

An Examination of the Environmental Impacts of Mega Projects on Rural Areas: A Case Study of Two Villages in the South Marmara Region of Türkiye

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Abstract

Mega projects are investments that make significant changes to land use structures and have the potential to cause major damage to the natural environment. Their impact is often discussed in relation to cities. However, they are much more fragile in rural areas. In Turkey, these projects are primarily located in the Marmara Region and encompass a series of initiatives aimed at creating a transportation corridor within the 'Golden Ring' framework and promoting the decentralisation of industry in the region.

The study will examine the rural areas of Yalova and Bursa in terms of the environmental impacts of mega projects. The reason for conducting the study in these rural areas is that the large investments are located at the intersection and focal point of these areas.

In this study, qualitative and quantitative data methods will be used in combination to concretely reveal how rural areas that are critical in economic, ecological and social terms have undergone a process of change over the last 10 years as a result of mega projects, and what effects this may have in the future.

Keywords: Mega Projects, Rural Areas, Sustainable Environment, Ecological Balance

Introduction

In recent years, increasing technological developments and innovations have brought about a rapid transformation process in both spatial and social structures. While the effects on the built environment are a subject of debate, the effects on the natural environment are much more fragile and irreversible. These effects in cities and natural areas are causing the social structure to disintegrate. Among the factors influencing this situation are mega-projects created to meet the needs of urbanisation and urban structures. In recent years, these projects have expanded beyond the boundaries of urban spaces and into rural areas. While this expansion benefits the projects, it causes damage to the natural environment. Research on this issue has generally focused on the urban scale. The ways in which rural areas are affected are explained within an urban context, and the visibility of the impact created by the projects on the natural environment is overlooked (Çalışkan, 2010; Ercan, 2020; Flyvbjerg, 2014; Flyvbjerg, Bruzelius, & Rothengatter, 2003; Keydal, 2021; Kızılay & Zorlu, 2020; Köksal & Öztürk, 2017; Özbay, 2019; Öztürk P. Ç., 2017; Sönmez, 2017).

This study aims to analyse environmental transformation in a multifaceted way by examining the environmental impacts of mega projects in the rural areas of Yalova and Bursa in Turkey's Marmara Region, together with social vulnerabilities. It aims to reveal the concrete reflections of the natural environment created by agricultural lands through land transformation analysis. Through thematic analysis, it seeks to support these analysis results and convey the social dimensions of environmental impacts in a comprehensive manner.

Results of the study. By presenting the environmental transformation process created by mega projects in rural areas in a multi-layered manner, including the social dimension of participation processes, it will serve as a guide for researchers and decision-makers.

Mega Projects and Their Environmental Impact on Rural Areas

Mega projects are projects that range from historically significant developments to large monumental structures. These projects have been followed by railways, infrastructure works and industrial developments (Söderlund, et al., 2017). Flyvbjerg (2014) defines mega projects as large-scale, complex ventures that typically cost a billion dollars or more, take years to develop and build, involve multiple public and private stakeholders, are transformative, and affect millions of people.

Mega projects are increasingly being preferred in many sectors. Examples of mega projects include railways, motorways, airports and industrial areas, among many other sectoral structures (Baysal, 2017; Flyvbjerg, 2014; Kızılay & Zorlu, 2020).

Mega projects should not be defined solely by their size, as this growth is steadily increasing. Although these formations, which were referred to as 'mega projects' in the 1970s, are now reaching giga and tera proportions, the term has remained largely unchanged (Flyvbjerg, 2014). However, the size of mega projects varies depending on the size of the areas they are located in. Both the areas covered by mega projects and their numbers are increasing (Baysal, 2017; Flyvbjerg, 2014). This quantitative growth also increases the risks involved and can have negative effects on cities in environmental, economic, social and cultural areas (Gellert & Lynch, 2003; Dündar, 2010). Projects of this scale can be large enough to change the spatial structure of cities (Aysev, 2022). For this reason, it has been emphasised that the resulting growth should be characterised as unpredictable and frenzied, and that it must be prevented (Ercan, 2020).

Regardless of geography, 90% of mega projects experience cost overruns. These cost overruns occur in both the private and public sectors. However, the benefits initially anticipated have generally turned into losses (Flyvbjerg, et al., 2003). Despite this loss, projects are increasing (Flyvbjerg, 2014). This inconsistency has been defined as a paradox by Flyvbjerg et al. (2003). It has been noted that cost overruns are sometimes considered insignificant in long-term investments, and that most monumental structures have suffered from cost overruns. However, the cost overruns of projects undertaken today are of such magnitude that they can affect the benefits and losses of all nations (Flyvbjerg, et al., 2003). For this reason, the time frame in which projects are evaluated is important (Söderlund, et al., 2017).

Despite the increase in their numbers and their growing influence in many areas, resources and management remain in the background in mega projects. In management processes, project officials tend to disregard all participation processes and leave civil society behind. In such cases, local communities and civil society organisations do not have the same say as other stakeholders. This situation leads to the public approaching projects with suspicion and certain negative developments emerging during the process (Flyvbjerg, 2014).

Mega projects are also uncertain and often do not turn out as planned, but can be used to serve various interests. This situation causes social and economic disruptions (MüllerMahn, et al., 2021). Such ruptures do not only appear in an abstract form, but also influence the shaping of the space and the city as a whole in a broader context (Robbins, 2014). When the studies are examined, it is seen that mega projects are generally emphasised for their significant impact on the shaping of urban spaces, but their impossible effects are also mentioned. In these studies, the effects on rural areas have been addressed mainly in relation to cities, and the direct changes and transformations they cause have been addressed to a limited extent (Çalışkan, 2010; Ercan, 2020; Flyvbjerg, 2014; Flyvbjerg, et al., 2003; Keydal, 2021; Kızılay & Zorlu, 2020; Köksal & Öztürk, 2017; Özbay, 2019; Öztürk, 2017; Sönmez, 2017; Tolunay, 2015).

Mega projects located in city centres have gradually spread to rural areas due to land constraints. With the arrival of these projects in rural areas, rent formation has begun, and their attractiveness in rural areas has increased because they generate more economic profit than rural production (Özbay, 2019; Tekeli, 2014). Rural areas, which serve as the primary source of land resources, are undergoing uncontrolled urbanisation due to the expansion of cities and mega projects, resulting in the degradation and loss of rural lands (Çalışkan, 2010; Keydal, 2021; Özbay, 2019; Uysal & Albayrak, 2024).

Looking at the case studies examined, projects related to transportation and industry stand out (Arslan & Üzülmmez, 2024; Debela et al., 2020; Döner, 2016; Kolukırık, 2016; Morshed et al., 2024; Mothorpe et al., 2013; Ramachandraiah, 2014; Robbins, 2014; Song et al., 2016; Uysal & Albayrak, 2024). These projects, which have a profound impact on the country and region, are generally constructed through tenders carried out by the public sector and through private sector investors. Although the public sector takes the lead in the decision-making and implementation processes related to the projects, the lobbies in the background are the biggest drivers of these projects (Robbins, 2014). At the same time, large-scale businesses in rural areas have benefited more, leaving individuals behind (Delphine et al., 2019; Ramachandraiah, 2014).

In most projects, it is known that certain external investors begin purchasing agricultural land and, in a sense, engage in land speculation at stages when the local community has no information, while planning and decision-making processes are still ongoing (Döner, 2016; Kolukirik, 2016). As the process continues, expropriations are carried out by the public sector, and compensation is paid to the local community. Typically, to prevent social opposition, efforts are made to maintain expectations that the project will create a high level of employment for the local community. However, it is argued that the employment generated by the investments will fall short of expectations once the projects are implemented. In this case, large businesses have benefited more, leaving individuals behind (Arslan & Üzülmmez, 2024; Debela et al., 2020; Delphine et al., 2019; Döner, 2016; Kolukirik, 2016; Ramachandraiah, 2014; Rashid et al., 2024; Robbins, 2014; Song et al., 2016). However, while it is argued that these projects will have a significant economic impact on national and regional development, they exceed their own cost limits and place the existing system under a financial burden (Müller Mahn et al., 2021; Robbins, 2014).

With mega projects, agricultural areas have been opened up to residential areas, and the urban fabric has begun to shift towards agricultural land. With this situation, rural areas have been merged with each other and added to the borders (Debela et al., 2020; Mothorpe et al., 2013). Rural areas have been concretely affected by these projects through the loss of agricultural land and damage to natural areas. The loss of land has increased in the context of these projects (Arslan & Üzülmmez, 2024; Morshed et al., 2024). The change in land affects many factors, including production quantities and types. Farmers whose income sources have changed have been unable to continue their production activities or have had to limit their activities. Farmers whose land has shrunk can only engage in irrigated or dry farming, depending on the nature of their expropriated land (Arslan & Üzülmmez, 2024; Debela et al., 2020; Döner, 2016; Kolukirik, 2016; Ramachandraiah, 2014). At the same time, these projects have also damaged the natural structure and ecosystem. They have resulted in air pollution, water pollution, and noise pollution (Delphine et al., 2019; Döner, 2016; Morshed et al., 2024; Robbins, 2014; Song et al., 2016). Furthermore, it has caused the fragmentation of the landscape structure in rural areas and led to changes in land quality, resulting in the formation of new landscape patterns (Morshed et al., 2024; Song et al., 2016).

All these environmental and spatial impacts also have social and economic repercussions. Although the economic impacts of projects are sometimes seen as positive at the outset, they have led to changes in or the loss of livelihoods. In particular, the agriculture and livestock sectors have been severely affected (Debela et al., 2020; Delphine et al., 2019; Morshed et al., 2024; Mothorpe et al., 2013; Ramachandraiah, 2014; Robbins, 2014; Song et al., 2016). Socially, the sudden disruption of traditional lifestyles in rural communities, forcing them to change their ways of life and livelihoods, has increased individuals' concerns (Kolukirik, 2016).

Impacts of Mega Project Trends on Rural Areas within the Framework of the Golden Ring

When looking at the historical process of mega projects in Turkey, it can be seen that the intensity of the projects is concentrated in Istanbul (Çalışkan, 2010; Ercan, 2020; Keydal, 2021; Kızılay & Zorlu, 2020; Köksal & Öztürk, 2017; Özbay, 2019; ÖztürkP. Ç., 2017). The projects have spread from Istanbul to the Marmara region and other provinces in conjunction with the industrial sector and central government strategies in this context (Ercan, 2020; Köksal & Öztürk, 2017).

When examining Turkey's development plans for the last 20 years within the scope of mega projects, it is seen that large-scale projects began to be mentioned in the 8th Development Plan (2001-2005), with particular reference to incentives in the industrial sector. At the same time, the development of infrastructure works was also mentioned during this period ((DPT, 2000). 9. The development plan (2007-2013) includes policies related to creating a competitive environment that addresses technological developments. Improvements in other areas are also addressed. ((DTP, 2006). 10. When it comes to the development plan (2014-2018), it is seen that large-scale investments are mentioned more frequently and that projects and policies are developed in this context ((SBB, 2013). Along with this, mega projects that will have a significant regional and national impact on Istanbul have begun to emerge and their foundations have been laid in recent years. Subsequent development plans have focused on mega projects on a much larger scale than the national level. In the latest development plan, the concept of sustainability has gained greater prominence (SBB, 2019; SBB, 2023).

During and after the 10th Development Plan (2014-2018), which saw a particular concentration of mega projects, major transportation projects were carried out in the northern region of Istanbul, including the 3rd Bridge, 3rd Airport, Northern Marmara Motorway, Istanbul-Izmir Motorway, and the Osmangazi Bridge. During the

construction of the 3rd Bridge, 3rd Airport, and Northern Marmara Motorway, it was noted that the area contained dense ecological habitats, a fact that was either clearly stated in the Environmental Impact Assessment (EIA) reports or overlooked due to the inadequacy of the reports. The projects were located in the peripheral region, one of the few areas in Istanbul with rich natural structures that had not been opened up for settlement. The fact that these projects were implemented without undergoing a detailed analysis phase has created negative environmental impacts on the region (Tolunay, 2015). This process is also mentioned in the assessment of the EIA report submitted in the context of the 3rd Bridge. It is emphasised that the process will negatively affect natural areas and rural settlements in the northern region, which will come under pressure. At the same time, it is stated that the transport routes built in this context will increase this pressure. Although the EIA reports do not fully reflect the current situation, the project has disregarded the inconsistencies with these reports (Çalışkan, 2010). Due to the ecological richness of Istanbul's northern region, which extends to the Black Sea coast, it is insufficient to carry out applications and interventions solely under the name of protection. In addition to protection decisions, comprehensive plans and models are essential for this region (Altınok, 2023).

Projects in the northern region of Istanbul have spread beyond Istanbul's sphere of influence to neighbouring provinces and the Marmara Region. Projects such as the Osmangazi Bridge and the Istanbul-Izmir Motorway have been carried out within this scope. In this context, a line called the Golden Ring has been created with the aim of connecting Istanbul, Kocaeli and Bursa Metropolises with Yalova (Doğu Marmara Kalkınma Ajansı, 2012).

This line, which has also been reported in the news as the Marmara Ring (Milliyet, 2011), is 400 km long and surrounds the Marmara region. (Doğu Marmara Kalkınma Ajansı, 2012). The Golden Ring route, which begins with the 3rd Bridge and Northern Marmara Motorway project, continues with the Çanakkale Strait Bridge between Lapseki and Gelibolu, and continues with the Gulf Crossing-Istanbul-Izmir Motorway (Kural, 2014), reduces the time required to travel around the Marmara Region to 4 hours. (Doğu Marmara Kalkınma Ajansı, 2012).

It is emphasised that the Golden Ring line is important for easing Istanbul's current traffic and preventing transit traffic from outside the city from putting pressure on central traffic. However, the Istanbul-Izmir Motorway, which is part of the line, has facilitated transportation between important industrial cities (Haber, 2022; Karaca, 2019; Ünal, 2022). However, other news sources have noted that the project continues to advance destructive initiatives toward regions in northern Istanbul that include agricultural lands and other natural areas, creating irreversible environmental pressure (Kural, 2014; Sendika.Org, 2016). It is also described as a 'concrete shackle around the Marmara Region' (Kural, 2014).

The Golden Ring project in the region does not only include transportation projects; the industrial zones affected by these projects are also located in the area. It is stated that 58 new industrial zones have been established in the region in 8 years. The establishment of industrial zones along the Istanbul-Izmir Motorway route has had a particularly significant impact. This has accelerated the development of both transportation and the industrial sector in the region (Haber, 2022).

The concept of the Golden Ring is not found in literature. It is only mentioned in reports on cities' visions, etc. Although this concept is found on news websites, it has not been included in scientific articles and research, but has been discussed in the context of Istanbul's northern axis and other projects.

Materials and Methods

The study used both quantitative and qualitative research methods. Quantitative research methods included land use analysis, while qualitative research methods included thematic analysis, allowing for a multi-layered examination of the environmental impacts of mega-projects in rural areas.

Land change analysis was conducted using data from 2000 to 2025. Since CORINE land cover data for the period 2000-2018 and current data sets were not available, 2025 data were used, which were manually drawn using Google Earth. In the study conducted in Yalova (Çiftlikköy)-Kılıç village and Bursa (Karacabey)-Taşpınar village, the data were classified and analysed using the QGIS programme. The analysis results were calculated numerically and mapped. The analysis provides a concrete framework for understanding the environmental dimensions of land conversion.

Before the thematic analysis, field research was conducted in the villages identified. Semi-structured interviews were conducted with the local community during the research. In order to examine the environmental impact of mega-projects in a multi-layered manner, the study also considered the social impact dimension, with interviews conducted with 25 individuals (Table 5). The interviews were categorised into themes within the scope of the environmental, spatial, social, economic, and participatory dimensions of mega-projects. Relevant codes were created for each theme, and these codes were organised into a diagram (Figure 5).

Study Area

Kılıç and Taşpınar Villages

Kılıç Village is located in the Marmara Region of Turkey, in the Çiftlikköy district of Yalova province, while Taşpınar Village is located in the Karacabey district of Bursa province. Both villages are Muhacir settlements. Kılıç Village is located at the toll booth exit of the İzmir-Istanbul Motorway, on the border of the Yalova Machinery Specialised Industrial Zone. TEKNOSAB is located around Taşpınar Village, and the İzmir-Istanbul Motorway is located on its periphery. Kılıç Village has a population of 727 (TÜİK, 2024), while Taşpınar Village has a population of 229 (Vural, et al., 2020). The economic structure of the villages is largely based on agricultural activities.

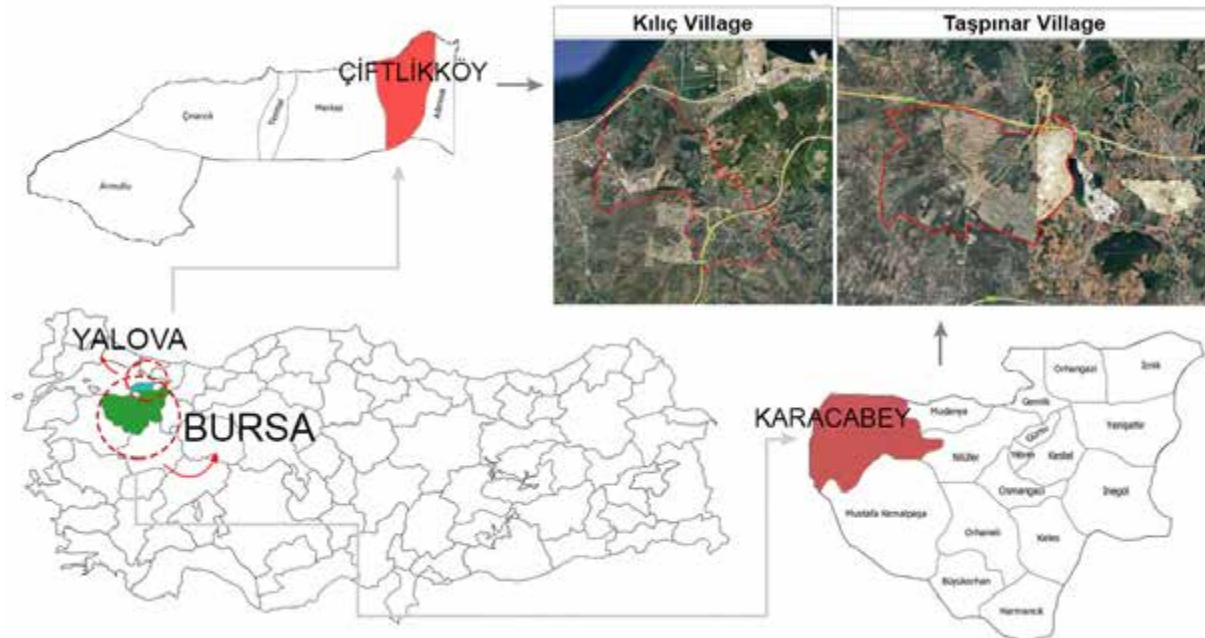


Figure 1. Study Area Location (Prepared by the author using Google Earth data)

Motorways and Industrial Areas

One of Turkey's largest transportation projects, the İzmir-Istanbul motorway, opened in 2019. The 426 km long motorway (Directorate, n.d.) passes through the villages of Kılıç and Taşpınar in the project area. The route of the highway has led to the establishment of industrial areas along its path (Ünal, 2022). The Yalova Machine Specialised Industrial Zone and TEKNOSAB area are examples of such industrial sites.

Yalova Machine Specialised Organised Industrial Zone (OSB) was established in 2017 and became operational in 2020. It was planned within the scope of the Green OSB model. The OSB, which was established on an area of 625 hectares, covers an area of 625 hectares. The settlement process has not been completed, and the occupancy rate is 20% (Çağlar, et al., 2022).

TEKNOSAB acquired legal personality in 2019, began infrastructure work in 2019, and commenced operations in 2021. The factories were constructed using a gallery reinforced concrete system, and the aim is to source a significant portion of the electricity from renewable energy sources (TEKNOSAB, n.d.).



Figure 2. Location of Mega Projects in the Field of Work (Prepared by the author using Google Earth data)

Findings

Land Cover Area Change Analysis

In this section, land change analysis was performed using CORINE land cover data for the villages of Kılıç and Taşpınar. Land use in the villages between 2000 and 2025 was calculated in hectares and percentages, and absolute and percentage changes in the area were analysed. The analysis was digitised in tables and visualised with maps.

Note: Since CORINE 2025 land cover data has not been published, data for 2025 has been manually generated based on Google Earth satellite imagery and project area data.

Table 1. Kılıç Village-Land Distribution Table by Year (Prepared by the author using CORINE data)

Code	Land Type	2000		2006		2012		2018		2025	
		ha	%	ha	%	ha	%	ha	%	ha	%
1.2.2.	Highways, Railways and Related Areas	0	0,00%	0	0,00%	0	0,00%	46,685	2,41%	46,685	2,41%
1.3.1.	Mining Areas	0	0,00%	0	0,00%	0,3004	0,02%	0,3004	0,02%	0,3004	0,02%
1.3.2.	Dumping Areas	0	0,00%	0	0,00%	0	0,00%	28,976	1,49%	28,976	1,49%
1.4.2.	Sports and Recreation Areas	65,43	3,37%	65,389	3,37%	66,651	3,44%	66,651	3,44%	66,651	3,44%

2.1.1.	Non-Irriga- ted Arable Land	527,13	27,17%	530,65	27,35%	577,06	29,74%	541,56	27,91%	541,56	27,91%
2.3.1.	Pasture Land	335,71	17,30%	241,57	12,45%	244,38	12,60%	243,1	12,53%	243,1	12,53%
2.4.2.	Mixed Agricultural Areas	367,29	18,93%	444,08	22,89%	442,17	22,79%	419,27	21,61%	419,27	21,61%
2.4.3.	Agricultural Areas with Natural Vegetation Cover	640,32	33,01%	556,48	28,68%	577,24	29,75%	561,25	28,93%	561,25	28,93%
3.2.4.	Plant Transition Areas	4,1748	0,22%	101,9	5,25%	31,997	1,65%	31,997	1,65%	31,997	1,65%
5.2.3.	Sea and Ocean	0	0,00%	0,2423	0,01%	0,5124	0,03%	0,5124	0,03%	0,5124	0,03%

Table 1 shows that agricultural areas accounted for 96.41% of the total land cover in 2000. However, agricultural areas with natural vegetation cover accounted for 33.01% of the total land cover, which was the highest land type. This was followed by non-irrigated arable land with 27.17%. In 2006, agricultural land types again accounted for the most land use at 91.37%. Marine and ocean areas accounted for a very low percentage of 0.01%. By 2012, artificial areas began to appear, and mining areas emerged as a new land use type, accounting for a very low percentage of 0.02%. In 2018, new land types emerged. Roads, railways, and related areas accounted for 2.41%, and disposal sites accounted for 1.49%. By 2025, the data from 2018 remained unchanged.

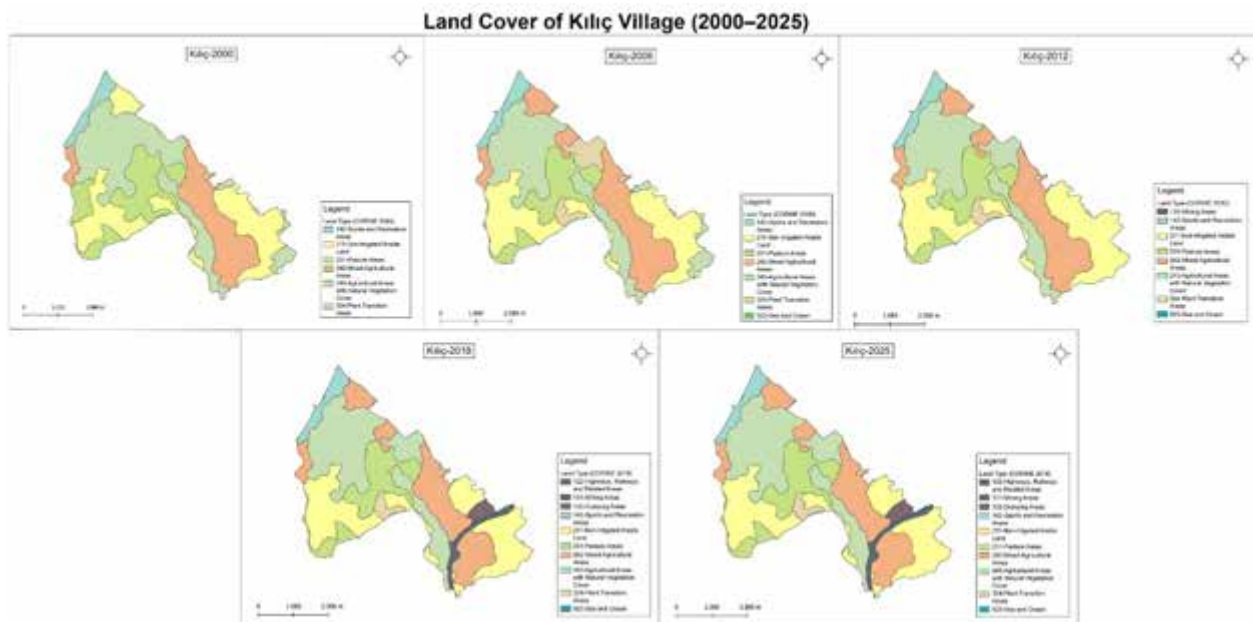


Figure 3. Kılıç Village - Land Distribution Map by Year (Created by author)

When examining the tables in Figure 1, it can be seen that agricultural areas in Kılıç village are spatially distributed over a wide area. Although artificial areas show limited growth, the general land structure of the area has not changed.

Table 2.Taşpınar Village-Land Distribution Table by Year (Prepared by the author using CORINE data)

Code	Land Type	2000		2006		2012		2018		2025	
		ha	%	ha	%	ha	%	ha	%	ha	%
1.1.2.	Discontinuous Urban Structure	47,403	2,51%	28,938	1,53%	28,937	1,53%	28,937	1,53%	28,937	1,53%
1.2.1.	Industrial and Commercial Units	0	0,00%	0,6599	0,03%	0,027	0,00%	0,027	0,00%	790,64	41,85%
2.1.1.	Non-Irrigated Arable Land	1649,4	87,31%	1686,3	89,26%	1687,5	89,32%	1687,5	89,32%	950,52	50,32%
2.3.1.	Pasture Land	190,78	10,10%	146,4	7,75%	146,04	7,73%	146,04	7,73%	94,231	4,99%
2.4.2.	Mixed Agricultural Land	0	0,00%	0,7763	0,04%	0,7665	0,04%	0,7665	0,04%	0,7665	0,04%
2.4.3.	Agricultural Land with Natural Vegetation Cover	1,5393	0,08%	0	0,00%	0	0,00%	0	0,00%	0	0,00%
3.2.4.	Plant Transition Areas	0	0,00%	26,042	1,38%	25,678	1,36%	25,678	1,36%	23,799	1,26%
5.1.2.	Water Bodies	0	0,00%	0	0,00%	0,2248	0,01%	0,2248	0,01%	0,2248	0,01%

Looking at Table 2, agricultural land accounts for 97.49% of the land use in Taşpınar village. The land type with the highest value is non-irrigated arable land, accounting for 87.31%. However, the settlement type included in artificial areas covers 2.51% of the land. In 2006, the land type with the highest land density was again non-irrigated arable land, accounting for 89.26%. At the same time, new land formations were observed. Industrial and commercial units accounted for a very low percentage of 0.03%, while plant change areas (scrub/semi-scrub, transition areas) accounted for 1.38% of new formations. Settlement areas covered 1.53% of the land. In 2012, the land structure remained similar. New formations were observed at a very low rate of 0.01%. In 2018, the land structure remained unchanged. By 2025, non-irrigated arable land will cover 50.32% of the area, while industrial and commercial units will cover 41.85% of the area. The ratios for other land types have remained largely unchanged.

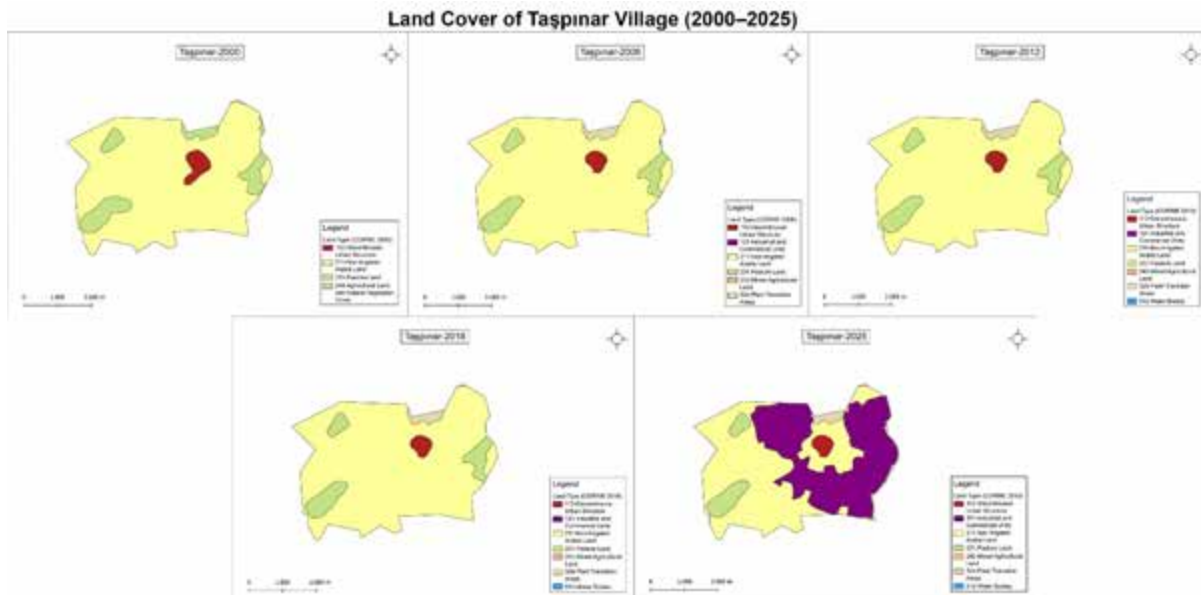


Figure 4. Taşpınar Village - Land Distribution Map by Year (Created by author)

When examining the tables in Figure 2, it can be seen that agricultural areas in Taşpınar village are spatially distributed over a wide area. However, newly formed areas have affected land use distribution. Industrial and commercial units have increased significantly and have come close to the proportion of non-irrigated arable land.

Table 3. Kılıç Village - Land Cover Change Table by Year (Prepared by the author using CORINE data)

Code	Land Type	2000–2006		2006–2012		2012–2018		2018–2025		2000–2025	
		Δha	%	Δha	%	Δha	%	Δha	%	Δha	%
1.2.2.	Highways, Railways and Related Areas	0	0,00%	0	0,00%	46,685	Newly occurred	0	0,00%	46,685	Newly occurred
1.3.1.	Mining Areas	0	0,00%	0,3004	Newly occurred	0	0,00%	0	0,00%	0,3004	Newly occurred
1.3.2.	Dumping Areas	0	0,00%	0	0,00%	28,976	Newly occurred	0	0,00%	28,976	Newly occurred
1.4.2.	Sports and Recreation Areas	-0,041	-0,06%	1,2626	1,93%	0	0,00%	0	0,00%	1,2214	1,87%
2.1.1.	Non-Irrigated Arable Land	3,519	0,67%	46,415	8,75%	-35,5	-6,15%	0	0,00%	14,434	2,74%
2.3.1.	Pasture Land	-94,14	-28,04%	2,8119	1,16%	-1,2836	-0,53%	0	0,00%	-92,61	-27,59%
2.4.2.	Mixed Agricultural Areas	76,788	20,91%	-1,915	-0,43%	-22,893	-5,18%	0	0,00%	51,981	14,15%
2.4.3.	Agricultural Areas with Natural Vegetation Cover	-83,84	-13,09%	20,755	3,73%	-15,984	-2,77%	0	0,00%	-79,07	-12,35%
3.2.4.	Plant Transition Areas	97,722	2340,76%	-69,9	-68,60%	0	0,00%	0	0,00%	27,822	666,43%
5.2.3.	Sea and Ocean	0,2423	Newly occurred	0,27	111,41%	0	0,00%	0	0,00%	0,5124	Newly occurred

Looking at the analysis results for Kılıç village, the greatest decrease in land types between 2000 and 2006 was observed in pasture areas, with a rate of 28.04%. The highest increase in land area was observed in plant change areas, with a very high rate of 2340.76%. Marine and ocean areas showed new formations. Between 2006 and 2012, mining areas showed new formations. While an overall increase was observed in agricultural areas, the mixed

agricultural land type decreased by 0.43%. At the same time, a significant decline occurred in plant change areas, with a decrease of 68.60%. The boundaries of sea and ocean areas within land boundaries expanded, showing an increase of 111.41%. Between 2012 and 2018, a decrease of 14.62% was observed across all agricultural areas. Meanwhile, 46,685 hectares of roads, railways, and related areas, and 28,976 hectares of disposal sites have emerged as new formations. Changes between 2018 and 2025 have remained constant.

Looking at the changes between 2000 and 2025 in general, new land formations are noteworthy. Here, roads, railways and related areas, mining sites and disposal sites, which have formed in a different way from the natural structure, have developed by changing the quality of agricultural land. At the same time, a decrease of 27.59% in pasture areas and 12.35% in agricultural areas with natural vegetation cover is noteworthy. Additionally, a significant increase of 666.43% has been observed in areas with vegetation changes.

Table 4. Taşpınar Village - Land Cover Change Table by Year (Prepared by the author using CORINE data)

Code	Land Type	2000-2006		2006-2012		2012-2018		2018-2025		2000-2025	
		Δha	%	Δha	%	Δha	%	Δha	%	Δha	%
1.1.2.	Discontinuous Urban Structure	-18,466	-38,95%	-0,0002	0,00%	0	0	0	0,00%	-18,47	-38,95%
1.2.1.	Industrial and Commercial Units	0,6599	Newly occurred	-0,6329	-95,91%	0	0	790,62	2929845,03%	790,64	Newly occurred
2.1.1.	Non-Irrigated Arable Land	36,915	2,24%	1,1412	0,07%	0	0	-736,93	-43,67%	-698,9	-42,37%
2.3.1.	Pasture Land	-44,389	-23,27%	-0,3585	-0,24%	0	0	-51,806	-35,47%	-96,55	-50,61%
2.4.2.	Mixed Agricultural Land	0,7763	Newly occurred	-0,0098	-1,26%	0	0	0	0,00%	0,7665	Newly occurred
2.4.3.	Agricultural Land with Natural Vegetation Cover	-1,5393	-100,00%	0	0,00%	0	0	0	0,00%	-1,539	-100,00%
3.2.4.	Plant Transition Areas	26,042	Newly occurred	-0,3646	-1,40%	0	0	-1,879	-7,32%	23,799	Newly occurred
5.1.2.	Water Bodies	0	0,00%	0,2248	Newly occurred	0	0	0	0,00%	0,2248	Newly occurred

Looking at the analysis results for Taşpınar village, the greatest decrease between 2000 and 2006 was in settlement areas, at a rate of 38.95%. This was followed by a 23.27% decrease in pasture areas. However, there was a 100% increase in agricultural areas with natural vegetation cover, and industrial and commercial units, mixed agricultural areas, and plant change areas showed new formations. Between 2006 and 2012, there was a slight decrease in agricultural and natural areas. However, there was a 95.91% decrease in industrial and commercial units. At the same time, water bodies showed new formations. The values between 2012 and 2018 remained constant. Between 2018 and 2025, a decrease of 86.46% was observed in agricultural areas and natural areas combined. However, there was a very high increase of 2929845.03% in industrial and commercial units.

Looking at the changes between 2000 and 2025 in general, new areas of development are noteworthy. Here, industrial and commercial units that have formed in a manner distinct from the natural structure have developed by altering the nature of agricultural land. At the same time, a decrease of -192.98% in the total agricultural area is noteworthy. Additionally, there has been a 38.85% decrease in residential areas, and water bodies have shown new formations.

Participant Profile

The participant profile is provided in Table 5. In the study, interviews were conducted with 11 people from Kılıç village and 14 people from Taşpınar village. The interviews addressed demographic variables such as gender, age, and occupation of the participants. While most of the interviews were conducted as in-depth interviews, some participants showed limited participation. Additionally, information provided by a village headman from a neighbouring village outside the study area was used in the study but was not included in the participant table.

Table 5. Demographic Distribution of Participants Interviewed in Kılıç and Taşpınar Villages (Created by author)

Code	Gender	Age Range	Occupation	Place of Residence	Type of Participation
P1	Male	30-40	Farmer (business owner)	Kılıç Village	Individual
P2	Female	70-80	Housewife (former village head)	Kılıç Village	Individual
P3	Female	40-50	Housewife	Kılıç Village	Individual - limited participation (general conversation)
P4	Male	40-50	Farmer (estimated)	Kılıç Village	Individual - limited participation (general conversation)
P5	Male	20-30	Farmer	Kılıç Village	Group interview
P6	Male	20-30	Farmer	Kılıç Village	Group interview
P7	Male	70-80	Retired farmer	Kılıç Village	Group interview
P8	Male	70-80	Retired farmer	Kılıç Village	Group interview
P9	Male	40-50	Village head	Kılıç Village	Group interview
P10	Male	60-70	Retired teacher	Kılıç Village	Group interview
P11	Male	60-70	Retired	Kılıç Village	Group interview
P12	Male	60-70	Retired farmer	Kılıç Village	Group interview
P13	Male	70-80	Retired farmer	Taşpınar Village	Group interview
P14	Male	60-70	Retired/Village headman	Taşpınar Village	Group interview
P15	Male	60-70	Retired/Private sector	Taşpınar Village	Group interview
P16	Male	50-60	Village headman	Taşpınar Village	Individual
P17	Male	10-20 (Age 19)	Student	Taşpınar Village	Group interview
P18	Male	50-60	Retired farmer	Taşpınar Village	Individual
P19	Male	70-80	Retired farmer	Taşpınar Village	Group interview
P20	Male	70-80	Retired/Private sector	Taşpınar Village	Individual
P21	Male	70-80	Retired farmer	Taşpınar Village	Group interview
P22	Male	30-40	Retired/Private sector	Taşpınar Village	Group interview
P23	Male	60-70	Retired farmer	Taşpınar Village	Individual (general discussion)
P24	Male	60-70	Retired farmer	Taşpınar Village	Individual
P25	Female	60-70	Retired/Private sector	Taşpınar Village	Individual - limited participation

Thematic Analysis Findings

In this section, a thematic analysis was conducted using data obtained from field research conducted in the villages of Kılıç and Taşpınar. As a result of the analysis, main themes were identified and supporting themes were created (Figure 5). The central themes, 'Loss of Natural Areas and Environmental Degradation' and 'Changes in Land Use,' form the basis of the environmental impacts of mega-projects. The conversion of agricultural and pasture lands into projects has led to multifaceted degradation in rural areas.

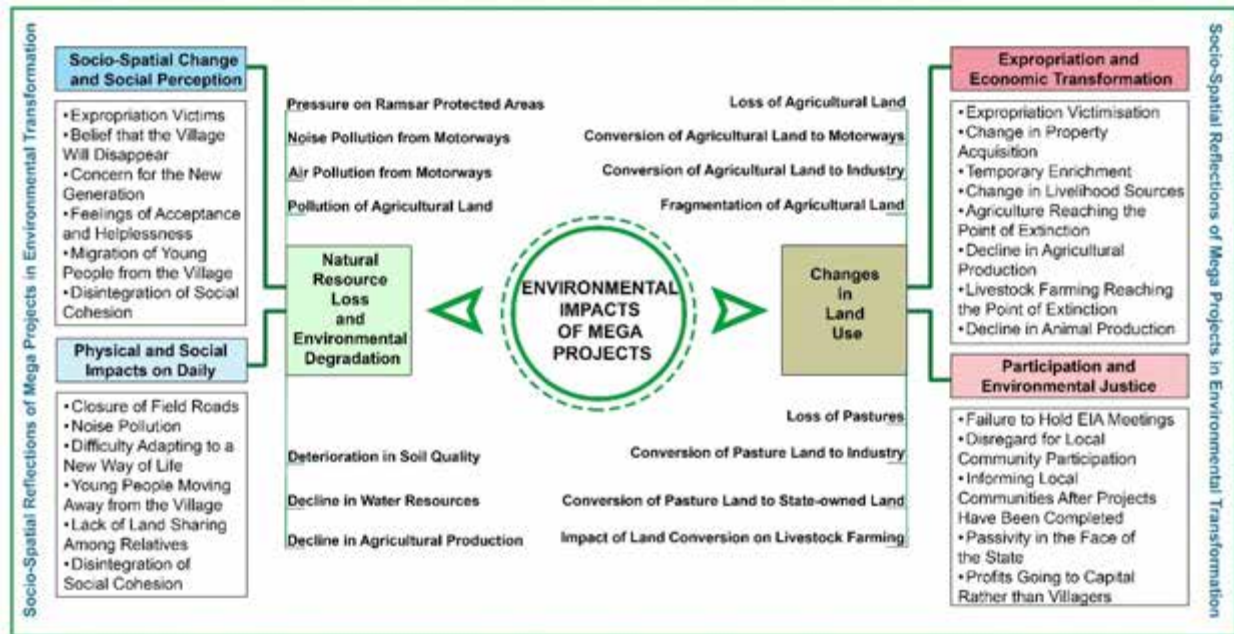


Figure 5 Themes and Related Codes Obtained Within the Scope of the Analysis (Created by author)

The themes on the periphery of the diagram reflect the environmental dimension of the transformation. The expropriation of agricultural and pasture lands has led to a change in their nature. At the same time, the inadequacy of EIA processes has led to environmental justice issues, and the lack of sufficient information provided to the public has left the participation process in the background. Furthermore, this has led to the emergence of effects such as the deterioration of rural community structures, migration, and a decline in production.

Theme 1: Natural Resource Loss and Environmental Degradation

The first theme that stands out in the study covers environmental degradation caused by the loss of natural resources. In particular, the conversion of agricultural and pasture lands into infrastructure projects such as industry and roads has increased environmental pressure.

Upon examining the codes, it was found that agricultural lands in the border region of the Ramsar protected area were expropriated for TEKNOSAB in Taşpınar village. The public believes that the remaining Ramsar areas will also be incorporated into industry through certain legislation and practices. One participant described the situation as follows:

"It didn't enter Ramsar, for example, the field was 10 acres, 5 acres were left for Ramsar. But it left the exact border. Now what will happen to these areas? Dry storage, water storage... Slowly, Ramsar will disappear." (P16)

Traffic caused by vehicles has reached an annoying level in both villages. Several people have stated that there is too much traffic and noise. Air pollution has also begun to be observed in Kılıç village due to the motorway. One user described the situation as follows: 'There is fog over the village in the mornings' (P1). This situation is also confirmed by the village headman of the neighbouring village:

'There is pollution from the motorway. Students from Istanbul came and took measurements, and it turned out to be polluted.' (Village Head)

Industrial waste has been dumped on olive groves in the village of Taşpınar. One participant described the situation as follows:

"The guy took the filth, there are olive groves here, and dumped it there. The factory said, 'Take it away, get rid of it.' So he did what he was told and dumped a truckload of filth on the olive groves." (P24)

The local population states that the agricultural land is very fertile, but that the quality of the agricultural land has been downgraded and expropriated for projects. One participant expressed this situation as follows:

'Whenever it suited them, they came and said, "agricultural land, barren land"; they took over our land.' (P15)

They also mention that water sources affecting agricultural land in Kılıç village have dried up. One group of participants stated:

"The land was expropriated, and our water disappeared. We had artesian water." (P10)

It has been noted that agricultural production has declined due to factors such as the loss of agricultural land, fragmentation of land, and water shortages.

Theme 2: Changes in Land Use

Another prominent theme in the study concerns changes in land use associated with the transformation of agricultural and pasture lands. The nature of the land has changed with the transformation of expropriated areas in the context of projects.

When the codes are examined, it is stated that a large part of the agricultural and pasture lands in both villages have been lost. It is stated that there is no land left in either village. In Kılıç village, the situation has been expressed many times as 'agricultural and wetland areas are gone' (P1, P2, P7). In Taşpınar village, it has been stated with expressions such as 'Our village had 30,000 acres of land; 3,000 acres of it was pasture. They took the pastures without paying' (P24) and 'The pasture business is over' (P23). Furthermore, with the conversion of pasture areas, there are no longer any areas available for livestock farming. Additionally, the nature of agricultural and pasture areas has been altered, with the highway in Kılıç village and the majority of the land in Taşpınar village being converted into TEKNOSAB. At the same time, agricultural lands have been fragmented, leading to the loss of their functionality and subsequent conversion. One participant described the situation as follows:

"Since half of the land is outside the border, the remaining agricultural land has become unusable. Instead of fertile land, the rightful owners were given infertile land on the edge of cliffs. Access to these areas is also impossible." (P5)

Theme 3-4: Socio-Spatial Change and Social Perception & Physical and Social Effects in Daily Life

These themes, which are both indicative of environmental impacts and supportive in nature, reflect not only the physical dimension of the transformation but also its social aspect and the perceptions of the local population. They also encompass the effects on the daily lives of local residents.

Upon examining the codes, it was revealed that agricultural and pasture lands in both villages were expropriated by force, leaving the local population feeling powerless. Participants expressed this situation with statements such as: "They seized our property here!" (P21), and "You cannot go against the state." (P2). Other reactions followed a similar pattern.

Due to the impact of mega projects, young people have migrated, and their ties with the village have weakened. One participant expressed this situation as follows:

There are no young people left. What would they even do here? There's no animal husbandry, farming is finished. A man is already 40 or 50 years old—what job could he possibly find? Even if he gets into a factory, what difference does it make? Everyone's life has been turned upside down." (P23)

In both villages, feelings of concern and hopelessness about the future are prevalent. Participants expressed this sentiment as follows:

"In the future, we'll be strangers in our own village—there's no land left. Every piece of land has been sold, and now outsiders hold power. Our land is gone, only the village centre remains. The water is gone—it's over." (P7)
As a result of the projects, particularly in Taşpınar village, there is a strong belief that the village will undergo complete transformation in the future. One participant stated, "If they open it for development, the village will be no more!"

With the introduction of these projects, especially in Taşpınar, some individuals have begun living in urban centres and only travelling to the village occasionally. This has led to a decline in social relations. One participant articulated the situation as follows:

"We used to have peace and comfort here. My own house... Look, my uncle is here, my maternal uncle is here. Now, when I sit in the café and look around—who's next to me? None of them." (P16)

The sale of land has also caused rifts within families. One participant described the situation as follows:

"My brother says, 'Brother, divide the fields with stone markers; divide them while our father is still alive...'" (P16)

Noise pollution is another disturbing factor, frequently mentioned in both villages. Participants voiced similar complaints, such as: "Traffic and noise have affected us greatly; now they're constant." (P9)

They also reported difficulties in accessing existing agricultural lands and pastures due to the projects implemented in the area.

Theme 5-6: Expropriation and Economic Transformation & Participation and Environmental Justice

Two additional themes reflecting the environmental impact, while also encompassing the social dimension, relate to economic transformation and the effects of participation processes.

An analysis of the codes reveals that in both villages, the expropriation of agricultural lands is frequently mentioned. As a result of these expropriations, the local population argues that their lands were sold below market value. They express that the lands acquired from them at low prices are now significantly more valuable. Participants note that the financial benefits of the land sales were granted to investors rather than the locals, and they also stated that there was nothing they could do about this situation. Participants expressed their frustration as follows:

"Most people's lands were sold at very low prices; those who didn't sell were forced to do so by the state. There was no other option. Our best lands were taken for nothing." (P7)

"What would happen if we objected? We are up against the state; everyone is intimidated." (P9, P10)

"The municipality is on their side anyway; whether you want it or not, they take it." (P15)

Due to land expropriation, a significant portion of the local population stated that they could no longer engage in agriculture or animal husbandry. Consequently, a sharp decline in production was reported. Participants described this situation as follows:

"They destroyed agriculture; dry and irrigated farming is over." (P9)

"They took the lands; farming declined, animal husbandry declined." (P13)

"It wiped out the young population, livestock farming, and agriculture." (P16)

"There used to be cattle in our village; now there's none left." (P25)

"Farming was affected by 90%. There's no farming anymore; there are no fields left." (P24)

It was stated in both villages that there was little to no prior information given before the projects began, and that they only became aware after the decisions had already been made. Moreover, Environmental Impact Assessment (EIA) meetings were held without properly informing the public, with only a few individuals being notified. Participants voiced their dissatisfaction with the participation process as follows:

"An EIA meeting was held, but it took place far from our village. In a way, people were deceived." (P9)

"No proper EIA meeting took place. A few people gathered at dawn; they handed out a couple of bagels and left." (P15)

On the other hand, the village headman (muhtar) of Kılıç village at the time of the projects claimed that the public was informed but chose not to participate in the meetings. The headman's statement is as follows:

"I was an expert witness in all of them. Everything was done; nothing happened without consulting the public. Why didn't anyone object? The industrial zone wasn't up to us; it wasn't even our land. It was built in an area with farms and private property. Still, no one asked us anything." (P2)

Finally, the sale of land brought temporary wealth to many individuals, enabling them to purchase homes, cars, and other assets. Particularly in Taşpınar, those who did not oppose the projects stated that farming no longer provided sufficient income, which is why they didn't resist much. Participants described this situation as follows: "The village became rich; everyone got a car after the expropriation." (P2)

"What did I do? I bought three houses and a car. Now we're struggling in the city, trying to survive. I used to be a respected man here; now I drive a taxi, trying to make ends meet." (P16)

"When the land was sold by presidential decree, everyone got their money — from Bursa, from Karacabey... Some bought taxis, others minibuses, some bought houses. The money is gone, and so is the land." (P24)

"Villagers were struggling to make ends meet; people were borrowing from their future. If you had a wedding or bought a tractor, you were already in debt for the next three years. When TEKNOSAB arrived, we all rushed to sell — just to get the money quickly. Everyone had kids renting in Bursa, weddings to pay for, already in debt. We all waited in line at the Provincial Directorate in Bursa for our payments." (P20)

Conclusion and Discussion

The findings of the study yielded results in two distinct analytical contexts. Firstly, looking at the results of the land use change analysis, it was found that agricultural areas constitute the majority of the land cover. When examining the changes over time, the motorway in Kılıç village emerged as a significant factor, passing along the edge of the settlement area and resulting in the loss of priority agricultural lands for the local population. Additionally, due to the village's proximity to the industrial zone, newly constructed industrial areas have also affected the agricultural lands.

Beyond this, the emergence of these artificial zones has caused environmental degradation by disrupting areas where agricultural and natural landscapes coexisted in a mixed form. In Taşpınar village, the recently constructed TEKNOSAB in particular has led to the loss of a substantial portion of the village's agricultural land. Together with the newly built motorway, it has also encircled the settlement area.

This transformation has led to significant destruction of the natural environment and has altered the environmental structure of the rural landscape. The analysis has clearly demonstrated the environmental transformation occurring in rural areas.

Alongside the land use analysis, thematic analysis has concretely revealed social, economic, and participatory dimensions in an inclusive manner. Upon examining the results obtained, the environmental and land transformations corroborate the findings of the land use change analysis. The indigenous population, who were actively engaged in production, have lost both their livelihoods and the natural environment in which they lived. However, unlike the land use change analysis, Kılıç village experienced less land loss relative to its existing land assets. Consequently, it was observed to be less affected than Taşpınar village. Furthermore, the village's more developed infrastructure has diminished the economic visibility of individual grievances. Nevertheless, the loss of fertile lands used for irrigated agriculture and water sources has led to the disappearance of some of the village's prominent characteristics.

In Taşpınar village, a substantial portion of the land has been expropriated for industrial purposes, causing a significant rupture in the community. The local population became aware of this situation rather late. Due to financial difficulties, they reluctantly accepted the situation, considering its economic dimension. However, the loss of their lands has led to various challenges in maintaining rural livelihoods. Lacking their own land, they have continued farming activities by renting fields, yet this constraint has resulted in competition among the locals. Additionally, in both villages, it was expressed that information dissemination was limited and that the views of the local people were largely ignored. The indigenous population frequently emphasised their lack of power to oppose decisions taken by the state.

From an environmental justice perspective, Taşpınar village, a rural settlement, has been encircled and constrained by an industrial zone of massive scale even by urban standards, without an adequate buffer zone, and bordered by a motorway. This has caused significant hardship for both the natural habitat and the local population. Similarly, although not within the boundaries of Kılıç village, the industrial zone at the edge of the settlement and the motorway crossing over the most fertile agricultural lands exert pressure on the natural environment and the lifestyles of the local inhabitants.

In both rural areas, environmental pressures arising from projects of a scale far beyond the local context and the social ruptures they have caused are clearly observed. Rural areas are not merely instruments for urban profiteering; they constitute the foundational pillars of sustainable development centred on production and host a diverse array of living beings within their complex, multilayered landscapes.

Accordingly, policies to be developed must carefully consider this fragile structure, incorporating the living organisms within it into the process, which is of critical importance.

By employing a multifaceted analytical approach, this study offers a holistic assessment that spatially and socially reflects the complex environmental degradations occurring in rural areas. Among the limitations of the study are the unavailability of up-to-date data, which introduces a margin of error—albeit not excessively large—in measurements and analyses. Future research conducted over broader temporal scales and with wider perspectives will enhance the significance of such studies.

In conclusion, mega projects primarily cause environmental degradation in rural areas. Although the destructive impacts of this environmental deterioration may not become immediately apparent in tangible terms, their reflections on social life are clearly evident.

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