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Konya Plain Agricultural Lands

Salinization Problem, Causes and Solution Suggestions[1]

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ABSTRACT

Due to the rapidly increasing world population, it is necessary to improve the lands that have been degraded and currently have production potential. It is inevitable that the greatest struggle of humanity for the future will be to combat the rapidly spreading degradation. It is imperative to change approaches and policies for sustainable agriculture. Basin management should not be considered as an idea aimed at protecting the hydrological services provided by the basin or minimizing or preventing groundwater effects, but as an integrated basin management.

A relationship has been established between excess water and agricultural product increase in the Konya plain for many years due to the irrigation culture, and even when surface water resources are insufficient, the use of underground water resources has increased day by day. So much so that irrigation is attempted with a well opened at almost every field. This situation causes the groundwater level to retreat to very deep depths.

The aim of the study is to examine the environmental impacts resulting from activities carried out to increase production in the Konya Plain, which is used as an agricultural production area, to identify the negative structural problems that occur and to offer solutions, thus contributing to the participatory approach proposal for sustainable basin planning. The material and data sources of the study consist of studies conducted as subject-field studies (articles, books, thesis, reports, notifications). The information obtained through the literature review was compiled and the environmental assessment of agricultural activity and soil-water use was emphasized, solution proposals were developed in the light of geographical principles, and suggestions for the sustainable development plans of the field were put forward.

Konya Ovası Tarım Arazileri Tuzlanma Sorunu, Nedenleri ve Çözüm Önerileri

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ÖZ

Dünya nüfusunun hızla artması nedeniyle bozulmuş ve üretim potansiyeli olan toprakların iyileştirilmesi gerekmektedir. İnsanlığın geleceğe yönelik en büyük mücadelesinin hızla yayılan bozulmayla mücadele olması kaçınılmazdır. Sürdürülebilir tarım için yaklaşım ve politikaların değiştirilmesi zorunludur. Havza yönetimi, havzanın sağladığı hidrolojik hizmetleri korumayı veya yeraltı suyu etkilerini en aza indirmeyi veya önlemeyi amaçlayan bir fikir olarak değil, bütünleşik bir havza yönetimi olarak düşünülmelidir.

Konya ovasında sulama kültürü nedeniyle uzun yıllardır aşırı su ile tarımsal ürün artışı arasında bir ilişki kurulmuş olup, yüzey su kaynakları yetersiz kaldığında bile yeraltı su kaynaklarının kullanımı her geçen gün

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Havza planlaması 2
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Toprak tuzlanması 4.

artmaktadır. Öyle ki neredeyse her tarlada kuyu açılarak sulama yapılmaya çalışılmaktadır. Bu durum yeraltı su seviyesinin çok derinlere çekilmesine neden olmaktadır.

Çalışmanın amacı, tarımsal üretim alanı olarak kullanılan Konya Ovası'nda üretimi artırmaya yönelik yapılan faaliyetler sonucu ortaya çıkan çevresel etkileri incelemek, ortaya çıkan olumsuz yapısal sorunları tespit ederek çözüm önerileri sunmak, böylece sürdürülebilir havza planlaması için katılımcı yaklaşım önerisine katkıda bulunmaktır. Çalışmanın materyal ve veri kaynaklarını konu-alan çalışması olarak yürütülen çalışmalar (makale, kitap, tez, rapor, bildiri) oluşturmaktadır. Literatür taraması yoluyla elde edilen bilgiler derlenerek tarımsal faaliyet ve toprak-su kullanımının çevresel değerlendirmesi vurgulanmış, coğrafi ilkeler ışığında çözüm önerileri geliştirilmiş ve sahanın sürdürülebilir kalkınma planlarına yönelik öneriler ortaya konulmuştur.

INTRODUCTION

Every minute, 10 hectares of arable land in the world is degraded. 5 hectares of this is due to soil erosion, 3 hectares of soil salinization, 1 hectare of soil degradation processes, and 1 hectare of it is due to non-agricultural uses.

Due to the rapidly increasing world population, it is necessary to improve the lands that have been degraded and currently have production potential. It is inevitable that the greatest struggle of humanity for the future will be to combat the rapidly spreading degradation. Approaches and policies must be changed for sustainable agriculture.

Basin management should not be evaluated as a thought aimed at protecting the hydrological services provided by the basin or minimizing or preventing groundwater effects, but as an integrated basin management. This method reveals the necessity of considering local characteristics, natural resource use, and climate changes within the causality relationship. Instead of a soil and water planning approach focused on engineering works, needs and activities should not be ignored and participatory approaches should be used (Garipağaoğlu, 2017).

Comprehensive studies have been carried out to bring water to the Konya Plain since the reign of Abdulhamid II. The first official irrigation project of our country, the Konya Cumra Irrigation, was carried out between 1907-1914 for the Konya Plain, and with the project, the waters of Lake Beyşehir were transferred through a conveyance channel and 57,000 hectares of agricultural land were opened to irrigation. Within the scope of the Konya Cumra Project, which is the largest irrigation investment after GAP, the projects implemented by DSI to realize Konya's water dream were called "Konya Plains Projects", or "KOP" for short. The project, which consists of a total of 18 project bundles consisting of 14 irrigation projects, 3 drinking water projects and 1 energy project, where 1,100,000 hectares of agricultural land will be irrigated, and where it is understood that flood irrigation is not efficient in agricultural production with its small and fragmented land structure, and where the development of agricultural infrastructure and ensuring environmental sustainability for water saving purposes are important, has been developed and implemented. However, since it would be difficult for a region, especially a region with water insufficiency, to develop with agriculture alone and since coordination is required due to the implementation of existing projects by different institutions, a structure was needed to coordinate, monitor and evaluate project implementations in the region. All these show that a participatory approach was demonstrated with the KOP project. However, with each project, positive features cannot be valid in the entire field, and new problems manifest themselves in the short or long term. The Blue Tunnel Project is a study where water transportation to the plain was taken as a step in this regard and added to the project later. While trying to eliminate a problem, another problem begins to manifest itself.

Therefore, it is important for the sustainability of the short and long term problem of the Konya Plain to be analyzed well, to identify and eliminate the problem and to increase the positive relationship between environmental impact assessment and human activities.

For many years, a relationship has been established between excess water and agricultural product increase due to the irrigation culture in the Konya Plain, and even when surface water resources are insufficient, the use of underground water resources has increased day by day. So much so that almost every field is tried to be irrigated with a well opened. This situation causes the underground water level to be drawn deeper.

The Konya Plain has semi-arid climate characteristics. There is a decrease of 10-25 mm compared to normal precipitation in the thirty-year period. The climate character is shifting from semi-arid climate type to arid climate type. Rainfall decreases towards the end of spring in the plain and decreases to almost zero levels in summer. 70% of the rainfall falls outside the plant growth period and does not receive regular and sufficient rainfall. Meteorological drought is increasing in the area. In addition to aridity, there is an alarming level of soil degradation as a result of almost all of the surface and underground water resources of the plain being directed to agricultural areas and the cultivation of crops with high water requirements becoming increasingly widespread. Soil degradation is defined as the decrease in soil quality as a result of salinization/desertification/concreting.

PURPOSE

The aim of the study is to examine the environmental impacts resulting from activities carried out to increase production in the Konya Plain, which is used as an agricultural production area, to identify the negative structural problems that occur and to offer solutions, thus contributing to the proposal for a participatory approach to sustainable basin planning.

METHOD-TECHNIQUE

The material and data sources of the study consist of studies conducted as subject-field studies (articles, books, thesis, reports, notifications). The information obtained through the literature review was compiled, and the environmental assessment of agricultural activity and soil-water use was emphasized, and solution proposals were developed in the light of geographical principles, and suggestions for the sustainable development plans of the field were put forward.

1.Location and Boundaries of the Field

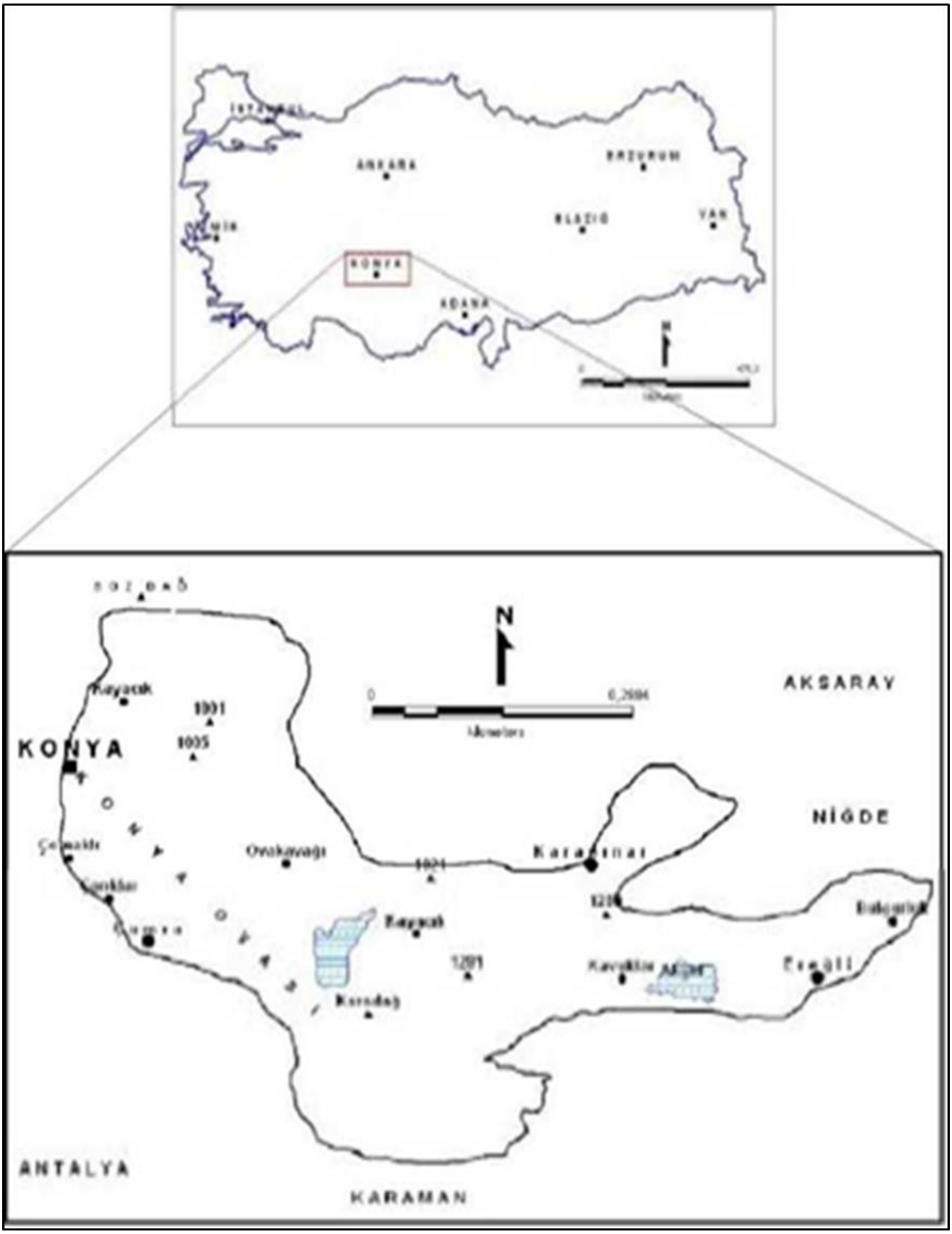
Konya Plain is located in the Central Anatolia Region, southeast of Salt Lake and within the Konya Closed Basin. The lowest point of the plain is Aslım Location (975 m.), and the highest point is Alaaddin Hill (1080 m.) (Figure 1).

The Konya Plain extends 80 km in the N-S direction and 50 km in the E-W direction. The westernmost point of the plain is at 32 degrees 06' N latitude. The 800 km2 Hotamış Plain (including the marsh), 700 km2 Karapınar Plain, 500 km2 Karaman Plain and 2500 km2 Ereğli Plain (including Ayrancı plain) are accepted within the Konya Plain (Başçiftçi et al. 2013;3).

2. Evaluation of Konya Plain in Terms of Soil

Soil is the source of life, the reason for existence of living beings. The place of such an important element of the geographical environment in planning is also indisputably special (Garipağaoğlu, 2017;89). In the Konya plain, in the areas where lake shores and temporary water deposits are located, sodium chloride, sodium sulfate, calcium and magnesium salts accumulate on the soil surface and cause the formation of salty soils, which we call soloncak soils, in the plain. In addition, as a result of the accumulation of hygroscopic salts (calcium and magnesium chloride) on the surfaces, there are sabbah or kal soils. These soils absorb moisture from the air in the early hours of the morning and this soil turns into a muddy salt mixture, and the slippery and unnavigable land shows salinity in the form of spots. The groundwater level in the plain creates local salt accumulations due to the effect of the arid climate. Salty and gypsum soils have also formed in connection with the marshes. In general, salts are transported in the area by rivers, seeps and surface flows and the wind plays an important role. Alkaline soils are found in small amounts and with salinity in the lower middle part. While sulfate and chlorides are common in the eastern part of the plain due to marine sediments, chlorides are high in vertisol soils where the groundwater level is below 1.80 m in the west.

Figure 1. Konya Plain Location Map (Taken from Bozyiğit and Güngör 2011



The KOP region constitutes approximately 12% of Turkey's agricultural areas (3,021,542 ha), approximately 16% of irrigated areas (909,269 ha), and 21% of madas areas (835,665 ha). In 30% of the agricultural areas in the region, irrigated (including unlicensed wells) and in 70% (2,112,273 ha) dry farming is done.

The lack of rainfall in the region and the shift to plants that consume a lot of water but have high incomes have increased the pressure on groundwater use. The groundwater level in the region drops by around 3 percent each year. If the groundwater level continues to drop, water extraction will no longer be economical after a certain depth. This situation creates the risk that a large portion of the currently irrigated areas will not be irrigated in the future. (KOP, 2013; 3)

3. Evaluation of Konya Plain in Terms of Water Potential

Konya plain has a total water surface area of 178,157 ha, 2,939 hm3/year surface water (66%), 1,508 hm3/year underground water (34%), with a water potential of 4,447 hm3/year. 94.1% of the total water surface area of Konya province consists of lakes and 2% consists of dams and ponds.

- Tuz Gölü => 44.1%
- Beyşehir Lake => 32.5%
- Hatamış Lake => 4.8%

Konya province's surface water potential is 2,939 hm3 per year. The 2 important sources that cause the increase in this potential are Göksu and Beyşehir Lake.

3.1.Groundwater Potential

Groundwater use in the Konya Plain began in the 1960s. At first, boreholes were opened by YAS (underground irrigation) cooperatives established through public and citizen cooperation, later they began to be opened by individuals alone, and groundwater use continued to increase. In addition to the need for water for agricultural production, the inadequacy of surface water resources in the plain, along with the increase in urbanization and industrial activities, has increasingly increased the use of groundwater. It has become the area where groundwater is used the most in Turkey (Table 1) (WWF Turkey 2014).

Name	Average Flow (h3/year)	Collection Rate
Konya-Çumra-Karapınar Basin	441	%29
Sarayönü-Kadınhanı-Ilgın-Yunak Basin	300	%20
Beyşehir-Seydişehir Basin	112,6	%7,5
Akşehir Basin	31	%2
Cihanbeyli-Yeniceoba Basin	62	%4
Altınekin Plain	74	%5
Others	487,4	%32,5
Total	1508	

Table 1. Konya Plain Groundwater Potential Distribution Rate.

The most common groundwater in the Konya Plain is aquifer formation Neogene aged lake limestones. In the Neogene, the Konya Closed Basin, which was an inland lake, rose with epeirogenic movements at the end of the Neogene and passed into the terrestrial environment. Therefore, the most common formations on the basin floor are limestone, krillstone, marl, etc. belonging to the Neogene. The Konya Basin, which was located in a terrestrial environment in the Pliocene, was covered with terrestrial sediments. These units, which are mostly in the sandstone conglomerate lithology, have low permiability. They are generally located on the edges of the basin. Lake sediments that show aquifer characteristics are generally located in the low floors of the plain floor. The Konya Plain aquifer formation is mesosaic limestones. It is possible to obtain groundwater from the cavities and cracks of these limestones. The waters in the drainage area of the Konya Plain are medium salty and low sodium. In the middle of the plain, the salt ratio increases. It is high salty and low sodium. The area around Ereğli, in the northeast of the Konya Plain (in the Salt Lake Basin), has very high sodium.

4. Environmental Impact Assessment in Land-Water Use

The imbalance between the region's water resources and soil resources has deteriorated in recent years to the detriment of usable water potential, threatening agricultural and environmental sustainability. It is important to open many wells to benefit more from groundwater. In such places, the groundwater table is falling, wells are deepened to get more water and fossil waters with high lime and salt content are extracted. This situation pollutes the soil in irrigated agricultural lands and reduces the quality of agricultural products (Atalay 2016 ;253). This situation not only pollutes the soil, but also leads to barrenness and pollution of quality groundwater, thus impairing water quality.

In the region where the effects of global climate change are felt the most, considering the availability of usable water, it has become necessary to make a radical change in the agricultural sector in order to ensure sustainability in agricultural production. In order to ensure the effective use and sustainability of soil and water resources; consolidation of agricultural lands, completion of on-farm development services, rehabilitation of irrigation systems in irrigation union and irrigation cooperative areas with classical open channel irrigation systems, transition to on-farm pressurized irrigation systems, combating drought, erosion control and afforestation activities will be supported (KOP 2018;12).

As a result of intensive water use in agricultural activities as a result of human activities, water resources, especially marshes, are drying up. Drying marshes lead to new environmental problems. For example, the peat bogs exposed with the drying of the Ereğli reeds in the Plain are being uprooted by the local people and used as fuel. The uprooting of peat bogs causes the upper layers of the soil to disappear and the area to become desert in the long term (WWF Turkey 2014). With the drying of the reeds, salinization and wind erosion have occurred in the soil. Both factors negatively affect agricultural production.

The salinization of agricultural lands causes the salinized areas to remain outside of agricultural production. The slope of the lands in the Konya Plain is 3%. Inadequate surface drainage, high groundwater levels and unconscious irrigations resulting from the low slope have brought the salinity problem in the plain to serious dimensions. Although an effective measure was taken in this regard with the opening of the Main Drainage Canal in 1974, the salinization experienced around Karapınar is an example of this. Soil salinity is especially seen in arid and semi-arid climate regions, especially in areas with lack of drainage. If no precautions are taken and irrigation is carried out, salinization occurs much more quickly. With irrigation, soluble salts in the soil are carried upwards by capillarity and accumulate in the soil. Other causes of salinization include incorrect application of irrigation, lack of sufficient drainage or the presence of high amounts of soluble salts in irrigation water (Deliboran and Savran 2015).

The idea of “too much water - too much product” is widespread among farmers as well as technical staff. Excessive water applied not only causes an increase in irrigation costs, but also disrupts the air-water balance of the plant in the root zone, preparing the environment for the plant roots to rot. As a result, there may be a significant decrease in yield. In addition, even a first-class agricultural land can cause barrenness in areas where drainage is inadequate as a result of excessive irrigation water application. The salt concentration of the groundwater is of great importance in soil salinization (Direk et al. 2006: 82).

In the Konya Closed Basin, which has a semi-arid climate, in addition to the drought in recent years, the increase in the cultivation of agricultural products with high water requirements has led to an increase in the number of thousands of deep irrigation wells in the basin. As a result, various problems such as lowering of the groundwater level and the formation of new sinkholes, as well as soil salinization, drying up of many marshes and springs, and falling levels of surrounding lakes arise.

There is a 14.3m drop in the groundwater level in the 33-year period (Bozyiğit and Tapur 2009;143). Groundwater level changes occur for various reasons. Meteorological, hydrological and geological reasons are the natural factors that create level changes. Water withdrawal from underground, especially for agricultural irrigation or drinking water needs, is seen as a human factor (Yılmaz 2010;152).

These changes in the aquifers located in the Konya plain and its surroundings have been observed to result in the use of water above the existing reserve in the basin, the decrease in water levels each year compared to the previous year, and the unconscious consumption of drinking and utility water by water consumers (Göçmez and İşçioğlu 2004). Groundwater dissolves the rocks it is in contact with and underground cavities are formed. As a result of the decrease in the groundwater level filling these cavities, the unbalanced surface plates collapse and karstic shapes that we call “sinkholes” are formed (Üstün et al. 2007 p.54). This situation emerges as a feature that threatens agricultural lands in the Konya plain (Bozyiğit et al. 2009:143).

The reasons for the change in groundwater levels that cause deterioration in soil structure can be roughly grouped under two headings:

1. Climate: In areas with a dry climate, the soil becomes saline, and due to insufficient rainfall, the salt in the soil cannot be removed.

2. Agricultural activities

5. Soil Salinity

Especially in arid and semiarid climate regions, soluble salts that are washed into the groundwater come to the soil surface with high groundwater through capillarity and accumulate on the soil surface as a result of evaporation (Ergene. 1982). Salinity, which causes adverse effects such as toxic effects on plants and creating water deficit, occurs when water leaks into the depths after excessive irrigation and rainfall, carries some minerals in the soil with it, and then moves upwards under the effect of capillarity and leaves the minerals in its content on the soil surface (Akgül, 2003). The main factors on soil salinization are Chlorine, Sulfate, Sodium, Magnesium and Calcium.

Soil salinization is one of the most important events of land degradation. In arid and semiarid regions, the main factors that reduce productivity in irrigated areas or rain-fed dry agricultural areas can be listed as waterlogging, alkalization and salinization.

Areas where soil salinity problems are seen:

a. Widely arid and semiarid regions

b. Intensively in coastal areas where seawater intrudes into the continent, especially in semi-humid and humid regions

c. Groundwater increases salinity to a large extent

d. Areas where groundwater with high salt content is used for irrigation purposes

5.1. Agricultural Irrigation and Environmental Interaction in Soil Salinity

Irrigation increases productivity in agricultural areas to a very significant extent. However, in addition to the benefits of water to the plant, it can also harm the soil on which irrigation is done. In some cases, as a result of uncontrolled irrigation activities, large agricultural lands can become barren, salty lands. Examples of such areas can be seen frequently in Turkey. (Yılmaz 2010;158).. One of the negative effects of salinization on agricultural activities is that salinized soils become unusable if the necessary reclamation works are not carried out in the future. With the accumulation of salts in the soil, productivity cannot be obtained after a certain period of time. With the decrease in productivity in the soil, plants can no longer grow. In such a case, the cultivated land is abandoned and left for non-agricultural use. (Yılmaz 2010;158)..

As a result of the opening of dry agricultural areas to irrigation, the part of the ions contained in the water that cannot be removed from the body with a suitable drainage system begins to accumulate in the soil, especially in arid and semi-arid regions. This also causes salinity and alkalinity problems in the soil (Bahçeci et al., 2008).

Environmental problems caused by irrigation seen in a farmer's agricultural land may seem insignificant. However, if these unconscious irrigations are applied by many farmers, a major environmental problem may arise. For this reason, irrigations should be monitored and evaluated in terms of environmental problems and measures should be taken to eliminate or reduce the problems. Environmental problems seen in irrigation mostly arise from the lack of an effective monitoring and evaluation system during the operation phase (Çakmak and Kendirli 2001:42).

The following measures should be taken in order to use irrigation with a sustainable understanding with the least harm to the environment and the most benefit are itemized in Çakmak and Kendirli (2001).

a. Determination of a management strategy that will provide effective project operation and maintenance: In terms of preventing excessive water use.

b. Training of the manager, operator and farmer

c. Technical solutions: In terms of problems related to drainage needs.

d. Establishment of an integrated regional plan covering basin planning, resource planning and environmental health planning: In order to identify the necessary measures in terms of quality and quantity and to eliminate potential environmental impacts.

5.2. Prevention of Soil Salinization

In the region where the effects of global climate change are felt the most, considering the availability of usable water, it has become necessary to make a radical change in the agricultural sector in order to ensure sustainability in agricultural production. In order to ensure the effective use and sustainability of soil and water resources; It is necessary to evaluate the use of soil-water balance and prevent salinization in the soil.

In order to solve the problem of salinization in the soil, first of all, an advanced drainage system must be established. Irrigation and drainage systems are activities that cannot be separated from each other and must be processed together (Yılmaz 2010;158). For this reason, drainage and irrigation systems must be established together in areas where irrigation is available.

Inappropriate water use and management prevents reaching possible potentials, causes high-productivity agricultural areas to be flooded, and increases salinity and alkalinity, causing agricultural lands to move outside their areas.

In the measures to be taken for soil salinization and its solution, the following issues should be examined/solved in a continuation of each other, and the priorities to be made should be in the planning:

• The management level of the soils should be improved by bringing uncultivated and potentially workable soils into agriculture.

• Economic incentives, input adequacy status, monetary resources, land management skills, water availability, changes from region to region in climate and soil characteristics should constitute the basic principle and general characteristic in the management, rehabilitation and diagnosis of salt-affected soils.

5.2.1. Planning regarding the Structure of Agricultural Lands

One of the factors affecting agricultural productivity and agricultural water use in Turkey is the small-scale and scattered structure of agricultural lands. (Parlak, 2010) These small, scattered and irregularly shaped parcels prevent irrigation planning, project design and the use of modern irrigation methods. It negatively affects agricultural productivity (Muluk et al., 2013). Land consolidation processes should be completed in order to eliminate these negativities.

5.2.2.Planning on Groundwater-Drainage

Drainage is an absolute necessity in salinity control. In areas where drainage is sufficient, accumulated salt must be removed from the root zone by washing. Washing should also be applied in conditions where it will not act as a source of salinity by raising the groundwater. Drainage, washing and more resistant plant selection practices should be carried out to prevent long-term salinity. Frequent irrigation, land leveling, adjustment of fertilization time and planting methods are helpful in salinity control studies.

5.2.2.1.Relationship Between Groundwater and Salinity:

As a result of high groundwater and unconscious irrigation, salty areas have formed in the plain. Especially in months when irrigation is intensive, groundwater rises (Çakmak and Kendirli 2001). The rise of groundwater to the plant root zone with capillarity disrupts the air-water balance in the soil against the air, carries salts to the upper layers or plant root zone and causes salinity and alkalinity problems. As a result of pores filling with water, cold and wet soil conditions occur, and accordingly, planting and harvesting processes are delayed; root cell division and proliferation slows down and thus root development cannot reach the desired level (Güngör et al. 1996; 295). For sustainable irrigated agriculture, the groundwater level must be constantly monitored and this level must be kept at acceptable values (Dinç et al. 2004).

5.2.2.2. Drainage System-Salinity Relationship:

Drainage systems can be constructed to ensure sustainable agricultural production. This goal can be achieved by designing and constructing systems that take into account all changing soil, plant, water and climate conditions and provide appropriate water and salt balance in the soil. For an appropriate water and salt balance in the soil, excess water must be removed from the root zone at the appropriate time and with an appropriate system. However, while removing excess water from the soil, short-term dry periods must also be taken into account. Otherwise, there may be more product losses due to water deficiency than those resulting from excess water. Excessive drainage in irrigated areas causes a decrease in water application efficiency, water insufficiency and therefore the reuse of drainage water in irrigation (Bahçeci et al. 2007;7). At this point, drainage water contains excess salt and emerges as a factor affecting soil salinization.

5.2.3. Water Potential Planning

Preventing the increase in groundwater use is an important situation that needs to be addressed in terms of soil salinization. For this purpose, the issues we have itemized regarding the amount of groundwater use in the planning should be included in the planning. Measures:

1. A large portion of farmers prefer the flood irrigation method due to low irrigation costs and not having sufficient knowledge about modern irrigation techniques. However, labor costs are high with this method and since water cannot be applied homogeneously to all plants, the yield is low. For this reason, there is a need for publication activities such as seminars, courses, etc. that provide significant water savings, namely irrigation methods, irrigation times.

2. In practice, the use of devices such as mercury tensiometers should be widespread, which will enable farmers to give up determining irrigation times by using plant appearance.

3. Instead of plant patterns such as sugar beet, beans, corn, squash and lettuce, where surface water is insufficient and groundwater resources are used for irrigation, farmers should be advised to grow plants with lower water consumption.

4. With the DSI underground measurement systems regulation, which entered into force with the Official Gazette numbered 27957, underground water banks should be documented and water withdrawals should be controlled.

5.2.4. An Effective Irrigation Method

When other methods are considered, the drip irrigation method brings some important advantages. Accordingly; it allows cultivation without creating stress on the plant with low water applications, minimizes water nutrient losses since it does not create surface flow and deep leakage, and provides irrigation opportunity in waters with high salt content (Ökten 2011 p.131).

Daytime irrigation should be prohibited with windy and rainy weather, and at least one "agricultural meteorology station" should be established in each district to correctly determine the water needs of plants. Drainage water should be recycled with natural treatment. Mulches should be used in combating weeds to prevent chemical pollution of underground water (KOP, 2013; 30).

5.2.4.1.Additional Water Application

Instead of expanding irrigation areas, additional water to be brought from other basins is primarily considered for artificial feeding purposes in order to restore the natural balance of underground water (KOP, 2013; 35).

Transporting water from outside the area should be removed from priority. Emphasis should be placed on the efficient use of existing resources, regulations regarding agricultural production and acceleration of land consolidation studies.

5.2.5.Agricultural Plants and Alternative Plant Application

When the water consumption values of the plants in irrigated agriculture in the Konya plain are examined, the precipitation-water use balance in the region is strikingly revealed. Because the water consumption required for many plants grown in the region to grow water is well above the annual precipitation average (Yılmaz 2010; 151). The development of agricultural products such as sugar beet, corn and sunflower, which have high irrigation needs, is increasing. Since the net water need cannot be met (Table 2), it causes excessive use of underground water.

	W	B	S	C	P	Su	Ve	A	K

	heat	arley	ugar Beet	orn	otato	nflower	getable	lfalfa	idney Beans
W ater Consu mption (mm)	4 41	4 20	8 25	6 85	6 05	61 5	75 0	1 200	5 35
N et Water Requir ement (mm)	4 00	3 50	7 05	6 30	5 40	50 0	70 5	1 000	4 80

Table 2. Water Consumption and Net Water Needs of Irrigated Plants in the Konya Plain (Toprak et al. 2008).

The plain crop pattern should be reviewed and especially the corn and sunflower production, whose cultivation areas have increased unplanned in recent years, should be re-evaluated.

Sweet-Sorghum, has a very low water requirement and low fertilization requirement compared to other similar products. On the other hand, since it is a plant with high adaptability to different climates and the ability to grow in low quality soil (Ökten 2011 p.136), the use of an alternative plant to sugar beet in the region will be an effective solution.

5.2.6. Contribution to Ecological Solutions

Forest green vegetation is an important element of the water method in the Konya plain with its soil and water retention feature. For this reason, afforestation studies in the plain are gaining importance.

False Acacia afforestation studies should be used as an important fact in providing water saving in the Konya basin. Factors such as the need to detect sands lost by transportation, afforestation of abandoned agricultural lands, abundant seed yield, vitality, excellent vegetative renewal ability, ability to detect free atmospheric nitrogen, wide range of uses of its wood, beekeeping that can be done by using its flower reveal the need to spread the use of false acacia (Ökten 2011 p.141).

5.2.7. Supportive Additive Application to Agricultural Soils

Salt (sodium) problems start in the soil due to reasons such as the natural structure of the soil, long-term agricultural activities, irrigation water, plant nutrients used, etc. The excessive salt problem threatens agricultural production. The product called Archer is used as a salt remover or soil conditioner in soils with salinity problems. This drug replaces the sodium element with the calcium element, freeing the sodium and moving downwards, removing it from the soil surface. 1.5-2 liters are used with dripping, and up to 5 liters are used in extremely salty soils.

5.2.8. Land Reclamation Studies

Partial or complete failures are observed in reclamation studies due to lack of proper diagnosis and use of incorrect methods. This situation causes loss of money and potential increase in plant production.

Conclusion and Recommendation

In light of the explanations we have made regarding the salinization problem observed in the agricultural lands of Konya Plain, we can itemize it under the following headings:

1. Since Konya Plain rose with epirogenic movements at the end of Neogene and passed to the terrestrial environment, aquifer formation caused it to be calcareous. This caused the soil and waters of the Plain to be salty.

2. The slope of Konya Plain lands is 3%. The low slope causes insufficient surface drainage and high ground water level.

3. Since Konya Plain has a semi-arid climate, it does not receive regular rainfall. Meteorological drought is increasing in the field.

4. Almost all of the surface and groundwater of the plain is directed to agricultural areas. This situation;

a. Water demand expands the crop cultivation area, which leads to soil degradation

b. Since it is insufficient to meet the water potential, it increases the tendency to supply water from other basins

c. It increases the tendency to groundwater. It appears as excessive irrigation or excessive use of groundwater in dry agricultural areas.

d. Marshes and reeds are drying up.

5. The plain is undergoing a rapid process in terms of industrialization. This situation;

a. It increases the use of agricultural lands for purposes other than their intended purpose and causes the soil structure to deteriorate.

b. Water and waste used in industrial facilities are directed to plain water resources and soils. This situation leads to changes in underground-surface waters and soil chemistry.

c. It creates high amounts of soluble salt in irrigation waters.

6. The population is increasing in the Konya Plain. This situation;

a. It increases the tendency towards agricultural lands.

b. It increases the tendency towards water reserves and consumes already scarce resources, increases basin water transportation and tendency towards groundwater.

c. Agricultural lands are evolving towards a small and fragmented structure.

d. It increases the idea of earning more income.

e. It leads to an increase in industrialization.

7. Low level of education of farmers and wrong irrigation methods increase salinization and the removal of peat bogs in the dried reeds and marshes and the destruction of the upper soil layer increase desertification in the long term.

In order to eliminate the problem of soil salinization in Konya Plain, the following issues should be re-evaluated as revised elements in basin planning.

• Farmers should be trained in irrigated areas

• Regular maintenance of the drainage network

• Establishment of in-field drainage systems

• Leveling arrangement studies for the field

• Development of land consolidation in the region

• Efforts should be made to reduce the share system

• Purchase of all or part of the water from users at its real price

• Selection of irrigation methods with high water use efficiency

• Production in accordance with the planned plant production pattern

• Regular monitoring of salt-affected areas

• Focus on sustainable land management

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