Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Dergisi
Journal of Agricultural Faculty of Gaziosmanpasa University
http://ziraatdergi.gop.edu.tr/

Araştırma Makalesi/*Research Article*

JAFAG
ISSN: 1300-2910
E-ISSN: 2147-8848
(2019) 36 (3), 187-196
doi:**10.13002/jafag4605**

Determination of Suitable Organic Grape Production Areas in Kelkit Basin and Mapping by Geographical Information Systems

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Alındığı tarih (Received): 02.04.2019 — Kabul tarihi (Accepted): 20.11.2019
Online Baskı tarihi (Printed Online): 29.11.2019 — Yazılı baskı tarihi (Printed): 31.12.2010

Abstract: Kelkit Basin contained 15 districts within boundaries of Tokat, Amasya, Gümüşhane, Erzincan, Giresun and Sivas provinces. Grape is an important feature of economic items of the basin. Grape production especially making in named lower Kelkit Basin area districts intensively. Our study aimed to determine the appropriate fields for organic grape production in the basin and mapping the suitable areas. For this aim, land surveys were conducted, point data were collected with GPS and the 1230 point value is calculated. On the calculation of point value, Land Use Capability, land pollution situation, erosion risk groups and soil groups are used as criteria. In line with the regulation of organic farming practices, in calculating the amount of pollution in compliance with organic farming, intense agricultural activity, the impact of roads, settlements influence, water resources, the effects of soil pollution and industrial-mining areas were taken into account. By using these calculated values, maps were created in the program ArcGIS (9.3) by analysis of IDW (Inverse Distance Weighted). According to the generated maps, organic grape production areas were put forward. In the study, it was determined that organic grapes could be grown in areas bearing microclimate and in a large part of the basin.

Keywords: Kelkit Basin, Organic Grape, GIS, IDW

Kelkit Havzasında Organik Bağcılık İçin Uygun Alanların Belirlenmesi ve Coğrafi Bilgi Sistemleri İle Haritalanması

Öz: Kelkit Havzası Tokat, Amasya, Gümüşhane, Erzincan, Giresun ve Sivas illeri sınırları içerisinde kalan 15 ilçeyi kapsamaktadır. Üzüm havzanın önemli ekonomik kaynaklarından biridir. Üzüm üretimi özellikle aşağı Kelkit Havzası bölgesinde yoğun olarak yapılmaktadır. Çalışmamızda, havzada organik üzüm üretimi için uygun alanların belirlenmesi ve haritalandırılması amaçlanmıştır. Bu amaçla arazi etütleri yapılmış, noktasal veriler GPS ile toplanmış ve 1230 nokta değeri hesaplanmıştır. Nokta değerinin hesaplanmasında, arazi kullanım kabiliyeti, arazi kirlilik durumu, erozyon risk grupları ve toprak grupları kriter olarak kullanılmıştır. Organik tarım uygulamalarının düzenlenmesi doğrultusunda, organik tarımla uyumlu kirlilik miktarının hesaplanmasında, yoğun tarımsal faaliyetler, yolların etkisi, yerleşim yeri etkisi, su kaynakları, toprak kirliliği ve sanayi-maden alanlarının etkileri ele alınmıştır. Bu hesaplanmış değerler kullanılarak, haritalar IDW (Ters Mesafe Ağırlıklı Enterpolasyon) analizi ile ArcGIS (9.3) programında oluşturulmuştur. Üretilen haritalara göre organik üzüm üretim alanları ortaya konulmuştur. Çalışmada, mikroklima özelliği taşıyan alanlarda ve havzanın büyük bir bölümünde organik üzüm yetiştirilebileceği belirlenmiştir.

Anahtar Kelimeler: Kelkit Havzası, Organik Bağcılık, Coğrafi Bilgi Sistemleri, IDW

1. Introductıon

Organic agriculture is a rapidly developing industry all over the world. The organic farming area, which was 11 million hectares in 1999, has increased by nearly three times to 37.5 million hectares nowadays. Turkiye has managed to keep pace with this rapid increase, and the amount of organic farming land has a rate of 2.16% in the total agricultural land amount.

There are 315979 hectares of the field, the organic vine is growing in the world. This area constitutes 4.5% of total wine production area. The European continent is the region with the most organic vine growing. With 266 thousand hectares, 6.8% of the total agricultural land is made. In Europe, organic vine breeding comes second after olive. In Turkiye, 9180 hectares of organic vine growing is being done and consumed not only in the wine industry but also in the table and dried food (FIBL, 2016). Organic Vine growing is concentrated in the Aegean region intensively. One of the main reasons for this is the close proximity of the export-oriented logistics network. The Kelkit Basin has been an important part of horsetail cultivation throughout history and this culture is still going on today. In particular, the appreciation of value in grape leaf has accelerated the investments in the region. In studies on grapevine cultivation, the majority of researchers agree that the annual average temperature for cultivation must be at least 9 ° C. The annual temperature average should be 9-12 °C and the hot months average (June-July-August) should be 17-20 °C in order to be able to

, economic development, education, agriculture, and forestry have seen a rapid increase in recent years. In the feasibility studies, ecological factors should be taken into account while making calculations such as economic, cultural, labor, investment costs. The selection of the crop to be cultivated, the selection of the region according to the soil, water and climate characteristics and the planning in this direction form the basis of agricultural investments. At this point, GIS offers the opportunity to analyze and present all the features of the regions together. The possibility of evaluating climate characteristics, soil characteristics, water resources and other factors of the region can be done easily in today's technology (ESRI, 1997). Bandyopadhyay (2009), in his work titled "Remote sensing and GIS-based approach and determination of the potential for agriculture"; Said that the potential assessment of land suitability is an important step in identifying viticulture anywhere (İştar, 1969). In order to be able to viticulture economically in any ecology, the annual mean temperature of 9 ˚C, the warmest month average of 18 ˚C, the coldest month average of 0 ˚C, the summer average of 20 ˚C, the development period (From 1 April to 31 October for the northern hemisphere) should be above 13 ˚C. On the other hand, the regions with an average annual temperature of 11-16 ° C are considered as the most suitable regions for viticulture (Cangi and Yağcı, 2012). When the basin is examined, especially in the lower Kelkit region, it is quite suitable for viticulture.

Measuring the years 2014 and 2015 as the hottest times of the last 130 years and rising ocean temperatures have caused global warming to become one of the busiest topics in the world's agenda in recent years. Alternative solutions for agricultural wastes that are regarded as one of the sources of global warming have begun to be produced and organic agriculture has been at the forefront of these (Anonymous, 2015a).

Using of Geographic Information Systems; Urban planning, natural resource management

sustainable land-use planning and environmental boundaries.

In today's technology, it is an inevitable necessity to carry out GIS-based studies in order to plan large areas, to present problems and to apply them rapidly. In the basins like the Kelkit Basin should be examined and planned as a whole in order to provide sustainable agriculture and ecological protection and to protect the natural equilibrium. The main objective of our work is to determine suitable areas for organic viticulture in Kelkit basin and to create agrofitability maps.

The area called Kelkit Basin is located between the borders of Amasya, Tokat, Sivas, Giresun, Gümüşhane, and Erzincan. The basin covers 15 districts and a total of 16.244,45 km^2 area. The location of the basin is 40,9968 North, 30,8491 East, 36,0482 West and 39,6943 South coordinates (Figure 1).

Figure 1. Kelkit basin satellite image
Şekil1. *Kelkit havzası uydu görüntüsü*

3. Materıals and Methods

3.1. Working area

The Kelkit Valley is one of the rare regions of our country that have not suffered serious destruction of their pollution and natural structure. The basin is located in the belt that the Black Sea region meets with Central Anatolia. To be located in a geographical transitional zone; The natural resources and biological diversity of the region are very high.

The altitude of the region is 200-1200 meters as it goes east. To be a climatic zone between the Black Sea and Central Anatolia and offers climatic advantages. In the study conducted by Doğan and Kılıç (2013b) using LOCCLIM (Local Climate Estimator) software developed by FAO, the spatial distribution of some climate values as an annual average of the basin was investigated. The average temperature in the basin ranges from 6.87 ºC to 12.2 ºC. The maximum temperature values range from 13.45 ºC to 17.91 ºC and are low in the southern and eastern parts of the basin and higher in the western and northern parts of the basin. The lowest temperatures range from 0.59 oC to 7.47 ºC. The average annual precipitation of the basin varies between 30.58 mm and 69.36 mm. Potential evapotranspiration values range from 66.56 mm to 81.89 mm. The abundant rainfall basin exhibits the features of the Black Sea vegetation cover. According to Davis grid system (Davis, 1971; Davis, 1988), the Kelkit Basin is located within grid squares A6 and A7. There are also some species in the region that are indicative of the Mediterranean climate (Karaer, 1994). There is a maximum of brown forest soils in the region. These lands constitute about half of the basin.

The lack of serious industrial development to pollute the ecology presents great opportunities for new development approaches for the region. The region's Organic Farming is located in the well-known area and the "Niksar Organic Fruit Producer Association" was established in 2009 by a group of producers. There is also a 1000-headed Organic Dairy Cattle Business established by the private sector in the province of Kelkit.

3.2. Methods

In the scope of the study, ArcGIS 9.3 software was used for the creation of the Kelkit basin (land use capability, pollution, topography, soil structure) database and the generation of maps (ESRI, 1997). In the study, maps of areas suitable for organic grape growing were established within the basin areas. In the study, 1230 random points that can represent the land were documented. Places known to have characteristics in land surveys are also added to the evaluation points. Thus, comparison of the actual use cases of the evaluation points has also been made.

Determination of Organic Agriculture Ineligible Areas

In our study, 17 district centers, 510 village centers, 20 industrial - mining areas and E80

highway were identified in the basin. These areas are marked as polygons in Google Earth and ArcGIS Earth and their fields are calculated. In order to minimize the effect of the settlement on the organic farming activities, a distance of 500 meters buffer was set around the determined polygons to give the effect distance. For these areas, the organic farming score was applied as "0" (Anonymous, 2011; Anonymous, 2015b).

Parameters Used and Scoring Parameters

The following formula has been used for the calculation of a point's organic farming score. In its form, pollution is the biggest effect on the organic farming score. The impact rate of pollution was determined as 70% (Anonymous, 2011).

Organic Agriculture Score = Land Use Capability Score × 0.1 + Risk areas of erosion x 0,1 + Large Soil Groups x 0,1 + Pollution Score × 0,7

Informing the formula, not only pollution also other factors affecting agricultural activities are added to the evaluation criteria. According to the Land Use Capability (LUC) classes, the most suitable areas for agricultural activities I to V. classes areas are used. The erosion rik areas map has been used as a source and the areas have designated as point data have been overlapped with the erosion risk map (Kılıç, 2015). The identified points were overlapped on large land maps and evaluated for soil groups. Soil groups were graded I to V (Doğan and Kılıç, 2013b, Kılıç, 2015).

Pollution

Sub-parameters of pollution was calculated as follows, pollution of point data was found (Anonymous, 2011).

Pollution Coefficient = Road Impact × 0.05 + Settlement Impact × 0.05 + Intense Farming Activity × 0.2 + Soil Pollution × 0.2 + Water Pollution × 0.1 + Industry and Mine Areas × 0.1

The parameters were established by evaluating the land pollution and pollution sources in line with the organic agriculture regulation. Areas with intensive farming were determined by taking into consideration the land surveys, the LUC class and the agricultural activity applied. According to the intensive agriculture activity of the sampling points, scored between 0 and 5 (Anonymous, 2011). The lack of water pollution caused by agricultural activities and industrial wastes in the basin gives advantages to organic agriculture. All points in terms of water pollution got 5 points.

According to the results of the year, 2014-2015 pesticide residue was found in Erbaa province at 1 point. No heavy metal remains were found at any point in the Kelkit Basin according to the results of the survey and analyses conducted at 250 points (Kılıç, 2015).

Calculation of point values

The method used to calculate the scores for the sampling points and the section of the generated excel page of the method are given in Table 1. In Table 2, in addition to the organic farming score, point values are added to some important criteria that will be effective for viticulture. Informing the viticulture map, the maximum, minimum and average temperatures, potential evapotranspiration, height, and precipitation were added to the table as factors.

Table 1. Excel table section for calculation of the organic farming score

Tablo 1. *Organik tarım puanının hesaplanması için oluşturulan exel tablosu*

					Land Use Capability (LUC)				Pollution	Road Impact			Settlement Impact			
Sample Point	Altitude (m)	Altitude	Latitude	**Organic Agriculture Score** of Points	LUC Rate	Land class	Impact score	Coefficient	Impact Score	Impact rate	Impact score	Coefficient	Impact rate	Impact score	Coefficient	
Eg. 1	567	36,1117374	40,69536717	**4,3**	0,2	4	2	0,1	3,5	0,25	5	0,05	0,25	5	0,05	
Eg. 2	535	36,13161832	40,69900957	**4,4**	0,3	3	3	0,1	3,5	0,25	5	0,05	0,25	5	0,05	
Eg. 3	1180	36,14459069	40,80027226	**4,4**	0,1	5	1	0,1	3,5	0,25	5	0,05	0,25	5	0,05	
“																
Eg. 719	1830	39,5697841	40,22216849	**4,2**	0,1	6	1	0,1	3,5	0,25	5	0,05	0,25	5	0,05	

Table 1. (Continued) Excel table section for calculation of the organic farming score

Tablo 1. *Organik tarım puanının hesaplanması için oluşturulan exel tablosu (Devamı)*

Intense Farming Activity			Soil Pollution			Water Pollution			Industry-Mine Area Impact			Erosion Risk Areas				Large Soil Groups			
Impact rate	Impact score	Coefficient	Impact rate	Impact score	Coefficient	Impact rate	Impact score	Coefficient	Impact rate	Impact score	Coefficient	Impact rate	Impact score	Land class	Coefficient	Impact rate	Impact score	Land class	Coefficient
1	5	0,2	1	5	0,2	0,5	5	0,1	0,5	5	0,1	0,3	3	2	0,1	0,3	3	3	0,1
1	5	0,2	1	5	0,2	0,5	5	0,1	0,5	5	0,1	0,3	3	2	0,1	0,3	3	3	0,1
1	5	0,2	1	5	0,2	0,5	5	0,1	0,5	5	0,1	0,3	3	2	0,1	0,5	5	7	0,1
1	5	0,2	1	5	0,2	0,5	5	0,1	0,5	5	0,1	0,1	1	4	0,1	0,5	5	7	0,1

Table 2. Excel table section for the determination of suitable areas for organic viticulture

Tablo2. *Organik bağcılığa uygun alanların belirlenmesi için oluşturulan exel tablosu*

				Organic Agriculture Score For Viticulture	PET (Potential evapotransprasion)		Precipitations		Average Taperature		
Sample Point	Altitude (m)	Altitude	Latitude		Annual PET average (mm)	Impact Status	Annual precipitation average (mm)	Impact Status	Annual temperature average (^{0}C)	Base value	Impact Status
Eg. 1	567	36,1117374	40,69536717	**4,3**	77,81	Suitable	35,91	Suitable	10,69	> 9 ^{0}C	Suitable
Eg. 2	535	36,13161832	40,69900957	**4,4**	77,76	Suitable	35,98	Suitable	10,75	>9 ^{0}C	Suitable
Eg. 3	1180	36,14459069	40,80027226	**4,4**	78,12	Suitable	36,77	Suitable	11,20	>9 ^{0}C	Suitable
“											
Eg. 719	1830	39,5697841	40,22216849	**4,2**	78,25	Suitable	39,58	Suitable	8,02	>9 ^{0}C	Not Suitable

Mapping Operations

The ArcGIS 9.3 program was used to process and evaluate maps. Mapping operations were performed using Inverse Distance Weighted Interpolation Technique (IDW) which is one of the most common techniques. IDW is an analytical method that forms a surface from data by creating a line with predominant combinations of point data (Childs, 2004; Arslanoglu and Özçelik, 2005). At the basis of the method, there is a decrease in cellular value as you move away from the point where it is valued (ESRI 2016). Using the mathematical calculation formula formed by Shepard (1968) as the basis of the IDW method (Lillesand, 2000; Arslanoglu et al. 2005, Üstançaş, 2006, Demircan et al, 2011, Doğan et al., 2013a, Demircan ve ark, 2014).

$$F(x,y) = \sum_{i=1}^{n} wifi \qquad (1)$$

$$wi = \frac{hi^{-p}}{\sum_{i=1}^{n} hi^{-p}} \qquad (2)$$

The function is expressed in terms of any base distance, inversely proportional to the weight used in the estimation (2). Here, the "p" value indicates the exponential. The sum of the "wi" values representing the weights must be 1. function finds the value of the unknown point giving more weight to nearby ones while giving less weight to distant ones (Doğan et al., 2013a).

4. Results and Dıscussıon

Due to the pollution levels being too low, organic farming scores are high in areas where agricultural activities are rare, and organic farming scores are low in soils with intensive agricultural activities. The low level of the organic farming score does not mean that organic farming will not be possible in the designated areas. Organic farming will be possible by applying transition process in these areas. Whether arable land is suitable for organic farming has been evaluated by considering the "Catalog of Measures" conditions used by Control and Certification firms (Etko, 2015).

Viticulture is an important source of income for the basin economy especially for Erbaa, Taşova, Niksar, Reşadiye districts, called as Lower Kelkit Basin (Figure 2). The economic value of the grape leaf, which provides additional income for producers, especially in recent years, has increased considerably in viticulture activities. 2013 exports values of the grape leaf, which is 13.5 million dollars, are increasing every year. However, the Aegean region, which exports 95% of the leaf, is under threat due to pesticide residues on the grape leaf (Anonymous, 2014). Since the use of pesticides in Kelkit basin is minimal, it is an important advantage for competition in exports. Cangi and Yagci (2012) stated that Tokat and Manisa regions had a quite favorable ecology for grape leaf production, indicating that grape leaf yielded more income than grape production.

In a study titled "Economic Analysis of Different Production Models in Slammed Leaf-Produced Bonds" by Cangi (2011), the most economical with the gross and net profit of 960.3 tl / da - 422.6 tl / da for three-period salamhoric leaf and 1-period ripe grape harvest Model. The development of the ready-made consumer industry and the increase of exports are rapidly increasing the economic value of the grape leaf. In grape leaf production, it is stated that the most Sultani seedless and Narince varieties are preferred. It is an opportunity for production of organic viticulture and organic grape leaf, especially since the cultivar of Narince variety is unique to the Tokat region and it is specially cultivated intensively in the Kelkit basin.

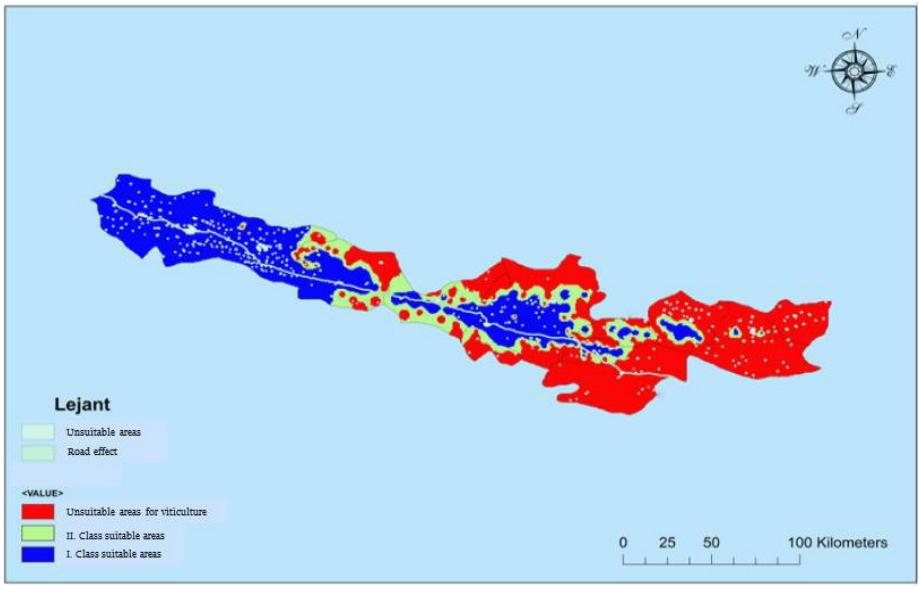

Figure 2. Map of suitable areas for organic viticulture in Kelkit basin
Şekil 2. *Kelkit havzasında organic bağcılık için uygun alanlar haritası*

In his work titled "The effects of global climate change on viticulture" (Küpe, 2012), he tried to create short and long-term scenarios for vineyard cultivation. Küpe (2012) emphasized that, while examining the effects on viticulture of increases in CO^2 concentration, it is an advantage in the short term that high CO^2 concentrations positively influence vegetative development. However, in the long term, negative effects will occur in the direction of ecological change and climatic conditions. As a result of global warming, it is estimated that there will be a temperature increase of 0.18-0.58 ºC in vineyards every 10 years (Jones et al. 2004). The increase in temperature and the change in precipitation regimes have revealed that the product variety will change in the eastern regions of our country. Microclimate areas for horticulture plants will emerge, and the agricultural importance will be improved has been put forward as a result of the study. Especially from the beginning of the century, it is observed that the winter temperatures are increasing, the beginning of spring is early, and the autumn is late (Hansen et al. 2012). Climate affects all living things as well as plants. In addition to the ecological distribution of crops, yield and quality depend on the effects of climate (Jones et al. 2004).

With the effect of global warming, vineyard areas in low-altitude and drought-bearing regions are within risk groups. The Kelkit basin is an important microclimate area for the future.

5. Conclusıon

The people of the region have earned significant income from viticulture in recent years. In order to protect the vineyard areas of the region and establish new aquaculture sites, organic farming should be carried out in the appropriate designated areas. Owing to organic viticulture, it will be possible to produce by-products such as grapefruit, molasses, fruit juice and wine. There is a very large area (>80% of total area) suitable for organic viticulture in the basin, as understandable from the map. The Lower Kelkit Basin is a candidate for being one of the important centers of our country in organic viticulture with old vineyards and new vineyards to be established with the species of Narince grape which is mainly locally produced.

Academic sense When it comes to organic agriculture, people first think of global warming, healthy living and environmental pollution (Kırımhan, 2005). Organic agriculture, identified with these issues, is among the proposed solutions that can be brought to the problems by

many authorities. Emphasis is placed on the regulation of people's eating habits towards organic agricultural products and the issue of dissemination of organic crops for the protection of future generations is at the forefront. In the social sense, macro policymakers emphasize the issue of organic agriculture, revealing the socio-economic dimension of organic agriculture (Gök, 2008). In particular, the increase in health expenditures and the fact that they are pushing the countries economically every day have shown that protection from the disease politically and economically is less costly than treatment. Organic feeding of people is especially important in terms of preventing cancer and obesity problems, which are the most important health problems of the century (Dönmez et al. 2008).

As a result, the Kelkit Basin must be protected and gradually declared organic production basin.

References

Anonymous (2011). Diyarbakır İlinde Organik Tarıma Uygun Alanların Belirlenmesi ve Haritalanması Projesi, 2010 Yılı Doğrudan Faaliyet Mali Destek Programı Kapsamında Karacadağ Kalkınma Ajansı Tarafından Sağlanan Mali Destek ile Yürütülmüştür. Sözleşme No: TRC2-10-DFD/30

Anonymous (2014). http://www.hurriyet.com.tr/ilac-kalintisi-ihracati-vurdu-ic-piyasayi-tedirgin-etti-27109662

Anonymous (2015a). http://www.ifoam.bio/sites/default/files/annual_report_2013 _web.pdf

Anonymous (2015b). Organik Tarımın Esasları ve Uygulamasına İlişkin Yönetmelik. Resmi Gazete. 22 Temmuz 2015 Çarşamba. Sayı: 29422

Arslanoğlu M and Özçelik M, (2005). Sayısal Arazi Yükseklik Verilerinin İyileştirilmesi. TMMOB Harita ve Kadastro Mühendisleri Odası 10. Türkiye Harita Bilimsel ve Teknik Kurultayı 28 Mart - 1 Nisan 2005, Ankara

Bandyopadhyay S, Jaiswall RK, Hedge VS and Jayaraman V, (2009). Assessment of Land Suitability Potentials for Agriculture Using a Remote Sensing and GIS Based Approach. International Journal of Remote Sensing, 30:4, 879-895, DOI: 10.1080/01431160802395235 http://dx.doi.org/10.1080/01431160802395235

Cangi R, Adınır M, Yağcı A, Topçu N and Sucu S, (2011). Salamuralık Yaprak Üretilen Bağlarda Farklı ÜretimModellerinin Ekonomik Analizi. Iğdır Üni. Fen Bilimleri Enst. Der. / Iğdır Univ. J. Inst. Sci. & Tech. 1(2): 77-84.

Cangi R, Yağcı A, (2012). Iğdır Yöresinde Salamuralık asma Yaprağı Üretim İmkanları. Iğdır Üni. Fen Bilimleri Enst. Der. / Iğdır Univ. J. Inst. Sci. & Tech. 2(2,Ek:A): 9-14.

Childs C, (2004). Interpolating Surfaces in ArcGIS Spatial Analyst. Esri Education Service, Arcuser. www.esri.com

Davis PH, (1971). Distribution patterns in Anatolia with particular reference to endemism. Plant Life of South-West Asia. Edited by Davis Harper and Hedge. Botanical Society of Edinburgh, Great Britain.

Davis PH, (1988). Flora of Turkey and the East Aegean Islands. Vol. 1-10, Edinburgh University Press. Edinburgh.

Demircan M, Alan İ and Şensoy S, (2011). Coğrafi Bilgi Sistemleri Kullanarak Sıcaklık Haritalarının Çözünürlüğünün Artırılması. TMMOB Harita ve Kadastro Mühendisleri Odası 13. Türkiye Harita Bilimsel ve Teknik Kurultayı 18-22 Nisan, Ankara

Demircan M, Türkoğlu N and Çiçek İ, (2014). Mevsimlik Sıcaklık Normallerinin (1971-2000) Coğrafî Bilgi Sistemleri İle Yüksek Çözünürlüklü Veri Setinin Üretilmesi. TÜCAUM - VIII. Coğrafya sempozyumu, 23-24 Ekim 2014, Ankara

Doğan HM and Kılıç OM, (2013b). Modelling and mapping some soil surface properties of Central Kelkit Basin in Turkey by using Landsat-7 ETM+ images. International journal of remote sensing,

Doğan HM, Yılmaz DS and Kılıç OM, (2013a). Orta Kelkit Havzası'nın BazıToprak Özelliklerinin Ters Mesafe Ağırlık Yöntemi (IDW) ile Haritalanması ve Yorumlanması. Gaziosmanpaşa Bilimsel Araştırma Dergisi 6 46-54

Dönmez N, Yıldırım M and Arslan P, (2008). Obezite ve Kanser. Sağlık Bakanlığı Yayın No: 729, Ankara, s 20.

ESRI, (1997). Understanding GIS the ARC/INFO Method. ISBN 1-879102-01-3. California 92373-8100. The USA.

ESRI, (2016). Understanding Raster Interpolation. ArcGIS Resource Service. http://resources.esri.com/help/9.3/arcgisdesktop/com/gp_toolref/geoprocessing_with_3d_analyst/understanding_raster_interpolation.htm

Etko, (2015). Catalogue of Measures. http://www.etko.org/Dosyalar/Belgeler/Belge_92.pdf

FIBL, (2016). Research Institute of Organic Agriculture FIBLhttp://www.fibl.org/en/ themes/organic-farming-statistics.html

Gök SA, (2008). Genişleyen Avrupa Birliği Pazarında Türkiye'nin Organik Tarım Ürünleri Ticareti Açısından Değerlendirilmesi. (AB Uzmanlık Tezi), Gıda Tarım ve Hayvancılık Bakanlığı Dış İlişkiler ve Avrupa Birliği Koordinasyon Dairesi Başkanlığı, Ankara

Hansen JE, Sato M, Berger A, Mesinger F, and Sijacki D, (2012). Paleoclimate implications for human-made climatechange. . Springer, ~350 pp. pp

İştar A, (1969). Erzincan merkez ilçesi bağcılık tekniği ve bağcılğın geliştirilmesi imkanları üzerinde bir çalışma. A.Ü. Zir. Fak. Zirai Araştırma Ens.Teknik Bülteni. No: 23, Erzurum

Jones GV, White MA and Cooper OR, (2004). Climate changeand global wine quality. Climatic Change

Karaer F, (1994). Kelkit Vadisinin Florası ve Vejatasyonu, 19 Mayıs Üniversitesi, Fen Bilimleri Enstitüsü, Doktora Tezi.

Kılıç OM, (2015). Kelkit Havzası Ekolojik Risk Değerlendirmesi. Gaziosmanpaşa Üniversitesi, Fen Bilimleri Enstitüsü, Toprak Bilimi Bitki Besleme Anabilim Dalı, Doktora Tezi, Tokat

Kırımhan S, (2005). Organik Tarım Sistemleri ve Çevre. Turhan Kitabevi Ofset Matbaacılık Tesisleri, Çevre Yönetimi Dizisi No: 2 ISBN 975-00284-0-6, 352 s, Ankara

Küpe M, (2012). Küresel İklim Değişikliğinin Bağcılık Üzerindeki Ektileri. Journal of the Faculty of Agriculture, 43(2).

Lillesand TM and Kiefer RW, (2000). Remote Sensing and Image Interpretation 4 th ed.. ISBN 0-471-25515-7 John Wiley & Sons. Inc. New York. USA.

Üstüntaş T, (2006). Sayısal Arazi Modellerinde Bazı Enterpolasyon Yöntemlerinin Karşılaştırılması. Selçuk Üniversitesi Teknik Bilimler Meslek Yüksekokulu Teknik-Online Dergi Journal of Technical- Online ISSN 1302/6178 Volume 5, Number:2