REPUBLIC OF TURKEY
MINISTRY OF FORESTRY AND WATER AFFAIRS
General Directorate of Combating Desertification and Erosion

SOIL INFORMATION SYSTEM (SIS)

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Forest and Water is Life.

GENERAL DIRECTORATE OF COMBATING DESERTIFICATION AND EROSION
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PREFACE

Soil is a natural resource that is one of the basic indicators of the production power and wealth of a country. The systematic recording of relevant data for the conservation, sustainability and effective management of natural resources such as land must be subject to data storage, verification, evaluation and information conversion processes under the records.

General Directorate of Combating Desertification and Erosion performs projects such as soil conservation, afforestation, erosion control, basin planning, etc. to reduce soil losses and damages in desertification, erosion, flood, landslide, avalanche issues at national scale. The latest software and systems such as geographical information systems (GIS) are used in the projects and the technological developments are closely monitored.

Today, in many projects, 1/100000 scale "Major Soil Groups Map" which is produced by abrogated General Directorate of SoilWater using 1/25000 scale topographic maps is used as a base in 1960's. Major Soil Groups Map is mostly prepared for agricultural areas and has undergone several revisions over time but it is not enough for many planning and application especially in forest and pasture areas.

In order to establish a common "Soil Database" which can meet the needs of all related sectors, especially forestry and agriculture, a workshop was organized by General Directorate of Combating Desertification and Erosion in which the General Directorates of the Ministry of Forestry and Water Affairs and the Ministry of Food, Agriculture and Livestock, related institutes, related faculties of universities and private sector participated in 2012. Meetings were held at different dates on the subject and common soil data structure was determined with the contributions of the participants.

In the light of the determined common soil data structure, the Soil Information System was established in the Department of Information Technologies, Ministry of Forestry and Water Affairs in 2013, under the coordination of the General Directorate of Combating Desertification and Erosion. Soil Information System consists of the following projects and activities;

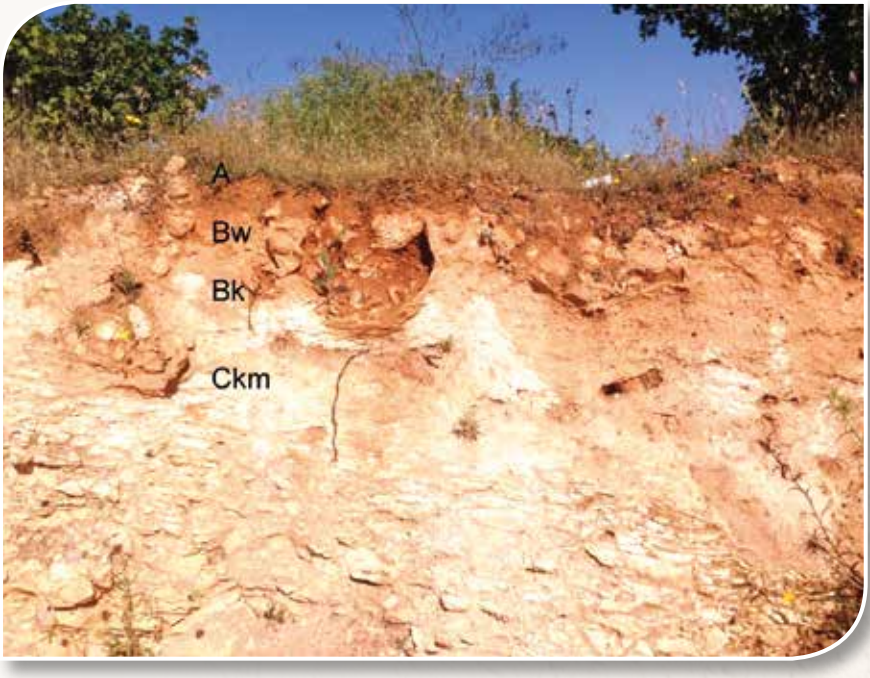
- **Establishment of the Soil Database**
- **Digitization of Soil Maps and Soil Survey Charts**
- **Data Collection System in the Field with Mobile Devices (ARAZİmobil)**
- **Laboratory Registration System**
- **Soil Portal**

The Soil Information System is being updated and developed day by day considering the needs of the sector and it is being designed to be integrated into the related systems and databases such as "Forest Information Systems (ORBİS)" conducted by General Directorate of Forestry and "National Soil Information System" executed by General Directorate of Agricultural Research and Policy.

M. Mustafa GÖZÜKARA
General Director of
Combating Desertification and Erosion

1 INTRODUCTION

One of the most important sources used in land planning studies is soil maps and reports. Soil maps and reports are used in agriculture, forestry and pasture planning, in modeling of environmental impacts, in different engineering branches and in the planning and conservation of integrated natural resources. One of the most important benefits of national plans for the development of land resources is the removal of inventories of resources. Before analyzing local, regional and national plans, it is necessary to analyze the land resources qualitatively and quantitatively, to determine the potentials of the resources available, and to create databases and maps in parallel with the developing technologies.



2 PROJECT OBJECTIVES

"Watershed Monitoring and Evaluation System" was developed by the General Directorate of Combating Desertification and Erosion with the aim of monitoring the efficient use of natural resources, ensuring sustainable watershed management, determined data theme geographically based in coordination with the institutions operating in the basin in Turkey. The Watershed Monitoring and Evaluation System consists of 16 different data themes, and the soil data is the main component of this data theme.

Today, the only soil data sources which is currently used and covering the whole of Turkey is ''Major Soil Groups Map'' which was established by the abrogated General Directorate of SoilWater based on the 1960's. Considering the opportunities and needs of the time, Major Soil Groups Map is not a sufficient candidate for many current projects despite the many updates and revisions over the years. Major Soil Groups Map is not particularly suited to applications in forest and pasture areas, as it is produced taking into account the needs of more farming areas.

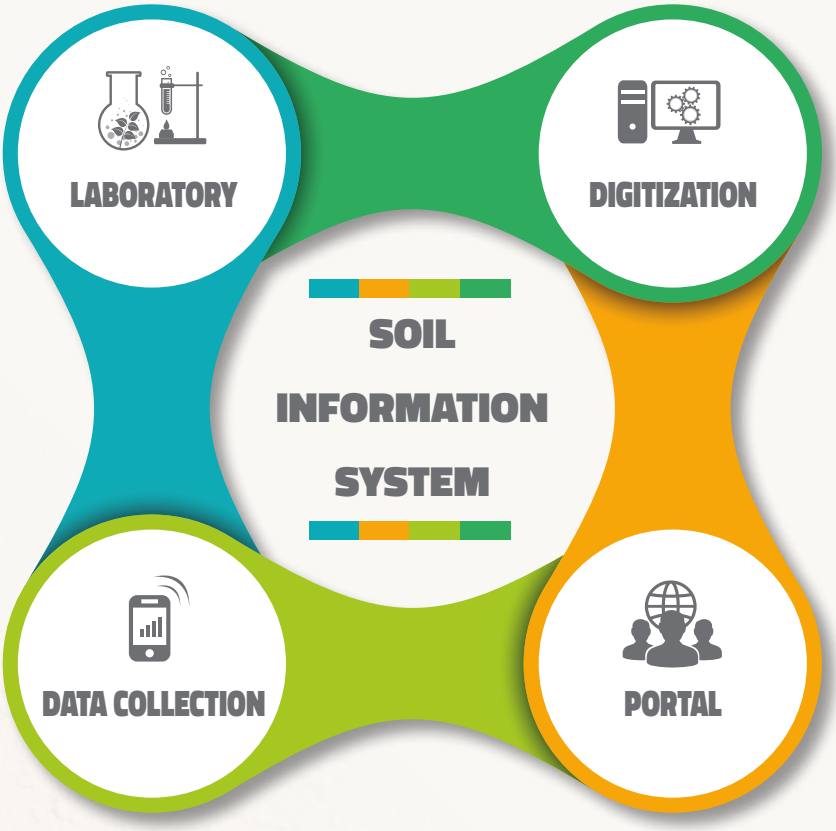
In this context; ''Soil Information System'' has been developed by the General Directorate of Combating Desertification and Erosion, which works on the reduction of soil losses and damages about desertification, erosion, flood, landslide etc., with the aim of providing basis for the related data themes of Watershed Monitoring and Evaluation System, avoiding the duplication of work, supporting the goal of producing the National Soil Map, collecting soil data in our country on a single system in accordance with the current software technologies and forming a base for many studies, especially in the agriculture and forestry sectors.

3 PROJECT PREPARATION / PROCESS

The General Directorate of Combating Desertification and Erosion organized a workshop entitled "Soil Survey and Mapping" in August 2012 with the aim of establishing a common soil database which can meet the needs of forestry, pasture and agriculture sector. The Ministry of Forestry and Water Affairs (MFWA), the relevant General Directorates of the Ministry of Food, Agriculture and Livestock, various institutes and universities participated in the workshop and various commissions were set up to establish the soil database. Following the workshop, widely participated meetings were organized on different dates and data types of soil database were determined. Based on these common ground data types, the "Soil Database" has been established under the coordination of the General Directorate of Combating Desertification and Erosion in the Department of Information Technologies, MFWA.

The Soil Database, which is the base of the Soil Information System Project, was taken into service by taking into account the sector needs in the coordination of the relevant units of the Ministry of Food, Agriculture and Livestock and the Ministry of Forestry and Water Affairs.

4 SOIL INFORMATION SYSTEM



The Soil Information System consists of the following subsystems and projects:

1. Digitization of Soil Maps and Soil Survey Charts
2. Data Collection System in the Field with Mobile Devices (ARAZİmobil)
3. Laboratory Registration System
4. Soil Portal

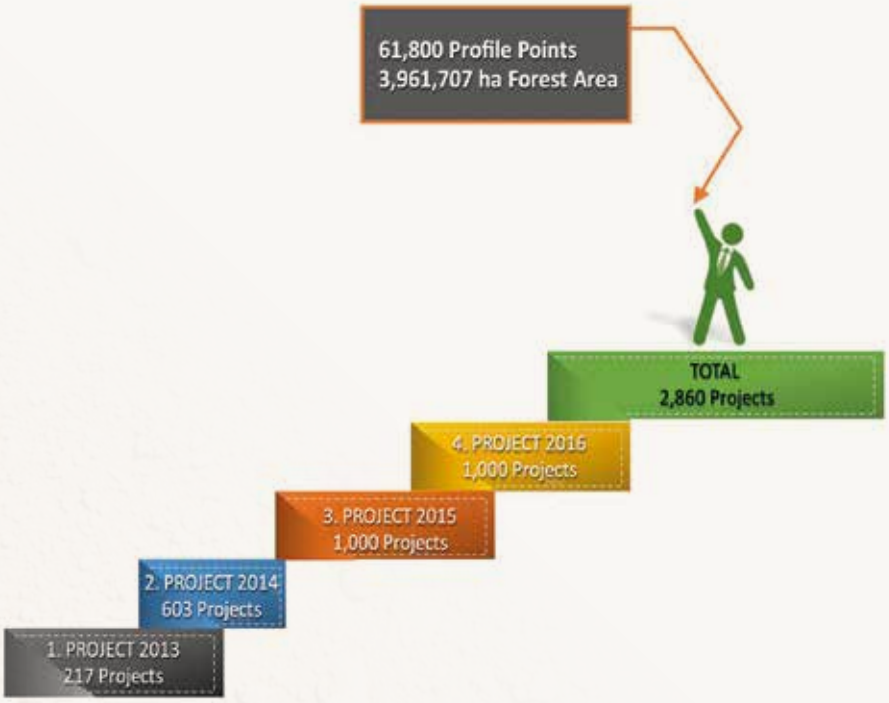
5 DIGITIZATION OF SOIL MAPS AND SOIL SURVEY CHARTS

The General Directorate of Combating Desertification and Erosion has developed and commissioned the ''Soil Information System'' to respond to the needs of all sectors, especially forestry and agriculture. For the purpose of transferring the soil data to the ''Soil Information System'', the soil maps stored in files in the General Directorate of Forestry archives are digitized and transferred to the soil database.

Within the scope of the project; soil maps, soil survey charts and soil analysis reports of projects such as erosion control, afforestation and pasture improvement in the archives of the General Directorate of Forestry are digitized and adapted to GIS.

The first cycle of this project started in the year 2013 and as the end of 2016, 2,860 copies of soil maps and soil survey charts of the projects have been digitized and transferred to the soil database. Digitized projects have transferred about 4,000,000 hectares of forest area and 61,800 profile points to digital media.

With the project of digitization of soil maps and soil survey charts, soil maps, survey charts and analysis reports stored in various media in the archives are transferred to the soil database and digital archive quality is gained and users can access this data more easily and regularly. In addition, scanned documents can be used to access documents such as signatures, acknowledgements and information notes in the original documentary.



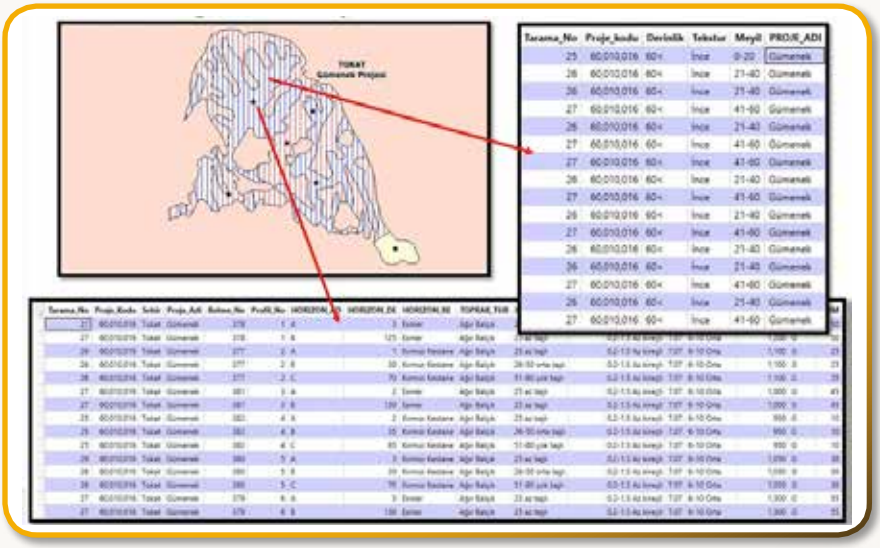


Figure 1: Feature tables obtained after digitization

Figure 2: Filing structure created after digitization

6 ARAZİmobil: DATA COLLECTION SYSTEM IN THE FIELD WITH MOBILE DEVICES

Field teams are set up for projects that are carried out in many areas, primarily forestry and agriculture, and information is gathered from the land. In general, the cost of field work is high and the working time is long. Sensitivity and correctness of the data collected in field studies vary according to the difficulty of the conditions and data standards are not provided. There is also a resource consumption for the standardization and regulation of the data to the same standard.

The General Directorate of Combating Desertification and Erosion has developed a mobile software that runs on Android, IOS (iPhone-iPad Operating System) and Windows operating system under the name of ''Land Data Collection System (ARAZİmobil)'' for data collection in the field. ARAZİmobil can work on all mobile devices, such as tablet computers and smartphones, which have integrated Android, IOS and Windows operating system, integrated GPS (Global Positioning System), internet connection available and digital cameras. With the most general definition, ARAZİmobil is the web-based mobile software that collects land data from mobile devices, and can simultaneously present staff figures, positions, reports and job descriptions.

Questions regarding the total number of data to be obtained in field work with ARAZİmobil can be instantly created, edited and deleted via internet. Administrative users can add or remove new questions during field work, which does not cause any glitches in the operation. The administrator can determine which fields are mandatory (such as minimum number of photographs to take, required field) or user constraints when determining the questions, and indirectly make the organization of field work. ARAZİmobil does not allow any changes on forms completed and sent to the central server via internet connection. Thus, changes are not allowed in the working position since they have no access to the coordinate information and they are prevented from being changed later when they are working on this screen. Since the data collected with ARAZİmobil are in the same standard, there is no need for data editing and the data is transferred to the database quickly. ARAZİmobil has been produced integrated with the soil database under the MFWA and it is aimed to prevent resource consumption in soil mapping studies. Although ARAZİmobil is designed to provide data flow to the soil database in the first place, it has a very flexible structure that allows to identify any survey questions. The main functions of this software are to enable data collection of a certain standard, quality and transparency, and the transfer of collected data to data bases through mobile devices in all "Forestry Activity" sites that already support field data collection process. Concerning the subject, integration process of ARAZİmobil to "Forest Information Systems (ORBİS)" is continuing; integration with the related systems of the Ministry of Food, Agriculture and Livestock is also planned.

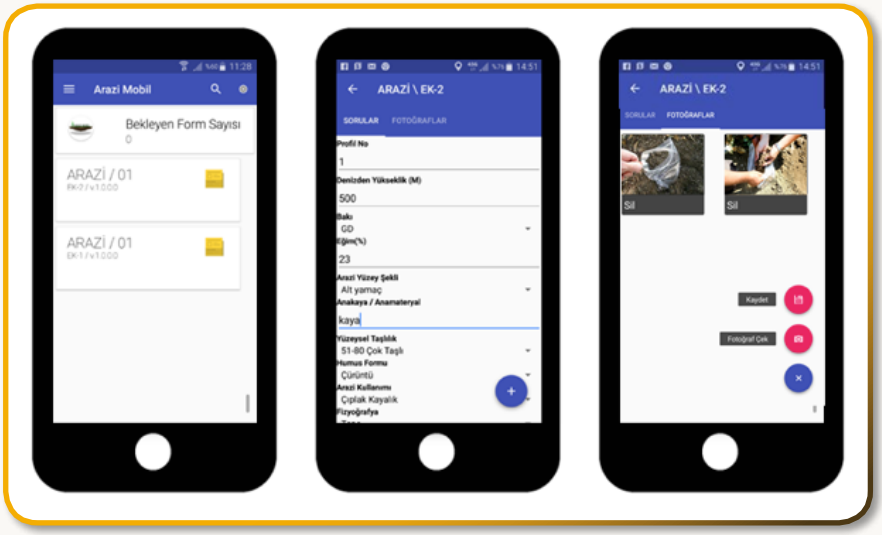


Figure 3: ARAZİmobil mobile device interfaces

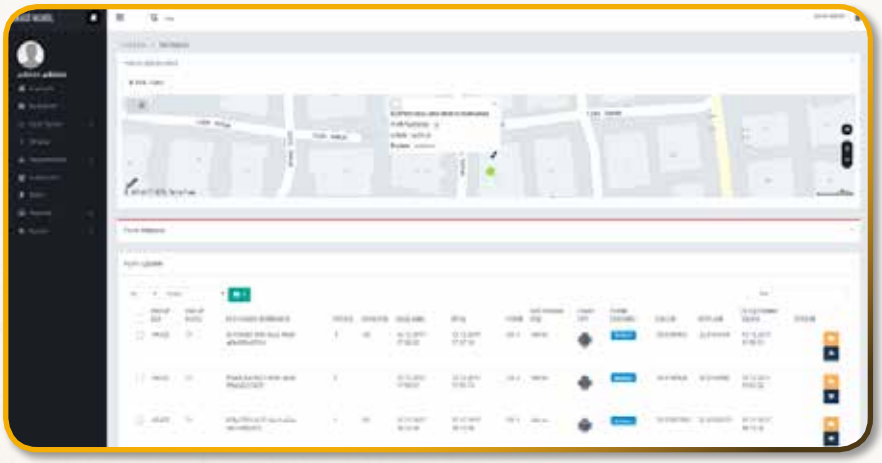


Figure 4: ARAZİmobil web interface

7 LABORATORY REGISTRATION SYSTEM

Land transactions in many soil laboratories operating in Turkey are continuing with independent software or paper file, the inquiry and reporting processes related to the analysis results are slow. In this context, it is necessary to design a system that enables the information of the soil samples coming to the soil laboratories and the results of the analysis to be inputted by the institutional personnel quickly, accurately and in a standard way.

In 2015, the General Directorate of Combating Desertification and Erosion and the General Directorate of Forestry have developed a web-based laboratory registration system for Eskisehir Forest Soil and Ecology Research Institute with an interface that allows multiple users to log in, view and query within the authority of the user. Since the laboratory registration system is web-based, the hardware cost is kept to a minimum. The Laboratory Registration System has been developed integrated with the Soil Database and ARAZİmobil software, which was established in the MFWA. In this context, analysis results of samples collected from the field with ARAZİmobil software are automatically transferred to the soil database, and the project manager can monitor the analysis process of the soil samples through the web interface. With the Laboratory Registration System, transparency, reliability and speed are targeted in soil analysis processes. The system was first established in the Eskisehir Forest Soil and Ecology Research Institute in 2015 and by 2017 it has been extended to the other 5 laboratories operating in the General Directorate of Forestry which are ''Western Mediterranean Forestry'', ''Eastern Black Sea Forestry'', ''Aegean Forestry'', ''Southeastern Anatolia Forestry'' and ''Poplar and Rapidly Developing Forest Trees'' Research Institutes.

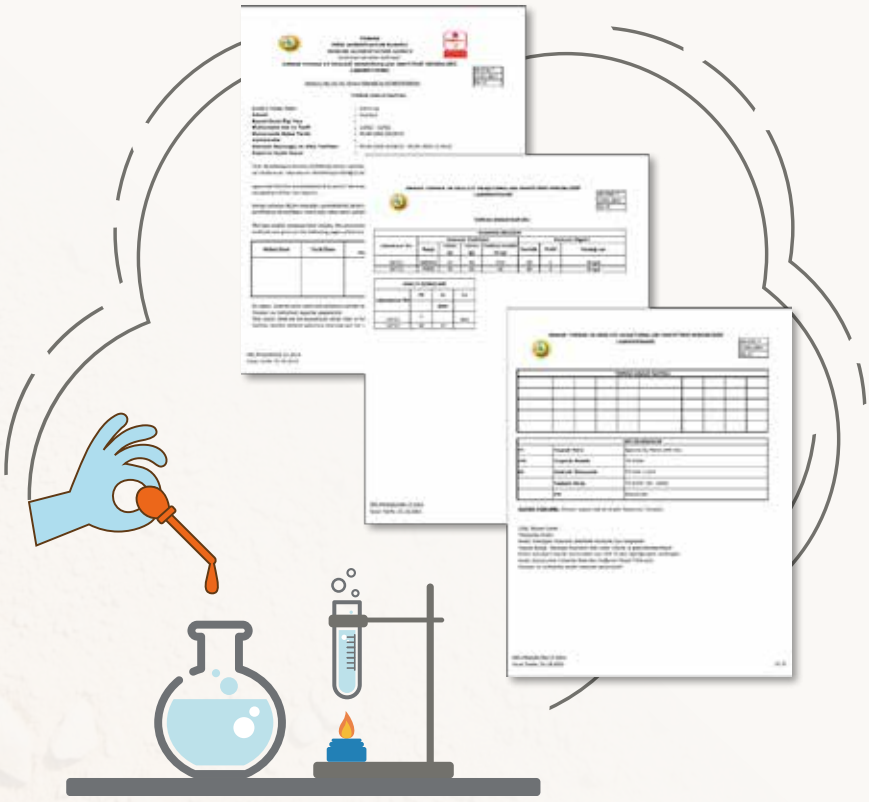


Figure 5: Sample analysis reports

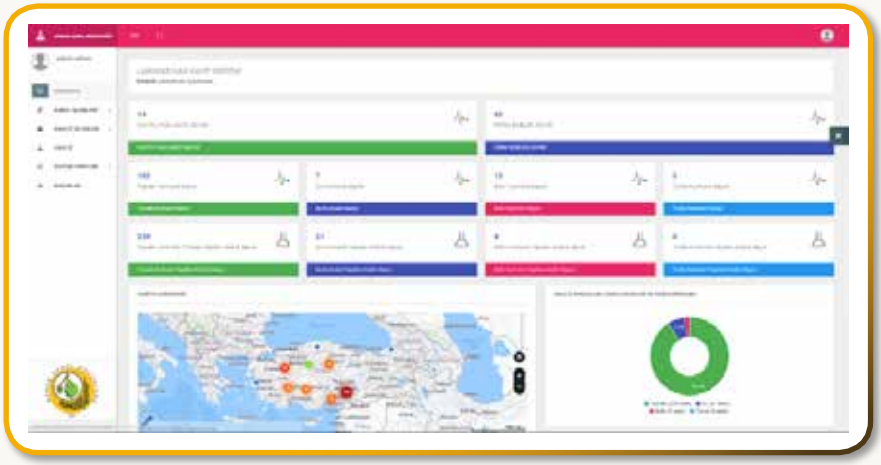


Figure 6: Laboratory registration system interface

PROCESS ANALYSIS

STEP 1

Customer

- Submits an application.
- Sends samples to the Institute with unique ID by hand or cargo.
- Pays for the analysis.

STAGE 2

Sample Acceptance

- Takes the application by hand or Electronic Document Management System.
- Calculates the price.
- Prepares sample entry and laboratory dispatch documents.

STAGE 3

Laboratory

- Makes the desired analysis.
- Performs calculations from analysis results.
- Sends the results of the calculations to the sample acceptance.

STAGE 4

Sample Acceptance

- Prepares reports for the analysis results.
- Send the samples to the archive.
- Follows the processes of returning or destroying the samples in the archive.

8 SOIL PORTAL

The soil database established by the General Directorate of Combating Desertification and Erosion is fed from many sources and soil data is stored in the determined standards. It is a web-based soil portal that opens the soil map and survey squares stored in the soil database to the users and allows them to do various interrogation and analysis. It is established by the Department of Information Technologies, MFWA under the coordination of the General Directorate of Combating Desertification and Erosion and is available at http://portal.cem.gov.tr/ToprakPortal. The Soil Portal provides the opportunity to load all the soil maps, etudes and analysis reports in the soil database, as well as the soil maps, study carvings and photographs in the appropriate form manually. Users can only download land maps, survey charts or raster files to their computers within the authority of the users and download all the data belonging to the selected projects to their computers at once. The Soil Portal is continuously improved according to the feedbacks and test results and the integration process with the "Forest Information Systems (ORBIS)" which is carried out by the General Directorate of Forestry continues. As a result of the integration, it is aimed that the mutual data flow between the systems will be provided and thus the more users can benefit from the data.

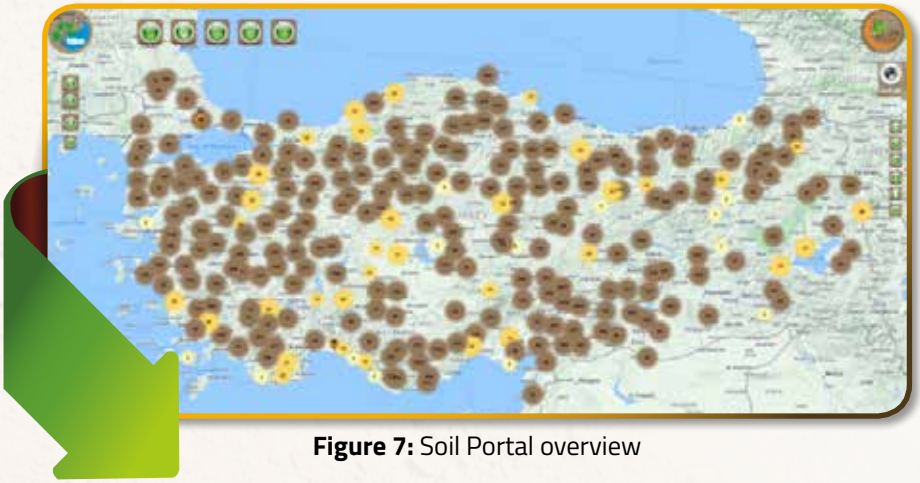


Figure 7: Soil Portal overview

Figure 8: Soil Portal general inquiry screen

Figure 9: Soil Portal project upload screen

Figure 10: Soil Portal map output

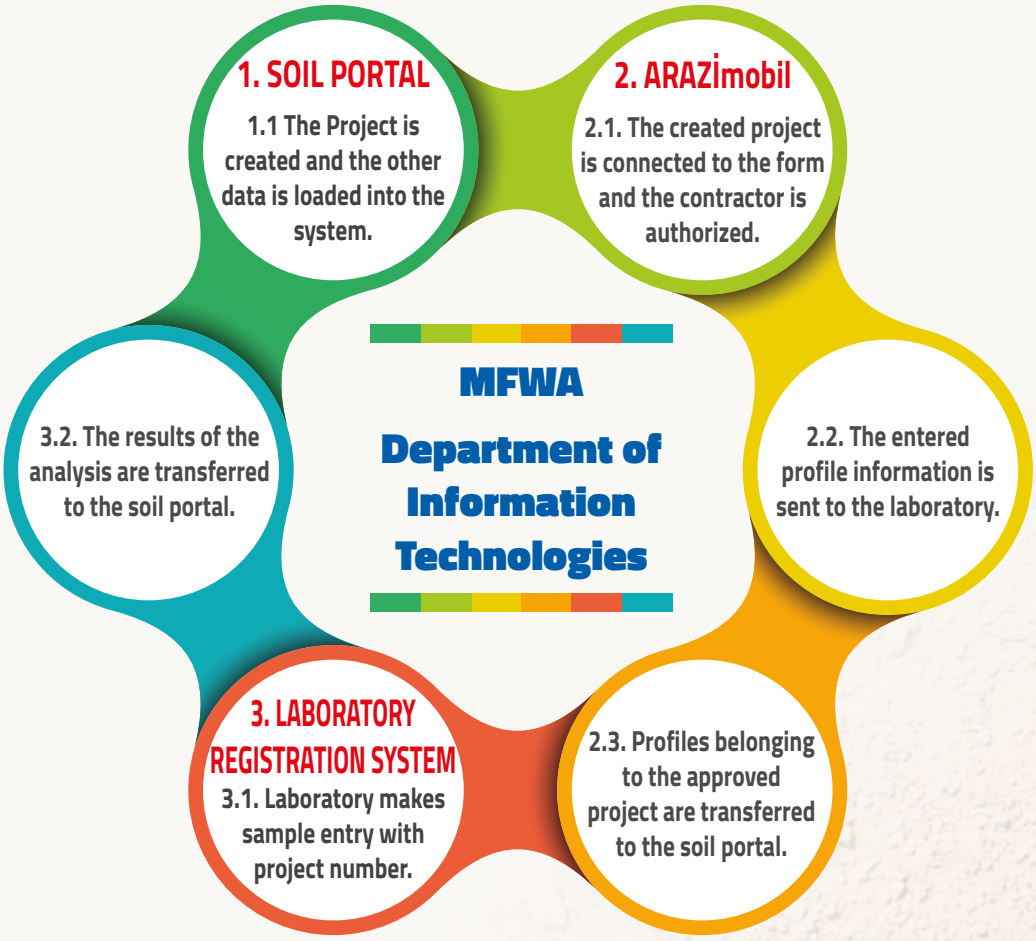


Figure 11: Soil Information System Integration Scheme

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