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Planning for Sustainable Agro-Ecosystems in Turkey a Systems Approach

Türkiye'de Sürdürülebilir Tarımsal Ekosistemlerin Planlanması ve Sistem Yaklaşımı

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Abstract:

Agricultural production is an important activity for the future of humanity. However, according to the observations and available data, it is seen that there will be serious problems in agricultural production in the not too distant future. Within this, agricultural production should be made sustainable. Made in this study is to define a sustainable ecosystem approach to Turkey. Especially in recent years, our country has started to severely deteriorate from agricultural production. As a result, there has been an increase in the number of producers who abandon production. It is expected to increase further. The main reason for this is determined as agriculture is not sustainable.

Keywords: Agriculture, Ecosystems, Sustainability, Turkey

Öz:

Tarımsal üretim insanlığın geleceği açısından yapılması gereken önemli bir faaliyettir. Ancak yapılan gözlemlere ve eldeki verilere göre çok uzak olmayan bir gelecekte tarımsal üretimde ciddi sıkınıtların yaşanacağı görülmektedir. Bunun içinde tarımsal üretimi sürdürülebilir hale getirmek gerekmektedir. Yapılan bu çalışmada Türkiye için sürdürülebilir bir ekosistem yaklaşımı tanımlanmak istenmiştir. Ülkemiz özellikle son yıllarda tarımsal ürtimden ciddi olarak kopmaya başlamıştır. Bunun sonucu olarak ta üretimden vazgeçen üretici sayısında artışlar olmuştur. Daha da artması beklenmektedir. Bunun ana nedeninin tarımın sürdürlebilir nitelikten uzak olması olarak belirlenmiştir.

Anahtar sözcükler: Tarım, Ekosistem, Sürdürülebilirlik, Türkiye

Introduction

Agricultural production is successful based on a certain system. The success of the system is influenced by the variety of goods produced. It is only possible to benefit from the services provided by the ecosystem and to understand it in the best way. The concept of 'ecosystem

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services' has been brought to the fore and started to be used in this respect (Daily, 1997). What is essential here is to establish a certain ecological system and apply it to the benefit of the people (Kremen et. al., 1993). Ecosystem approach has a distinct importance for sustainability of ecosystem. If we do not provide a system approach, we may not have anything to talk about in the ecological sense in the near future. There is a long history of information about the vital importance of ecosystems and the establishment of an appropriate system. In fact, it is stated that the first study was made by Plato in 400 BC (Mooney et. al. 1995). In his observations, Plato examined the conditions of forests, tree losses, soil erosion and pastures (Pimental et al., 1992).

Serious studies have been carried out on the re-consideration and more serious review of ecology. There was consensus on the need for a paradigm shift. Especially the environmental problems that have been observed in recent years have reached a level that threatens our health and our future, and necessitates to take precautions. In particular, it is agreed that experts between economics and ecology should work more on eco-ecology. Ecological production is one of the most important things to be done. In ecological production, ecology had to come to the forefront both in industry and agriculture. In order to achieve this, agroecological systems had to be developed and applied.

Biodiversity is essential for the survival of life. But we've just started to realize that. Especially the increasing ecological and economic problems in recent years have begun to make us feel this. Change of all kinds of genes in order to maintain a healthy life, species, communities, ecosystem function, which is important for all ecosystems. The relationship between biodiversity and the ecosystem is complex and complex, but understandable. Biodiversity is usually directly related to mobility in a particular system (Balvanera et al. 2006). For example, the increase in plant species and diversity is also important in erosion control (Cardinale et. al., 2012).

Because as the plant diversity increases, the amount of root in the soil increases and so the amount of soil uptake increases. As the amount of retention increases, the amount of erosion decreases. Some abiotic factors, sometimes found in the ecosystem, can be effective in securing biodiversity. In particular, the structures of some soils, slope, physiography and altitude can be effective in preserving biodiversity (Brauman et. al., 2007). However, it is only necessary to know that it is not possible to protect the ecosystem with these. The characteristics of ecological structure are defined as ecosystem performance (Naeem and Li, 1997). Ecosystem performance, on the other hand, has the ability to determine the development of ecosystem events, plant diversity and also the direction of change.

With an appropriate management system, Agroecosystem relies on the ability to maintain the production of 40% of food, fiber and other products (Foley et al., 2005). Another contribution is the production of many strategic and critical products, especially food supply. Agorecological system approach has started to be used as a result of unsustainable agricultural management and other human activities(Foley, 2012). The production systems designed to sustain the modern life today have seriously damaged the world's biophysics and biochemistry (Rockström et. al., 2009). Particularly in the field of agriculture, the desire to produce more has made it compulsory to use more fertilizers and pesticides. Changes in the use of fertilizers and drugs have also led to changes in ecological processes that determine the existence of the ecosystem (Kremen, 2005). Zhang et al. (2007) emphasized that agriculture should be redesigned in order to maintain the ecosystem. However, there is insufficient information on how to design it. It would not be right to design according to a single region or country. Every place has its own ecological characteristics (Garbach, et. al., 2012). According to these ecological features, it would be more appropriate to spoil ecological planning.

In order to establish the agroecological system, the agricultural structure needs to be well known. It is also important to know that climatic factors and changes are determinant in agricultural production. Soil structure and productivity development studies, soil formation processes, physical, chemical and biological properties of soil, and nutrient cycle mediated by biotic and abiotic factors support the growth and development of the plants growing there. In case of deficiency, growth and development are interrupted and ecological structure is interrupted (Heuperman, et. al., 2002). In particular, the duration of the negative ecological structure is important. If the negativity period is short, the plants have tolerances to overcome this with minimal damage. However, in the case of prolonged periods of time, there is often no opportunity to compensate.

Soil structure and properties are very important in ecology. Soil structure is effective in determining the quantity and quality of the product taken (Zhang et al., 2007). They process the organic substances in the soil and make them useful for the plants. Thus, the plants identified as primary producers are provided to be more productive. The continuity of these biological events in the soil and the fertility of the soil are preserved (Daily et al. 1997).

It is recommended that soil tillage in agroecosystems should be reduced as much as possible. As the number and depth of tillage increases, the soil structure starts to deteriorate. Distortion primarily affects productivity. The decrease in productivity reduces the amount of product that can be taken. It is called adlandır nutrient losses inde in this agricultural ecosystem (Daily et al., 1997). When nutrients begin to disappear within the system, new nutrients that can be

substituted must be replaced. Each product to be added externally will incur a separate cost. The increase in the cost will increase the price of the product. This will become an increasingly vicious circle and will eventually become unsolved. Food management in the management of agricultural ecosystems tries to ensure that the nutrient cycle is maintained intact(Bianchi, et. al., 2006). The more successful food management can be, the less input from the outside. The real problem is the content of the input rather than the input. Chemical inputs tend to disrupt soil structure and soil balance. Using it properly does not create a big problem. However, excessive use of chemical fertilizers and pesticides can cause serious problems. Particularly in intensive agricultural systems where intensive agricultural practices are carried out, the sustainability of agricultural production does not remain (Matson et al., 1997).

An important issue in planning the agricultural ecological structure is related to the active functioning of the fertilization mechanism. The presence and activity of the pollinating insect in it should be sufficient. 85-90% of the flowers can be fertilized only with the help of animals (Klein et al., 2007). Here it is useful to briefly explain the existence of animals. By animal, we mean bees (including hornets), other insects, birds, bats, thrips, butterflies, moths, flies, and similar creatures (Nabhan and Buchmann, 1997). Seed formation will not be possible unless pollination occurs. It is sometimes sufficient in the wind to pollinate plants such as wheat, corn, rice and sugar cane which are important in the world. However, the duration of wind and blowing speed can be effective in this. Of course, the humidity of the environment should be considered as an effective factor. In our country, pollination is carried out by insects, which provides an advantage over 10 billion dollars to the economy. Therefore, it is not right to ignore pollination in ecosystem planning. From a commercial point of view, Apis spp. known as honey bees. Both agricultural management and landscape configuration are important for the successful distribution of pollination.

Animal pests are known to be an important limiting factor for world food production. It is reported that the damage caused by pests is around 15% on average worldwide (Oerke, 2005). The monetary equivalent of this amount is approximately 30 billion dollars. We lose this money which is a very high amount due to pests. Although the extent of damage caused by pests in our country is not known exactly, it is estimated to be 15-20% of the total crop (TZYMB, 2012). Although large amounts of pesticides are used in agricultural holdings, this loss is a matter that should be considered separately. Particularly intensive use of drugs leads to a decrease in the effectiveness of the drugs after a certain period of time. More chemical use is preferred. However, this also increases costs (Bianchi et al., 2006). Studies show that

although the amount of chemicals used for pests has increased considerably, the damage cannot be significantly reduced (FAO, 2011). and pesticide applications have started to fail, with a similar effect seen in locusts in Indonesia (Naylor and Ehrlich, 1997). While ecological planning is done, it is cheaper and healthier to use their predators instead of using chemical drugs in the fight against pests (Thies and Tscharntke, 1999). It is important to consider this issue when developing an agricultural strategy.

Sustainability in the agricultural ecosystem is characterized by tremendously divers an arrow of ecological characterizes. Ecological diversity depends on human behavior that economic and socio-cultural characteristics of them. The focus on one major agroecosystem classification, arid and semi-arid ecosystems extend for just arid one-third of Turkey's land surface constituting 65 percent of Turkey.

FAO, which prepares a report on meadow and pasture ecosystems, has described different grazing systems actively used in the world (Anonymous 1979; Gill 2003). These systems are used almost everywhere in the world.

1. Free grazing system controlled by the natural ecosystem. In this system, there is no serious intervention to animals. Animals graze freely. It can be applied successfully in pastures without feed production problems.

2. Grazing of straw, straw and stubble left in the field at the time of harvest. This bypass system is very heavy throughout the world. It is applied intensively especially in developing countries and in countries that are not systematized in terms of animal husbandry. It is necessary to eliminate the feed gap.

3. Grazing in private production farms. The facilities are specially built and the animals are grazed in a controlled manner. Such areas are used for commercial purposes.

4. Pastures are improved after being improved by special breeding methods or conservation programs.

5. To eliminate the feed deficit by breeding forage crops.

This diversity observed in grazing systems results from insufficient production in terms of feed supply. However, the main problem is that the necessary and sufficient standards for grazing are not developed. The absence of a specific standard indicates that it is not in order. As a result of irregularity, our pastures are starting to come out of hand.

While the pasture existence in our country was 44 million hectares in 1960, this area has decreased to 8 million hectares today. If the necessary measures are not taken, it will not be wrong to say that this area will decrease further in the coming years.

Turkey tried to yapıul rural development in general studies report that did not provide sufficient development. The reason for the failure is that managers do not make serious efforts on the issue. There are many social and political reasons for this. As in the rest of the world, major changes are taking place in our country in the field of management. These changes force changes in the agricultural field. However, it is understood that the change is not very fast and our manufacturers cannot adapt to this change. The real problem is that it is not clear that change is really necessary for our manufacturers. The socio-cultural structure of the producers working in the field of agriculture also changes their view of ecology. In order to do this, it is necessary to change the view of the ecology in the producers. They need to be convinced that without ecology there is no human being. This is also important for the sustainability of agricultural production. As long as this is not achieved, there will be continuous problems and concerns about ecology (Gill 2003).

Turkey has a large number of universities and agricultural research institute in. All of these institutions endeavor to ensure the sustainability of agriculture. Of course, this issue is also very difficult to be affected by the changes in the international arena. Stuck between economy and ecology, humanity must make a decision. Which one to choose. He knows whichever one he chooses will face the problem. But a new structure, which can be called eco-economy, can save us. Its rules and institutional infrastructure need to be established urgently. Because sustainability is a multi-factor issue. Human-nature, animal-nature and human-animal-nature is a structure that contains and believed to be harmonized. It should be remembered that the continuation of this will also mean the continuation of it in humanity. The traditional perspective on natural resources economy should be left in this. Mankind must learn to respect nature and understand that protecting it is protecting its own future.

Planning for sustainable agroecosystems:

In order for the system to function actively, standards must be established first. Within this, manageable farms need to be established. All stages need to be planned from the establishment of these farms to the operation and the final user. Traditional farm management should now be abandoned. More current and more ecological models should be emphasized. Because traditional agricultural management methods are only for recovery, they do not have environmental protection and ecological concerns or they are not sufficient, it is too late to get feedback in getting problems and results, there are big deficiencies in terms of feedback, they have a harder position in terms of growth and development, external they are easily influenced by factors and hesitate to be dynamic (Dillon and John, 1992)

Consequently, classical operating systems are not ecological. This system, which still continues today, continues to protect itself. Moreover, it resists not to implement the ecological economy(Arthur, 1989). The dynamics of the system are no longer sustainable. Therefore, it is necessary to change the thinking and action. It may be possible to say that the new system, which consists of a combination of only economics or ecology with two systems, is far from feasible. Because if the joins are not performed in accordance with the conditions, new and larger problems will be encountered (Forrester, 1961). The level of concessions to be made from both ecology and economy will determine the success of consolidation. Very important details can be found here, so be very careful (Mandala and Ivanhrenko, 1993). Farmers are open to all kinds of effects in their work. If the effect is positive, the result will be positive, if negative, the result will be negative (Radzicki, 1990). In all ecological modeling studies, the approval of the farmers must be obtained and approved (Mosekilde et. al., 1983).

System Definitions

What Sustainability means is that the system is successful. As long as the system can survive, successful processes can be achieved (Stafford and Coull, 1991). Sustainability should be addressed to include ecology, economy and socio-cultural concerns of people (Garbach et. al., 2014). These three factors are also effective in determining and guiding individuals' living conditions. Because being sustainable means moving the existing system forward. This will not be sustainable if we cannot move forward (Gill 1996). To ensure sustainability, let us briefly consider this internal factor;

-If there's ecology, it's us. Without ecology, we won't have one. If this principle is taken, we can see the problems in a healthier way and solve the problems. Ecological continuity is important and effective in almost every field not only as agricultural production but also with humanity. We must protect our natural resources and be able to transport them to the next generations. Within this we must avoid interfering with the naturalness of the natural ecosystem. Any intervention without a thought of conservation and sustainability in nature will become a weapon that destroys the ecological structure. It won't be wrong to say that this weapon will shoot us the last time.

- Economic sustainability is important for the prosperity, future and peace of the countries. It should be adjusted so that it does not contradict ecology when guiding economic studies. Economic requests should only be prevented from being economically based. Ecology needs to be taken into account. Because in ecology-protected studies, overheating can also reduce the area of motion of the economy. No one in his right mind would like this.

Another sustainability is the socio-cultural one. The results obtained from the adaptations that will be spoiled economically and ecologically will also affect the social and cultural structures of individuals. However, the amount of influence should not reach the level that would disrupt social fat. Social and cultural structure is a very valuable bond that keeps societies together. Any effect that will weaken this bond will damage it. Therefore, care must be taken and careful.

All three factors should be taken into consideration in the planning. It can be difficult to create a system in which these will take place in harmony. But it is not impossible. Human beings are able to achieve this. Turkey is more advantageous in this regard. If he can take advantage of this, he can set an example in terms of sustainability.

Socio-economic and ecological systems, including agriculture-based systems, are always in contact with each other. These relationships are generally nonlinear. It is difficult to recognize non-linear models. It is important to know the model parameters that should be included in the nonlinear model. However, it should be remembered that these parameters really need to be known (Gleick 1987). Because when working with linear models, determining the effect can be easier and more descriptive. However, this is very difficult to say in nonlinear models. There will be no specific analytical analysis of a nonlinear system. Nonlinear dynamics are effective in the majority of agricultural ecosystems.

However, when the models are installed and the test phase is started, disassembling the model may give more reliable results. This is because the nonlinear model can be divided into appropriate parts to make it more descriptive. When dealing with small parts instead of the whole model, the model solution will be easier and will be useful for future integrity.

Wolstenholme (1982) examined the dynamics of the system in his study. He stated that system dynamics can be subjected to qualitative and quantitative analysis. He also explained the differences between them. It is necessary to try to identify these differences. Some of the differences can be determined very easily, while others are very difficult to identify. It will need to be determined in order to increase the power of the model, whether it is difficult or not. It is clear that great efforts must be made for this. However, if we want to achieve a truly sustainable structure, let's not forget that we are obliged to do so. We know that it is difficult to make predictions about the future healthily because there are many interactions in non-linear and multi-factor studies. But we also know that this has to be done. We also believe that this can be done. Waldrop (1993), Staces (1993) and Lewin (1999) stated that the probability of estimation is low through modeling of nonlinear complex systems. However, in today's world it will be easier and more likely to succeed. and their practicality.

Following a systematic modeling procedure developed by Gill (1993), the system dynamic model was developed by a program called STELLA. This model is seen as applicable in the conditions of our country. However, some changes may need to be made. The model consists of six interrelated parts or business models (Figure 1).

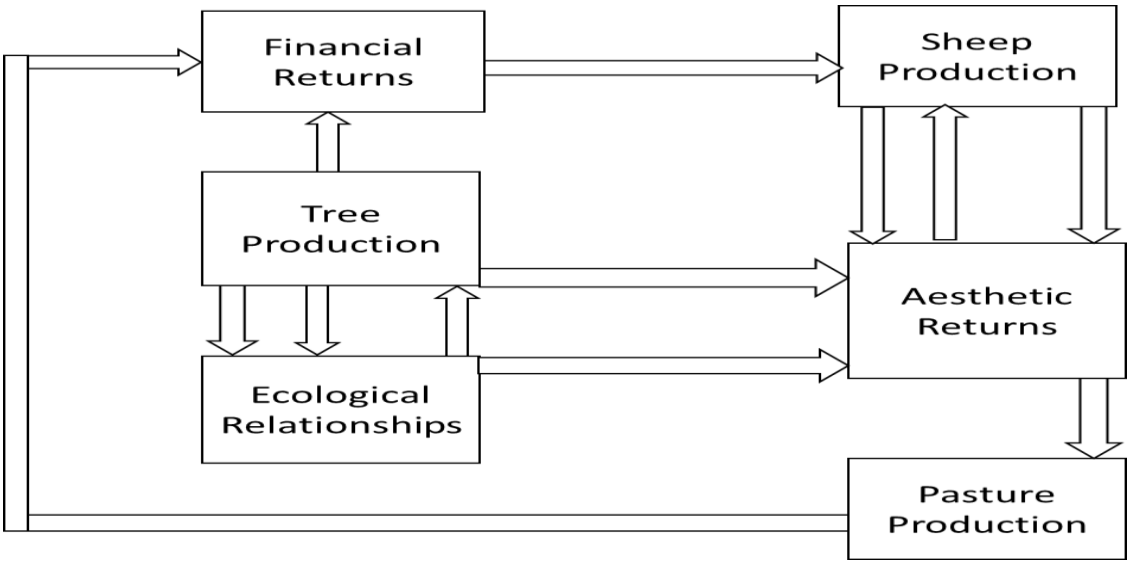

Figure 1. The system dynamic model (Gill, 1993).

The developed model tries to integrate the ecological, economic, financial and aesthetic aspects of the system under study. In our country, these factors should be evaluated together. It can be a little easier to solve multivariate changes in developed and working countries. However, this is much more difficult in Turkey, and the like. Because the calculated effects are not always effective, sometimes they can be very different but unrelated factors that are not in the calculation. At this point, who knows the Turkey agriculture needs to be done and will identify the model parameters as well organized team jumps establishment.

Garbach et al. (2014) tried to model the ecosystem and defined the system as follows;

1- Provision of services for the maintenance of the ecosystem (food, fuel and agricultural production)

2- Irrigation, planting norms, disease and pest control and regulation of waste

3- Support systems such as soil, nutrient cycle required for quality production and

4- cultural services and intangible benefits. Researchers have stated that the system works successfully.

Turkey is fortunate in this regard. This model developed by Gill can be done in our country better. Model parameters can be adjusted according to our own conditions. More importantly

the model can work. To do this, the priority is to create a team of experts in modeling. After the team is formed, the parameters to be used for the model are determined with a detailed study and the model is installed and operated. In the model, all parameters related to economy, ecology and steam will be taken into consideration and studies will be done. The ecological and economic structure in each country is different. However, the main difference is the social and cultural structure. We can do this by using the systems that we will develop instead of the imported systems.

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