10% of the visitors recorded in Karacadağ Steppes in 2019. The questionnaire is given in the annex of the monitoring program.

The monitoring for the below indicators will be carried out by questionnaires, interviews and, comparing statistical data in each 3-year interval:

☐ Visitor management indicators:

- Change in the number of visitors
- Change in visitor pattern
- Change in visitor satisfaction
- Change in visitor pressure
- Change in visitor profile
- Change in the perception of nature conservation
- Change in the perception of cultural heritage

5.3.4. Monitoring Methods for Tourism and Recreation

The monitoring for the below indicators will be carried out by questionnaires, interviews and, comparing statistical data in each 3-year interval:

☐ Tourism and recreation indicators:

- Changes in income from tourism activities
- Change in number of people working in tourism business.

The specific questions on tourism and recreation are part of the main socio-economy questionnaire stated above.

5.3.5. Monitoring Methods for Illegal Archeological Excavations

Change in the number of reporting by local people and the number of official reports will be monitored by comparing statistical data on official records, and interviews with local people.

5.3.6. Monitoring Methods for Poaching

For monitoring the poaching there are indicators for 2 different hunter groups: 1. Hunters with permit; 2. Hunters without permit. Hunting activities by the hunters with permit will be monitored by the effectiveness of hunter trainings via comparing hunter training records of Provincial Branch of Şanlıurfa DKMP for each year. Hunting activities by the hunters without permit will be monitored by the effectiveness of the inspections via comparing records of Provincial Branch of Şanlıurfa DKMP for each year.

5.3.7. Monitoring Methods for Illegal Collection Pressure on Plants and Animals

Effectiveness of the controls will be monitored by comparing inspection records of Provincial Branch of Şanlıurfa DKMP for each year.

5.4. Monitoring Methods for Management Effectiveness Component

The monitoring methods for management effectiveness component of Karacadağ Steppes Monitoring Program are given below.

5.4.1. Monitoring Methods for Success of the Management Plan Implementation

Monitoring the effective management of the protected area management plan, yearly success of activity implementation, and success of reaching targets at 3 years interval are the main monitoring indicators will be done by topic specific interviews and assessments by independent experts.

5.4.2. Monitoring Methods for Change in Protected Area Management Effectiveness:

Monitoring the change in protected areas' management effectiveness, Management Effectiveness Tracking Tool (METT) will be used for Karacadağ Steppes in every 3 years. The total score will be compared with previous scores to determine the progress in effective management of protected areas.

As an alternative approach UNESCO EOH tool (12 tools) may be used to see the progress in different tools at annual or triennial assessments The scores of each tool will be compared with previous scores to determine the progress in effective management of protected areas

5.4.3. Monitoring Methods for Changes in Number of Personnel, Personnel Capacity

The monitoring will be done comparing records of Provincial Branch of Şanlıurfa DKMP for each year.

5.4.4. Monitoring Methods for Changes in Equipment and Infrastructure Investment

The monitoring will be done comparing records of Provincial Branch of Şanlıurfa DKMP for each year.

5.5.5. Grazing and Livestock Sub-Program Methods

Methods for data collection and analysis for grazing and livestock monitoring program component were prepared data forms for each indicator's data collection methods were given in the annex of the monitoring program.

5.5.1. Monitoring Methods for Animal Husbandry and Economic Efficiency Component

The monitoring methods for Animal Husbandry and Economic Efficiency component of Kızılkuyu Wildlife Reserve Monitoring Program - Grazing and Livestock Sub-Program are given below.

5.5.1.1. Monitoring Methods for Economic status and life standards of the beneficiaries (shepherds)

The monitoring for the below indicators will be carried out by questionnaires, interviews and field surveys:

☐ Beneficiaries indicators:

- Change in income from main products
- Change in the economic status and life standard and socio-cultural aspects of the shepherds

The questionnaire given as entitled "Animal husbandry and economic efficiency field form" in the annex of the monitoring program.

5.5.1.2. Monitoring Methods for Grassland Productivity and Effectiveness

Monitoring methods for change in animal number, type of species, size of the herd (mean value), and distribution in the pastures	The monitoring will be done by interviews, field surveys, and comparing statistical data. The questionnaire is "Animal husbandry and economic efficiency field form".
Monitoring methods for change in the grazing site and periods of the nomads	The monitoring will be done by field surveys and comparing GIS data.
Monitoring methods for change in the size of grazing area	The monitoring will be done by field surveys and comparing GIS data.

5.5.1.3. Monitoring Methods for Herd / Animal Performance

The monitoring for the below indicators will be carried out by Interviews, questionnaires, filed surveys, and comparing statistical data:

☐ Herd/animal indicators:

- Change in the mean value of weight of the one-year-old animals at the end of grazing season
- Change in the number of animals died compared to previous year
- Change in the rate of lamb death
- Change in total forage weight

The questionnaire given as entitled "Herd / animal performance field form" in the annex of the monitoring program.

5.5.2. Monitoring Methods for Health of Steppe Ecosystems Component

The monitoring methods for Health of Steppe Ecosystems component of Karacadağ Steppes Monitoring Program - Grazing and Livestock Sub-Program are given below.

20 monitoring lines will be set in Karacadağ Steppes for the monitoring of Health of Steppe Ecosystems component indicators.

5.5.2.2. Monitoring Methods for Biomass Production Effectiveness

The monitoring for the below indicators will be carried out by comparing statistical data, field surveys, GIS data:

☐ Biomass production effectiveness indicators:

- Change in the number of trees or shrubs (or woody plants)
- Change in the rare or threatened species
- Change in the distribution of dominant (invasive) species

For the field surveys, 50 random point will be set at each monitoring line and a circle with15 cm radius will be the sampling point for these indicators. At each sampling point the data form "Biomass production effectiveness and upper soil protection data form" will be filled out. The form is given in the annex of the monitoring program.

5.5.2.3. Monitoring Methods for Upper Soil Protection

The monitoring for the below indicators will be carried out by comparing statistical data, field surveys, and GIS data:

☐ Upper soil protection indicators:

- Change in the number of trees or shrubs (or woody plants)
- Change in the rare or threatened species
- Change in the distribution of dominant (invasive) species

For the field surveys, 50 random point will be set at each monitoring line and a circle with15 cm radius will be the sampling point for these indicators. At each sampling point the data form "Biomass production effectiveness and upper soil protection data form" will be filled out. The form is given in the annex of the monitoring program.

5.5.1.2. Monitoring Methods for Grassland Productivity and Effectiveness

Monitoring methods for change in water infiltration and retention of soil	For monitoring the change in water infiltration and retention of soil, data will be collected by the water infiltration and retention apparatus at 8 points at each 50 monitoring lines.

Monitoring methods for change in soil carbon or organic materials	For monitoring the change in soil carbon or organic materials, soil samples (0-15 cm, 15-30 cm) will be taken at 2 points in each 50 monitoring lines and will be analyses in accredited laboratories.
Monitoring methods for change in soil biology	For monitoring the change in soil biology, the soil samples collected for change in soil carbon or organic materials will be used. The samples will be observed under the microscope in experienced laboratories and the functional groups will be recorded.

5.5.3. Monitoring Methods for Management Effectiveness Component

The monitoring methods for Management Effectiveness component of Karacadağ Steppes Monitoring Program - Grazing and Livestock Sub-Program are given below.

5.5.3.1. Monitoring Methods for Ownership and Consistency of the Plan

Monitoring methods for change in the success of the implementation of the grazing plan activities: Monitoring the effective implementation of the annual grazing plan will be done with interviews and assessments by independent experts.Monitoring methods for change in the number of legal violation official reports: Change in the number of legal violation official reports will be monitored by comparing the official records of Provincial Branch of Şanlıurfa DKMP and Şanlıurfa Provincial Directorate of Agriculture and Forestry for each year.

5.5.3.2. Monitoring Methods for Capacity of Planning and Implementation of the Plan

The monitoring for the below indicators will be carried out WİTH Interviews and assessments to fill out the special assessment forms prepared by independent experts.

☐ Capacity planning and implementation indicators:

- Change in the success of the implementation of the grazing plan activities and the success in the achievement of the objectives
- Change in the technical capacity on developing grazing plans with vegetative recovery period
- Change in the evaluations made by the beneficiaries on the annual grazing plans.

6. EFFECTIVE IMPLEMENTATION OF THE MONITORING PROGRAM

One of the most important steps is to prepare a work plan for each monitoring study, which specifies the purpose of protection or management, the place and time of monitoring, with whom it will be carried out, what methods and tools will be used. For this, the details and work plan of the Monitoring Program Coordination Board and Monitoring Group, which will be formed for the effective implementation of the monitoring program, have been prepared below.

Monitoring Program Coordination Board

For the effective implementation of the monitoring program, the Monitoring Program Coordination Board, which will consist of representatives of the following institutions, should be established.

Coordination Board Members

From the members of the Technical Implementation Unit assembled within the scope of the Protocol on the Implementation and Monitoring of the "Şanlıurfa Steppe Conservation Strategy and Action Plan" between Şanlıurfa Governorship, Ministry of Agriculture and Forestry, 3rd Regional Directorate of Nature Conservation and National Parks, Şanlıurfa Regional Directorate of Forestry and Şanlıurfa Provincial Directorate of Agriculture and Forestry, the Monitoring Program Coordination Board will be established with the participation of representatives of:

☐ Board Members:

- 3rd Regional Directorate of the Ministry of Agriculture and Forestry
- Şanlıurfa Regional Directorate of Forestry
- Şanlıurfa Provincial Directorate of Agriculture and Forestry

under the chairmanship of the 3rd Regional Directorate of the Ministry of Agriculture and Forestry.

The Board may invite relevant institutions and organizations to its meetings on necessary issues.

It is envisaged that the Board will meet at least twice a year.

Duties of the Coordination Board

To carry out the following tasks for the effective implementation and evaluation of the monitoring program:

☐ Duties:

- To ensure coordination and cooperation between public institutions, experts, and relevant stakeholders for the implementation and evaluation of the monitoring program.
- Establishing the necessary technical and financial resources to ensure the implementation of the monitoring program work plan and to evaluate their progress
- Establishing the monitoring group and monitoring its work
- To ensure the preparation of the Annual Monitoring Report
- To ensure the preparation of a Monitoring Status Report every 3 years
- Informing the relevant institutions about the actions to be taken according to the results of the monitoring reports
- To ensure that the reports are shared with the relevant institutions and organizations.

Secretariat Unit
The secretariat duty of the Coordination Board will be carried out by the 3rd Regional Directorate of the Ministry of Agriculture and Forestry.

Monitoring Group
The monitoring group will be established within the scope of the protocol to be signed with Şanlıurfa Harran University (Annex 2). The Independent Experts Group defined in the Şanlıurfa Steppe Conservation Strategy and Action Plan will take part in the effective implementation of the protocol to be prepared for the establishment and effective operation of the monitoring group.

For the effective implementation of the monitoring program, it is recommended to establish a monitoring group and, if possible, to conduct regular studies by the same experts every year.

Members of the monitoring group will carry out monitoring studies in the field, specific to their expertise. They will process the collected data into the database and support the Coordination Board in the preparation of analysis studies and annual reports.

Monitoring Group Members:

- Monitoring group coordinator
- Vascular plant specialist
- Ecologist (for ecosystem/habitat monitoring)
- Bird species specialist
- Mammalian species specialist
- Reptile and amphibian specialist
- Invertebrate species specialist (butterfly and insect species)
- Soil and environmental monitoring specialist
- Socio-economy monitoring specialist
- Livestock and grazing specialist
- Geographic Information Systems specialist
- Protected areas specialist

Members of the monitoring group must have at least a master's degree in their subject or have at least 5 years of experience in the subject. While implementing the monitoring program, care should be taken to assign or employ the same experts for a long time.

Şanlıurfa NCNP Provincial Branch Directorate and Şanlıurfa Provincial Directorate of Agriculture and Forestry experts will be assigned to the monitoring group when necessary.

Duties of the Monitoring Group
To carry out the following tasks for the effective implementation and evaluation of the monitoring program:

Duties:

- Taking an active role in the fields of expertise (field studies, analysis, and evaluation processes) during the implementation of the work plan of the monitoring program
- Carrying out field and evaluation studies related to their subjects and to take part in the preparation of the Annual Monitoring Report.
- Taking part in the preparation of the Monitoring Status Report every 3 years.

Reporting

To strengthen the coordination and cooperation between public institutions and stakeholders for the effective implementation and evaluation of the monitoring program, necessary information will be received at the end of each year about the progress in matters of communication with the relevant institutions and organizations and will be evaluated at the board. The work and transactions related to reporting will be carried out by the secretariat. Reports from institutions and experts will be used in the preparation of the annual monitoring report at the end of each year. The annual reports will be compiled, and a Monitoring Status Report will be prepared every 3 years. The preparation of these reports will be finalized by the secretariat with the support and contributions of the Monitoring Group members and will be submitted to the Coordination Board. Reports will be shared with central and local institutions and organizations related to monitoring issues. For effective implementation of the 10-year monitoring programs complementary to the existing monitoring efforts of the responsible local directorates, 2 implementation periods are proposed in the work plan. The first period covers between the 1st and 3rd years of the implementation phase; the second period covers the remaining time to the end. Each period has specific actions for selected indicators, and the results and experience gained in this period will support the actions of the next period.

Table 3. Monitoring Program Work Plan

Activities	Years								
	2021	2022	2023	2024	2025	2026	2027	2028	2029
Establishment of the Monitoring Coordination Board	X								
Creation of the monitoring group	X			X			X		
The onset of the first period monitoring works	X								
Continuation of the first period follow-up studies		X	X	X	X	X	X	X	X
Preparation of the Annual Monitoring Report	X	X	X	X	X	X	X	X	X
Preparation of Monitoring Status Report			X						
Preliminary preparation for the second semester monitoring works			X			X			X
Onset of the second period monitoring works				X					
Continuation of the second period monitoring works					X	X	X	X	X

7. ANNEXES

Annex 1: Suggested Monitoring Group and Monitoring Group Job Description
Annex 2: Draft Protocol
Annex 3: Monitoring Equipment and Specifications

Annex 1. Suggested Monitoring Group List and Monitoring Group Job Description

For the implementation of the prepared monitoring program, it is recommended to establish a monitoring group that will ensure effective monitoring of all four components. According to the monitoring topics included in the monitoring program, the recommended specializations for the monitoring group are:

☐ Monitoring Group Members:

- Monitoring group coordinator
- Vascular plant specialist
- Ecologist (for ecosystem/habitat monitoring)
- Bird species specialist
- Mammalian species specialist
- Reptile and amphibian specialist
- Invertebrate specialists (butterfly and other invertebrate species)
- Soil and environmental monitoring specialist
- Socio-economy monitoring specialist
- Livestock and grazing specialist
- Geographic Information Systems specialist
- Protected areas specialist

☐ Minimum Requirements For Monitoring Group Members:

- To have at least a master's degree in the subject of monitoring or to have at least 5 years of experience in the subject,
- Having experience in the area to be monitored.
- It is recommended that the monitoring group coordinator has at least 10 years of experience in monitoring issues.

☐ Duties of Monitoring Group Members:

- To take an active role in the fields of expertise (field studies, analysis, and evaluation processes) during the implementation of the work plan of the monitoring program,
- To make and report land and assessment studies related to their subjects,
- Taking part in the preparation of the Annual Monitoring Report,
- To take part in the preparation of the Monitoring Status Report to be prepared every 3 years,
- To support the development of the monitoring capacity of the employees of the relevant institutions participating in the field studies in the implementation of the monitoring programs,
- To provide input for updating the monitoring database

DRAFT PROTOCOL

BETWEEN T.R. MINISTRY OF AGRICULTURE AND FORESTRY 3RD REGIONAL DIRECTORATE OF NATURE CONSERVATION AND NATIONAL PARKS, SANLIURFA REGIONAL DIRECTORATE OF FORESTRY, SANLIURFA PROVINCIAL DIRECTORATE OF AGRICULTURE AND FORESTRY AND HARRAN UNIVERSITY RECTORATE

REGARDING THE IMPLEMENTATION OF KIZILKUYU WILDLIFE RESERVE, TEK TEK MOUNTAINS NATIONAL PARK, AND KARACADAG STEPPES MONITORING PROGRAMS

1. PARTIES

This Protocol has been made between the Ministry of Agriculture and Forestry, Nature Conservation and National Parks 3rd Regional Directorate, Şanlıurfa Regional Directorate of Forestry, Şanlıurfa Provincial Directorate of Agriculture and Forestry and Harran University Rectorate, addresses and contact information of which are provided, within the framework of the conditions written below.

T.R. MINISTRY OF AGRICULTURE AND FORESTRY 3RD REGIONAL DIRECTORATE OF NATURE CONSERVATION AND NATIONAL PARKS

Address: Doğukent Mah. Fatih Sultan Mehmet Bulvarı No:1 Karaköprü/ Şanlıurfa
Phone: (0414) 313 55 39

T.R. MINISTRY OF AGRICULTURE AND FORESTRY SANLIURFA PROVINCIAL DIRECTORATE OF AGRICULTURE AND FORESTRY

Address: İmambakır Mahallesi Veteriner Caddesi No: 19 Haliliye/Şanlıurfa
Phone: (0414) 313 27 11

T.R. MINISTRY OF AGRICULTURE AND FORESTRY SANLIURFA REGIONAL DIRECTORATE OF FORESTRY

Address: Doğukent Mah. Fatih Sultan Mehmet Bulvarı No:1 Karaköprü/ Şanlıurfa
Phone : (0414) 347 93 29

HARRAN UNIVERSITY RECTORATE

Address: Şanlıurfa-Mardin Karayolu Üzeri 18. Km Şanlıurfa
Phone: (0414) 318 30 00

2. PURPOSE AND SCOPE

The purpose of this protocol is the environmental monitoring component, biodiversity monitoring component (species/population, habitat/ecosystem level), and the socio-economic monitoring component included in the programs for the effective implementation of Kızılkuyu WR, Tek Mountains National Park, and Karacadağ Steppes Monitoring Programs prepared within the scope of Conservation and Sustainable Management of Turkey's Steppe Ecosystems Project and the monitoring of the subjects included in the livestock and grazing monitoring sub-plan.

3. LEGAL BASIS

- Articles 410 and 420 of the Presidential Decree No. 1 on the Presidential Organization,
- The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention),
- United Nations Convention on Biological Diversity
- Protocol on the Implementation and Monitoring of the "Şanlıurfa Steppe Conservation Strategy and Action Plan" between the Şanlıurfa Governorship, the Ministry of Agriculture and Forestry, the 3rd Regional Directorate of Nature Conservation and National Parks, the Şanlıurfa Regional Directorate of Forestry and the Şanlıurfa Provincial Directorate of Agriculture and Forestry.

3. DEFINITIONS AND ABBREVIATIONS

In the text of the protocol,

"**3. Regional Directorate**" refers to Ministry of Agriculture and Forestry, Nature Conservation and National Parks 3rd Regional Directorate,

"R**egional Directorate Forestry**" refers to Şanlıurfa Regional Directorate of Forestry,

"**Provincial Directorate**" refers to Şanlıurfa Provincial Directorate of Agriculture and Forestry

"**University**" refers to Harran University Rectorate,

"**Fauna**" refers to vertebrate wildlife (birds, mammals, reptiles, and amphibians) and invertebrates (butterfly and insect species)

"**Flora**" refers to vascular plants

"**Special Area**" refers to habitats rich in target species to be monitored, special plant communities, and special wildlife areas in monitoring at the habitat/ecosystem level.
"**Monitoring Group**" refers to the group of experts assembled for the effective implementation of the monitoring program (Monitoring group coordinator, vascular plant specialist, ecologist (for ecosystem/habitat monitoring), bird species specialist, mammalian species specialist, reptile and amphibian species specialist, invertebrate species specialist (butterfly and insect species), soil and environmental monitoring specialist, socio-economic monitoring specialist, livestock and grazing specialist, Geographical Information Systems specialist, protected areas specialist)

5. BASIC PRINCIPLES

The environmental monitoring component in the monitoring programs include monitoring works related to vascular plants and vertebrate wild animals (birds, mammals, reptiles, amphibians), butterflies and insect species at the population level in the biodiversity monitoring component, and the special areas at the habitat/ecosystem level, the socio-economic monitoring component and the topics in the livestock and grazing monitoring sub-plan for the effective implementation of the Kızılkuyu WR, Tek Tek Mountains National Park, and Karacadağ Steppes Monitoring Programs prepared within the scope of Conservation and Sustainable Management of Turkey's Steppe Ecosystems Project.

The work program is prepared in cooperation with the specialist personnel assigned by the Harran University and the 3rd Regional Directorate, the Regional Directorate of Forestry, and the Provincial Directorate within the framework of the monitoring programs.

6. RIGHTS AND LIABILITIES OF THE PARTIES

6.1. Liabilities of the 3rd Regional Directorate:

6.1.1. Digital topographic maps with a scale of 1/25.000 for the study area will be provided by the 3rd Regional Directorate.

6.1.2. It will provide tools and equipment such as cameras, camera traps, GPS, binoculars, telescope to be used during the works.

6.1.3. The samples to be collected within the scope of monitoring programs will be duly stored.

6.1.4. The per diems of the personnel of the Ministry participating in the fieldwork. In accordance with the relevant article of the Allowance Law No. 6245, the per diems of the experts/persons who are not personnel of the Ministry will be covered by their own institutions.

6.1.5. The secretariat of the necessary official correspondence within the scope of the protocol will be carried out by the 3rd Regional Directorate.

6.1.6. It will allocate vehicles in field works.

6.1.7. The staff of the 3rd Regional Directorate and the expert(s) assigned by the University will participate in the field studies together.

6.2. Liabilities of the Regional Directorate of Forestry:

6.2.1. 1/25.000 scale digital forest stand maps for the study area will be provided by the Regional Directorate.

6.2.2. It will allocate vehicles in field studies related to the forest ecosystem.

6.2.3. The staff of the Regional Directorate of Forestry and the expert(s) assigned by the University will participate in the field studies together.

6.3. Liabilities of the Provincial Directorate:

6.3.1. The 1/25.000 scale digital agricultural and rangeland maps and information for the study area will be provided by the Provincial Directorate.

6.3.1. It will allocate vehicles in field studies related to agriculture and rangelands.

6.3.2. The personnel of the Provincial Directorate and the expert(s) assigned by the University will participate in the field studies together.

6.4. Liabilities of the University:

6.4.1. It will assign experts to establish the Monitoring Group within the scope of the Kızılkuyu WR, Tek Tek Mountains National Park, and Karacadağ Steppes Monitoring Programs attached to this protocol.

6.4.2. It will ensure that studies that require expertise are carried out based on scientific foundations.

6.4.3. Responsible for the preparation of annual and three-year reports.

7. DURATION OF THE PROTOCOL

This protocol enters into force from the date of signature and remains in effect for 6 years. At the end of 6 years, if needed, a new protocol is made.

8. AMENDMENT AND REVIEW

If each of the parties wishes to make changes in all or some of the provisions of this protocol, other parties are notified of the request in writing in advance and the requested amendments are made by mutual agreement by the 3rd Regional Directorate, Regional Directorate of Forestry, Provincial Directorate, and the University.

9. RESOLUTION OF DISPUTES

Disputes that may arise due to the interpretation or application of the provisions of this protocol will be resolved through mutual negotiation.

10. RESOLUTION OF DISPUTES AND AUTHORIZED COURT

If the disputes arising from this protocol cannot be resolved by agreement, "Şanlıurfa Courts" are authorized to settle the said disputes.

11. ENTRY INTO FORCE

This protocol, consisting of 11 articles and its annex, Kızılkuyu WR, Tek Tek Mountains National Park, and Karacadağ Steppes Monitoring Programs was prepared in 2 copies to be given to the parties of the protocol and entered into force by being signed by the parties on …/…/2021.

APPENDIX: Kızılkuyu WR, Tek Tek Mountains National Park, and Karacadağ Steppes Monitoring Programs

Ministry of Agriculture and Forestry,
3rd Regional Directorate of Nature Conservation and National Parks

Ministry of Agriculture and Forestry Şanlıurfa
Regional Directorate of Forestry

Ministry of Agriculture and Forestry
Şanlıurfa Provincial Directorate of Agriculture and Forestry

Harran University Rectorate

Annex 3. Monitoring Equipment and Specifications

This document provides the list and technical specifications of monitoring equipment, tool and materials for the monitoring methods described in the Karacadağ Steppes monitoring program.

Table 1. Summary of monitoring equipment

Equipment and materials	Number
A. ENVIRONMENTAL MONITORING	
1. Soil Sampling Auger	1
2. Soil Test Kit (for each monitoring study)	5 packs
3. Wind Erosion Measurement Setup (BEST Setup)	1
4. Weather-Control Station	1
B. BIODIVERSITY MONITORING	
Large Mammal Monitoring	
1. Binoculars	*
2. Telescope	*
3. Tripod	*
4. GPS	*
5. Compass	*
5. Camera trap set (Camera trap, protective cover, lock cable, memory card, batteries)	10
6. GPS collar	5
Bird Species Monitoring	
1. Binoculars	*
2. Telescope	*
3. Tripod	*
4. GPS	*
5.GPS transmitter	4
Reptile Species Monitoring	
1. Binoculars	0
2. GPS	0
3. RFID microchip	5

* These tools were purchased at the initial stage of the project, and they will not be purchased again. They are currently available.

Equipment and materials	Number
4. Snake tongs	1
5. Camera trap set (Camera trap, protective cover, lock cable, memory card, batteries)	5
Invertebrate Species Monitoring	
1. Binoculars	0
2. GPS	0
Plant Species Monitoring	
1. GPS	0
C. OTHER EQUIPMENT	
Camera	**
Tablet (with built-in GPS)	**
D. LIVESTOCK and GRAZING MONİTORING SUB-PROGRAM	
Short-term monitoring	
1. Aluminum pole	50
2. Triangular flags	50
3. Plastic/wooden mallet	1
4. A tablet with built-in GPS and equipped with a GSM line	1
Long-term monitoring	
1. Set: 1 aluminum/iron pipe, 1 waterproof tarpaulin or plastic sheet (30 cmx30 cm), 1 500 ml water bottle and water, 1 stopwatch, 1 hammer, Board (30 cmx15 cmx1cm)	1
2. Set: 1 handheld auger ***, 1 hand shovel, 50 zip-top bags (15 cmx20 cm), 1 felt-tip pen, 2 plastic buckets	1

** These tools are essential for monitoring. Since they will be provided by the Ministry, they will not be purchased by the project resources.

*** It is stated under the Environmental Monitoring component as a soil sampling auger. The institution may purchase an additional one for each area, if needed, within the scope of the Livestock and Grazing Monitoring Sub-Program.

1. ENVIRONMENTAL MONITORING

The technical specifications of the equipment and materials required for the implementation of the methods determined for the monitoring of the indicators within the scope of the environmental monitoring component are given below.

1.1. Soil Sampling Auger

For monitoring soil organic carbon and agricultural pollution (cadmium and nitrate measurement), soil samples should be taken with the soil auger, the example of which is given in Figure 1. Samples can be taken from different depths with the auger that is bored into the soil by pushing down the two handles while rotating it.

Figure 1 Soil sampling auger

1.2. Soil Test Kit

Soil test kits are used to measure the soil nutrient cycle and the change in plant nutrients. The test kit detects nitrogen, phosphorus, and potassium nutrients. Field kits based on ready-made visual reference cards can be used (Figure 2). Approximately 1 cm of sample soil is placed in the measurement chamber of the test kit, the contents of one capsule are carefully opened and emptied into the test chamber, paying attention if the test cover colors and capsule colors are the same. It is filled with pure water up to the mark using the dropper included in the package. The lid of the test kit is closed tightly, and it is shaken until the soil, capsule contents and water are thoroughly mixed. At the end of the shaking process, the soil particles precipitate in 1 to 1.5 minutes. When the soil has settled to the bottom, the test result is determined by comparing the color of the liquid in the test kit with the scale next to it.
There are 10 test products in each of the soil test kits on the market. There are 10 pH, 10 Nitrogen, 10 Phosphate and 10 Potassium test kits in a pack.

Figure 2 Soil pH – Nitrogen – Phosphorus – Potassium test kit

1.3. Best Setup

It is an equipment for measuring soil loss due to wind erosion. The measuring setup consists of a metal pole, a wing and 5 sediment traps (Fig. 3). In the BEST setup, where 5 poles make up a set, the sediment traps are mounted at 20–40–60–80–100 cm heights on the poles and are used to capture the sediment flow through suspension and saltation (splash) within 1 m of height. The recommended technical features of the device are listed below.

1. The device should be a system that measures, monitors and models the amount of wind erosion.
2. The device should have piezoelectric sensors that can be placed on a metal pole at certain distances apart, a data logger fixed to a metal pole, a storage box containing batteries, electronic blocks, and GPRS, a solar panel that provides the electrical energy of the system, and a stake that fixes the system to the field.
3. The device must have a data measurement system, a data logger where the measured data is recorded, a GPRS system that provides the transfer of the recorded data, and software that automatically calculates the data transferred online.
4. The data calculation and mathematical modeling system on the device must have ArcView software and geostatistics module, where the calculated data is transferred and instantly or cumulatively mapped

Figure 3 Best setup example

Sediment Traps (5 pcs for each post in one set): Plastic injection
Horizontal and Vertical Pipe (5 in 1 set): Chrome
Triangle Sheet: Chrome or galvanized sheet
Clamp: Chrome or galvanized clamp
Wind Router: Dekota
Screw-Nut-Bolt: Galvanized
Stake: Galvanized iron

1.4. Weather-Control Station

It is possible to monitor climate variables with weather control stations that can measure many meteorological variables. The measurements can be tracked via a smartphone, tablet, or PC. Transmission of weather conditions data to a gateway, via the internet to a smartphone, tablet, and PC, regional measurement of temperature, atmospheric pressure, humidity, precipitation, global solar radiation, wind direction, and speed to a wireless transmitter (868 MHz, max. sensors) remote access, display of previous data and instant data are supported. The meteorological station is a piece of equipment suited for data continuity and point detail (Figure 4).

These stations also offer data on rainy days, maximum wind speed, real-time data display, adjustable alarm limits, instant notification in case of alarm, and multi-user support. The recommended technical features of the station are listed below. If all the recommended technical specifications are not available at the weather control station, additional equipment and integrated systems that can perform all measurements should be installed.

- Temperature Measurement Range: -40 °C/+80 °C (-40 °F/ 140 °F)
- Humidity Measurement Range: 20%-90%
- Temperature/Humidity Transmitter: 30.3217.02, 2 x 1.5V AA
- Wind- Transmitter: 30.3218.02, 2 x 1.5V AA
- Rain- Transmitter: 30.3219.02, 2 x 1.5V AA
- Gateway: 13.5 x 8 x 2.5 cm, 110 g

Figure 4 Weather-control station

Technical Specifications:

- Gateway Power Consumption Input: 100-240V-50/60Hz-100 mA
- Power Consumption Output: 5V-400mA
- Transmission Interval: 3 minutes
- Reception frequency: 868 MHz
- Outdoor Transmitter
- Temperature Sensor Measurement Range: -40°C/+80°C
- Accuracy: ± 1%
- Humidity Sensor Measurement Range: 20%/ 90% Relative Humidity
- Sensitivity: 1%
- Accuracy: ± % 5 relative humidity
- Communication Frequency: 868 MHz
- Communication Range: Approximately 100 m in free space
- Power Consumption: 2 X AA batteries
- Soil temperature sensor measuring range: -20°C/+60°C
- Accuracy: ± 1%
- Rain Gauge Measuring Range: 80.0 mm-500.00 mm
- Precision: 0.7 mm
- Accuracy: ±10% of the measured value
- Communication Frequency: 868 MHz
- Communication Range: Approximately 100 m in free space
- Power Consumption: 2 X AA batteries
- Anemometer speed measurement range: 0.0-199.9mph (199.9km/h,173.7 Knots, 89.3 m/s)
- Accuracy: ±5% of the measured value
- Direction measuring range: 16 positions
- Sensitivity: 22,5°
- Communication Frequency: 868 MHz
- Communication Range: Approximately 100 m in free space
- Power Consumption: 2 X AA batteries
- Pyranometer measuring range: 0-2000 W/m2
- Spectral range: 305-2800 nm
- Accuracy: ±10% of the measured value
- Wind speed measurement range: 0-180 km/h
- Wind direction indicator: 360 degrees
- Accuracy: ±5% of the measured value

2. BIODIVERSITY MONITORING

The technical specifications of the equipment and materials required for the implementation of the methods determined for the monitoring of the indicators within the scope of the biodiversity monitoring component are given below.

2.1. Large Mammal Species

2.1.1. Equipment for line transect counting and counting station methods

The equipment required for the study is binoculars (Figure 5), telescope (Figure 6), GPS (Figure 7), and compass (Figure 8). For wildlife observations, 10x50 (magnification power x lens diameter (light-gathering power)) binoculars and 16x60 telescopes are suitable. The location of the observed individuals/groups is determined in advance with binoculars, and observation details such as group size, composition, and behavior at the detection point are more easily obtained with the help of the telescope. Devices such as GPS or GPS-enabled tablets and phones make it possible to collect location data from the field by their point recording and track recording features. The compass is necessary to measure the north angle of the observed groups and for walking straight on the line.

2.1.1.1. Binoculars

Figure 5 Binoculars

Technical Specifications:

- Magnification (x): 10
- Lens diameter (mm): 50
- Angular field of view (Real / degree): 6.5
- Angular field of view (Visible / degree): 59.2
- Field of view at 1000 m (m): 114
- Exit pupil (mm): 5
- Relative brightness: 25
- Eye relief (mm): 11.8
- Close focus distance (m): 7.00
- Dioptric correction: ± 5
- Light transmittance: 85% minimum
- Length (mm): 179
- Width (mm): 197
- Depth (mm): 68
- Weight (g): 900
- Interpupillary distance adjustment (mm): 56-72
- Prism system: Porro

2.1.1.2. Telescope and Tripod

Figure 6 Telescope

Telescope Technical Specifications:

- Magnification (x): 16-48
- Angular field of view (Real / degree): 2,3 (at 16x)
- Angular field of view (Visible / degree): 35.6 (at 16x)
- Field of view at 1000 m (m): 40 (at 16x)
- Exit pupil diameter (mm): 3.8 (at 16x)
- Relative brightness: 14.4 (at 16x)
- Eye relief (mm): 19.0 (at 16x)
- Lens diameter (mm): 60
- Dioptric correction: ± 5
- Light transmission: 85% minimum
- Length (mm): 313
- Width (mm): 74
- Weight (g): 620

Tripod Technical Specifications:

- Minimum/maximum height: 60/170 cm
- Closed length: Maximum 70 cm
- Head type: It should be compatible with the telescope to be used together. It should have a single button locking mechanism for practical use.
- Body material features: Light and durable body material suitable for land use should be preferred. Aluminum alloy or carbon fiber material may be preferred.
- Heading features: It should be able to lean back and forth and rotate 360 degrees around its own axis.
- Carrying capacity: Minimum 1 kg
- Weight: Maximum 2 kg
- Foot features: It must have a non-slip foot structure suitable for land use.
- Balancing: Should be bubble level for fast and accurate balancing.
- Additional features: It should have a gravity hook to add weight and increase tripod stability in windy weather. It should have a shoulder pad and a carrying strap for comfortable use.

2.1.1.3. GPS

Figure 7 GPS

GPS Technical Specifications:

- Physical dimensions: 2.1 "x 4.0" x 1.3 "(5.4 x 10.3 x 3.3 cm)
- Display size: 1.4 "x 1.7" (3.5 x 4.4 cm); 2.2 "diag (5.6 cm)
- Screen resolution: 240 x 320 pixels
- Display Type: 2.2 '' transreflective, 65K color TFT
- Weight: 5 oz (141.7 g) with battery
- Battery: 2 AA batteries
- Battery life: 25 hours
- Water resistance: IPX7
- Memory/History: 8 GB, SD card support according to usage purpose
- High sensitivity receiver: Yes
- GPS accuracy: ± 5 m
- Interface: USB
- Preloaded maps: yes (European TopoActive; routable)
- Ability to add maps: Yes
- Base map: yes
- Storage and Power Capacity: microSD ™ card (not included)
- Waypoints / favorites / locations: 2000
- Routes: 200
- Track record: 10,000 points, 200 recorded paths
- Area calculation: yes
- Automatic route: yes
- Geocaching-friendly: yes (electronic)
- Sun and moon information: Yes
- Image viewer: Yes

2.1.1.4. Compass

Figure 8 Compass

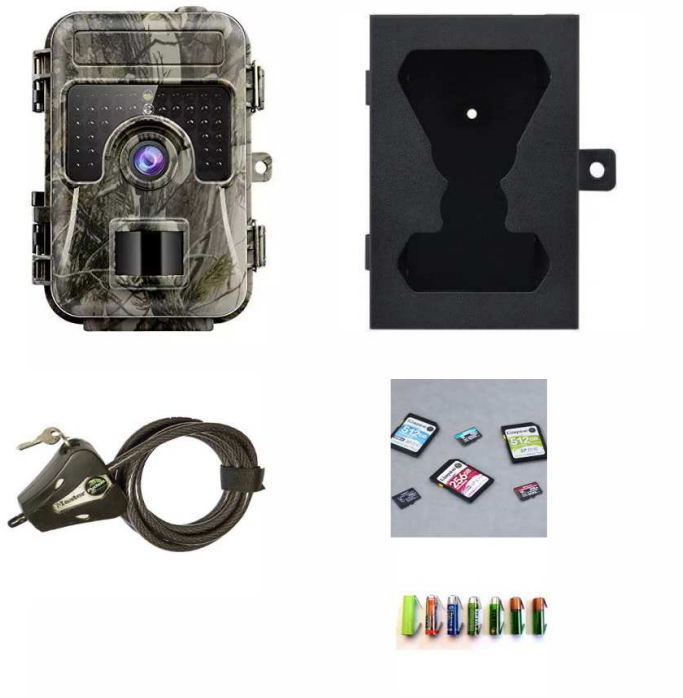
Compass Technical Specifications:

- 360 Degree Rotating Scale
- Ability to work in extreme weather conditions (-20, +50)
- Waterproof
- Shakeproof
- Adjustable Prism Lens
- Cm and Inch Scale
- Distance Estimation
- Latitude-Longitude

2.1.2. Camera trap and accessories

Required equipment for 1 camera trap station (Figure 9):

- 1 camera trap
- 1 protective cover
- 1 lock cable
- 1 memory card (recommended not lower than 16 GB)
- Batteries as many as the battery capacity of the device (Rechargeable are recommended)



Camera Trap Technical Specifications:

- Higher than 6 MP high-quality full-color resolution,
- Day/Night automatic sensor and adjustable PIR or Automatic PIR sensor,
- 1.6 seconds or faster trigger speed,
- Programmable trigger range,
- Multiple image taking feature,
- 640x480p or higher video recording,
- Adjustable video length feature,
- Supporting 32GB or higher storage specification memory cards

Figure 9 Samples for Camera trap and accessories

Important Notes for Camera Traps:

- Since the batteries and memory card of the camera traps installed in the field are renewed, it is recommended that the number of batteries and memory cards is twice as much as the number of camera traps.
- It is recommended that camera traps, suitable cover and lock cables are obtained from the same supplier to ensure compatibility with each other.
- Since the brands and models sold in the market have sufficient technical details for the monitoring study, no details are given.
- Preferably, camera traps with GSM transmitter can be used, the photographs taken can be taken without going to the field, but the camera trap station being outside the GSM coverage area and the continuity of the transferred data may cause storage and various technical problems. It is not recommended within the scope of this study as it also increases the cost of equipment.

2.1.3. Equipment for Tracking with GPS Collar

Related accessories (Figure 10, 11):

- GPS collar
- Antenna
- Receiver
- Headphones

Figure 10 GPS collar

Figure 11 Sample receiver, antenna and headset

GPS Collar Technical Specifications:

- It must have a GSM transmitter feature. It enables data to be obtained without going to the field.
- The data should also be able to be downloaded in the field. It prevents data loss in case of technical or GSM network problems.
- The device must be capable of recording and storing data (store-on-board feature). If the collared individual cannot send data when it is out of the GSM coverage area or due to technical problems, and there are problems with remote downloading during fieldwork due to technical problems, data can be downloaded from the dropped collar itself at the end of the set monitoring period.
- It should have an automatic drop-off mechanism (drop-off feature) at the end of the specified monitoring period, which allows the battery to be renewed and the collar can be used again.
- It should be trackable with VHF signals of certain frequencies at determined time intervals in the field.
- There must be a specific signal in case of death. When the monitored individual is inactive for a certain period, the frequency of emitting data should increase and give a death signal different from the VHF band.
- The frequency of receiving GPS and VHF data should be adjustable. Thus, battery life and data acquisition frequency can be adjusted, and the most efficient data collection program can be set.
- It should have activity and temperature sensors to allow the monitoring of the behavior of the animals.
- The weight of the collar should not exceed 5% of the weight of the individual to be monitored. Considering the average body weight of adult gazelles (females 20 - 43 kg, males: 18 - 33 kg), it is recommended that the collar weight not exceed 1 kg. The average body weight of lynxes is between 13 - 21 kg in females and between 18 - 38 kg in males. In this case, it is recommended that the collar weight of the lynx should not exceed 650 g. The bodyweight of wolves is between 18-55 kg in females and 20-80 kg in males. In this case, it is recommended that the collar weight of the wolves should not exceed 900 g.

2.2. Bird Species Monitoring

2.2.1. Equipment for line transect counting and point counting methods

The equipment required for the study is binoculars (Figure 5), telescopes (Figure 6), and GPS (Figure 7).

2.2.2. GPS transmitter for Great Bustard monitoring

GPS transmitter Technical Specifications:

- Technical specifications:
- Dimensions: 70x25x31 cm (Length x width x height)
- Number of ports: 4
- Weight: 60-70 g
- Battery: 6400 mAh
- Recording capacity: 15.000 points

Figure 12 GPS transmitter (https://e-obs.de/products.html)

2.3. Reptile Species Monitoring

2.3.1. Equipment for the line transect count method

The equipment required for the study are binoculars (Figure 5) and GPS (Figure 7).

2.3.2. Equipment and materials for RFID tracking

Individuals captured in the RFID marking technique are injected subcutaneously with RFID microchips and tracked with a reader in field studies (Figures 13 and 14).

Figure 13 Image of RFID microchips

RFID Microchip Technical Specifications:

- Body material: Bio glass
- Protocol support: ISO11784/5 FDX-B
- Frequency: 134.2 KHZ/125 KHZ
- Chip type: EM4305
- Memory: 512 bits
- Dimensions: 2.12x12mm/1.25*7mm
- Operating temperature: -25 °C-+ 85 °C
- Storage temperature: -40 °C-+ 90 °C
- Peak temperature: + 120 °C (100 hours), + 140 °C (10 hours)
- Chemical and environmental resistances: IP68 (1 m, 24 h), saltwater, alcohol, HCL, fuel, ammonia.
- Mechanical resistances: vibration IEC 68.2.6, shock IEC 68.2.29
- Memory retention: > 20 years
- Application: Dog, cat, horse, fish, mouse, etc. many small animals.
- International certification: International commission for animal registration (ICAR)

Figure 14 RFID microchip reader

In addition to these, snake catching tongs should be used to catch snake species. (Figure 15).

Figure 15 Snake tongs

In addition, the use of camera traps is recommended for monitoring studies on monitors (Figure 9).

2.4. Invertebrate Species Monitoring

2.4.1. Equipment for Line Transect Counting

Required equipment for line transect counting is binoculars (Figure 5) and GPS (Figure 7). Compact handheld binoculars with close focus are suitable for 8x40 butterfly watching.

2.5. Plant Species Monitoring

2.5.1. Equipment for Field Observation

GPS is the only equipment required in plant field work (Figure 7).

3. LIVESTOCK AND GRAZING MONITORING SUB-PROGRAM

The technical specifications of the equipment and materials required for the implementation of the methods determined for the monitoring of the indicators within the scope of the Livestock and Grazing Monitoring Sub-Program are given below.

3.1. Short-Term Monitoring for Grassland Efficiency

- An aluminum pole, 2.5 meters long, hollow (light), with a minimum wall thickness of 1.5 mm, one end of which has been cut diagonally at a wide angle to form a stake. Number: (Number of observation sections times 2) + 10 spares
- Triangular flags, if possible, in a color that creates a high contrast to the predominant colors of the field (green, yellow, brown) at different seasons, which will be easy to see from afar. Number: (Number of observation sections times 2) + 10 spares
- Plastic or wooden mallet
- GPS (with a maximum deviation of 5 meters if possible) and/or a tablet with built-in GPS and equipped with a GSM line with these features

3.2. Long-Term Monitoring for Grassland Efficiency

3.2.1. Change in Soil Water Absorption and Holding Capacity

- Aluminum or iron pipe with an inner diameter of 15 cm, a wall thickness of at least 5 mm, and a length of 25 cm, which is sharpened at a slight angle on one end to facilitate insertion into the ground,
- Square, waterproof tarpaulin or plastic sheet with a side of 30 cm,
- 500 ml water bottle and water,
- Stopwatch,
- Medium weight hammer,
- A wooden board that is 10 mm thick, 15 cm wide, 30 cm long.

Figure 14 A sample of metal pipes and other equipment needed for monitoring water absorption and water holding indicator.

3.2.2. Change in Soil Carbon/Amount of Organic Matter

- Handheld auger for soil sampling (if the depths are not marked on the auger, 15 and 30 cm depths are marked using a meter and felt-tip pen) (Figure 1)
- Hand shovel
- Plenty of zip-top nylon bags (15 cm deep and 20 cm wide)
- Felt-tip pen
- Two medium-sized plastic buckets

4. OTHER EQUIPMENT

For all monitoring activities, a compact digital camera is recommended for taking specific images of each area during the monitoring process, a GSM-enabled tablet for data entry and daily data evaluation, and a drone to shoot aerial views from all areas.

4.1. Digital Camera

Camera Technical Specifications:

- Camera Type: Compact
- Image Processor: Digic 8
- Sensor Type: BSI CMOS
- Effective Pixels: 20 MP
- Maximum Resolution: 5184x3888
- Sensor Format: 1/2.3 Inches
- Sensor Size (Width): 6.16 mm
- Sensor Size (Length): 4.62 mm
- Lowest ISO: 100
- Highest ISO: 3200
- Lens: Fixed Lens
- Lens Type: Zoom (Variable Focus)
- Focal Distance (Wide): 21 mm
- Focal Distance (Narrow): 1365 mm
- Aperture (Wide): f/3.4
- Aperture (Narrow): f/6.5
- Auto Focus (AF): Yes
- Optical Zoom: Yes (64x)
- Battery Type: Li-Ion (Lithium-Ion)
- Battery Capacity: 875 mAh
- Battery Life (Photo): 325 pcs
- Battery Life (Video): 85 min
- Exposure Compensation (AEB): ± 3EV
- Image Stabilizer: Yes
- Shutter (Low)1/2000 sec
- Shutter (High) 15 sec
- Digital Zoom: Yes (4x)
- AF Point: 9 pcs
- Continuous Shooting: 10 fps
- Built-in Flash: Yes
- Maximum Video Resolution: 3840x2160

Camera kit should also include:

- Lithium-ion battery pack
- Charger for battery pack
- Neck strap for machine
- Lens cover
- Memory card (512 GB)

4.2. Tablet (with Built-in GPS)

Tablet Technical Specifications:

- Screen Resolution: 2160x1620 px
- Screen Size: 10.2 inches
- Internal Memory: 128 GB
- Operating System Version: iPadOS 14
- Number of Processor Cores: 6 Cores
- Wi-Fi, GPS, Bluetooth, front camera, rear camera and fingerprint reader.

4.3. Drone

DroneTechnical Specifications:

Camera (Two different camera features):

1. Thermal camera
- Resolution: 640x512
- Frame rate: 30 Hz
- Zoom: 16x
- Temperature measurement variability: 2°C

2. Visual camera
- MP: 48 MP
- CMOS Sensor: 1/2”
- Zoom: 32x
- Lossless zoom: 4x

Battery:
- Battery type: LiPo
- Battery capacity: 3850 mAh
- Charging time: 90 minutes

Sensor:
- Versatile sensor system
- Scanning up to 20 meters in difficult basin conditions and up to 40 meters in normal conditions

Weight:
- Without accessories: between 900-1000 g
- With accessories: between 1050-1200 g

Flight time:
- In a windless area at 40 kilometers per hour: 31 minutes
- With RTK module: 28 minutes
- Beacon on: 29 minutes
- Beacon off: 30 minutes
- Flash on: 24 minutes
- Flash off: 28 minutes
- Speaker on: 27 minutes
- Speaker off: 28 minutes

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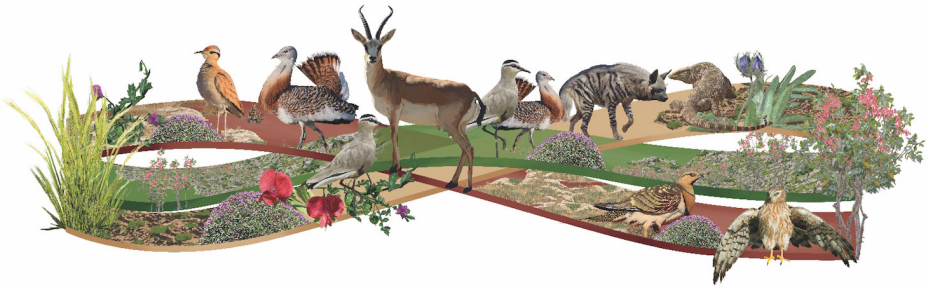

For Detailed Information:

The Food and Agriculture Organization of the United Nations
www.fao.org/turkey E-mail: fao-tr@fao.org

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