Planning Greenway Alternatives within the Rural Areas of Bartın Province, Turkey

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Introduction

Recently overall the world, fragmentation in land uses has increased due to the rapid increase in population, urbanization and unplanned development. Fragmented landscapes have less connectivity and greater isolation. On the other hand, species are negatively influenced in a fragmented landscape. Greenway and connectivity are evaluated in landscape ecological studies in order to mitigate negative ecological conditions in urban areas (UN, 2014; Leitao and Ahern, 2002, Linehan et al., 1995). Under these conditions, linear green elements within the rural areas have gained prominence to be considered within greenway planning studies.

Nowadays, rural areas obtain increasing importance. These areas include ecological, cultural and agricultural resources (Randolph, 2004). The importance of the rural areas was emphasized in "Agenda 21". In the report, pertaining to the rural areas, planned, sustainable use and development requirements were specified. Sustainability is a fundamental approach in planning and management studies to improve the ecological conditions (Leitao and Ahern, 2002; UN, 1992).

Bartın is a small province in northern part of Turkey. It is located in the north-western part of Black Sea region of Turkey and covers approximately 230,000 ha. It also includes historically valuable centers. The population of the Bartın have increased up to 190,708 in 2015 (TUİK, 2016). Climate of the study area is dominated by humid mesothermal climate regime (Atalay, 2011). Study area is rainy throughout the year due to the airflows which comes from the north where the Black Sea is located. The average annual temperature and precipitation of the area are 12.6 oC and 1030 mm, respectively (Atalay, 2011; MGM, 2016). In this study, it was aimed to evaluate the greenway approach around the concept of landscape planning and development process within the rural areas of Bartın Province.

Background/Literature Review

Greenway is an approach that has been applied to protect networks of land in landscape planning studies. Greenways are defined as ecologically significant corridors that have recreational, historical, aesthetic and cultural values. Greenways are used to decrease fragmentation and isolation of habitats. Different terms are used to address greenway. These terms generally involve linkage and corridor concepts (Benedict and McMahon, 2006; Fabos, 2004; Ahern, 2002; Ahern, 1995).

In some of the case studies, greenways were classified and evaluated according to scale, goals and planning strategies. Scale identifies size and importance of an area. Ahern (1995) classified greenways under four different groups dependent upon the geomorphology and physical geography. These groups are small streams (1-100 km2), and rivers (100-10.000 km2), river basins-mountains (10.000-100.000 km2), and continental land (>100.000 km2). Goals should be emerged based on the spatial and functional consequences. Spatial and functional characteristics determine the landscape processes and dynamics. Goals can be classified into several types. These types are related to biodiversity, water resources, recreational, historical/cultural and development control (Ahern, 1995; Fabos, 1995).

Landscape ecological principles have been provided to implement important progress in landscape planning and related studies (Gökyer, 2009). From the landscape ecological perspective, landscapes have three attributes including structure, function and change (Forman and Godron, 1986). Structural pattern consists of the three types of landscape elements, including patch, corridor and matrix. Corridors are important linkage elements between the landscapes. The most important feature of the corridors is their connectivity. In particular, flow corridors regulate the water flow and material flow from surrounding land to the water source (Dramstad et al., 1996; Odum and Barrett, 2008).

Goals and Objectives

Greenway planning is relatively a new approach to protect and develop ecological networks in Turkey. This study supplies some proposals on greenway planning within the rural areas of Bartın province (Figure 1). These proposals include connections among the green areas, cultural and historical sites based on provincial and local scale. The objectives of this paper are: (1) to analyze greenway planning within the rural areas of Bartın province. (2) to highlight and discuss greenway planning, and alternative areas of greenway development in the study area.

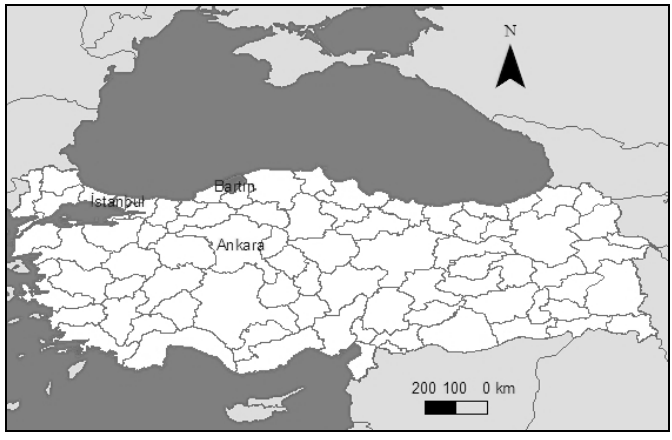

Figure 1. Location of the research area in Turkey

Methods

Steps of the research method are listed below;

1. *Datasets:* Land cover, Hydrology and Basin, Geomorphology
2. *Assessment:* (1) Land cover: Dominant land cover types and structural characteristics of land uses were determined based on landscape ecological principles (Dramstad et al., 1996; Forman and Godron, 1986). (2) Geomorphologic: Local characteristics of the lands were defined based on geological and topographical structure (Turoğlu and Özdemir, 2005). (3) Habitat and Species: Wilde habitats (forestlands), endemic plant species and important mammals, (4) Connectivity: Stream corridors are important linkage elements (Forman and Godron, 1986) and forestland connectivity reveals important movement zone.
3. *Evaluation* (Typology of greenway) (Ahern, 1995; Fabos, 1995): (1) Scale of the area (Local, Provincial, Regional), (2) Important species (endemic plants and indicator species), (3) Core areas were defined to determine habitat of mammals based on landscape ecological approach.

Land cover: Land cover map was derived by satellite images (Landsat 8) using supervised classification (Jensen et al., 2009) method. Four main land use types were identified in the study area. Land use types are forestland, cropland, urban and/or built up land and water (Figure 2). Land cover data were used and adopted from other researches related to the same area (Gökyer et al., 2016).

Hydrology and Basin: Hydrology and Basin datasets were produced by topographical maps. Streams of Bartın River and Boundary of Bartın River Basin are identified and showed on the map (Figure 2).

Geomorphology: Geomorphologic structure of the area was investigated under four different ranges engaged with altitude (Turoğlu and Özdemir, 2005). These ranges are shown on the Figure 3.

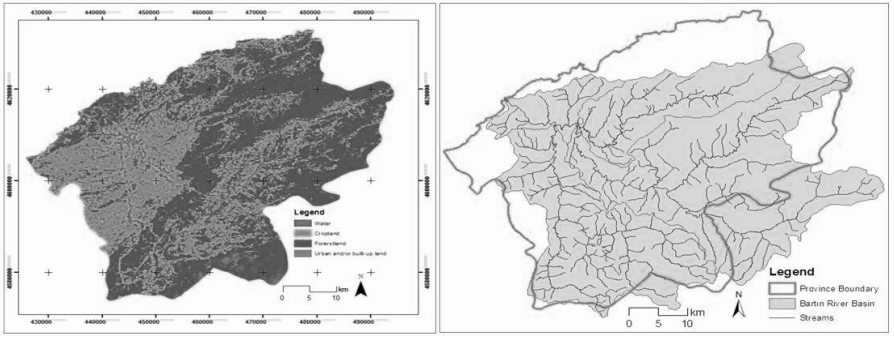

Figure 2. Land cover, Hydrology-Basin maps of the research area

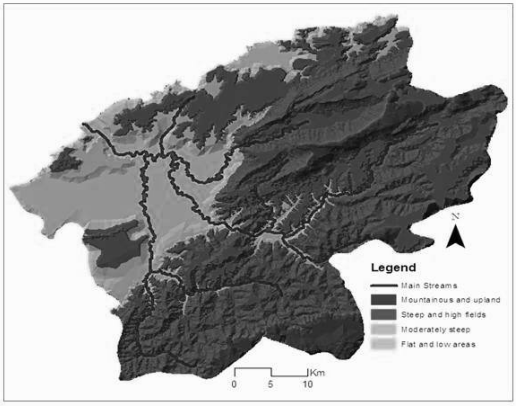

Figure 3. Geomorphology map of the research area

Results and Discussion

Land Cover Assessment: Forestlands (126.898 ha) are dominant landscape characteristics within the rural areas. Assessments associated with general land use types of study area are listed below:

1. Forestland: Forestlands include deciduous, coniferous, mixed plants, shrubs.

2. Croplands: In the study area, croplands (87.653 ha) are fragmented and cover small area. Some agricultural areas are located at the higher elevations and steep slopes within the upper lands (Gökyer, 2009; Gökyer and Öztürk, 2016).
3. Urban or built-up lands (14.712 ha): Urban area of Bartın Province is a historically significant center. Similarly, Amasra is an important small historic tourism center within the coastal part of the Bartın Province. Residential areas around the Bartın River are affected from flooding during the rainy seasons (Gökyer and Öztürk, 2016).
4. Water (252 ha): It includes tributaries of Bartın River. Bartın River is an important stream corridor that spreads in wide basin area.

Conservation: Küre Mountains National Park includes east part of the research area (Figure 4). Black Sea humid forests on karstic mountains expand within this zone of the research area. This part of the study area was granted by the World Wide Fund Nature (WWF) in 1988 as one of the Forests Hot Spots of Europe. Küre Mountains and its buffer zone have endemic plant species, important mammals (*Urcus arctos, Felix sylvestris and Lynx lynx*) and bird species (KDMP, 2015).

Geomorphologic Assessment: Assessments related to four geomorphologic groups are listed below (Turoğlu and Özdemir, 2005; Gökyer and Öztürk, 2016):

1. Flat and low areas: 0-100 m, these areas include city center of Bartın Province, agricultural lands around city center and along the Bartın River.
2. Moderately steep: 100-200 m, these areas include agricultural lands, rural settlements and forest areas.
3. Steep and high fields: 200-1000 m, these areas include forest areas, agricultural areas and rural settlements.
4. Mountainous and upland: 1000-1700 m, these areas include forest areas, rural settlements and restricted agricultural areas.

Two different parts (scale) were defined to evaluate greenway planning due to the geomorphologic assessment. First area extends along the coastal zone. Second area is the basin area of Bartın River.

Habitat and Species Assessment: In the study area, important habitats are forest and agricultural matrixes. Tributaries of Bartın River which pass throughout the agricultural and forest areas support the functions of these areas and the activities of the species. There are three important mammals that live in the upper zone of the research area. These species are *Urcus arctos, Felix sylvestris, Lynx lynx*.

Mountainous areas in the upper zone include important habitat attributes for these species. West part of Küre Mountains has 80 endemic taxa. In the protected part of the area, there are 32 rare species. On the other hand, 45 endemic species are under threat (Özhatay et al., 2005; Ekim et al., 1989). Mountainous areas in the eastern part which include a variety of vegetation and wildlife are gaining concern. Especially, core areas of forestlands are very important for mammal species. Co-existence these species in the area indicate the ecological health of the area.

Connectivity: In the study area, human activities have decreased over time. However, boundaries of forestlands are extending and connectivity of forest patches in the forest matrix is continuously increasing over time. Agricultural areas around the forestland have partially been converted to the forest. In the study area, particularly in forestland, connectivity is favorably supported.

Other studies related to Bartın Province have proved the increase of the connectivity in forestlands. According to these studies, numbers of the patches have decreased and size of forest patches and forest matrix have increased over time (Gökyer, 2014a; Gökyer, 2014b; Gökyer, 2009).

Evaluation: In the study area two different scales can be identified. These are (1) coastal zone which extends along the Black Sea and (2) Bartın River Basin which includes different areas with geomorphologic structure. Forestlands and tributaries of Bartın River are important attributes for greenway planning (Figure 4). These zones possess biodiversity, historically and culturally significant attributes, water resources and protected areas.

In the study area different greenway planning strategies were evaluated based on the attributes of the area. Mountainous and upland areas including forest matrix and protected areas were evaluated for the protection of species and habitats. Coastal zone should be developed for recreational requirements. Planning and organizing links via corridors between cultural-historical values, protected areas, agricultural areas, and forestlands are important for the sustainability and development of the entire area.

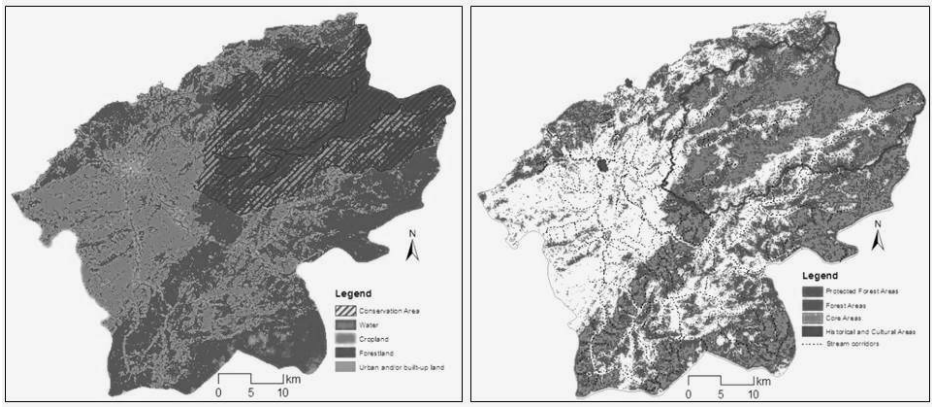

Figure 4. Elements of the greenway and protected part in the study area

Conclusions

This study provides substantial proposals on greenway planning within the rural areas of Bartın province. These proposals involve connections among the green areas, cultural and historical sites based on provincial and local scale.

According to the planning and design professions, greenway is evaluated as efficient and socially desirable concept for open space planning (Linehan et al., 1995). Greenways do construct fundamental planning approach that is complement for comprehensive landscape and physical planning (Ahern, 1995). As linear corridors, greenways have accomplished the connectivity and protection of valuable historical, cultural, ecological and recreational resources within a region (Fabos, 1995). In this research, the study area has important historical, cultural, ecological and recreational resources. Greenway approach supports the connectivity among these resources. On the other hand, protection and sustainability of these resources have emerged with greenway approach in landscape ecological planning. Greenway approach is supported with landscape ecological principles and Geographical Information Systems (GIS) during the planning process and monitoring after the planning.

In the study area, there are two main matrixes. Forest matrix is the main land cover characteristic representing the richness of biodiversity, hosting the rural settlements and reserving the stream corridors. Agriculture matrix expands on the flat and low areas around streams of the Bartın River. Agricultural areas include fertile soils which intrinsically are capable of serving for various types of crops.

There are various types of opportunity in order to evaluate greenway approach in landscape planning process. These opportunities include coastal and mountainous areas which expand broadly within the study area. Notably the forestlands which include mixed plant species, endemic species and important mammals should be handled with different planning strategies and objectives. On the other hand, historical-cultural values in the city centers are evaluated for recreational purposes. Interactions among these resources in the study area have supported the maintenance with connectivity. Stream corridors provide linkage in the study area. Stream corridors should be assessed in an attempt to improve greenway concept towards landscape planning processes and objectives.

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