THE USE OF GEOGRAPHIC INFORMATION SYSTEMS (GIS) IN FRUIT GROWING

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Abstract

It is called Geographic Information Systems (GIS) which manage and analyze large-scale geographic data intended for complicated social, economic, environmental problems on the world and for the solution of these problems.

GIS, one of the newly maturing concepts with technological developments, have been used in particular application areas in the world, but it has been used in our country only in recent years. The use of GIS is becoming more and more important in a strategic area concerning entire living beings whose lives depend on totally ecological conditions like agriculture. Hardware, map module, software including data base module and methods which provide solution for complicated planning and method problems, storing, modeling, processing, analyzing and presenting the spatial data connected to location are being developed with this system consisting of hardware, software and users on the purpose of acquiring, storing, processing, analyzing the data belonging to geographical beings and reacquiring, presenting new data from the produced information. GIS are very important in terms of determining crop pattern and parcel land and suitability of fruit growing and also important for fruit growing and agriculture in terms of providing characteristics of the land in advance such as climatic data, cultivated land, distance to water resources, suitability for irrigated farming, slope and soil depth of agricultural land, erosion risk depending on slope, drainage and soil salinity, risk of frost. Therefore, there may be more conscious farming and many parameters can be

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improved positively such as better products, more efficiency and resistance to harm and plant diseases by means of GIS.

Key Words: GIS (Geographic Information System), software, analysis, Agriculture

COĞRAFİ BİLGİ SİSTEMLERİNİN (CBS) MEYVE YETİŞTİRİCİLİĞİNDE KULLANIMI

Özet

Dünya üzerindeki karmaşık sosyal, ekonomik, çevresel sorunlar ve bunların çözümüne yönelik büyük hacimli coğrafi verilerin yönetimi ve analizi ile uğraşan sisteme Coğrafi Bilgi Sistemleri (CBS) denilmektedir. Teknolojik gelişmelerle birlikte yeni olgunlaşan kavramlardan biri olan CBS dünyada belirli uygulama alanları bulmuş ülkemizde ise ancak son yıllarda kullanılmaya başlamıştır. Tarım gibi tamamen ekolojik koşullara bağlı yaşamlarını sürdüren ve bütün canlıları ilgilendiren önemli bir alan da CBS'nin kullanımı daha da önemli hale gelmektedir. Coğrafi varlıklara ait bilgileri elde etme, depolama, işleme, analiz etme üretilen bilgilerden yeni bilgiler elde etme ve sunma amacıyla donanım, yazılım ve kullanıcılardan oluşan bu sistem ile, karmaşık planlama ve yöntem sorunlarının çözülebilmesi, konuma bağlı mekansal verilerin depolanması, modellenmesi, işlenmesi, analiz edilmesi ve sunulmasını sağlayan donanım, harita modülü ve veri tabanı modülü içeren yazılımlar ve yöntemler geliştirilmektedir. CBS' leri arazi parsel alanın ve ürün desenin ortaya çıkarılması ve meyve yetiştiriciliğine uygunluğu bakımından son derece önemlidir. Meyve yetiştiriciliğinde meyve bahçesi kurmadan önce iklimsel verileri, ekilebilir alanları, su kaynaklarına olan mesafeyi, sulu tarıma elverişliliği, toprağın; eğim, derinlik, erozyon, tuzluluk gibi karakteristik özelliklerini, don risklerinin önceden belirlenmesi bakımından CBS' leri meyve yetiştiriciliği ve tarım için çok büyük öneme sahiptir. Meyvecilikte CBS' lerinin sağladığı bu yararlardan dolayı daha bilinçli yetiştiricilik yapılabilir ve daha kaliteli ürün, daha fazla verim, hastalık ve zararlılara daha çok dayanım gibi birçok parametre olumlu yönde artırılabilir.

Anahtar Kelimeler: CBS (Coğrafi Bilgi Sistemi), meyve, yetişitiricilik

1. INTRODUCTION

Information systems which are globally applied at present are the ones which are built up in order to use data much more efficiently. Besides this, main function of information systems nowadays is to enhance the capacity of being able to make a "correct-decision". Being very important tools in making correct decision, GIS systems were developed for that purpose.

A geographic information system (GIS), or geographical information system, is a system that captures, stores, analyzes, manages, and presents data that are linked to location.

In the simplest terms, GIS is the combination of cartography and database technology. GIS are used in cartography, remote sensing, land surveying, photogrammetry, geography, urban planning, emergency management, navigation, and localized search engines.

Nowadays, GIS courses begin to be developed in undergraduate, graduate programs especially in geodesy, cartography, computer sciences, geology, photogrammetry departments of the universities in Turkey [1].

Today, GIS is used in many areas such as local administrations, planning, parcelization and environmental management.

For fruit growing which has been carried out in agricultural production for a long time, improving productivity per unit area of fruit which will be cultivated in fruit growing area is only possible by determining the cultivation time. Maintaining this condition may be possible by providing data systems including long periods to the cultivators. In these data there are many factors affecting agriculture directly such as annual rain fall of long years, frosts, temperature values of the territory, water basins and topographic structure. When such data are determined with GIS method, factors such as crop patterns, production planning, market supply and crop amounts come up with positive result territorially. Likewise, with the use of these applications precisely, growing has taken on new dimension in the world

Applying the GIS becomes much more important for the fields such as agriculture which depends on totally ecological conditions and requires people to invest through long years. Investing in agricultural products in

conventional crop growing is done by observing other product samples whose adaptation to that area has been settled and whose regional demand, economical significance have been increased. Mistakenly choosing the products to cultivate especially in fruit fields causes irrevocable investments. In addition, time loss for these applications takes long periods like 15-20 years.

For fruit growing which has been carried out for a long time, improving productivity per unit area of fruit which will be cultivated in fruit growing area is only possible by determining the cultivation time and area. And this would be possible by submitting data system including long periods to cultivators. In these data, there are many factors affecting agriculture directly such as long annual rain falls, frosts, temperature values of the territory, water basin and topographic structure. When such data are determined by GIS method, factors such as crop pattern, production planning, market supply period and crop amounts will give positive results territorially in terms of modern cultivation. Likewise, with the use of these applications precisely, cultivation has taken on new dimension in the world. In our country, GIS is not very common system and its usage is rather limited.

Land use planning in our country is seen very important and essential day by day. Agricultural lands in our country are fragmental and small-scale and this situation raises the importance of agricultural land use planning. The change of the land cover in our country is gaining more vitality in terms of both ecologically and economically, because fertile lands in our country have been decreasing for some reasons. To minimize the factors that trigger these negative proceedings would be possible only by increasing activity of land use. And it depends on constituting data base about agricultural land and other natural sources and therefore making an effective land use planning. Today, in parallel with developing technology, computer aided remote sensing system and geographic information system techniques are used to determine production and capacity of plant cultivation area. GIS is a system which makes it possible to constitute such data base and do essential analysis.

Turkey has global importance in terms of vegetable and fruit production, and 87% of Turkey’s greenhouse agriculture (37,703ha) is in the

Mediterranean region. Of the greenhouse areas in this region, approximately 39% are in Antalya province [6]. A large proportion of the greenhouses are far from meeting the needs of good agriculture practices (EUREPGAP). For this reason, with regard to EUREPGAP and food safety, there is a need for a controlled greenhouse production system [3,9]. The ultimate goal is to start controlled agricultural production according to the Integrated Administration and Control Systems (IACS). One of the most important requirements from the EU is that this process be done to the field-parcel level as a Land Parcel Identification System (LPIS) [10]. The EU also requires that IACS and LPIS systems (code 3508/92, section 2) be prepared as national databases created on the basis of remote sensing (RS) and geographic information system (GIS) technologies [2,4,8,11,14].

The importance of GIS in terms of fruit growing; ideal land use can be determined on the basis of parcel of land by transferring land capability classes, suitability classes for irrigated farming, risk of frost, distance to water resources, suitability classes for agricultural use and potential use groups into GIS in the form of map layers. Besides, it would be possible to determine the products to be cultivated and the appropriate crop pattern according to alternation system. At first, GIS is benefited from in the process of determining crop pattern and parcel lands. It is also benefited from while finding out the relations of parameters as characteristics of soil, slope, drainage, erosion, stone amount etc. One of the most important benefits of GIS in terms of fruit growing is providing a planned land use scheme by determining the most appropriate lands on the basis of products in advance. In fruit growing, there is a risk of frost which may lead to decrease in productivity and even loss of product sometimes. Frost resistance of each product is different. For the reason that which fruit are affected or to what extent they are affected by frost risk can be determined through statistical data of long period with the help of GIS, it can prevent that negative condition in advance by determining risk of frost that affects productivity in fruit growing.

In fruit growing GIS is very beneficial in the process of defining total cultivated land because it states parameters as which perennial or one-year plants are cultivated in these lands, to extent of which amount of these lands are suitable for irrigated farming. Besides, it is very important for fruit

growing because it determines slope and soil depth of agricultural land and erosion risk depending on slope.

In a study, it is aimed to discover AEZs of Çarşamba and Bafra lowlands regarding agricultural planting via GIS and data of remote sensing. This study is mainly based on a research carried out by the Marmara Research Institute Space Technological Group at The Yeşilırmak Development Project. The layers of the data are as follows;

1. Landsat-TM satellite data layer
2. Land data layer
3. Topographical layer
4. Climatic layer

Every layer has many weighted sub layers. For example, the climatic layer is prepared by taking into account the period of plant growing, the total amount of rain in summer times and the average temperature of weather [5].

In another search, did Agro-Ecological Zoning study in terms of Almond growing in Azerbaijan - Shanghi region [13]. In the study, it was aimed to classify the region according to suitability degree in respect to Almond growing. For that purpose, these conditions were determined for Almond growing, primarily in dry circumstances;

- ✓ Frost probability during blossoming and budding period,
- ✓ Having more than 250 mm of the rain fall,
- ✓ Rate of total rain fall amount of spring and summer months to annual precipitation,
- ✓ Utilizable moisture content

Later he took 25-years temperature, rain fall and evapotranspiration values from 10 meteorology stations. He prepared every each parameter as one layer within the frame of GIS and analyzed them by overlapping. In the course of events, he classified the study area as; very suitable, suitable, weak and unsuitable areas in point of Almond growing.

In abroad, using GIS, a study on citrus farming showed that the land is suitable for citrus farming. Land mapping units are grouped into classes

according to degree of limitation in use or risk of damage when used. Thus, the most serious degree of limitation determines the suitability classes and classes are indicated by numeric 1 to 4 increasing order of suitability and each class is subdivided into subclass according to dominant kinds of limitations. Lower case letters following the class number indicates the dominant limitation [12].

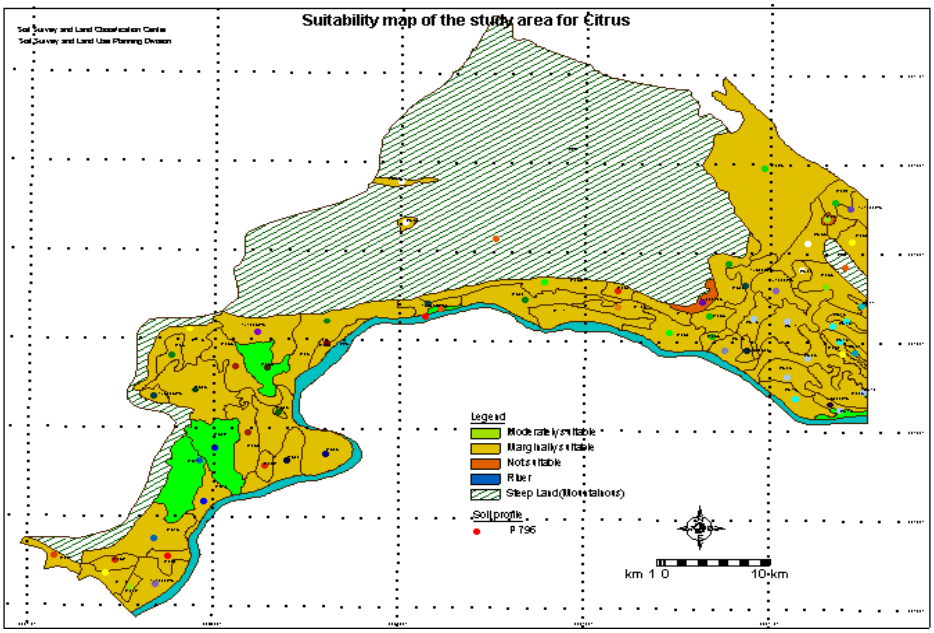

Figure 1. Suitability map of the study area for Citrus.

Along the same line, the soils of all EU countries were classified with GIS methods in terms of herbal production potentials and their results were published in 1992 [7]. The given results of the studies are being used intensely by countries as a data source.

While GIS is very common across the world, its usage is rather limited in our country and therefore, the studies about this system are limited in our country.

5 or 10 years later from now, the use of GIS techniques will be inevitable for all governmental sectors as well as municipalities.

2. CONCLUSION

The use of Geographic Information Systems in association with other computerized land evaluation tools to generate land suitability assessment has both superiorities and disadvantages. However, the advantages are relatively greater.

Agricultural lands in our country are fragmental and small-scale and this situation raises the importance of agricultural land use planning. GIS is very important system in terms of agriculture and fruit growing as it determines crop pattern and parcel land. Computer aided GIS techniques are used in determining total cultivated land, which perennial or one-year plants are cultivated in these lands, to extent of which amount of these lands are suitable for irrigated farming, distance to water resources, the suitability of product according to climatic data, production and productivity of cultivated lands. In fruit growing, there is a risk of frost which may lead to decrease in productivity and even loss of product sometimes. Frost resistance of each product is different. For the reason that which fruit are affected and to what extent they are affected by frost risk can be determined through statistical data of long period with the help of GIS, it can prevent that negative condition in advance by determining risk of frost that affects productivity in fruit growing. Besides, it is very important for fruit growing because it determines slope and soil depth of agricultural land and erosion risk depending on slope.

Suggestions

- Unmethodical productions cause illness and unnecessary costs in terms of pest control. Use of some agricultural pesticide can affect the environment, human health, all ecology negatively. These negations can be prevented by GIS.
- GIS can be used for applying and planning the new agricultural protection ways in determining the predators which are used in biological protection.

- It can be used for ascertaining the harvest time of the products and developing the storage methods that are applied after harvest.
- In the following areas we can benefit from GIS; in locating the places of the institutions that will be established for the products being saved later, determining the places where less energy can be used.
- GIS can be useful while choosing the districts for crop pattern, preventing the troubles seen in the applications.
- The received data can be used for answering to questions as "where and how agricultural products that have been planned will be cultivated?"
- By creating GIS inventories, agricultural investments can be directed to the regions where optimum economic and environmental income can be fetched.
- By keeping non-agricultural lands under observation roughly in terms of all factors and by appointing the problematic regions mainly groundwork for the studies that will be carried in future can be done.
- One of the benefits of the GIS studies is providing opportunity to determine the areas that show suitability for the planned target by having regard to very different factors. As an example; decision making process can be carried out by regarding the efficient constraints of areas which can be used for purposes of settlement, road, factory, industry etc.
- When considering different conditions, GIS studies will be useful about determining the fields like agriculture whose application is affected by varieties and it will give chance to have much more realistic results.
- It is important in terms of determining parcel land of an area where fruit orchard will be built and determining crop pattern.
- GIS is beneficial in terms of fruit growing because it can determine which plants including perennial or one-year plants, are cultivated in these lands.

- It provides more conscious farming because it determines characteristics of the land in terms of distance to water resources, suitability for irrigated farming, slope and soil depth of agricultural land, erosion risk depending on slope, drainage and soil salinity

- GIS provides huge advantage economically because it presents information about which fruit to cultivate and where they are cultivated by statistical evaluation of climatic data and risk of frost that causes harm in fruit growing on the basis of fruit variety.

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