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ІНСТИТУТ ЗЕМЛЕКОРИСТУВАННЯ

ФОРМУВАННЯ СТАЛОГО ЗЕМЛЕКОРИСТУВАННЯ: ПРОБЛЕМИ ТА ПЕРСПЕКТИВИ

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Видання містить матеріали IV Міжнародної науково-практичної конференції «Формування сталого землекористування: проблеми та перспективи». Тематика конференції відображає комплексність, міждисциплінарність і багатовекторність проблем формування сталого землекористування та інноваційних підходів до їх вирішення. У тезах доповідей учасників представлено технічні, організаційні, економічні, екологічні та соціальні засади забезпечення формування сталого землекористування.

Матеріали збірника будуть корисними для фахівців у сфері землеустрою, геодезії, картографії, містобудування, геоінформаційних технологій та ін.

The publication contains materials of the IV International scientific-practical conference "Formation of sustainable land use: problems and prospects". The theme of the conference reflects the complexity, interdisciplinarity and multi-vector nature of the problems of sustainable land use formation and innovative approaches to their solution. The participants' reports present the technical, organizational, economic, environmental and social principles of ensuring the formation of sustainable land use.

The materials of the collection will be useful for specialists in the field of land management, geodesy, cartography, urban planning, geographic information technologies, etc.

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СЕКЦІЯ 9.
МЕЛІОРАЦІЯ ЗЕМЕЛЬ І МЕЛІОРАТИВНІ ЗАХОДИ

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PROBLEMS IN THE USE OF SOIL AND WATER RESOURCES IN TÜRKIYE AND SUSTAINABLE USE STRATEGIES

Abstract. Food, water and energy are the three essential factors in living life. For this reason, the land and water resources have strategic importance and are an economic value for countries. Climate change and global warming will negatively affect the life of organisms in the near future and on a global scale. Use of natural resources in effectively and sustainably ways is very important in order to transfer them to future generations under better conditions. The effect of erosion is greater in areas with a high slope due to weak vegetation in Turkiye. For this reason, more than 90% of agricultural lands have mild or severe erosion problems. Turkiye is, thus, vulnerable to erosion due to climate conditions, topography and soil structure. Another problem in terms of agricultural lands is decrease in cultivated agricultural lands due to main reasons such as urbanization, tourism and industrial use. The other main problems are crop stubble burning, irregularity of property distribution and insufficient land consolidation, high loss and leakage of drinking and domestic purposes in water, excess water in agricultural irrigation, salinization and drainage. For sustainable use and protection of soil and water resources, technical and agronomic practices and institutional decision and approaches could be considered. Use of modern pressurized and smart systems with qualified personnel in irrigated areas, preventing erosion, use of agricultural lands for only agriculture purposes, diversifying the plants to be grown in crop rotation, avoiding overgrazing, and preventing stubble burning are of strategic importance for the sustainable use of agricultural lands. Increasing of irrigation efficiency and water productivity for sustainable irrigation is essential. In addition, applying more sanctions and penalties to those who engage in use of inapproriate soil and water resources, and preventing decrease the parcels' dimension of agricultural lands.

Intoduction. Soil and water resources are the habitat of all living things in nature, and also serve as the basis for providing food for all. Additionally, food, water and energy are the three essential factors in living life. For this reason, the land and water resources owned by countries have strategic importance and are an economic value.

According to the reports of the Intergovernmental Panel on Climate Change (IPCC), climate change and global warming will negatively affect the life of organisms in the near future and on a global scale, as well as having an impact on the ecosystem (TTGV, 2022). In this context, the adequacy of land and water resources, their basic and limited existence, becomes even more critical. Accordingly, it has become necessary to use resources

strategically and effectively. Considering all these, it is extremely important to use these natural resources effectively and sustainably in order to transfer them to future generations under better conditions. The use of these natural resources is the responsibility of decision-makers, as well as users such as farmersand organizations/ authorities responsible for its management.

The total area on earth is 510 million km2, of which 149 million km2 consists of land (29%) and 361 million km2 consists of water (71%). Only 48 million km2 is agricultural lands (Anonymous, 2023). Accordingly, agriculture can be done on a limited amount of land on earth. This also varies by country. Turkiye's total surface area is 78 million hectares, and while the area of cultivated agriculture was 28 million hectares in the past, this has decreased to 24 million hectares in recent years (TUIK, 2018; DSI, 2023). The most important reasons for this are to use for new settlements and urbanization, tourism, highways and industry as well as the fact that some farmers have given up farming due to the increase in input costs and the decrease in population in rural areas.

On the other hand, the economically irrigable land in Turkiye has been determined as 8.5 million hectares. In the country, approximately 81.9% of the 8.5 million hectares of economically irrigable agricultural area can currently be irrigated (DSI, 2023).

Turkiye is a country that can be considered topographically mountainous. More than half of the country's surface area is above 1000 m above sea level (Kük and Burgess, 2010; Çetin et al., 2018). The average annual precipitation is 574 mm, and this average varies greatly depending on the region, ranging between 250 mm and 2500 mm. However, it is generally an arid and semi-arid country (MGM, 2023).

In addition, soil and water resources in Turkiye are more affected by climate change and other misuse of land and water resources because continental and Mediterranean climate prevails in Turkiye

In this article, problems and challenges in the use of land and water resources in Turkiye and sustainable use strategies and recommendations are discussed.

Challenges on Use of Soil and Water Resources in Turkiye

The use of land and water resources can be divided into two main groups: natural factors such as geology, topography, soil properties and climate, as well as the effects of active users. Vegetation cover, soil depth, erosion, biodiversity, water availability, land slope and shape, and precipitation are among the first group of factors. By taking all these features into account, users can use soil and water resources effectively and sustainably and even improve those resources.

The most important environmental problems in recent years are climate change and global warming which affect the earth and are still a major handicap. Depending on population growth, environmental pollution is one of the biggest problems due to reasons such as agriculture, industry, urbanization, mining and tourism. This causes pollutants on soil and water resources and a decrease in the quality of natural resources.

Considering the topographic structure in Turkiye, the effect of erosion is greater in areas with a high slope due to weak vegetation. For this reason, more than 90% of agricultural lands in Turkiye have mild or severe erosion problems. The improper plowing and fertilization of agricultural lands, excessive plowing and cultivation (plowing and

planting parallel to the slope) also cause erosion. In addition, natural or intentional burning in forests and scrub areas outside of agricultural lands is also another problem. Thus, Turkiye is vulnerable to erosion due to climate conditions, topography and soil structure.

Water erosion occurs by both natural and human-induced and it especially occurs on slopy lands with insufficient vegetation. In addition, the fertile upper part of the soil is lost due to excessive water use and improper irrigation and goes into streams as siltation in irrigated areas where surface irrigation is used. In general, surface irrigation performs as parallel to the slope on the lands and it results in both excessive irrigation water usage and lost of the upper fertile part of the soil. Thus the lost soil goes as siltation to streams and rivers at lower elevations. According to the a study carried out by Çetin et al. (2015), the siltation rate in surface waters at the lower elevations of irrigated lands was 28-42%. However, the siltation rate is expected as reasonable to be between 15-25%. This shows that use of improper surface irrigation causes high levels of erosion.

One of the important problems in Turkiye is the decrease in cultivated agricultural lands due to main reasons such as urbanization, tourism and industrial use (TTGV, 2022). Because, it has currently decreased to 24 million hectares while the agricultural land was 28 million hectares approximately 20-30 years ago (TUIK, 2018; DSI, 2023).

Other reasons that reduce soil quality include not using agricultural lands according to land capability class, growing the same crops every year on the same fied and not including forage crops in the plant pattern. In addition, the organic matter content of lands in Turkiye which already have arid and semi-arid climate characteristics is low (average: 1-2%) (Sönmez et al, 2018). This situation also prevents the improvement of soil fertility and soil physical conditions.

Another important problem in Turkiye is stubble burning. It occurs in especially regions where irrigated agriculture is practiced. Because, the main crop harvest residues in the field are burned in order to prepare an appropriate seed bed for the second crop after the main crop harvest. The aim of the farmers is to remove and clean the harvest residue from the field in case they can plow and a better planting at the field. Although the government has enacted laws to prevent stubble burning and imposes penalties however it could not be prevented as desired. Almost macro and micro organisms in the soil which has lower organic matter content are killed by burning. Whereas, development of agricultural tools and equipment enables cutting of these crop residues and burying them in the soil and this is important for both providing organic matter and improving soil physical conditions. Farmers continue to burn stubbles due to the fact that shredding and burying crop harvest residues in the soil cause additional costs to farmers and hindering the seeder in planting the second crop. Security forces or other relevant agricultural organizations are also insufficient to prevent this.

There are also important problems in land use such as irregularity of property distribution and insufficient land consolidation. For these reasons, use of modern agricultural technology and profitable farming are not easy. In addition, average parcel size for a farmd is quite smaller (6.1 ha) compared to that (12.6 ha) in European (Uzundumlu, 2012; Anonim, 2014).

The rate of loss and leakage of drinking and domestic purposes in water use is quite high (30-40%) in most big cities (Anonymous, 2023b). In addition, more than 10,000 m3 of irrigation water per unit hectare is used in agricultural irrigation (DSI, 2023). It shows that there are excessive water use in agriculture and improper operation of surface irrigation systems and this situation causes salinization and alkalization in agricultural lands. Moreover, water erosion and surface runoff at the slopy agricultural lands are also important problems. For this reason, irrigation efficiency is still around 50% (DSI, 2023). In addition, use of unregistered deep well for irrigation purposes casue also ground water levels (aquifer) decrease and thus water resources are rapidly depleted.

Sustainable Strategies for Soil and Water Resources

There are two basic components in the sustainable use and protection of soil and water resources. One of these is technical and agronomic practices, the other is institutional decision and approaches. Thus, the holistic approach and/or management must be taken on a basin basis in the sustainable use and protection of soil and water resources.

Irrigation efficiency (50%) and irrigation water productivity are very low and the use of gross irrigation water is more than 10,000 m3 ha-1. This has caused to more runoff, waterlogging, salinity, water erosion and drainage problems. If the modern irrigation technologies together with other technical and appropriate agronomic applications, total water use could be decreased to 6000-7000 m3 ha-1. This is significantly important to prevent of the risks of water scarcity and some negative environmental issues (Çetin, 2023). One of the most important ways to reduce excessive water use in agricultural irrigation is to use pressurized and modern irrigation systems such as sprinkler and drip irrigation systems. Because drip irrigation saves a large amount of irrigation water such as 30-50%. Thus, it is important that old surface irrigation systems which have insufficient maintenance should be converted to closed pressurized irrigation systems and farmers should be also adopted to these systems. In recent years, the works on those issues have accelerated in Turkiye, but it is still not sufficient. In addition, regarding this, the government subsidizes as 50% for the investment cost of the pressurized irrigation systems for farmers. If this continues to increase, the use of these systems will also become widespread.

Considering drought and decreasing water resources, water productivity, that is, more crop production per unit of water, has become inevitable. Water productivity is quite high in drip irrigation which provides more agricultural production even if less irrigation water is used. This is why the importance of modern irrigation systems use such as drip irrigation is important. On the other hand, other practical and agronomic practices such as appropriate soil cultivation, use of mulc and/or harvest residues to prevent evaporation, hoeing, selection of appropriate varieties, deficit irrigation practices, water harvest etc. also play a role in increasing water productivity.

The educational status, socio-economic structure, political relations, habits and traditions of the users and/or farmers have an important role in the use of new techniques and technologies. Therefore, it is important to continuously implement training and

extension activities. This is especially necessary when applying research and development results to farmers and agricultural lands.

Takin the rapid population growth and decreasing water resources into account, the use of treated wastewater should be increased in agricultural irrigation. Currently, this rate is hardly any. However, this rate is quite high in countries such as Lebanon and Israel.

Other suggestions and strategies could be preventing the burning of forests and crop stubbles, planting and afforesting in more areas, applying more sanctions and penalties to those who engage in use of inapproriate soil and water resources, and preventing decrease the parcels' dimension of agricultural lands.

Conclusion. Agricultural lands and water resources are indispensable natural resources for of all living things. In order to benefit from these natural resources at the highest level and in a sustainable way, it is inevitable to implement legal regulations including sanctions as well as appropriate technical (engineering) and agronomic practices, and decision makers and users also must have necessary sensitivity and awareness on this issue.

It has become important to use developing technology in the management of natural resources.

Using modern pressurized and smart systems with qualified personnel in irrigated areas, preventing erosion, use of agricultural lands for only agriculture purposes, diversifying the plants to be grown in crop rotation, avoiding overgrazing, and preventing stubble burning are of strategic importance for the sustainable use of agricultural lands.

Although all these technical applications are known, the main issue is that we cannot protect soil and water resources well enough due to some economic, social and political reasons, as well as the lack of adequate training and the inability to apply sanctions sufficiently.

As a result, it is inevitable to use these vital resources in a sustainable way by using technology and smart systems with a holistic approach on a basin basis.

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