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RESEARCH ARTICLE

Evaluation of Optimal Area Usage in Kastamonu City Center in terms of Landscape Planning

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ABSTRACT

Nowadays, natural and cultural resources are being rapidly depleted. However, protection approaches that can be effective against this situation are not exhibited. Existing resources are at risk of extinction with to use incorrect of space. In order to be able to make the right resource use and planning decisions, it is necessary to determine the optimal area uses considering the ecological basis. The study was conducted at the border urban area of Kastamonu province. Natural and cultural resource values have been examined to determine area uses. In the first phase, the literature search is completed. Then field inventory studies were carried out. In the second phase; numerical suitability maps have been established for three different field types of agriculture, forest, settlement areas. Geographic Information Systems program, that ArcGIS 10.0 software, was used as a tool. Finally, the optimal fitness of the digitized areas has been determined. Potential resource values of Kastamonu city center, due to incorrect use of areas and lack of planning, was determined not adequately assessed. To prevent incorrect use of space; local governments are required to make area utilization decisions in a short time. Making the environmentally sensitive planning studies, to provide tourism within the protection-utilization balance of resources and it has been found that the promotion of the promotion is very economically important. It has been determined that there is misuse in the study where ecological conformities of existing natural and cultural resources are tested. It has been determined that resource values for these areas have deteriorated due to misuse. The reason behind all this is unconscious urbanization. It has been determined that sustainable resource use will not be possible due to this pressure.

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Introduction

As of the 21st Century, countries have faced a fast change and development process, and have begun to feel the effects of globalization at serious levels. Fast population increase caused that the resources were not adequate in developing countries, the development speed is slowed down, and economic and social reasons are increased (Dönmez, 2017). Today, factors such as rapid population increase, rural depopulation and rapid resource consumption cause environmental problems (Gülgün et al., 2014; Tuna Kayılı et al., 2016; Tuna Kayılı and Özmen, 2020). Therefore, the effect on natural resources, the pressure on the nature and resistance of the nature against the pressure must be determined in advance in order to ensure sustainability and optimum utilization of natural resources (Çepel, 1994). Although resources held by humans can automatically redress the use-renewal balance, this balance may be disrupted due to increased interventions. And this will expose humans to

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constant problems in the short-term (Kırımhan, 2005; Zengin, 2007).

Despite the fact that the area usage problem exists for the whole world; problems such as water and soil pollution, erosion, landslide, conversion of agricultural and forestry areas for other purposes increase day by day and become more and more unpreventable. The main reason of some of the recent starvation, drought, overflows, floods, landslides and climate changes is area misuse (Babalık, 2002). This results in land degradation. Use of natural resources, which are capable of automatically renewing themselves up to a certain point, must be planned and minimized to the lowest possible extent. While making area usage decisions; ecology-based processes and handing down to next generations are not taken into consideration. Projects are designed momentarily and sustainability is disregarded, thus resulting in environmental problems. Planning works depend on individual decisions of the designer, and therefore solutions are sought as environmental problems arise (TUIK, 2015). Land usage plans are influenced by many factors, such as socio-economic, demographic, environmental and geographical problems (Kim et al., 2002). As a result, the geographical and demographic structure of the built environment leads to important social and physical factors (Onur-Işıkoğlu, 2020). Many factors that affect natural conditions within the immediate environment, such as geology, climate, ground and surface water resources, are addressed, and the general limits set by such factors for the targeted area are determined (Yılmaz, 2001). With the purpose of ensuring optimal use; socio-cultural, economic and environmental effects influencing the land use must be taken into consideration (Karaelmas, 2003). Countries seek ways to increase in all areas incomes by applying various encouragements in different fields (Dönmez and Türkmen, 2018). Towards a land planning that must be conducted in the light of science, analyses have been performed on agricultural, forestry and settlement areas in Kastamonu city center, which is rich in natural resource values. The purpose has been determining sustainability-based area uses in consideration of conservation-usage balance of natural resources. Geographic Information Systems (GIS) have been used as a tool and area usage, compatibility maps and optimal area use recommendation maps have been prepared.

Materials and Methods

Scope of the study is within the urban area boundaries of Kastamonu province, located on 41°30'0" Northern latitudes and 33°41'0" Eastern longitudes (Figure 1) (Şahin et al., 2014). Having a surface area of 13.108.1 km^2, 76.6% of the city consists of mountain and forestry areas, 21.6% consists of plateaus and 3.7% of the city consists of lowlands (İbret and Aydınözü, 2009; TUIK 2015). Population of the city center is 110.908 (Uzun et al., 2015).

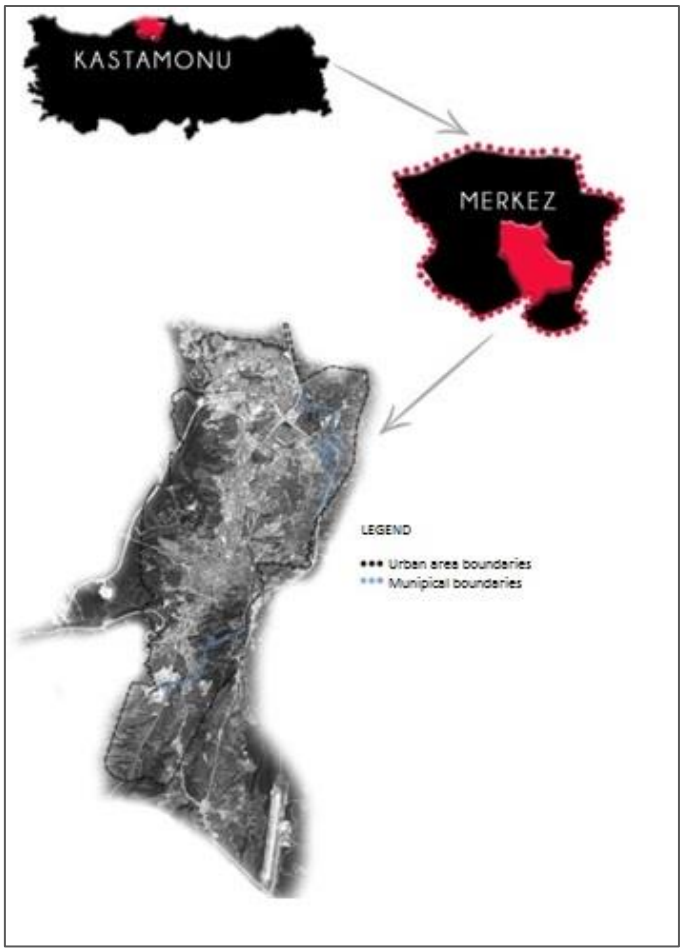

Figure 1. Location map of the study area

Karaçomak Stream passes through the city center. Furthermore, Küre Mountains parallel to the Black Sea are located on the Northern part, and Ilgaz Mountains running on east-west direction are located on the Southern part of the city (Öztürk and Bozdoğan, 2015).

Observations, data collection studies and literature review have been conducted in order to determine optimal area uses of the study area. Elevation curves at 10-meter intervals and elevation groups have been created within the borders of the research area. Afterwards, inventory of natural and cultural resource values has been taken and the data on the area have been collected. The natural structure and the existing area use of the study area have been demonstrated, thus determining the area usage decisions, purposes and goals.

In the second stage, inventory works on the research area as well as necessary maps have been digitized and a database has been created. Topography, hydrology, elevation, climate, vegetation, soil structure, slope, exposure of the study area have been created using the ArcGIS 10.0 software (Mert and Kıraç, 2017). The ArcGIS software allows for obtaining the data for digitizing the relevant modules (Aricak, 2015; Kale and Acarlı, 2019).

ASSESSMENT FACTORS

TYPE OF AREA USE	Land Use Capability Classes		Education		Exposure		Elevation (m)		Vegetation		Elevation (m)		Hydraulic Structure (Proximity to Water Resource)		Erosion		Precipitation (mm)		Temperature (°C)		Proximity to Means of Transportation (m)	
	SS	CV	SS	CV	SS	CV	SS	CV	SS	CV	SS	CV	SS	CV	SS	CV	SS	CV	SS	CV	SS	CV
SETTLEMENTS	Class IIV	4 Points	3% - 6%	4 Points	Sunny	4 Points	720 m - 770 m	4 Points	External Areas	4 Points	0 - 100 m	4 Points	0 - 100 m	4 Points								
	Class VI	2 Points	6% - 12%		(S, SE, SW, W, E)		770 m - 820 m	3 Points	Forestry Areas	1 Point	100 - 200 m	3 Points	100 - 200 m	3 Points								
	Class IV	1 Point	12% - 20%	3 Points	Plain	2 Points	820 m - 870 m	2 Points	Afforested		200 - 300 m	2 Points	200 - 300 m	2 Points								
	Class III		0% - 3%	2 Points	Opacus	1 Point	870 m - 920 m	1 Point			300 +	1 Point	300 +	1 Point								
	Class II		20% - 30%	1 Point	(N, NE, NW)		920 m - 970 m															
	Class I		30%				970 m - 1020 m															
FORESTRY AREAS	Class VII	4 Points	30%	4 Points	Opacus	4 Points							0 - 100 m	4 Points	High	4 Points	550 - 540 mm	4 Points	11,8 °C - 11,3 °C	4 Points		
	Class VI	3 Points	30% - 20%		(N, NE, NW)								100 - 200 m	3 Points	Medium	2 Points	540 - 530 mm	3 Points	11,3 °C - 10,8 °C	3 Points		
	Class IV	1 Point	20% - 12%	3 Points	Plain	2 Points							200 - 300 m	2 Points	Little or None	1 Point	530 - 520 mm	2 Points	10,8 °C - 10.3 °C	2 Points		
	Class III		12% - 6%	2 Points	Sunny	1 Point							300 m +	1 Point			520 - 510 mm	1 Point	10,3 °C - 9.8 °C	1 Point		
	Class II		6% - 3%	1 Point	(S, SW, SE, W, E)																	
	Class I		3% - 0%																			
AGRICULTURAL AREAS	Class I	4 Points	between 0% and 3%	4 Points	Plain	4 Points			Forestry Areas	1 Point					Little or None	4 Points	530 mm - 540 mm	4 Points	11,8°C - 11,3°C	4 Points	0 - 500 m	4 Points
	Class II		between 3% and 6%	3 Points	Sunny	3 Points			Afforested Areas	1 Point					Medium	2 Points	520 mm - 530 mm	4 Points	11,3°C - 10,8°C	3 Points	500 - 1000 m	3 Points
	Class III	3 Points	between 6% and 12%	2 Points	(S, SE, SW, W, E)				External Areas	4 Points					High	1 Point	510 mm - 520 mm	3 Points	10,8°C - 10,3°C	2 Points	1000 - 1500 m	2 Points
	Class IV	2 Points	between 12% and 20%	1 Point	Opacus	3 Points											540 mm - 550 mm	2 Points	10,3°C - 9,8°C	1 Point	1500 m +	1 Point
	Class VI		between 20% and 30%		(N, NE, NW)																	
	Class VII	1 Point	30%																			

SS: SELECTED SUBUNITS
CV: COMPATIBILITY VALUES

Figure 2. Assessment factors and compatibility values of settlement area uses

Results

In the study conducted within Kastamonu urban boundaries, slope, exposure, elevation, climate, vegetation, erosion state maps have been created in order that compatibility maps are created according to settlement, agricultural and forestry area usages (Figure 3, 4).

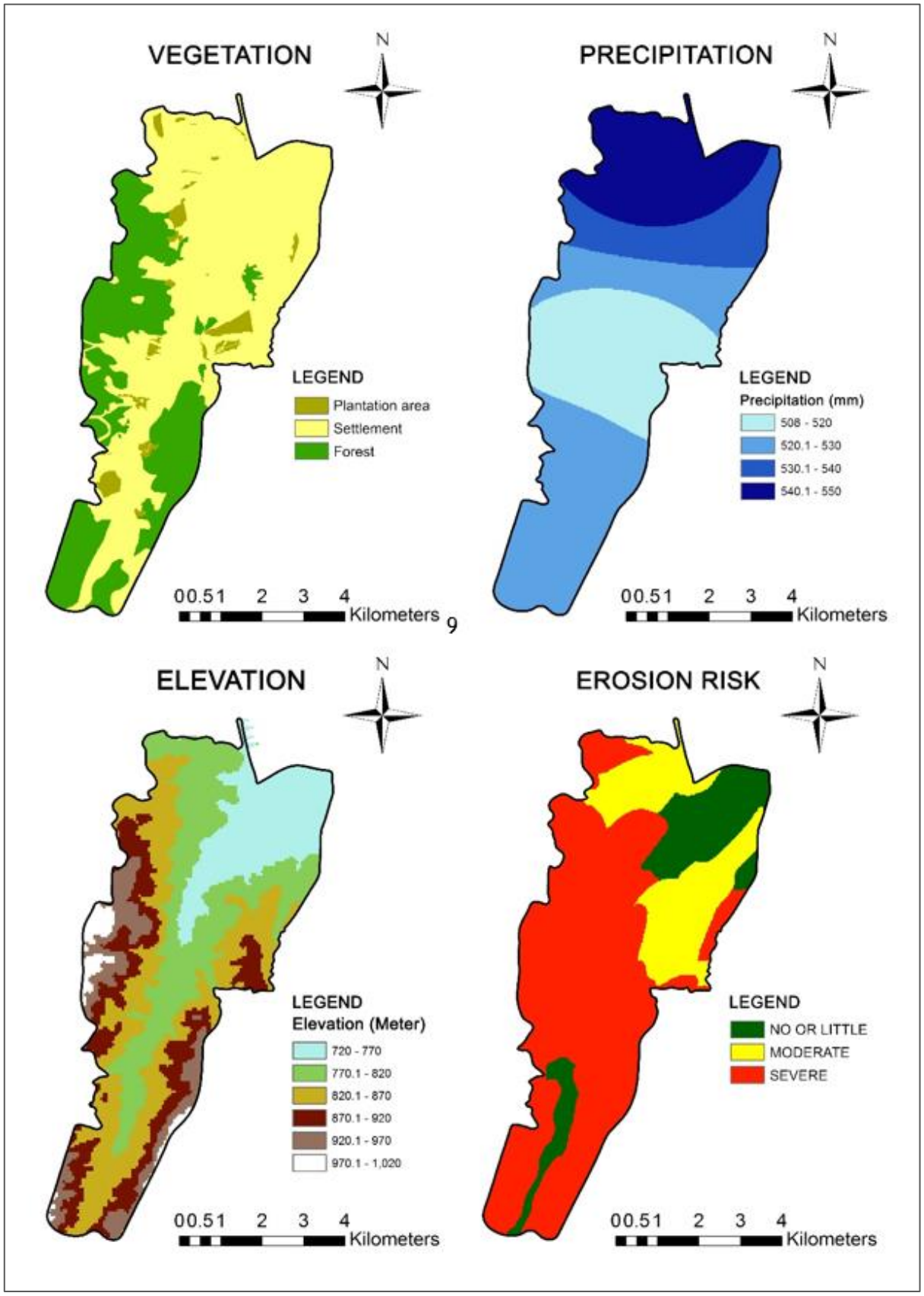

Figure 3. Base maps on the study area

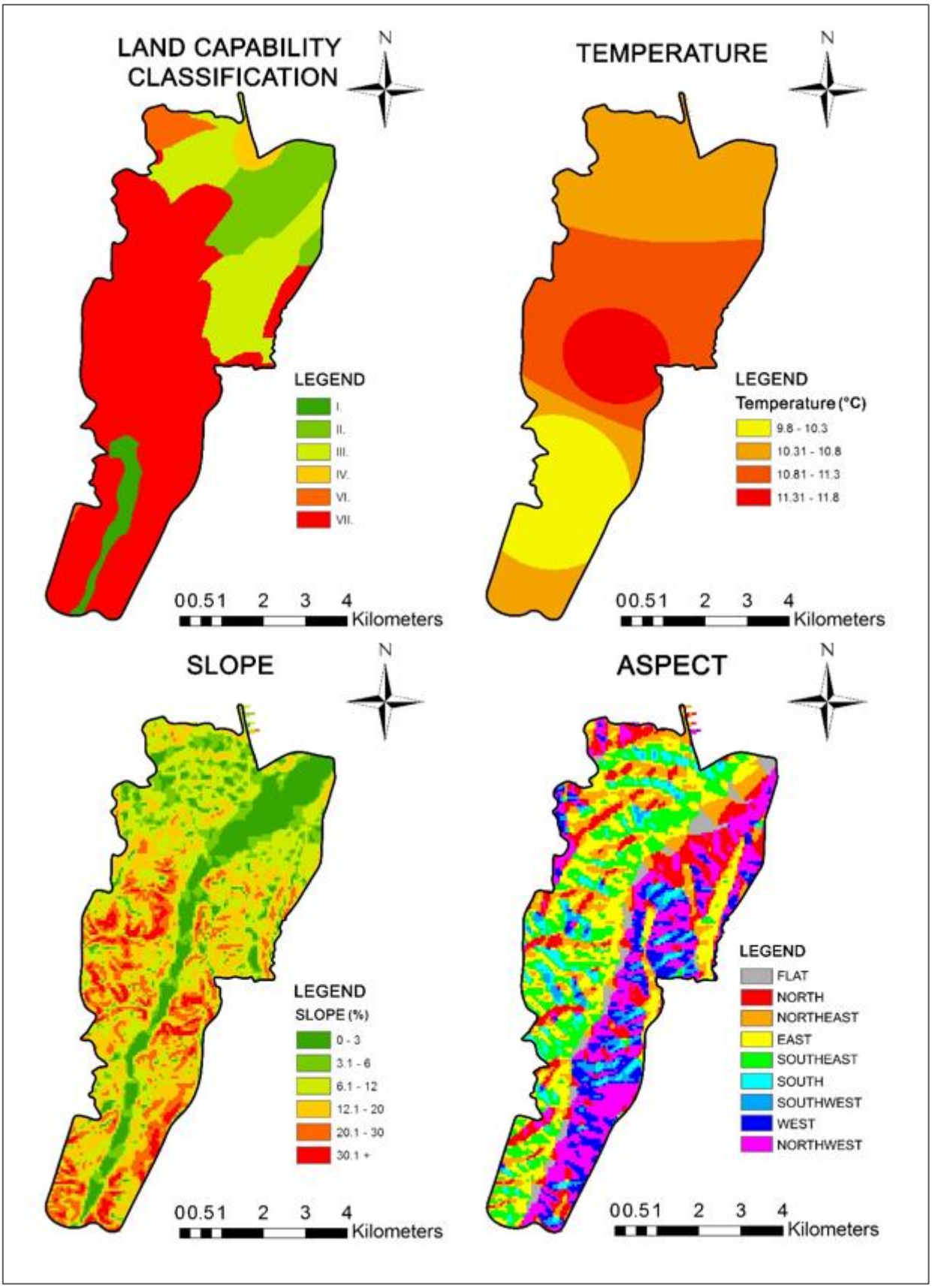

Figure 4. Base maps on the study area

According to the created existing area uses map; Areas to be afforested have a footprint of 4% with 163.33ha, archeological areas have a footprint of 0.1% with 3.7ha, settlement areas have a footprint of 60% with 2633.41ha, urban sites have a footprint of 4% with 230.78ha, forestry areas have a footprint of 30% with 1334.22 ha, and recreational areas have a footprint of 1% with 48.6ha (Figure 5).

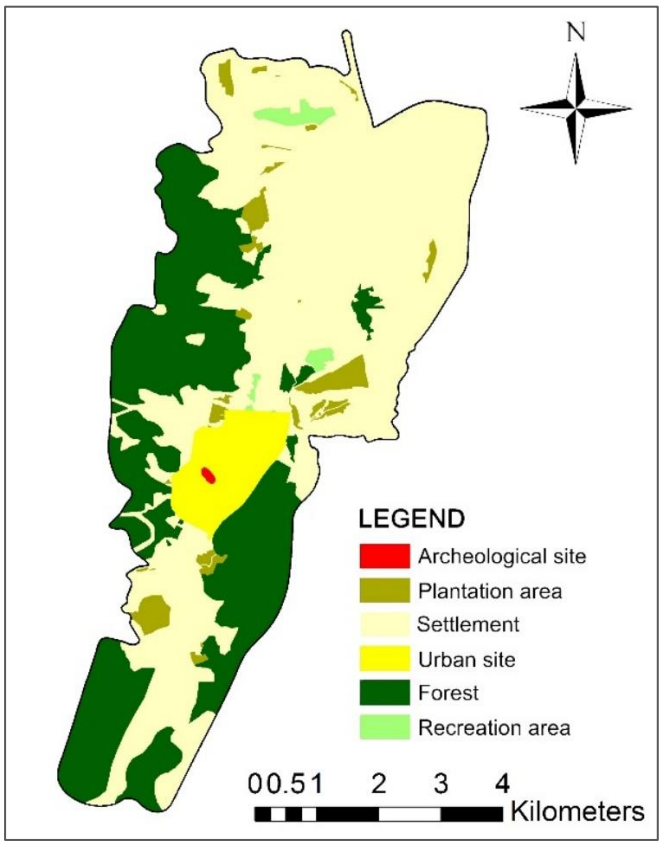

Figure 5. Existing area uses map in Kastamonu city center

During determination of settlement areas compatibility values in terms of area use, land use capability classes, slope, exposure, elevation, vegetation and proximity to water resources factors have been scored (Figure 6). Highly compatible areas within settlement areas have consisted of areas with a land use capability of class VII, low and medium slope, and sunny exposure, 720-770 m elevation, located outside the forestry and afforested areas and within 0-100 m distance to water resources. Settlement areas footprint and ratio distribution are; 18% highly compatible with 752.13ha, 34% compatible with 1420.69ha, 34% less compatible with 1378.90ha and 15% non-compatible with 626.80ha.

A method scoring has been conducted for forestry areas in terms of land use capability classes, erosion, slope, exposure, precipitation and temperature factors, thus determining the highly compatible, compatible, less compatible and non-compatible areas. Highly compatible areas within the forestry areas have consisted of areas with class VII land use capability, high erosion, high slope, opacus exposure, 550 to 540 mm precipitation and within the temperature range of 11.8 and 11.3 °C (Figure 7). Forestry areas footprint and ratio distribution are; 17% highly compatible with 710.35ha, 36% compatible with 1504.26ha, 26% less compatible with 1086.41ha, and 21% non-compatible with 877.49ha.

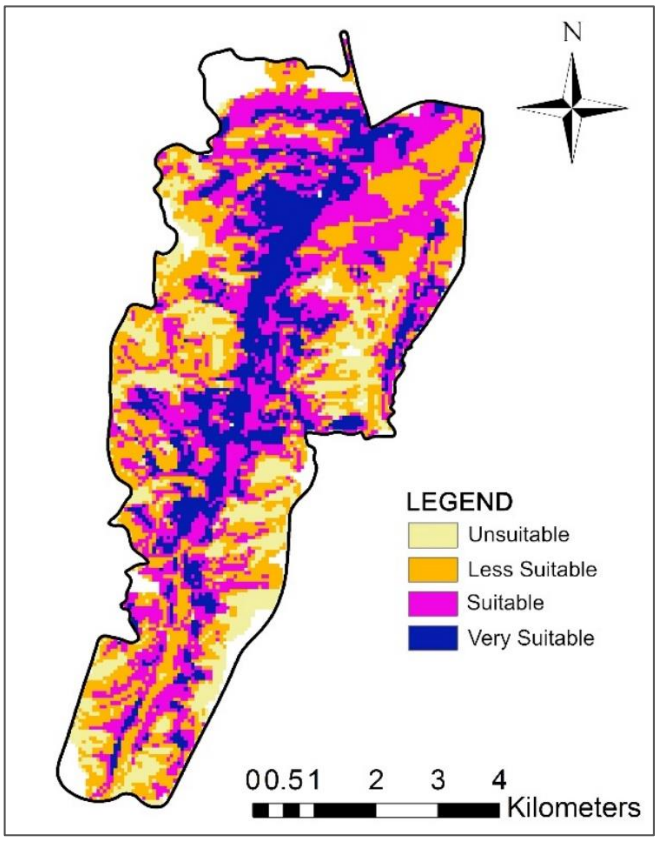

Figure 6. Compatibility map for settlement areas

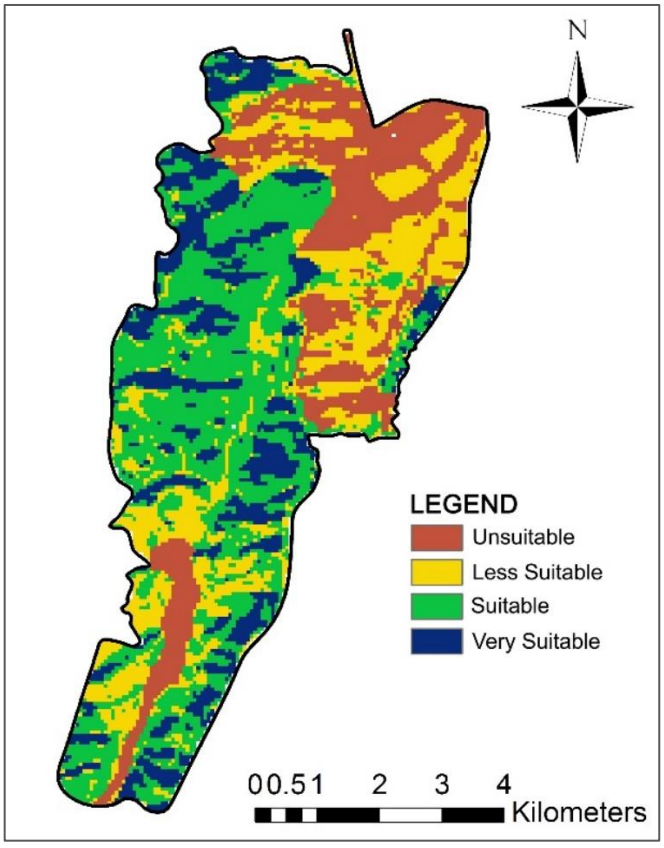

Figure 7. Compatibility map for forestry areas

A method scoring has been performed for land use capability classes, slope, exposure, elevation, vegetation and proximity to water resources factors during the determination of agricultural areas land use compatibility values. Highly compatible areas within the agricultural areas have consisted of areas with class I, II land use, little or no erosion, plain or almost plain slope, within plain exposure group, within 0-100 meter distance to water resources, with precipitation between 520 and 540 mm, areas at temperatures between 11.8 and 11.3 °C, areas outside forestry and afforested areas and within 0-500 meter distance to means of transportation. Agricultural areas footprint and ratio distribution are; 16% highly compatible with 668.56ha, 24% compatible with 1002.84ha, 32% less compatible with 1337.12ha, and 28% non-compatible with 1169.98ha.

Settlement, agricultural and forestry area uses have been analyzed for area usage compatibilities towards a correct and sustainable planning, and optimal area uses of the study area have been determined based on such compatibility values. According to the recommended optimal area usage distribution prepared for the research area; 35% forestry areas with 1474.68ha, 7% recreational areas with 299.51ha, 15% agricultural areas with 617.96ha and 35% settlement areas with 1467.64ha have been recommended (Figure 8).

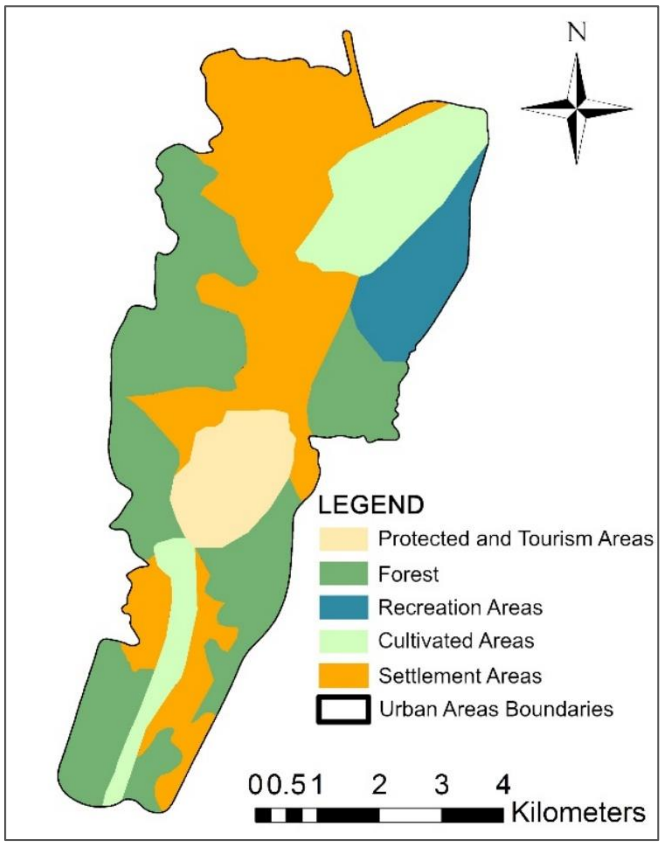

Figure 8. Recommended optimal area usage map for Kastamonu city center

Discussion

Recommended optimal area uses have been created through overlapping the compatibility maps prepared in accordance with the study method adopted in settlement, agricultural and forestry areas in Kastamonu city 4. center and the existing area usage map (Table 1, Figure 9).

Table 1. Comparison of distribution and ratio of existing area uses and recommended optimal area uses

Optimal Area Usage	Footprint (hectares)	Footprint Ratio (%)	**Existing Area Usage**	Footprint (hectares)	Footprint Ratio (%)
Settlement Areas	1467.65	35%	Settlement Areas	2633.41	60%
Forestry Areas	1474.69	35%	Forestry Areas	1334.22	30%
Agricultural Areas	617.97	15%	Afforested Areas	163.33	4%
Other	619.11	15%	Other	284.07	6%

In the optimal area usage map, an area of 1467.64 ha has been determined to be highly compatible, compatible and less compatible for settlement areas. It is seen that existing settlement areas cover an area of 2633.41ha and are established on class I agricultural areas and protected forestry areas in certain regions. Such determined areas have been included in agricultural and forestry areas in the optimal area usage map.

While the forestry areas determined in the optimal area usage map must be 1474.69ha, the total forestry area in the existing area usage consists of 1334.22 hectares. Furthermore, a certain part of the area determined as afforested area in the existing area usage has been included in the forestry area in order to achieve optimal area in forestry areas.

In the optimal area usage map, an area of 617.97ha has been determined to be highly compatible for agricultural areas. It has been demonstrated in the study that class I agricultural areas in the existing area usage map are used as settlement areas in the No. 3194 zoning plan. Agricultural areas not being included in zoning plans, which is one of the most significant findings of the study, result in disruption of ecological systems balance and disappearance of agricultural landscaping element in the city skyline. Within this context, it has been deemed suitable that such areas are removed from

settlement use and converted into agricultural areas in the optimal usage map. However, it cannot be ignored that it is too late for implementation stage of such conversation. In consideration of such data; certain problems have been found in the in the study, in which optimal area uses of Kastamonu City Center have been demonstrated, regarding the compatibility scale of existing area uses. It is anticipated that resources sustaining a disruption in the natural ecologic balance will continue decreasing in the research area due to incorrect area usage. It has been determined that class I agricultural areas are used for settlement purposes and unconscious urbanization creates an immense pressure on the ecologic resource balance in this region, which is specifically based on agriculture and forestry. However, it is advised especially to local administrations that there are areas available within the city that are more compatible for settlement and that development areas in Kastamonu city are consciously opened for use.

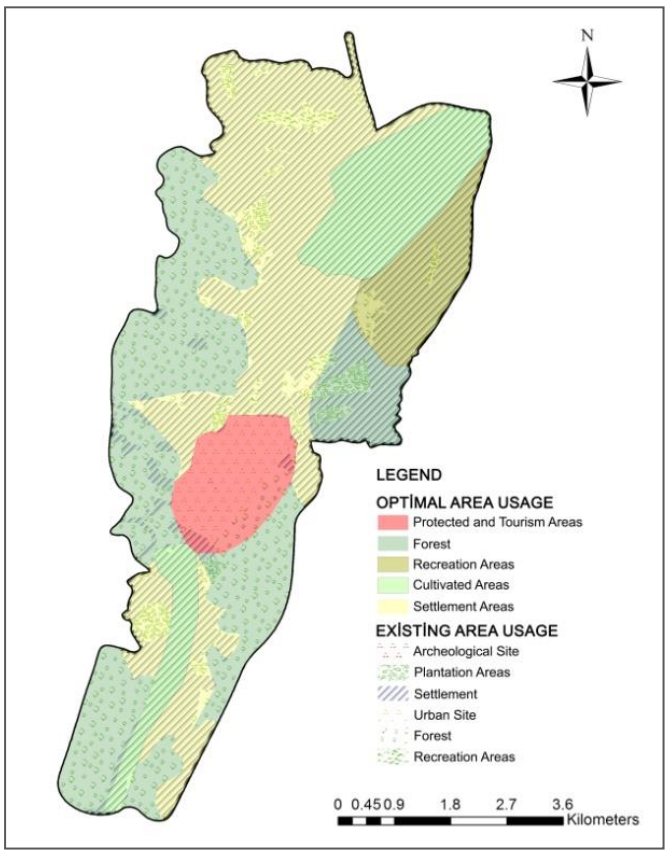

Figure 9. Overlapping the existing area usage and optimal area usage map of Kastamonu city center

Conclusion

Necessary regulations must be made in order to ensure settlement development on suitable potential locations and to prevent class I agricultural lands from being zoned for construction and such areas must be analyzed so that they contribute to the city landscape in integration within the central city boundaries. It is aimed to ensure that areas compatible for settlement are zoned for construction in consideration of optimal area uses in strategical plans prepared by local administrations. Additionally, it has been found that afforested and forestry areas are used for settlement and recreational purposes. This mistake must be corrected as soon as possible and natural resources must be used according to optimal compatibility. This is also the responsibility of local administrations. In order that such resource values can be conserved and optimal area uses can be actualized in Kastamonu province, a naturally and culturally rich city; studies must be continued through adopting an integrated planning approach to which all city members cam participate.

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