

# DEVELOPMENT OF A WEB-BASED GIS MANAGEMENT SYSTEM FOR AGRICULTURAL AUTHORITIES IN IRAQ

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## ABSTRACT

A Geographic Information System (GIS) is a technological tool for comprehending geography and making decisions in any discipline. In agriculture, GIS is playing an increasing role by helping farmers increase production, reduce costs, and manage land and water more efficiently. In collaboration with USAID, Texas A&M University implemented a program aimed at providing direct support to the Ministry of Agriculture in implementing GIS as a data management and planning tool. Training was provided to personnel in GIS methods and procedures, and assistance offered in planning and implementing the overall GIS program.

Much of GIS implementation has to do with the proper construction of databases with required information structured in such a way to be compatible with GIS products. Therefore, technical assistance was provided in the construction and reformatting of databases. In addition, technical expertise was also provided to implement web-based GIS and data tools for internal use or presentation with the public.

In this paper we describe the phases of the work done, and some examples of the results obtained. In the first phase an assessment was conducted to develop a detailed work plan on the degree of technical assistance and training required. This assessment included elements such as goals and scope of project, GIS and database capabilities of Iraqi cooperators, software/hardware and internet resources available to cooperators, existing data and data organization. In a second phase, Iraqi cooperators and USAID personnel were involved in the implementation of the GIS. In this phase training was also provided in basic and advanced GIS, database software and data management, and use and maintenance of the completed GIS system.

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## **INTRODUCTION**

Texas A&M University assisted the Ministry of Agriculture, Iraq National Program for the preparation of Agro-ecological Zoning System maps Department (AEZ), to initiate an online GIS program. Training was provided to personnel as needed in GIS methods and procedures, and assistance was offered in planning and implementing the overall GIS program. Technical expertise was also provided to implement web-based products. The activity was part of the USAID-Inma Agribusiness Program, which is a comprehensive program funded by the United States Agency for International Development (USAID) to support the development of agribusinesses and agricultural markets in Iraq. Inma means "growth" in Arabic.

The objectives of the project were:

- Conduct a preliminary analysis of the current organization, and identify the goals and scope of project
- Provide training to Iraqi cooperators on basic GIS skills needed for project
- Work with Iraqi cooperators and Inma personnel on implementation of the GIS

Focus of current analysis was on GIS and database capabilities of Iraqi cooperators; software, hardware and internet resources available to cooperators; existing data and GIS available; database system including software and data organization; Web-based products needed.

## **PRELIMINARY ANALYSIS**

Several meetings at the USAID-INMA Monsur compound in Baghdad, and one visit at the AEZ office premises were organized to conduct an analysis of the current organization and to plan the activity. People participating to one or more meetings included all AEZ personnel, the local ESRI software provider Atlas GIS and Surveying System Company (Atlas), and Inma personnel.

The AEZ Department was constituted in 2010, with a crew of 15 people with various background (ex. Agronomist, Computer Science and Statistical, data entry and analysis responsibilities). Personnel had GIS experience ranging 3-7 years. Available data include land-use and land-cover classification maps, crop suitability maps, and temperature maps. Part of the GIS database and maps were created from a previous project that the Ministry of Agriculture carried out in 2005. AEZ current focus is to contribute improving management of water issues in Iraq, to identify soil salinity using satellite imagery, and to create land crop maps based on desertification.

The software utilized is Excel and ArcGIS version 9.3. Personal computers are not connected to a local network which would allow file sharing between computers; each person works independently. Back up of files is carried out monthly from each computer using a mobile external unit. A training room exists with several machines connected to a server with installed software such as ArcGIS Server 9.3 Advance Enterprise and Microsoft SQL Server 2005 Enterprise. The server is not currently in use.

The identified main interests are:

- Move to use of a real database (ex. SQL)
- Connect all computers
- Develop GIS advanced skills and image processing
- Create a website to be used for internal or public use

### **TRAINING AND GIS IMPLEMENTATION**

Based on the collected information a 3-weeks training was conducted on advanced GIS. Thirteen people from the Ministry of Agriculture in Baghdad were trained: 7 people from the AEZ Department, and 6 people from the Engineering Department/Department of Planning and Follow-up. The training program was agreed with AEZ personnel, and classes were taught by Atlas at their training center. Training was given in 4 components: advanced GIS, ArcGIS server, multiuser geodatabase, and image processing. The ESRI Arcgis server was identified as a key component of the training, considering also that it was already installed in their server. Some of the benefits of using ESRI Arcgis server are to allow sharing resources, like maps, and to access the GIS functionalities embedded in them. Trainees completed successfully all training, practiced on how to use also their own data, and showed interest on all classes.

A website called “AEZ-GIS Online” (<http://aez-gisonline.org/>) was set up to host an Iraqi Online GIS Demonstration. The demonstration includes data provided by the AEZ personnel on existing completed projects. Data was provided as SHP files and XLS files on: 1) Land use/Land cover maps for the Middle Tigris area, 2) monthly average temperature in Iraq for several years and meteorological stations, including interpolations for the entire Iraq territory, 3) Soil Suitability map for wheat in North Iraq, and 4) Soil Suitability map for wheat in Baghdad. All published information is currently hosted in our server in Texas, but can be at any time moved to the AEZ server, once it is functioning correctly. The website is organized in three components:

- The home web page, which welcomes to the “Iraqi Online GIS Demonstration” and lists the available “Project demonstration” for the online GIS mapping (Fig. 1)
- The “Esri ArcGIS Map Server” demonstration, which uses an Esri ArcGIS Map Server to directly publish the maps' SHP files into an online presentable format (Fig. 2). A possible fee-based use of these ArcGIS Map Server services is as ArcGIS Online Map, which provides several display and interactive features, including a choice of base maps (Fig. 3).

- The “Google Maps with KML overlay” demonstration, which uses Google Map API to overlay a KML export of the SHP files onto the Google map (Fig. 4 and 5). KML is an XML-based format used in Google map, and SHP files are converted into KML export using a tool from the ArcToolBox in ArcMap. The final export is KMZ, which is a compressed KML and which works as well in Google map. SHP files exported as KML/KMZ can be in any projection, and will be re-projected automatically in the Latitude/Longitude projection using the WGS 84 Auto datum.

In order to move toward a database management system, we provided and installed in the AEZ server the Cisco Firewall and one upgrade to ArcGIS Server Enterprise Advanced Up to Four Cores, version 10. Other preliminary steps were identified in collaboration with the AEZ personnel, including getting an IP address and setup a network among computers. For security reasons visits to the AEZ office were limited and working using a remote desktop was not possible; therefore at the end of the project the setup of the network and the construction of the database were not completed.

## CONCLUSIONS

The program provided a preliminary analysis of database and GIS capabilities at the Iraqi AEZ Department, together with a list of main interests. While GIS skills resulted fairly advanced, computers and database setup are basic and need improvement. Interviewed personnel agreed on this analysis, and expressed interest in specific GIS advanced training (image processing) and in opening a public website.

Training was an important part of the program, and was agreed with the AEZ Department and a local Esri software provider. All personnel involved in GIS analysis completed a 3-weeks advanced training successfully. The implementation component of our program included exchanging completed project data, creating a new “AEZ-GIS Online” website, and hosting several online GIS demonstrations using the collected data. To give a wider view of online GIS capabilities, we demonstrated two options, directly publishing SHP files with Esri ArcGIS Map Server, and overlaying KML export of SHP files using Google Map API.

For security reasons it was organized only one visit to the AEZ office, and working using a remote desktop was not possible. Therefore some related activities were slowed down and in some cases not completed. Assisted by the local Esri software provider, we managed to provide and install a Cisco Firewall and an upgrade to ArcGIS Server Enterprise, but we could not setup the database and complete the ArcGIS Server registration. Online GIS services are therefore currently hosted in our server in Texas.

## Welcome to the Iraqi Online GIS Demonstration

We have demonstrated two different options available for the online GIS mapping. The first option is using ESRI ArcGIS Map Server to directly integrate the maps' SHP files into an online presentable format. The second option is using Google Map API to overlay a KML export of the SHP files onto the Google map.

[ESRI ArcGIS Map Server](#)  
[Google Maps with KML overlay](#)

Figure 1 - Home web page welcoming to the “Iraqi Online GIS Demonstration” and listing the available “Project demonstration” for the online GIS mapping (<http://aez-gisonline.org/>)

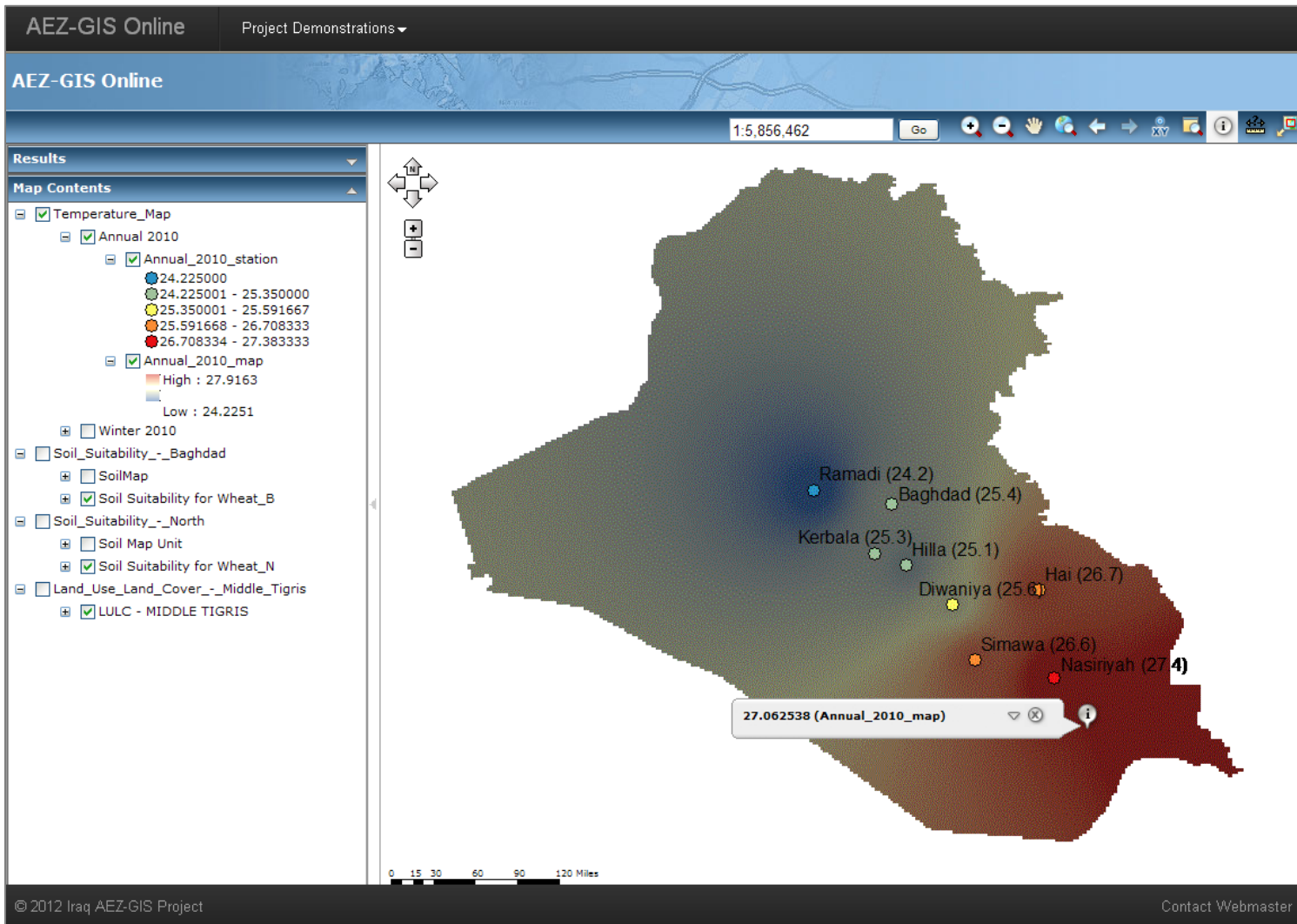


Figure 2 - Esri ArcGIS Map Server demonstration. Web application showing the 2010 annual temperature average map service

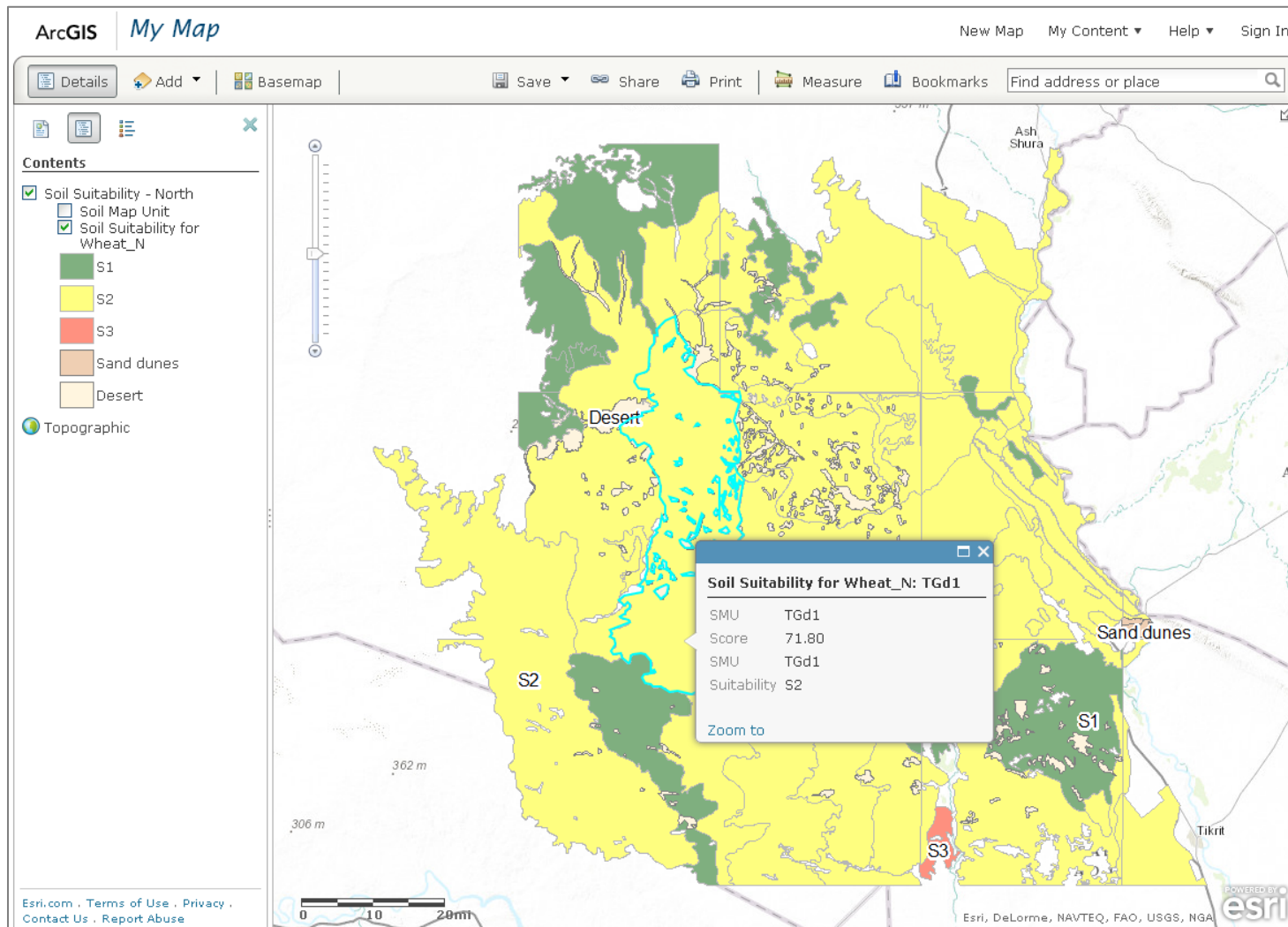


Figure 3 – Proposed use of the Esri ArcGIS Map Server services as ArcGIS Online Map

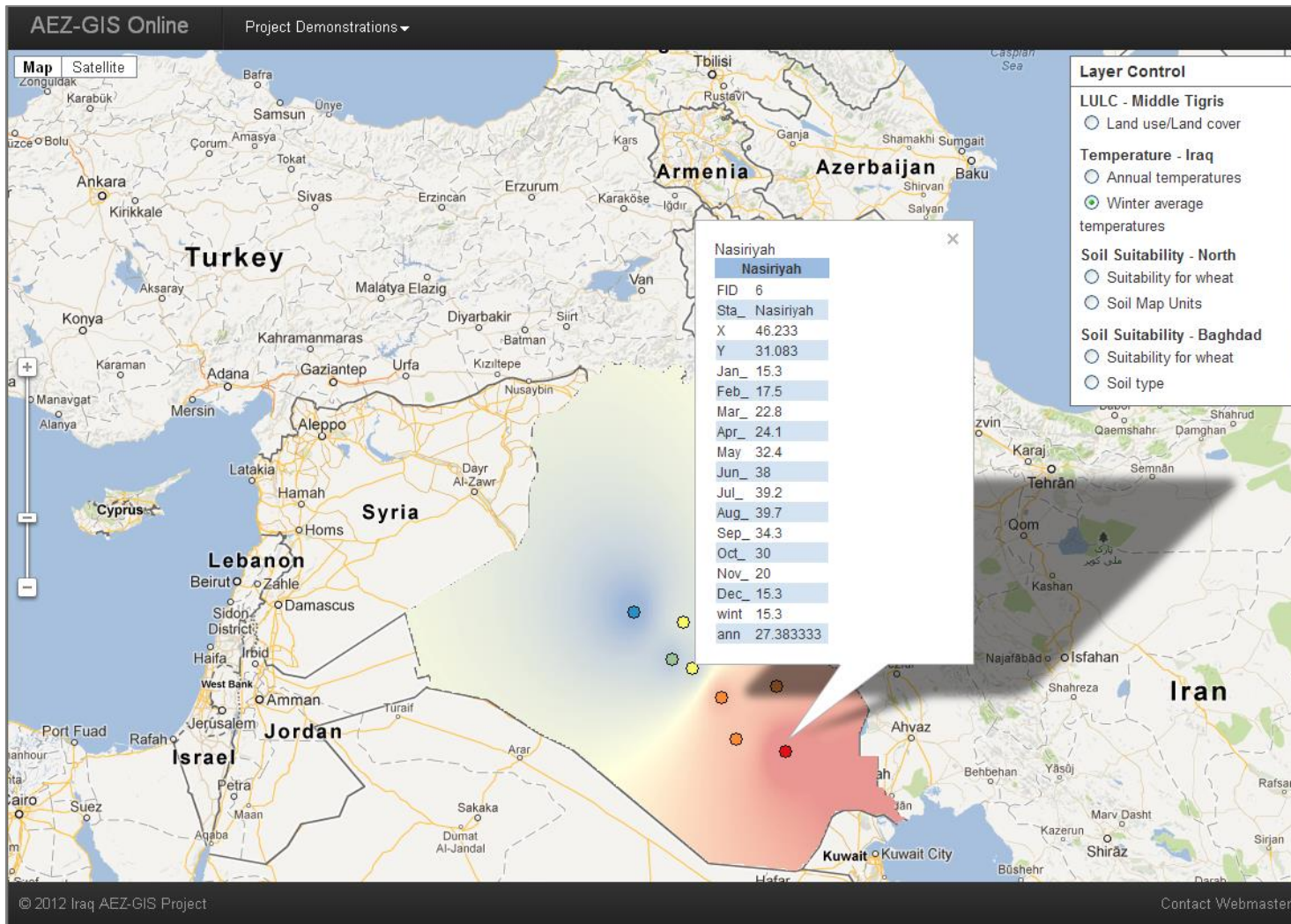


Figure 4 - Google Maps with KML overlay demonstration. Layer showing the 2010 Winter average temperature map



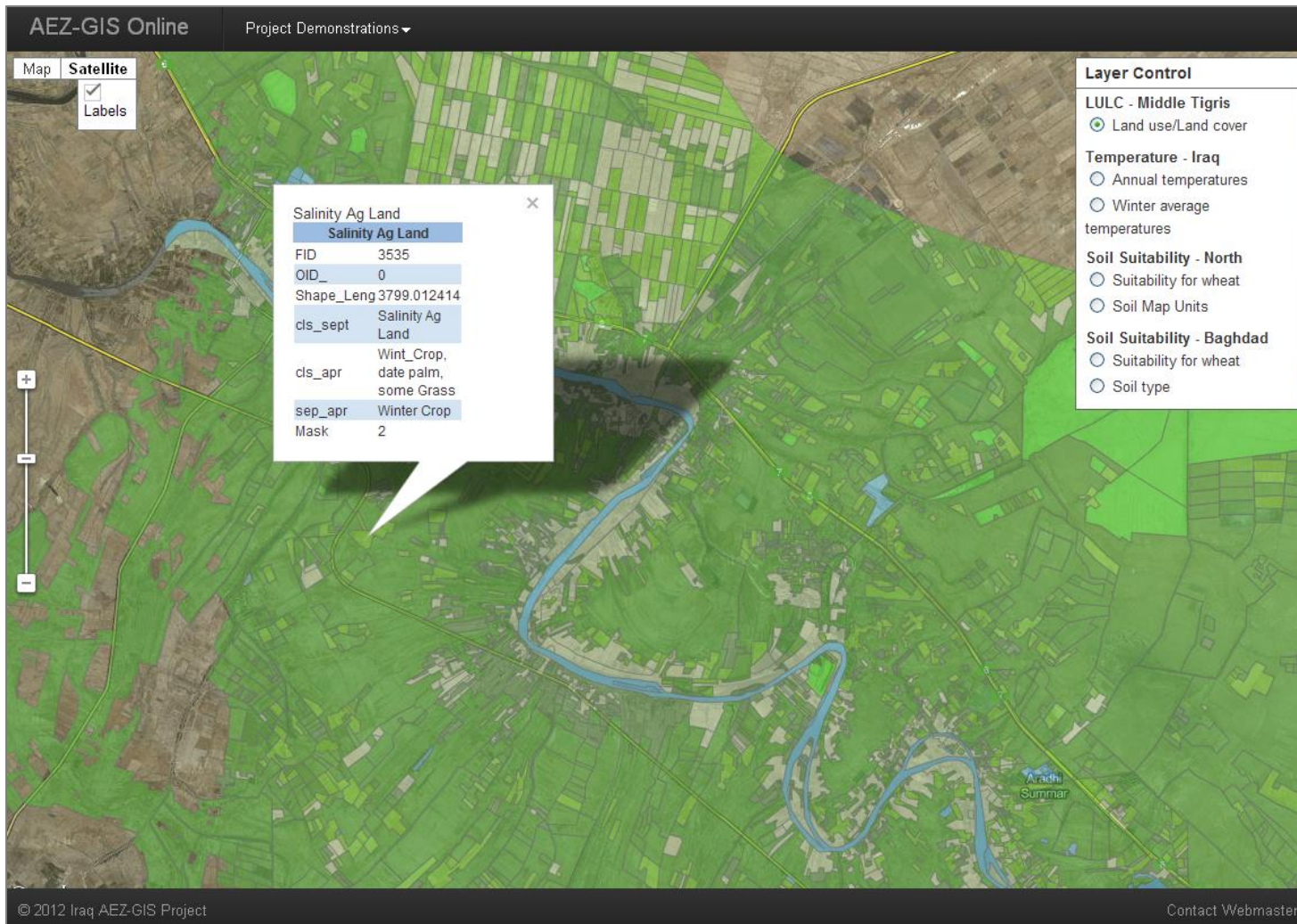


Figure 5 - Google Maps with KML overlay demonstration. Layer showing the Land Use/Land Cover map created within the Middle Tigris Project