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LOCAL LAND USE PRACTICES HANDBOOK

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MASTERS OF
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TEMA

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TEMA, The Turkish Foundation for Combating Soil Erosion, for Reforestation and the Protection of Natural Habitats

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TEMA

As part of the Climate Change Adaptation Grant Program (CCAGP), the Masters of Drought project aims to transfer climate-resilient traditional knowledge and practices from experienced farmers in Konya's Karapınar, Ereğli, and Beyşehir regions to the next generation of farmers. By integrating insights gained from field visits with modern technological approaches, the project seeks to equip young farmers with sustainable and adaptive agricultural practices in response to climate change.

(CCAGP) is designed to support the implementation of climate change adaptation actions at local and regional levels in Türkiye. CCAGP aims to improve the resilience of communities, protect natural assets and ecosystems, and enhance the adaptation capacity of vulnerable social groups, cities and economic sectors. The Final Beneficiary of the Grant Programme is the Directorate of Climate Change of the Ministry of Environment, Urbanization and Climate Change of the Republic of Türkiye (MoEUCC), and the Contracting Authority is the Department of European Union Investments of the General Directorate of European Union and Foreign Relations of the MoEUCC.

The institutional framework of the (CCAGP) consists of the following institutions and organizations:

- The Directorate of Climate Change of the Ministry of Environment, Urbanization and Climate Change of the Republic of Türkiye (MoEUCC) is the Final Beneficiary.
- The Department of European Union Investments of the General Directorate of European Union and Foreign Relations of the MoEUCC is the Contracting Authority.
- The United Nations Development Programme (UNDP) Türkiye Office is the Technical Support Team.

1. Country-City Context

The planet is facing biodiversity loss caused by human-induced climate change and desertification. The unique and shared impacts of these problems are altering the structure and network of ecosystems, leading to a crisis that threatens all life. Land degradation and human-induced soil degradation are at the center of the effects that cause all these problems. Soil and the biodiversity shaped by it and the climate are essential for people's livelihoods and quality of life. However, as a result of overconsumption and improper land use since the early 20th century, approximately 75 billion tons of soil are eroded each year[1]. In addition to erosion, soil degradation is occurring in 33%[2] of the cultivated land worldwide[2] due to factors such as pollution, salinization, acidification, and soil compaction. Furthermore, destructive human activities are affecting 75% of ecosystems[3]. In this context, the prevention of land degradation and the restoration of degraded lands are highlighted as preventive, mitigation and adaptation measures in the United Nations Convention to Combat Desertification (UNCCD) and Convention on Climate Change and Biodiversity.

Türkiye is at high risk of desertification since an arid and semi-arid climate prevails across most of its continental area. In the future, precipitation levels are expected to decrease, leading to more frequent and severe droughts. According to data from the General Directorate of Combating Desertification and Erosion, 53.2% of Türkiye is at moderate risk, while 22.5% is at high risk of desertification[4]. Due to climate change, a loss of 34.1 million tons of soil organic carbon, one of the three key indicators of land degradation monitored in the Land Degradation Neutrality Decision Support System, is projected in Türkiye's soils by 2040[5].

[1] Food and Agriculture Organization of the United Nations (FAO). (n.d.). Global Soil Partnership highlights. Retrieved January 15, 2025, from https://www.fao.org/global-soil-partnership/resources/highlights/detail/en/c/416516/

[2] United Nations Office for Disaster Risk Reduction (UNDRR). (n.d.). Hazard information profiles (HIPs). Retrieved January 16, 2025, from https://www.undrr.org/understanding-disaster-risk/terminology/hips/en0005

[3] Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). (2018). Summary for policymakers of the assessment report on land degradation and restoration. IPBES Secretariat, Bonn, Germany.

[4] General Directorate of Combating Desertification and Erosion (CDE). (2017). Turkish desertification model: Technical summary. General Directorate of Combating Desertification and Erosion, Ankara, Turkey.

[5] Project GEFFAO. (n.d.). LDN Turkey. Retrieved January 14, 2025, from https://projectgeffao.users.earthengine.app/view/ldn-turkey

Climate models indicate that in the future, precipitation levels will decrease, while droughts will increase and intensify in Türkiye. This situation highlights the need for measures to prevent land degradation and soil erosion.

Anatolia has faced drought caused by climate change for thousands of years. Since most of Anatolia has an arid and semi-arid climate, only rainwater has been used in agriculture. The consequential dry farming culture includes local knowledge to be used to fight against problems faced today[6]. This local traditional knowledge is defined as the body of knowledge and practices accumulated by a community over generations through direct experience and observation of their local environment. Examples of local traditional knowledge related to agricultural activities in Central Anatolia can be seen in Çatalhöyük, which dates back 10,000 years, and in an ear of wheat and a bunch of grapes presented to the Hittite King by God at the Ivriz Rock Monument, which dates back 5,500 years. (Figure 1)

Figure 1. Ivriz (Ereğli, Konya) Hittite Rock Monument.

[6] Akça, E., Nagano, T., Kume, T., Zucca, C., & Kapur, S. (2022). Traditional land use systems' potential as the framework for soil organic carbon plans and policies. In Plans and policies for soil organic carbon management in agriculture (pp. 59-93). Springer Nature Singapore.

The project area (Figure 2) includes districts that play a significant role in Turkish agricultural production, such as Karapınar (1,245,782 decares of agricultural land), Ereğli (1,154,597 decares of agricultural land), and Beyşehir (693,825 decares of agricultural land), which are located in the Closed Basin of Konya in the Central Anatolia Region. Karapınar and Ereğli have a steppe climate characterized by cold winters and hot, dry summers. Karapınar has an average annual temperature of 11.5°C and an annual precipitation of 276 mm, while Ereğli has 12.5°C and 336 mm, respectively. According to the Köppen-Geiger[7] climate classification, both districts fall under the BSk category (Cold Steppe Climate - Cold Semi-Arid Climate. Unlike Karapınar and Ereğli, Beyşehir has a Continental-Mediterranean Transitional Climate. Its average annual temperature is 10.8°C, and the annual precipitation amount is 495 mm. According to the Köppen-Geiger climate classification, it falls under the Cfb class with a warm winter and warm, dry summer.

Figure 2. The Project Area.

The project areas are where dry farming was dominant until the 1980s. Even though the share of dry farming in total agriculture tended to decline in all three regions with the development of irrigation techniques in the 1990s, dry farming lands still account for 53.6% of all agricultural land in Karapınar, 48.21% in Ereğli, and 75.25% in Beyşehir.[8]

[7] Peel, Finlayson, and McMahon (2007), Updated world map of the Köppen-Geiger climate classification, Hydrology and Earth System Sciences, 11(5), 1633–1644.

[8] Konya Provincial Directorate of Agriculture and Forestry. (2019). Konya agricultural statistics. Retrieved January 24, 2025, from https://konya.tarimorman.gov.tr/Belgeler/liflet/%C4%B0l%C3%A7e%20Baz%C4%B1nda%20Tar%C4%B1m%20%C4%B0statistiklerii-2019.pdf

It is inferred from these data that dry farming still has a higher rate than irrigated farming in all three regions. According to the data from the General Directorate of State Hydraulic Works (DSI), as of 2022, irrigated farming is practiced on 6.5 million hectares out of Türkiye's 24 million hectares of agricultural land, while the remaining 17.5 million hectares are used for dry farming[9]. Dry farming is still the dominant type of agriculture in Türkiye; therefore, the information to be obtained in the project will be useful not only for Karapınar, Ereğli and Beyşehir but also for the whole country.

[9] Republic of Türkiye Ministry of Agriculture and Forestry, General Directorate of State Hydraulic Works (DSİ). (2023). 2023 general activity report of the State Hydraulic Works. Department of Strategy Development, General Directorate of State Hydraulic Works, Ankara, Turkey.

2. Agricultural Productivity and Dry Farming History of the Project Regions

2.1 Agricultural Data of Karapınar

Karapınar has 5,956 farmers registered in the farmer registration system. Agriculture and livestock continue to be an intertwined culture in Karapınar, so pasture areas are used as intensively as agricultural areas. Karapınar has 1,370,252 decares of irrigated and dry farming land and 1,149,360 decares of pasture. Dry farming is practiced in 53% of the total farming lands. The main agricultural products include wheat (365,500 daa), corn (325,000 daa), barley (163,000 daa), sugar beet (approximately 110,000 decares, though it has varied over the years due to quotas), and alfalfa (82,000 daa). The total annual production amount of these crops reaches 2,956,967 tons. Due to the fact that a large portion of the production relies on irrigated farming, high levels of water and agricultural chemicals are used in the region. This situation leads to environmental issues, such as the accumulation of nitrogen in groundwater, creating negative impacts on the ecosystem.

Since a significant portion of agricultural production relies on irrigated farming, high levels of water and agricultural chemicals are used in the region, which has adverse impacts on the environment, especially a nitrogen increase in groundwater.[10]

[10] Büyük, G., Akça, E., Kume, T., & Nagano, T. (2016). Investigation of nitrate pollution in groundwater used for irrigation in Konya Karapınar region, central Anatolia. KSÜ Doğa Bilimleri Dergisi, 19(2), 168–173.

As of 2023, there are 383,183 sheep and goats and 85,790 cattle in the district.[11] The growing number of cattle over the years has increased the production of forage crops, most of which rely on irrigated farming, thereby putting greater pressure on water assets.

2.2 Dry Farming History of Karapınar

Today, dry farming is practiced at a higher rate than irrigated farming in Karapınar. With an annual precipitation of around 280 mm, Karapınar is one of the least rainy regions in Türkiye, along with certain areas of Iğdır, Ağrı, and Şanlıurfa[12], and it has no streams. After the 1970s, when Lake Hotamış and Akgöl dried up, irrigation from these lakes was no longer possible. Irrigation is completely based on groundwater assets, and the number of sinkhole formations has increased due to the increasing pressure on groundwater after the 1990s.[13] (Figure 3)

Figure 3. The sinkhole formed on the way to the Strait of Niğde in 2023.

2.3 Agricultural Data of Ereğli

Ereğli has 6,174 farmers registered in the farmer registration system. It has 1,078,549 decares of farming land and 812,128 decares of pasture. The fallow land is 164,323 decares, and the dry farming land is 48% of the total farming land. The main

[11] Republic of Türkiye Ministry of Agriculture and Forestry. (2023). Konya agricultural statistics. Retrieved from https://konya.tarimorman.gov.tr/Belgeler/kitap/%C4%B0I%C3%A7e%20Baz%C4%B1nda%20Tar%C4%B1m%20%C4%B0statistikleri-2023.pdf

[12] Ministry of Environment, Urbanization and Climate Change, General Directorate of Environmental Impact Assessment, Permit and Inspection. (2023). Environmental indicators (Publication No. 58). Ankara, Turkey.

[13] Göçmez, G., Dülger, A., Arık, F., & Delikan, A. (2022). Ürünlü (Çumra-Konya) çevresinde yeraltısuyu seviye değişimleri ve obruk oluşumları [Groundwater level changes and sinkhole formations around Ürünlü (Çumra-Konya)]. Selçuk Üniversitesi Sosyal ve Teknik Araştırmalar Dergisi, 20, 172–178.

agricultural products include wheat (204,000 daa), barley (132,000 daa), silage corn (88,000 daa), sweet corn (85,000 daa), tomato (106,000 daa) and alfalfa (50,500 daa)13. In terms of production amounts, the products are listed as silage corn (465,000 tons), alfalfa (125,000 tons), apple (123,322 tons), and tomato (734,010 tons). In this context, it is observed that all the products in the top five are grown through irrigated farming, which indicates a serious pressure on water assets. As of 2023, there are 312,562 sheep and goats and 189,273 cattle in the district[14]. Due to the high number of cattle, the majority of the agricultural production in the region consists of silage corn and alfalfa. The increase in tomato production is also considered as another reason for the pressure on water assets.

2.4 Dry Farming History of Ereğli

Irrigated farming dates back to ancient times in Ereğli due to the presence of the Ivriz River. However, an irrigation network could not be established until the 1970s, and dry farming became the main agricultural activity. The ratio of irrigated farming has surpassed dry farming today, and the main products of the district have become silage corn, alfalfa and sugar beet, which consume a high level of water.

It is observed that farmers in Kutören and Zengen try to adapt to dry farming with fallow rather than crop rotation (alternation)[15]. Before the 1990s, sheep and goat breeding and dry farming were widespread in the region. Due to the low level of agricultural mechanization, there was a labor-intensive production. With the spread of irrigated farming, the need for labor was met seasonally by workers from the surrounding areas, especially from the mountain villages around Mount Hasan in Aksaray. It is believed that the low level of agricultural mechanization not only increases regional employment but also prevents soil compaction, water loss, and organic matter loss resulting from over-cultivation.

[14] T.C. Tarım ve Orman Bakanlığı. (2023). Konya tarım istatistikleri (s. 69). Retrieved from HYPERLINK "https://konya.tarimorman.gov.tr/Belgeler/kitap/%C4%B0I%C3%A7e%20Baz%C4%B1nda%20Tar%C4%B1m%20%C4%B0statistikleri-2023.pdf" https://konya.tarimorman.gov.tr/Belgeler/kitap/%C4%B0I%C3%A7e%20Baz%C4%B1nda%20Tar%C4%B1m%20%C4%B0statistikleri-2023.pdf

[15] Crop rotation is the successive planting of different crops in a specific order on the same land.

2.5 Agricultural Data of Beyşehir

Compared to other project districts Karapınar and Ereğli, Beyşehir has the highest ratio of dry farming to irrigated farming with 75%. The total agricultural area in the district is 543,159 decares. Beyşehir has 3,526 farmers registered in the farmer registration system. In the district, the top five crops by cultivated area are wheat (273,000 daa), barley (140,000 daa), chickpeas (32,000 daa), sugar beets (18,500 daa), and red lentils (12,000 daa). In terms of production volume, sugar beets lead with 133,054 tons, followed by wheat (98,067 tons), barley (47,618 tons), alfalfa (22,500 tons), and potatoes (15,572 tons). Dry farming is more prevalent than irrigated farming in Beyşehir; however, it is noteworthy that sugar beets, alfalfa, and potatoes, which require significant amounts of water, rank among the top in the district's production despite its pressure on water assets. As of 2023, the district has 53,785 sheep and goats and 35.125 cattle.[16]

2.6 Dry Farming History of Beyşehir

The dry farming yield per decare is higher in Beyşehir not only because its annual precipitation is 495 mm and its annual average temperature is 10.8 °C[17], but also because it is cooler and wetter than Karapınar (279.5 mm, 10.9 °C)[18] and Ereğli (336 mm, 12.5 °C)[19]. For instance, an average annual precipitation yields 250 kg of wheat per decare in Karapınar, whereas the yield increases to 450 kg in Beyşehir. For this reason, farmers practicing dry farming in Beyşehir could sustain their livelihoods with smaller lands compared to those in Karapınar and Ereğli.

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[16] Konya Provincial Directorate of Agriculture and Forestry. (2023). Agricultural statistics by district – 2023. Konya Provincial Directorate of Agriculture and Forestry. Retrieved from https://konya.tarimorman.gov.tr/Belgeler/kitap/İlçe%20Bazında%20Tarım%20İstatistikleri-2023.pdf

[17] Sarı, S., & İnan, N. (2011). Seydişehir ile Beyşehir'in iklimlerinin karşılaştırılması [Comparison of the climates of Seydişehir and Beyşehir]. Selçuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, (26), 291–310.

[18] Konya Governorship. (2025). Karapınar District Governorate. Konya Governorship. Retrieved January 14, 2025, from http://www.konya.gov.tr/karapinar

[19] Climate-Data.org. (n.d.). Climate data for Ereğli, Konya. Climate-Data.org. Retrieved January 14, 2025, from https://en.climate-data.org/asia/turkey/konya/eregli-14999/

3. Geographical Features of the Project Area

The project area is located within the Closed Basin of Konya, where the average elevation from sea level is higher than 1000 m. (Figure 4) Karapınar and Ereğli have a steppe climate with cold winters and dry, hot summers. While the average annual temperature of Karapınar is 10.9°C and the average annual precipitation is 279.5 mm, it is 12.5°C and 336 mm in Ereğli, respectively[17, 18]. According to the Köppen-Geiger climate classification, both districts fall under the BSk category (Cold Steppe Climate–Cold Semi-Arid Climate. Unlike Karapınar and Ereğli, Beyşehir has a Continental-Mediterranean Transitional Climate. The average annual temperature in Beyşehir is 10.8°C, and the annual precipitation amount is 495 mm[19]. According to the Köppen-Geiger climate classification, it falls under the Cfb class with a warm winter and warm, dry, summer[20].

Figure 4. The Location of the Closed Basin of Konya and Project Districts.

[20] Bölük, E., Eskioğlu, O., Çalık, Y., & Yağan, S. (2023). Köppen iklim sınıflandırmasına göre Türkiye iklimi [Turkey's climate according to the Köppen climate classification] (p. 11). Directorate of Climate and Agricultural Meteorology, Department of Climate and Climate Change, Ankara. Retrieved from https://mgm.gov.tr/

According to the soil classification by IUSS Working Group WRB (2022)[21], Beyşehir mostly has shallow (0-30 cm) calcareous Leptosols on sloping lands, moderately deep Cambisols on flat and nearly flat slopes, and deep Fluvisols and Vertisols with high clay content in riverbeds. Karapınar has deep Calcisols with high lime content in flat areas and shallow calcareous Leptosols on sloping lands, and Ereğli has Cambisols in nearly flat areas and Leptosol soils on sloping lands. Regosols are also developed on basaltic formations in the Yeşilyurt region of Karapınar. In the project area, only the organic carbon of Beyşehir soils (49.11 tons) is higher than the average of Türkiye, which is 47 tons of carbon/hectare. (Figure 5) The organic carbon of Karapınar soils is 35.41 tons/hectare, while it is 37.32 tons in Ereğli[22]. Soil organic carbon values can be considered as an indicator that the region's soils have a low level of productivity.

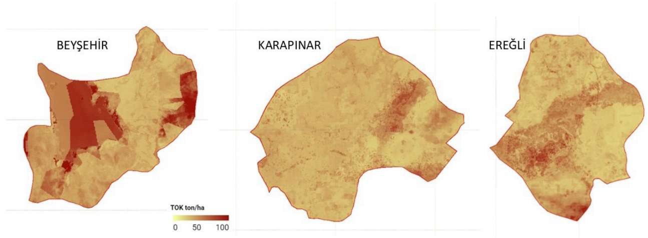

Figure 5. The soil organic carbon contents of Beyşehir, Karapınar and Ereğli soils in tons per hectare.

When the desertification risk map created by the General Directorate of Combating Desertification and Erosion of the Ministry of Environment, Urbanization and Climate Change[23] is examined, it is observed that Karapınar and Ereğli are at a high risk of desertification, while Beyşehir has a moderate risk. (Figure 6)

[21] IUSS Working Group WRB. (2022). World reference base for soil resources: International soil classification system for naming soils and creating legends for soil maps (4th ed.). International Union of Soil Sciences (IUSS). Retrieved from https://www.isric.org/sites/default/files/WRB_fourth_edition_2022-12-18.pdf
[22] Çölleşme ve Erozyonla Mücadele Genel Müdürlüğü (ÇEM). (2018). Toprak organik karbonu projesi, teknik özet [Soil organic carbon project, technical summary]. Çölleşme ve Erozyonla Mücadele Genel Müdürlüğü, Ankara, Turkey.
[23] General Directorate of Combating Desertification and Erosion (CDE). (2017). Turkish desertification model, technical summary. General Directorate of Combating Desertification and Erosion, Ankara, Turkey.

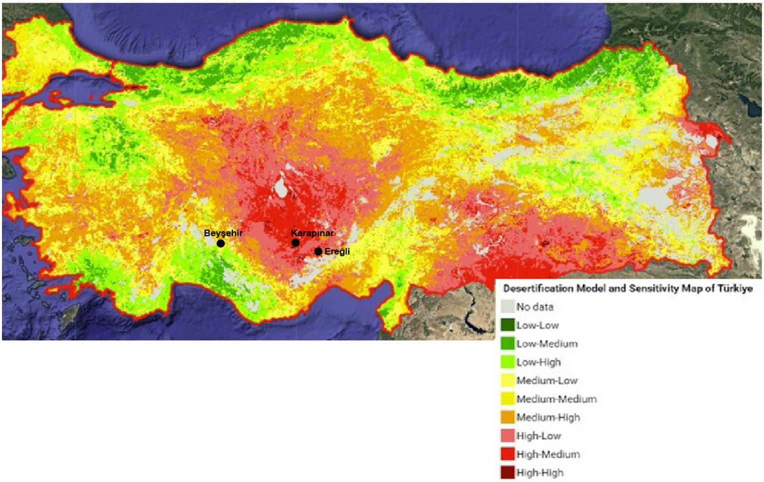

Figure 6. The desertification risk levels of the project areas according to the Turkish Desertification Model.

3.1. Land Use

The project area is an important agricultural production area in Türkiye. Due to climate and topographic structure effects, there are more forestlands than farmlands in Beyşehir, unlike Karapınar and Ereğli. (Figure 7) The proportion of farmlands in Karapınar and Ereğli is over 50%, while the proportion of pasture areas in both districts is more than 40%. Although the number of pasture areas supports sheep and goat breeding, it leads to overgrazing pressure on pastures.

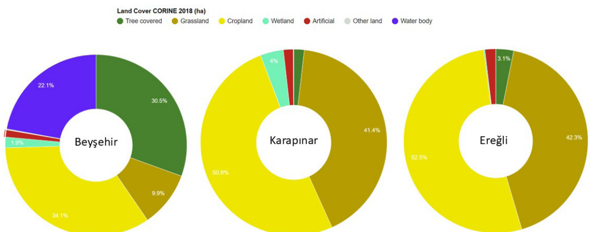

Figure 7. Land use distributions of Beyşehir, Karapınar and Ereğli[24].

[24] Project GEFFAO. (n.d.). LDN Turkey Viewer. Retrieved January 14, 2025, from https://projectgeffao.users.earthengine.app/view/ldn-turkey

In places where there is no possibility of irrigation due to the arid climate in Karapınar and Ereğli and semi-arid climate in Beyşehir, the lands are exposed to wind erosion after harvesting, since only one crop is harvested per year.

4. Research Method

During the initial stage of field visits to the region, relevant local individuals and organizations were contacted to identify experienced male and female farmers aged 70 and older. District Directorates of Agriculture and Chambers of Agriculture located in Karapınar, Beyşehir and Ereğli regions of Konya were visited in the first field visit program. During the meetings with these institutions, the project was introduced and the representatives of the institutions were interviewed to reach experienced farmers. A visit was made to the Directorate of the Research Institute for Combating Soil, Water and Desertification and experiences were shared following the project introduction. Some of the institutions interviewed directly assisted in reaching experienced farmers in the region, while others informed local authorities in the villages about the project, allowing the project team to meet with the village headmen. The field visits, especially in Ereğli, were mostly planned by contacting the headmen of the relevant villages.

In the field visits performed on March 22-25 and May 24-28, 2024, interviews were conducted with a total of 20 experienced farmers. At the beginning of each interview, the project and its purpose were introduced to the farmers.

5. Plant Production Techniques Applied in the Project Area

The farmers were asked about the practices they observed from their families during their childhood, including when and how these practices were performed, whether there were specific practices for dry periods, and if there were any measures taken to mitigate droughts. The interviewed farmers were asked about the practices they observed in their families during childhood—specifically, the timing and methods of these practices, whether they used techniques specific to dry periods, and what measures they took against drought.

The information from the interviews indicated that, in the past, the climate was not as variable, the seasons were more stable, and snowfall was more common in the region. Today, however, it has been emphasized that conditions have become much more challenging. It was also noted that field farming was practiced on smaller plots of land, with the remaining land used as pasture, since farming relied on animal power. It was also noted that, back then, field farming was carried out on smaller plots of land compared to today due to its reliance on animal power, and the remaining lands were used as pastures, as cultivated areas were more limited. Additionally, wheat, rye, and barley were commonly grown, and the land was typically left fallow every 1 to 3 years. When asked whether crop rotation was implemented, one experienced farmer from Karapınar replied as follows:

“We used to do it every two years. There was nothing; what were we supposed to do it with? We used to leave it fallow. It was like one year wheat, one year fallow, one year rye, and one year fallow. Everywhere, in the countryside, the field remained empty for a year. Crops were harvested from the land every two years. Without water, even barley was rare in Karapınar. There was no fertilizer, and there was too much frost on winter days because our climate was harsh. Even barley could not stand much. Even if we had it, we did not sow it because we were exposed to frost during the winter. Mostly wheat and then rye.”

Additionally, it was stated that a small number of lentils and chickpeas were planted after wheat and barley, especially in the highlands, and that the yield following chickpea and lentil planting was higher than in other years. However, chickpea cultivation was abandoned in recent years due to increasing damage caused by boars.

It was also noted that there was no water harvesting or similar practice in the fields, which was probably because almost all the fields were flat and non-sloping lands.

Terracing was the most effective soil protection method in regions where sloping lands were widespread. (Figure 8)

Figure 8. Terracing method.

In these lands, where oak trees are protected in rows, terraces are formed by collecting stones. Terraces reduce the slope, slowing down the speed of rainwater; thus, they allow more water to infiltrate into the soil and help prevent erosion. The preservation of existing trees between the terraces stands out as a good example of agroforestry. However, agriculture is no longer practiced in parts of these lands with small-scale ownership that are unsuitable for machinery use. In parts where terracing has not been implemented and the slope is steeper compared to flat lands, the strip tillage method stands out. Similar to terraced systems, this practice reduces the runoff velocity of rainwater, enhancing water infiltration into the soil.

Figure 9. Trees protected on separate terraces built on sloping lands.

In areas where horticulture is practiced viticulture is has emerged as one of the prominent agricultural activities.. Farmers have stated that the taste of grapes harvested from vineyards with no irrigation is so distinct and flavorful that it cannot be compared to the grapes sold on the market. The application of sulphur has been the most common practice in vineyards from past to present, and it is noteworthy that no other agricultural chemicals, chemical fertilizers, or pesticides are used. This is mainly attributed to the fact that viticulture is practiced to meet household needs rather than for the market.

Riveted vineyard, practiced in the Karapınar region for water harvesting and water retention in soil, is an eminent application. In this method applied on sloping and stony lands, a wall is built with stones. In this way, a terrace is formed, the infiltration of rainwater into the soil is enhanced by blocking it with stones, and water is conserved by reducing evaporation in the soil under the stones. Vines (bare stocks) are planted at the base of the wall, which prevents the grapes from rotting as the stone blocks their contact with the soil. It is notable that farmers spontaneously described the functions of the riveted vineyard in detail. Riveted vineyards on the highlands in the Yeşilyurt region of Karapınar are the most remarkable ancient practices in the region. (Figure 10)

Figure 10. Riveted vineyard.

The most important product of the region in horticulture is the production of pickle melon (unripe melon), locally called "hırtlak". It also attracts attention as a dry farming practice in the region. The basaltic sand soils in Karapınar and their moisture retention make it possible to produce pickle melon without irrigation. As stated by the farmers, these melons grown without irrigation have higher quality than those grown with irrigation. For example, according to a female farmer, crops grown through dry farming are more delicious, have a longer shelf life, and make pickles that stay intact for a long time; however, crops grown through irrigated farming are less tasty and spoil quickly.

The common ground of all agricultural practices in the past is the lack of machine use and labour-intensive work.The farmers commonly emphasized the use of a wooden plow for tillage, sickles and scythes in harvesting, and animal power for threshing. . Using the agricultural tools they had at home, some farmers shared which ones they used and why a traditional hand guard called 'elcek', used to prevent injury while harvesting with a sickle. During an interview, a farmer wittily remarked, 'The earliest primitive tractor was one horsepower,' humorously highlighting how labor-intensive agriculture used to be.

Figure 11. A safety tool called elcek.

The farmers also stated that agricultural mechanization began in the late 1960s, and land cultivation using tractors with a horsepower (40-50 HP) much lower than today did not significantly compact the soil. Farmers also stated that agricultural mechanization began in the late 1960s, and that tillage using 40–50 horsepower tractors at the time did not compact the soil as much as today. However, the fact that the machines used then would be insufficient today due to the soil compaction was explained as follows:

"Our tractors used to have 45-50 horsepower. Now, they have 300 horsepower. When we look at the soil, we see its hardening and compaction. We cannot cultivate today's fields with the old machines. Excessive fertilizer has hardened the soil. These require precautions."

5.1 Seed Production

When experienced farmers were asked where they got the seeds or how they produced them, they stated that they used to produce their seeds themselves, yet they had almost none remaining today. One experienced farmer from Karapınar explained the process as follows:

"We used to spread our own seed. I still use this seed. I do not see a huge difference in yield. In some villages on the way out of Konya, they plant large-grained, soft wheat with easy germination, which we call white wheat; they buy and plant seed wheat. These seeds have more diseases and pests. In addition, the ancestral seeds are drought-resistant."

Another remark is that the taste of the products has changed as seeds and production conditions have changed. A farmer from Ereğli stated that nothing had changed, and he still got that nice smell of bread as he used his own ancestral seed. Among the farmers interviewed, some still grow their own seed, yet their number is limited.

According to the farmers, they abandoned their old seeds because the government distributed new seeds every 10-15 years, including the seed known as "Mexican wheat".

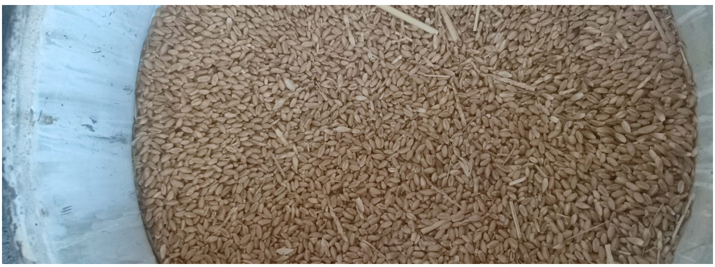

Figure 12. The wheat known in the region as "6 Ay 2001" is the Sönmez 2001 wheat variety.

5.2 Transition from Dry Farming to Irrigated Farming

The farmers were initially asked questions about the drought periods in the region, how dry farming was practiced in the past, and what crops were grown. It was identified that nearly all the farmers recalled the drought periods in 1954 and 1974 and had negative experiences with dry farming. They stated that, with irrigation, their yields increased by 1 to 1.5 times, there was no need for fallowing, and they could harvest crops yearly.

When farmers were asked about their experiences with irrigated farming, it was revealed that they faced new challenges following their transition to irrigation. The main problems included increased costs, greater dependence on fertilizers, and the emergence of pests and diseases.

It was noted that dry (non-irrigated) farming used to be practiced in all lands in Karapınar in the past, but wells started being drilled in the region in 1965. Starting from 1965-1966, the drilling of wells and the promotion of irrigated farming led to an increase in both cultivated lands and water consumption in the region. Before the drip irrigation system, the uncontrolled-flood irrigation method was used.

Another reason for the transition to irrigated farming was indicated as the change in precipitation regime. Farmers often emphasized that the region began to get less precipitation, and it kept decreasing every year. As of today, it has been noted that the number of illegal wells in the region is quite high. When asked about the reason for the increase in the number of illegal wells, one farmer made the following explanation:

"For example, one of the neighbors dug a well, and as the return of irrigated farming is high, another neighbor became their land partner, when they used to irrigate only 100 acres through rented underground pipes, now they are irrigating 600-700 acres with one well."

The example indicates that the unplanned well-drilling process rapidly increased water consumption. According to the farmers, the process lacked proper planning, and they did not take the risk of a water crisis into consideration. The significant decrease of water levels in the wells in all three project areas was described as follows:

"I had a well in Karapınar. I used to draw water from a depth of 16 meters, but now the water level has dropped to 60-65 meters. For example, in the southern part, we used to draw water from under 100 meters, but now it is at 260 meters. Every year, the level drops by at least 6 meters. We do not know what will happen in the end."

The low yield in dry farming is the main reason for the widespread adoption of irrigated farming. Farmers stated that they would lose profits if they switched back to dry farming, and a return was impossible. Regarding this issue, one experienced farmer from Karapınar summarized the resistance to dry farming in the region as follows:

"People's lives changed with the introduction of irrigated farming. Their income quadrupled, and now it is impossible to convince them to return to dry farming."

The statement indicates that farmers will resist abandoning irrigated farming and reducing water consumption. On the other hand, it is believed that the increase in irrigation has led to a higher demand for fertilizers, and the crops now require more water and chemicals, which is considered harmful.

When farmers were asked what they would do when the water ran out, nearly all of them stated that they would migrate because life would not go on in the region when the water ran out.

Although the farmers did not explicitly refer to climate change, they all reported experiencing its effects. For instance, they observed that planting and harvest times were delayed by 3 weeks to 1 month, and increasing drought caused significant yield losses on dry lands in recent years. They also noted that shifts in harvest timing disrupted other agricultural activities, such as tillage, sowing, and fertilizing, and that crops became more vulnerable to extreme weather conditions like frost, heat waves, and storms.

Most farmers expressed concern that no one would remain in their villages to continue their work once they were gone. This prediction about the region's future may stem from the declining young population in the area and the fact that many young people are not pursuing farming or livestock activities.

5.3 Relationship between Agriculture and Livestock Practices

All the experienced farmers interviewed stated that, in the past, everyone engaged in both livestock farming and crop production, but these activities are now completely separate. In Ereğli, the situation was summarized with the following statement: "Livestock farming has been declining since 1978. In the 1970s, there were 35,000 sheep and nearly 20,000 cows". Similarly, the change in Karapınar was described as follows: "Not everyone is engaged in livestock production now, and it is decreasing day by day. In the past, 80% of people had sheep and goats, and livestock production was much higher. It has now shifted towards cattle farming."

The saying "Wheat and sheep, the rest is cheap" summarizes this relationship between agriculture and livestock farming. Despite the decrease in livestock activities today, sheep and goat farming was quite common in the past. In order to understand how agricultural production and livestock activities supported each other, the farmers were asked whether they used manure on the fields, and it was identified that the practice was not very common in the past. The majority of the farmers confirmed the following statement:

"Everyone had livestock, but no one used their manure on the fields. There was no way to transport it. Only a few people used to carry it by cart, but most did not. Now, they do."

Another reason for not using manure was the widespread concern that manure would be insufficient for large lands, while another reason was that they could sell it. It was specifically mentioned that sheep manure was sold to greenhouse producers in Mersin, primarily for bananas.

When the interviewees were asked how they obtained animal feed, it was concluded that agricultural yields in a year directly affected the ability to meet the animals' feed requirements. Many families shared examples of their animals facing hunger during drought years due to insufficient feed availability.

5.4 Change in Social Life

Agricultural and livestock practices in the region are closely intertwined with its social structure, each directly influencing the other. In the past, when dry farming and sheep and goat breeding were practiced together, all family members contributed to both agricultural and livestock work. However, today, most experienced farmers do not pass their knowledge on to their children. The primary reason is that parents prioritize their children's education and encourage them to pursue careers in other sectors rather than physically demanding farm work.
Some farmers mentioned in interviews that their children see other occupations as more advantageous and choose not to engage in agriculture. However, others argued that, considering the effort and time involved, farming offers a better balance compared to many alternative professions.

According to some farmers, agriculture alone is no longer economically sufficient for young people to meet their needs under current conditions. While this is attributed to the economic crisis, it appears that perceptions of welfare differ across generations. Relevantly, it was noted that young people today struggle to continue their family businesses due to "dissatisfaction". However, this dissatisfaction is not a criticism of young farmers but rather a result of shifting social dynamics. The decline in sheep and goat farming, a major source of income in the region, and the increasing difficulty of making a living solely from agriculture contribute to this trend. For these reasons, the number of young farmers living in villages and working in agriculture has decreased. Nonetheless, the field visits also revealed cases of reverse migration, with some young people returning to their villages to continue farming.

Due to the decreasing population today, employing Afghan workers in agricultural lands has become a widespread practice. As stated by most of the people interviewed, they have to employ workers, and the cost of labor has increased.

6. Information about Good Use of Local Land

In the project area, examples of good practices related to land use were examined such as water harvesting and improving the soil's water-holding capacity, protection from erosion, providing soil nutrient balance, increasing soil organic matter, pest control that does not pollute the soil and grazing techniques that do not put pressure on pastures.

6.1 Water Harvesting and Erosion Control

The geological structure in the Karapınar Yeşilyurt region consists of basalt rock, and the sloped topography is dominant. Shallow, highly stony and rocky soils develop on basaltic formations. These adversities must be addressed to engage in farming. For this purpose, measures based on stone terraces have been formulated in the region. In order to retain rain in the vineyards and prevent runoff and erosion accordingly, sets of stones with a diameter of 10-30 cm are created. Vineyards formed with stone terraces are locally called riveted vineyards. Here, the word 'rivet' is used to imply strength and durability. In such vineyards, there is soil between the sets. While the upper part of the stone sets is 1-1.2 m wide, its height is 50 - 60 cm. (Figure 13) Vines are planted at the end point of the stone sets. The distance between the vines varies between 100 and 120 cm. Planting the vines right at the end of the stones prevents evaporation from the root area and allows the plants to benefit from the moisture between the stones.

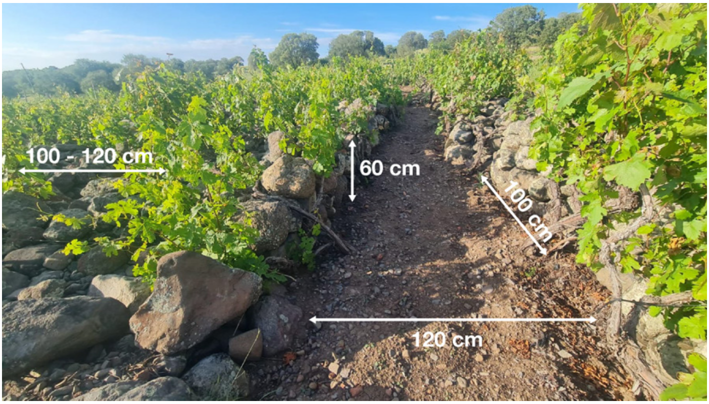

Figure 13. Dimensions of the stone terraced vineyard in Yesilyurt.

In other agricultural areas, terraces were created with similar stone walls. It is believed that the stones being larger than 10 cm in diameter also made the terraces resistant to floods. While the terraces reduce runoff and prevent erosion, they also increase the infiltration of water into the soil. (Figure 14)

Figure 14. Protection from erosion and prevention of runoff with stone walls.

Snow and rainwater falling during the winter months are retained by these walls, allowing the infiltration of water into the soil without flowing away. (Figure 15) The stone walls are created in a discontinuous manner, not exceeding 100 cm and allowing sheep and goats to pass between them. The areas previously used as fields appear to have been abandoned due to the decrease in the village population and the decreasing grazing pressure.

Figure 15. Stone walls/sets that allow snow to infiltrate into the soil before it melts and runs off.

In the villages of Ereğli, where the slope is relatively higher compared to the districts in the project area, the tillage of the soil perpendicular to the slope is also an indication that the local people are aware of the negative effects of erosion. Through this technique, the soil is protected against erosion, while at the same time, allowing the rainwater to penetrate the soil more, thus protecting the soil against water erosion. Producers planting cumin in Ereğli Çayhan emphasized that the tillage of the soil perpendicular to the slope is a very old tradition.

6.2 Regulating the Content of Soil Nutrient

Livestock farming remains important, but few producers engage in it today compared to the past. In this way, although the link between plant production and livestock production seems to be broken, producers want and even encourage grazing in areas where plant production is made. Thus, nitrogen, phosphorus and potassium are added to the soil with the feces left by the animals during grazing.

In agricultural production, nitrogen is the most intensively provided nutrient element. As of 2022, nitrogenous fertilizers constitute 58% of the fertilizers used in the whole world[25]. Therefore, providing nitrogen through natural means is among the priority measures in terms of environmental and soil health[26]. Another useful practice in terms of adding nitrogen to the soil in the region is the traditional use of chickpeas and lentils in crop rotation. The use of these species in crop rotation increases the nitrogen bound to the soil and reduces the rate of decomposition of organic matter in the soil, allowing the organic matter in the soil to maintain its effectiveness for a longer period[27, 28]. Thus, in arid climates, moisture retention is also increased with the increased organic matter in the soil[29]. A 1% increase in soil organic carbon provides 12.5 mm more water retention in the first 20 cm of the soil. This is equal to 12.50 tons of additional water retention per decare[30].

In the project area, it is known that legume farming makes positive contributions to increasing soil organic matter accumulation, improving soil porosity, recycling nutrients, improving soil structure, reducing high soil pH (as the case in the project areas), diversifying beneficial microscopic life in the soil, controlling weeds and diseases, and increasing soil quality[31]. When some of the studies conducted are examined, it was determined that nitrogen retention reaches up to 682 kg per hectare with legume farming[32]. In another study, it was found that Macrotyloma uniflorum, used as horse feed in Asia, increases soil organic matter by 24% when used as green manure in the soil[33].

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[25] Statista. (n.d.). Global fertilizer consumption by nutrient from 2010 to 2022. Retrieved January 14, 2025, from https://www.statista.com/statistics/438967/fertilizer-consumption-globally-by-nutrient/

[26] Akça, E., Büyük, G., İnan, M., & Kırpık, M. (2022). Sustainable management of land degradation through legume-based cropping system. In Advances in legumes for sustainable intensification (pp. 267–280). Academic Press.

[27] Li, X. G., Jia, B., Lv, J., Ma, Q., Kuzyakov, Y., & Li, F. M. (2017). Nitrogen fertilization decreases the decomposition of soil organic matter and plant residues in planted soils. Soil Biology and Biochemistry, 112, 47–55.

[28] Bowden, R. D., Wurzbacher, S. J., Washko, S. E., Wind, L., Rice, A. M., Coble, A. E., & Lajtha, K. (2019). Long-term nitrogen addition decreases organic matter decomposition and increases forest soil carbon. Soil Science Society of America Journal, 83(Supplement 1), S82–S95.

[29] Kallenbach, C. M., Conant, R. T., Calderón, F., & Wallenstein, M. D. (2019). A novel soil amendment for enhancing soil moisture retention and soil carbon in drought-prone soils. Geoderma, 337, 256–265.

[30] Blanco-Canqui, H., Shapiro, C. A., Wortmann, C. S., Drijber, R. A., Mamo, M., Shaver, T. M., & Ferguson, R. B. (2013). Soil organic carbon: The value to soil properties. Journal of Soil and Water Conservation, 68(5), 129A–134A.

[31] Meena, R. S., & Kumar, S. (2022). Legume-based agroecosystem for sustainable intensification: An overview. In Advances in legumes for sustainable intensification (pp. 3–8). Academic Press.

[32] Ledgard, S. F., & Steele, K. W. (1992). Biological nitrogen fixation in mixed legume/grass pastures. Plant and Soil, 141(1), 137–153.

[33] Venkateswarlu, B., Srinivasarao, C., Ramesh, G., Venkateswarlu, S., & Katyal, J. C. (2007). Effects of long-term legume cover crop incorporation on soil organic carbon, microbial biomass, nutrient build-up and grain yields of sorghum/sunflower under rain-fed conditions. Soil Use and Management, 23(1), 100–107.

In addition, chickpeas and alfalfa are expected to retain 2.8 kg and 5.5 kg of pure nitrogen per decare respectively. It is also known that legume-type grasses increase water infiltration into the soil by 30% compared to cereal-type grasses[34]. In this case, the traditional use of legumes in the crop rotation after wheat and barley in the region is extremely beneficial for soil health and yield. However, it has also been observed that legume cultivation areas have decreased significantly in recent years. The main reason for this is the high labor cost of chickpeas and lentils compared to corn and wheat, the increasing damage by boars in the region and the spread of irrigated farming.

6.3 Agricultural Pest Control

The main causes of soil pollution are excessive use of agricultural chemicals. It was stated that ash is used against agricultural pests in the region. Especially the effect of wood ash was underlined. The average elemental content in wood ash is as follows:

Total carbon 190,3 g/kg
Total nitrogen 8,7 g/kg
Phosphorus 22,9 g/kg
Potassium 127,7 g/kg
Calcium 268,8 g/kg
Magnesium 34,9 g/kg
Sulfur 24,3 g/kg
Cadmium 10,4 mg/kg
Zinc 592,2 mg/kg
Copper 197,6 mg/kg
Manganese 840,2 mg/kg
Nickel 32,8 mg/kg
Chromium 27,3 mg/kg'dır.

[34] Huang, Z., Tian, F. P., Wu, G. L., Liu, Y., & Dang, Z. Q. (2017). Legume grasslands promote precipitation infiltration better than gramineous grasslands in arid regions. Land Degradation & Development, 28(1), 309–316.

Measurements have shown that the pH value of oak wood ash can reach as high as 13.5.[35] It is believed that this high pH level can neutralize harmful organisms, while the nutrients in the ash may support the plant in its fight against pests. In vineyards, ash is applied by hand directly onto the plant. Another control method mentioned is the application of powdered clay lime to the affected areas. This method works through the adhesive property of clay and the pest-reducing effect of lime. In riveted vineyards, it was noted that preventing the vines from contacting the soil and allowing them to grow their branches over stones helps stop the transmission of soil-borne pests to the plant. As no chemicals are used in these practices, they are considered highly environmentally friendly.

6.4 Preventing Soil Compaction

It is known that tilling the land with a plough and horses or oxen does not compact the soil in the project area. In addition, farmers state that the field soil is not compacted when tilled with light tractors of 40-50 horsepower instead of the tractors of over 100 horsepower today. In Ereğli Çayhan, it was stated that tillage and sowing were carried out after the appearance of a type of spider known locally as 'ilbez' (Crytocarenum cunicularium)[36] in the field. Since this spider is most active at the beginning of autumn, farmers wait for this period to begin sowing. This practice has drawn attention as an observation-based planting calendar.

6.5 Growing Drought-Resistant Crops

In the area where volcanic sand dunes are located in Vahapobası in Karapınar, volcanic sand grains have the property of retaining water due to their spongy structure. Melon is grown in this area but it is collected as unripe, without allowing it to grow. This product, locally known as pickle melon (hırtlak), is used to make pickles. It was reported that when the melon is harvested

[35] Symanowicz, B., Becher, M., Jaremko, D., & Skwarek, K. (2018). Possibilities for the use of wood ashes in agriculture. Journal of Ecological Engineering, 19(3).
[36] Chatzaki, M., Trichas, A., Markakis, G., & Mylonas, M. (1998). Seasonal activity of the ground spider fauna in a Mediterranean ecosystem (Mt. Youchtas, Crete, Greece). In P. A. Selden (Ed.), Proceedings of the 17th European Colloquium of Arachnology (pp. 235–243). British Arachnological Society.

as pickle melon before it is fully grown, it saves over 3 tons of water per decare.[37] In pickle melon production, farmers prepare sandy soil with animal manure and bury 4 melon seeds in each hole with a diameter of 20x20 cm and a depth of 5 cm. The row spacing is 2 m and the hole spacing within the row is 1 m. (Figure 16)

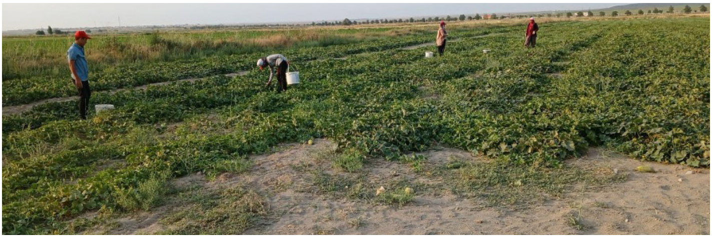

Figure 16. Pickle melon field in Karapınar Kesmez area.

After germination, two plants are planted per hole. Fields are allocated separately for the two stages of melon production. One is for pickle melon which is harvested before ripening when it is 3-5 cm in length on average, and the other is for fully ripe melons from July to the end of August. It is reported that a total of 30 tons of pickle melon are harvested from 1 hectare. The labor force is provided by family members and local people—mostly women—creating an additional source of income, especially for village women. The process is run with low energy input without irrigation. Farmers use the plants left in the field at the end of the harvest for sheep grazing. While the sheep consume these plant residues, they also leave manure on the field. Post-harvest grazing also creates an opportunity for farmers to increase their income by reducing the need to buy feed for sheep from the market. However, since the plateaus in the Vahapobası area, where pickle melon is mainly grown, have been abandoned, production has shifted to areas with irrigation possibilities. (Figure 17) Producers stated that the taste of irrigated pickle melon significantly different from that of pickle melon grown with the dry farming method, and they have shorter shelf life.

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[37] Akça, E., Erpul, G., Çullu, M. A., & Erdoğan, E. H. (2021). Pickle melon (Cucumis melo) production in Karapınar, Central Turkey. In Recarbonizing global soils (p. 259). Springer.

Figure 17. Abandoned pickle melon gardens in Vahapobası Krizman Plateau.

6.6 Grazing of sheep and goat

The project area, Ereğli and Karapınar pasture areas, constitute 40% of the total area of the districts. For this reason, although sheep farming has decreased in recent years, it is still an activity. Sheep breeders stated that they take their animals out to graze in the evening hours in the summer to protect them from the adverse effects of the sun. They reported that they do not always go to the same area for grazing, but to different areas, thus increasing plant diversity by carrying the seeds of plants consumed by animals in different places with their manure. They stated that animals consuming different types of plants grow faster. Producers also expressed that when a suitable number of animals are grazed in pastures, the seeds that fall to the ground are buried in the soil by the animal hooves, which increases the possibility of germination.

7. Comparison of the Sustainable Land Management and Local Land Use Information

There are 14 technology groups within the scope of UNCCD's Sustainable Land Management (SLM) practices (Table 1). In general, these practices are recommended for agricultural, pasture and forest areas. The recommendation in each technology group depends on the characteristics of the local labor force, economy and natural assets. The dry farming practices tested within the scope of the project are directly related to technology groups 3, 5, 8, 9, 10, 11, 13 and 14 in Table 1.

	Technology group	Content	Benefits	Its Existence in Traditional Use in the Project Area
1	Afforestation / Reforestation	Afforestation is the planting of trees or forest cover on land which historically did not contain forests. Reforestation is the planting of trees or forest cover on land which previously contained forest that was converted to another land use.	•Reversing land degradation and rehabilitating degraded land, •An effective climate change mitigation strategy, •High soil organic carbon (SOC) accumulation, •Above and below ground biomass accumulation and biodiversity, •Soil erosion control, soil and water conservation, •Increase in aesthetic and cultural services thanks to improvement in ecosystem functions and services.	•No
2	Agroforestry	It refers to the integration of trees with crops and/or animals within the same land unit. Afforestation in agricultural (crop) lands also includes different coverage and spread rates of pasture-pasture/animals and agriculture-tree-pasture systems.	•Controlling soil erosion, •Improving soil productivity, fertility and soil structure, •Improving forest cover, water retention and reducing nutrient losses, •Income generation opportunities, •Protecting and increasing biodiversity, •Socio-economic benefits, •Mitigating and adapting to climate change by increased carbon sequestration, •Increased resilience to climate change.	•No
3	Minimum Soil Disturbance: Minimum Tillage of Surface Soil	Actions that reduce the degree of tillage by applying low soil disturbance at shallow depths or on small strips of land	•Maintaining or increasing soil fertility/quality, •Reducing soil erosion and soil compaction, •Improving water availability and retention, •Increasing soil organic carbon (SOC) storage, •Potential to reduce climate change.	•Tillage with ploughs and low horsepower tractors
4	Reducing deforestation	Reducing deforestation involves measures that aim to prevent or reduce the removal or clearance of a forest or stand of trees, or the conversion of forest land to non-forest land.	•Reducing greenhouse gas emissions and effects of climate change, •Protecting soil quality and preserving soil carbon stocks and biodiversity, •Increasing livelihoods and resilience of forest-dependent communities.	•No

	Technology group	Content	Benefits	Its Existence in Traditional Use in the Project Area
5	Soil Erosion Control	Soil erosion control is the prevention or control of wind or water erosion that leads to the detachment, transportation and re-deposition of soil particles and the loss of soil fertility	•Controlling soil erosion on site, •Improving soil fertility and water availability, •Vegetative measures using perennial woody vegetation (shrubs and trees) or grasses, •Increasing SOC and supporting carbon sequestration in woody biomass, •Increasing plant and terrestrial biodiversity.	•Stone terrace walls •Healthy plant production
6	Sustainable Forest Management	Sustainable forest management (SFM) aims to responsibly manage natural and planted forests, and combines both forest productivity and forest conservation to sustainably increase benefits derived from forests and forest ecosystems	•Generating income and providing employment opportunities to forest-dependent communities, •Providing socio-economic goods and services such as food, timber and non-timber products, •Reducing forest vulnerability and maintaining forest productivity; promoting significant carbon sequestration, biodiversity and soil and water conservation, •Reducing land degradation and also contributing to climate change mitigation	•No
7	Vegetation Management	It involves practices to manage vegetation to improve its quality, quantity and diversity through the selection and management of appropriate species for different land use types (cereals, legumes, forage crops, pasture plant varieties and species or variable vegetation such as timber trees). Vegetation management also includes the management of invasive species, which could affect native diversity and the overall functioning of the ecosystem.	•Improving soil structure, •Increasing soil carbon, •Soil erosion control	•Lentil, chickpea rotation, •Pickle melon

	Technology group	Content	Benefits	Its Existence in Traditional Use in the Project Area
8	Water Management	Water management is the management of water assets, including ground-, surface- and rainwater, to promote efficient use and protect water assets from pollution and over-exploitation. This also includes the removal of excess water from the ground surface or from the root zone.	•Increasing the soil's capacity to receive, retain, release and transmit water, •Reducing soil erosion, •Improving water quality and use efficiency, •Adaptation to climate change and drought, •Water and financial savings.	•Fallow, •Stone terraces and walls, •Pickle melon production
9	Agro-pastoralism	Agro-pastoralism is the integration of crop production and livestock production, and is practiced amongst settled, nomadic and transhumant communities	•Mitigating climate change, •Increasing productivity, •Reducing soil erosion, increasing nutrient and water use efficiency.	•Providing harvest residues to sheep and goats after harvest
10	Animal Waste Management	Animal waste management is the proper collection, handling, storage, and utilization of waste generated from animals (manure and urine), with the aim of recycling as much of the collected material as possible	•Increasing soil fertility and productivity, •Reducing losses by providing nutrient cycling.	•Barn manure (although at low levels), •Ashes given to plants.
11	Pest, Fire and Diseases Control	Fire, pest, and diseases control are measures that manage, prevent, or control fire, pests, and diseases, with the aim of reducing their negative effects on land, vegetation, and ecosystems.	•Controlling pests and diseases, •Reducing crop/vegetation losses and the spread of outbreaks, •Protecting biodiversity, •Reducing forest degradation, •Mitigating climate change	•Chemical and physical control with ash, string and lime
12	Forest Restoration	Forest restoration supports the recovery or restoration of a degraded forest, with the aim to re-establish the forest structure and its ecological functioning, biodiversity, and productivity levels.	•Restoring or rehabilitating degraded land, •Mitigating climate change, •Increased forest productivity, •Biodiversity and carbon sequestration, •Improved livelihoods and resilience of forest-dependent communities. •Aesthetic and socio-cultural benefits	•No

	Technology group	Content	Benefits	Its Existence in Traditional Use in the Project Area
13	Grazing Pressure Management	Grazing pressure management assesses the maximum livestock population that a habitat or ecosystem can support on a sustainable basis (the carrying capacity), to ensure that assets such as vegetation, soil, and water, are not damaged, degraded, or depleted.	•Preventing soil erosion and degradation, •Regulating soil carbon dynamics.	•Since there are enough pastures for each village, the lands have been used sustainably. The reason for the decrease today is not the pastures but the lack of young population.
14	Integrated Soil Fertility Management	Integrated soil fertility management (ISFM) is a set of soil fertility management practices that aim to optimize nutrient use efficiency and improve crop productivity.	•Improving soil quality, •Soil erosion control, •Water retention and SOC accumulation in soil, •Reducing nitrogen losses and greenhouse gas emissions, •Protecting and maintaining soil biodiversity, •Ensuring the efficient functioning of ecosystem services in terms of nutrient cycling.	•Crop rotation

Table 1. UNCCD Science-Policy Interface[38] Land Degradation Neutrality and Sustainable Land Management Approaches.[39]

[38] Critchley, W., Harari, N., & Mekdaschi-Studer, R. (2021). Restoring life to the land: The role of sustainable land management in ecosystem restoration. UNCCD and WOCAT. https://wocat.net/documents/1085/211018_RestoringLifetotheLand_Report_2.pdf

[39] Sanz, M. J., de Vente, J., Chotte, J.-L., Bernoux, M., Kust, G., Ruiz, I., Almagro, M., Alloza, J. A., Vallejo, R., Castillo, V., Hebel, A., & Akhtar-Schuster, M. (2017). Sustainable land management contribution to successful land-based climate change adaptation and mitigation: A report of the Science-Policy Interface. United Nations Convention to Combat Desertification (UNCCD). https://www.unccd.int/sites/default/files/documents/2017-09/UNCCD_Report_SLM.pdf

8. Discussion and Conclusion

Following the interviews conducted in Karapınar, Ereğli and Beyşehir, it was determined that farmers in the past had adapted to dry farming in arid climate conditions through plant patterns, tillage and crop rotation. Until the 1960s, they continued dry farming with local seeds and then with improved seeds and chemical fertilizers provided by the state. They also definitely included small livestock in their agricultural activities. Lentils and chickpeas were used in crop rotation, which would contribute to the nitrogen content and organic matter content of the soil. In sloping lands such as Yeşilyurt, the accumulation of water content in the soil was ensured with walls made with the use of local stones and practice of fallow. However, it was observed that the crop pattern was achieved not through crop rotation, scientific evaluation of the positive effects of fallow in combating agricultural pests, but through experiences.

The most striking issue in the interviews with farmers was the statements that no training was provided in the 1960s and 1980s, other than fertilizer and seed support for dry farming. In fact, the dry farming technique studies of the research station, which was established on December 13, 1925 under the name Islah-ı Buzr (Eskişehir Seed Improvement Station) and is currently known as the Transitional Zone Agricultural Research Institute Directorate of the Ministry of Agriculture and Forestry of the Republic of Türkiye, date back to the 1940s. The farmers interviewed reported that the villages included in the project area were not visited by this organization. It is thought that the fact that the benefits of water harvesting, increasing soil organic matter, tillage and crop rotation are not sufficiently known among farmers may be due to the fact that scientific training has not been provided to farmers in the area. However, having knowledge about the problems caused by today's agricultural practices is an important advantage for them. Farmers in the region have a very positive attitude to training and promotion activities aimed at eliminating the mistakes of today's agricultural practices.

When the farmers' dryland farming approaches are evaluated within the scope of the 14 techniques recommended for Land Degradation Neutrality[40] and Sustainable Land Management of the United Nations Convention to Combat Desertification, it is seen that they compatible with many of the techniques. (Table 1)

[40] Erpul et al. (2023), Arazi tahribatının dengelenmesi karar destek sistemi ile istatistikler ve sürdürülebilir arazi yönetim yaklaşımları ve uygulamaları, General Directorate of Combating Desertification and Erosion Publications, Ankara.

	LDN-SLM Techniques	Karapınar-Ereğli-Beyşehir Dry Farming Activities
1	Afforestation/Reforestation	Not used. However, there are suitable areas for afforestation
2	Agroforestry (Agriculture – Forest Mixed Production Systems)	Not used. However, there is a high potential especially in the Karapınar-Yeşilyurt region
3	Minimum Soil Disturbance: Minimum Tillage of Surface Soil	Plough, low horsepower tractor use
4	Reducing Deforestation	Not used
5	Soil Erosion Control	Low erosion due to low tillage
6	Sustainable Forest Management (SFM)	Not used
7	Vegetation Management	Crop rotation
8	Water Management	Fallow and water harvesting through stone terraces
9	Agro-pastoralism (Agriculture-Rural Livestock Production)	In small cattle breeding, rotational grazing is implemented in pastures although it is limited
10	Animal Waste Management	Using barn manure in gardens and fields – although not very common.
11	Pest, Fire and Diseases Control	Pest control with ash, dust and rope
12	Forest Restoration	Not used
13	Grazing Pressure Management	As the number of animals has decreased, the pressure on pastures has indirectly decreased
14	Integrated Soil Fertility Management	Increasing soil nitrogen content with lentils and chickpeas

Table 2. Compatibility of the Recommended Practices within the Scope of LDN-SLM and the Activities Implemented within the Scope of Dry Farming.

However, the importance of training activities aimed at disseminating knowledge on the sustainable use of land has become even more evident as a result of interviews conducted during the field studies. The project area is highly fragile in terms of its climatic characteristics; therefore, applying the most appropriate methods in land use is of great importance. When traditional examples of good land use are examined, it is observed that local communities have developed sustainable practices in areas such as water harvesting, erosion control, soil fertility, pest management, and small ruminant farming. Nevertheless, considering the declining number of farmers engaged in dryland farming and the increasing pressure on irrigated agriculture, and in light of LDN (Land Degradation Neutrality) and SLM (Sustainable Land Management) approaches, it is clear that training and awareness-raising activities are needed on issues such as afforestation, animal waste management, mechanization, agroforestry, and integrated soil fertility (e.g., avoiding excessive fertilizer use, implementing crop rotation, etc.) to ensure the long-term sustainability of agriculture in the region.

References

Akça, E., Büyük, G., İnan, M., & Kırpık, M. (2022). Sustainable management of land degradation through legume-based cropping system. In *Advances in legumes for sustainable intensification* (pp. 267–280). Academic Press.

Akça, E., Erpul, G., Çullu, M. A., & Erdoğan, E. H. (2021). Pickle melon (Cucumis melo) production in Karapınar, Central Turkey. In *Recarbonizing global soils* (p. 259). Springer.

Akça, E., Nagano, T., Kume, T., Zucca, C., & Kapur, S. (2022). Traditional land use systems' potential as the framework for soil organic carbon plans and policies. In *Plans and policies for soil organic carbon management in agriculture* (pp. 59–93). Springer Nature Singapore.

Blanco-Canqui, H., Shapiro, C. A., Wortmann, C. S., Drijber, R. A., Mamo, M., Shaver, T. M., & Ferguson, R. B. (2013). Soil organic carbon: The value to soil properties. *Journal of Soil and Water Conservation, 68*(5), 129A–134A.

Bowden, R. D., Wurzbacher, S. J., Washko, S. E., Wind, L., Rice, A. M., Coble, A. E., & Lajtha, K. (2019). Long-term nitrogen addition decreases organic matter decomposition and increases forest soil carbon. *Soil Science Society of America Journal, 83*, S82–S95.

Climate-Data.org. (n.d.). *Climate data for Eregli*, Konya. Retrieved June 24, 2025, from https://en.climate-data.org/asia/turkey/konya/eregli-14999/

Critchley, W., Harari, N., & Mekdaschi-Studer, R. (2021). *Restoring life to the land: The role of sustainable land management in ecosystem restoration.* UNCCD and WOCAT. https://wocat.net/documents/1085/211018_RestoringLifetotheLand_Report_2.pdf

Ministry of Environment, Urbanization and Climate Change, General Directorate of Environmental Impact Assessment, Permit and Inspection. (2023). *Çevresel göstergeler* [Environmental indicators] (Publication No. 58). Ankara, Turkey.

General Directorate of Combating Desertification and Erosion (CDE). (2017). *Türkiye çöllesme modeli: Teknik özet* [Turkish desertification model: Technical summary]. Ankara, Turkey.

General Directorate of Combating Desertification and Erosion (CDE). (2018). *Toprak organik karbonu projesi: Teknik özet* [Soil organic carbon project: Technical summary]. *Ankara, Turkey.*

General Directorate of State Hydraulic Works (DSİ). (2023). *Devlet Su Isleri 2023 genel faaliyet raporu* [2023 general activity report of the State Hydraulic Works]. Republic of Türkiye Ministry of Agriculture and Forestry, General Directorate of State Hydraulic Works.

Erpul, G., Akça, E., Tekin, S. N., Karaman, N. A., Canlı, P., Morkoç, S., & Kavaklı Karataş, Z. (2023). *Arazi tahribatının dengelenmesi karar destek sistemi ile istatistikler ve sürdürülebilir arazi yönetim yaklasımları ve uygulamaları* [*Decision support system for land degradation neutrality: Statistics and sustainable land management approaches and practices*]. General Directorate of Combating Desertification and Erosion Publications.

Food and Agriculture Organization of the United Nations (FAO). (n.d.). *Global Soil Partnership highlights.* https://www.fao.org/global-soil-partnership/resources/highlights/detail/en/c/416516/

Göçmez, G., Dülger, A., Arık, F., & Delikan, A. (2022). Ürünlü (Çumra-Konya) çevresinde yeraltısuyu seviye değişimleri ve obruk oluşumları [Groundwater level changes and sinkhole formations around Ürünlü (Çumra-Konya)]. *Selçuk Üniversitesi Sosyal ve Teknik Arastırmalar Dergisi, 20*, 172–178.

Huang, Z., Tian, F. P., Wu, G. L., Liu, Y., & Dang, Z. Q. (2017). Legume grasslands promote precipitation infiltration better than gramineous grasslands in arid regions. *Land Degradation & Development, 28*(1), 309–316.

IPBES. (2018). *Summary for policymakers of the assessment report on land degradation and restoration of the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services.* IPBES Secretariat.

IUSS Working Group WRB. (2022). *World reference base for soil resources: International soil classification system for naming soils and creating legends for soil maps* (4th ed.). International Union of Soil Sciences (IUSS). https://www.isric.org/sites/default/files/WRB_fourth_edition_2022-12-18.pdf

Kallenbach, C. M., Conant, R. T., Calderón, F., & Wallenstein, M. D. (2019). A novel soil amendment for enhancing soil moisture retention and soil carbon in drought-prone soils. *Geoderma, 337*, 256–265.

Konya Provincial Directorate of Agriculture and Forestry. (2019). *Konya agricultural statistics.* Retrieved January 24, 2025, from https://konya.tarimorman.gov.tr/Belgeler/liflet/%C4%B0l%C3%A7e%20Baz%C4%B1nda%20Tar%C4%B1m%20%C4%B0statistiklerii-2019.pdf

Konya Governorship. (n.d.). Karapınar District Governorate. Retrieved January 24, 2025, from https://www.konya.gov.tr/karapinar

Ledgard, S. F., & Steele, K. W. (1992). Biological nitrogen fixation in mixed legume/grass pastures. *Plant and Soil, 141*(1), 137–153.

Li, X. G., Jia, B., Lv, J., Ma, Q., Kuzyakov, Y., & Li, F. M. (2017). Nitrogen fertilization decreases the decomposition of soil organic matter and plant residues in planted soils. *Soil Biology and Biochemistry, 112*, 47–55.

Meena, R. S., & Kumar, S. (2022). Legume-based agroecosystem for sustainable intensification: An overview. In *Advances in legumes for sustainable intensification* (pp. 3–8). Academic Press.

Peel, M. C., Finlayson, B. L., & McMahon, T. A. (2007). Updated world map of the Köppen-Geiger climate classification. *Hydrology and Earth System Sciences, 11*(5), 1633–1644.

Project GEFFAO. (n.d.). *LDN Turkey Viewer.* https://projectgeffao.users.earthengine.app/view/ldn-turkey

Sarı, S., & İnan, N. (2011). Seydişehir ile Beyşehir'in iklimlerinin karşılaştırılması [Comparison of the climates of Seydişehir and Beyşehir]. *Selçuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 26*, 291–310.

Sanz, M. J., de Vente, J., Chotte, J.-L., Bernoux, M., Kust, G., Ruiz, I., Almagro, M., Alloza, J. A., Vallejo, R., Castillo, V., Hebel, A., & Akhtar-Schuster, M. (2017). *Sustainable land management contribution to successful land-based climate change adaptation and mitigation.* A Report of the Science-Policy Interface. United Nations Convention to Combat Desertification (UNCCD). https://www.unccd.int/sites/default/files/documents/2017-09/UNCCD_Report_SLM.pdf

Statista. (n.d.). *Global fertilizer consumption by nutrient from 2010 to 2022.* Retrieved from https://www.statista.com/statistics/438967/fertilizer-consumption-globally-by-nutrient/

Symanowicz, B., Becher, M., Jaremko, D., & Skwarek, K. (2018). Possibilities for the use of wood ashes in agriculture. *Journal of Ecological Engineering, 19*(3).

Republic of Türkiye Ministry of Agriculture and Forestry. (2023). *Konya agricultural statistics* [Konya tarım istatistikleri]. Retrieved January 24, 2025, from https://konya.tarimorman.gov.tr/Belgeler/kitap/%C4%B0l%C3%A7e%20Baz%C4%B1nda%20Tar%C4%B1m%20%C4%B0statistikleri-2023.pdf

United Nations Office for Disaster Risk Reduction (UNDRR). (n.d.). *Hazard information profiles (HIPs).* https://www.undrr.org/understanding-disaster-risk/terminology/hips/en0005

Venkateswarlu, B., Srinivasarao, C., Ramesh, G., Venkateswarlu, S., & Katyal, J. C. (2007). Effects of long-term legume cover crop incorporation on soil organic carbon, microbial biomass, nutrient build-up and grain yields of sorghum/sunflower under rain-fed conditions. *Soil Use and Management, 23*(1), 100–107.

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