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**YAYIN KURULU**

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# ÇANKIRI BARIŞ MANÇO CHILDREN'S PLAYGROUND SAFETY EVALUATION OF COMPLIANCE CRITERIA

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## ABSTRACT

Playgrounds are so effective for the children's social, sensual, cognitive and physical development. These grounds, if they wouldn't designed in significant criterias, they can cause hurtings and injuries that affects child's development negatively. In this study, Barış Manço Children's Playground, located in Çankırı and as specified for the kids aged between 0-7, and the physical properties of the game elements on the playground were analyzed by TSE (Turkish Standards Institution) safety standards, were assayed for standards compliance. USCPSC (U.S. Consumer Product Safety Commission) standards were included the study, because TSE standards don't have criteria in terms of discriminations in the age of the children and playground site selection. Besides, in this study, it was examined that other outfit equipments, plants on the area and playground's maintenance status in terms of safety. At the end of the study, 78% of playground equipments were determined that not suitable for TSE standards. In accordance with the results that are obtained, suggestions have been made in terms of landscape architecture.

**Key Words:** Child, play, safety, game equipment, playground

## 1.INTRODUCTION

The main factor of a healthy child is a game which has an aim or not, whether it can be done by rule or not but in every situation, it is consisted of child's activities that makes him happy (Dönmez, 1992; MEB, 2012; Jaspert et al., 1988). Child learns lots of things about life and himself with game, she/he agrees with social and physical environment and she/he develops her/his creativity (Heseltine and Holborn, 1987; Senda, 1992).

According to Alqudah (2003), playgrounds are places which are designed for the purpose of supporting child's social, sensual, cognitive and physical activities (Bal, 2005). For Zinger (2002), playgrounds are beneficial and constructive educational areas for children, and at the same time they are ideal areas for outdoor activities (Botsoglou et al., 2011).

In children's developmental stages, physical situation and behaviours differ. Playgrounds, if it is not constructed for the needs of children's developmental stages, it can be bring security problems and injury risks. These injuries usually happen depending on children's falling down from the game equipments, their clothes' or other parts' rambling, their heads' are caught some potential gaps on the equipments, oversetting of game equipments or construction error. Besides in playgrounds, children hit game equipments while they're running; contact with broken, rusty, sharp points and keen corners and game equipments which are made by false materials that can be heated quickly; are the other danger risks that could hurt children (USCPSC, 2008; Heseltine and Holborn, 1987).

Many countries such as European Union, America, Canada, Australia and New Zeland developed standards on the purpose of preventing accidents, providing child safe (Caglar et al., 2010).

Generally, aged between 0-12 is evaluated as a childhood (Şişman ve Özyavuz, 2010). By USCPSC (2008), child age groups; according to child development, are discussed 06 months- 2 (toddler), 2-5 (pre-school) and 5-

12 (school age) and standards were developed, besides these age groups not shows differences only physical measures and skills, but also intellectual and social skills.

Turkey, EU harmonization in the framework by the European Union in 1998 created the EN 1176 and EN 1177's standards, defined TS EN 1176 series in 2008, had given time for transition period by the company until 2010 and adopted 31 October 2010. TS EN 1177 standard was enacted in 2011. These standards consist of playground equipments for the children, elder than 3 years. It is indicated that, younger children and the children who has less power and less skill can use these playground equipments under family supervision (Çakıroğlu ve Arslan, 2010, Deretarla Gül, 2012; SMP, 2013).

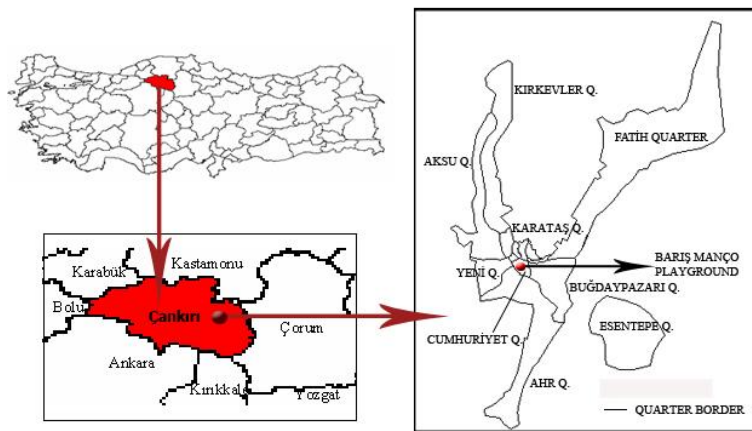
Açık and his/her friends did a research in Turkey's Elazığ city in 24 playground to determine their security levels and suitability for the USNPSS (The National Program for Playground Safety) and USCPSC safety criterias; it is indicated that just 12.5% of this are suitable for age groups. According to research results, %95.8 of playground equipments of Elazığ aren't suitable. A similar research in Greece Volos and Nea Ionia 45 playground have been done to determine the level of compliance to USNPSS, USCPSC and ELOT (Greek Organization for Standardisation) safety criteria. As a result of this research most of the playground does not fulfill safety criteria, especially regarding inspection and maintenance of the playground have stated that a plan must be created at the national level (Botsoglou et al., 2011).

In this research, Barış Manço Children's Playground located in Çankırı city that is only playground for 0-7 age group and its game equipments' physical properties were compared to TSE safety standards and were evaluated to compliance these standards. USCPSC criterias were included the study, because TSE standards don't have criteria in terms of discriminations in the age of the children and playground site selection. Besides, in this study, it was examined that other outfit equipments, plants on the area and playground's maintenance status in terms of safety. Within the results that are obtained, suggestions have been made in terms of landscape architecture.

## 2.MATERIALS and METHODS

In this study, located in the central district of the city Çankırı and as belonging to the age group 0-7 Barış Manço Children's Playground was selected as the research area. Çankırı province is located on the northwest of the Central Anatolia region, between 40° 30' and 41° north latitude and 32° 30' and 34° east longitude. Kastamonu and Zonguldak lie north of the city, while Bolu is on the west, Ankara is on the south and Çorum is on the east (Figure 1)

The research materials are constituted by the research area, studies conducted on the children's playground, domestic and foreign standards about playgrounds, obtained data as a result of measurements and observations conducted in the survey site, on-site photographs taken.



**Figure 1.** Location of Barış Manço Playground (Original, 2013)

In this study conducted in 2013, landscape research method was used depending on etude, data collection, analysis and synthesis.

Research area was evaluated according to TS EN 1176's 7 series and TS EN-1177. USCPSC safety standards were included, because of the research area for the 0-7 age group.

At the first stage of the research, a literature review was made on the subject, various countries safety standards were examined on the safety of playground and playground safety forms were prepared in accordance with area's physical characteristics, TS EN 1176-1177 and USCPSC standards. Then in accordance with this forms, observations and measurements made in the playground, photos were taken. In the third step, the data obtained was analyzed in comparison with the TS EN 1176-1177 and USCPSC standards. The playground, game equipments, other outfit elements, plants on the area and maintenance status of the area were evaluated in terms of safety as based on literature reviews and observations and these analysis, recommendations have been developed in terms of landscape architecture.

### **3.RESULTS and DISCUSSIONS**

Barış Manco Children's Playground, differs from in other playgrounds, is the only playground as specified age group. It is located in a very central location in the city and so is used extensively. Playground was expanded in 2011 and new game equipments were added.

Çankırı City Center's total population is 80 590 according to in 2010. In Çankırı City Center, 06 months-2 years children population is 1410, 2-5 years population is 6695 (Çankırı İl Sağlık Müdürlüğü, 2012). 06 months-5 years old children constitute 10% of the population of the city center. Barış Manco Children's Playground is extremely important because of it is the only playground that appeals to this age group.

According to Öztan (2004); it is recommended that ground measurements between 250m<sup>2</sup> and 1000m<sup>2</sup> for the period pre-school playgrounds. Barış Manco children's playground is 294m<sup>2</sup>. By the same investigator is recommended not to be less than 6.5m<sup>2</sup> average field size for each child (Şişman ve Özyavuz, 2010). In this case, research area is suitable that can play for 45 children at the same time.

#### **Assessment of Safety on The Area in terms of Place Selection**

In this research as a priority, the place selection of the playground in terms of safety features (power lines, irrigation canals, lakes, rivers, traffic, etc.) are suitable for standards because they does not take place in the Turkish Standards. TSE standards in terms of safety features in the choice of location is not specified, the playground is evaluated according to the criteria specified in USCPSC.

Playground is located at the intersection of Adnan Menderes Street and Atatürk Boulevard. There is 2m footpath between the playground and street. Plastic fencing was used on a low wall to cut the relation between street and playground . Playground has two entry-exit doors. One of the exit door is a way to road. Here's not a barrier to prevent the rapid advent of children and on this point there is no crosswalk exit from the area for the children. This situation causes dangerous for children. The west side of the playground is adjacent to Tatlıçay which comes through the city Çankırı, was surrounded by metal fences. The children's theater is located on the south side of the playground.

Taking into account that children due to the smallness of the mass heats up quickly than adults, in the selection the place for the playground the situation of excessive sun exposure of children should be considered. The areas which sun's rays are intensive to prevent burns because of heating of metal slide, platform or stairs these areas must be shaded or must be provided with warning signs (Moore, 1993; USCSPC, 2008).

According to Özgüç (1998), children's playgrounds; in winter at noon and in the afternoon the sunshine is able to received as long as possible, in summer is able to shaded in the afternoon (Yılmaz and Bulut, 2002). The city Çankırı where the playground located in; has continental climate which summers are hot and dry, winters are



cold and harsh (Çankırı Valiliği, 2010). Therefore, in terms of protecting the health of children playing in the area, especially in summer afternoons the area must be shaded.

Bariş Manco Children's Playground made after the 2011 partition (where the swing section 2 and 3/Figure 3) are completely unprotected against the sun. Children who stay under the sun can cause many ailments. Also located in this part of the playground is made of metal swing chains and that there is no warning sign of this condition, children's hands can cause burns. Shading on the other part of research area is provided with the use of trees. From this perspective having metal parts (slides, stairs and handrails, swing chains, carousel) game equipments are not a problem.

### Safety Assessment of the Game Equipments

Game equipments in the playground, consist of three two-seater and a three-seater swing, unified structure one tunnel and one free slides, one carousel, one seesaw, one that is unusable from two rocking element.

Safety criteria for swing; TS EN-1176-2 (Additional Specific Safety Requirements and Test Methods for Swings) symbols are shown in Figure 2.



**Figure 2.** According to TS EN-1176-2 (2010), symbols of safety criteria for swing (Orjinal, 2013)

The measurement results on the swing safety, according to TS EN-1176-2 (2010) was analyzed and evaluated and presented in Table 1.



**Figure 3.** General view of swings in the playground (Original, 2013)

According to Table 1, next to the game equipment to provide passing ( $h_5$ ) is required to leave a space at least 150cm. In the research area, Swing 1 and Swing 3 show compliance to TSE safety criterias, Swing 2 and Swing 4 don't (Figure 3)

Between swing seat and the side of iron (swing leg) should be safety distance (C). Swing1 and 4 provide, Swing 2 and 3 do not provide this criterias.

Take consideration of the safety distance between seats (S), Swing1 and 4 show suitability, Swing 2 and 3 do not show.

**Table 1.** Assessment of swings safety dimensions to TS EN-1176-2 (2010) and USCSPC (2008)

		TS EN-1176-2	USCSPC			Swing 1		Swing 2		Swing 3		Swing 4	
		Age group	Age group			R.A.	√ X	R.A.	√ X	R.A.	√X	R.A.	√X
		0-12	0-2	2-5	5-12								
Safety criteria	<b>h4</b>	≥35cm	60,9	30,4	30,4	38	√	32	<b>X</b>	35	√	50	√
	<b>h5</b>	150	180	180	180	330	√	160	√	114	<b>X</b>	110	<b>X</b>
		150	180	180	180	235		240		142	<b>X</b>	130	<b>X</b>
	<b>C</b>	≥%20h2+20	50,8	76,2	76,2	65	√	55	<b>X</b>	50	<b>X</b>	65	√
	<b>S</b>	≥%20h2+30	50,8	60,9	60,9	85	√	55	<b>X</b>	50	<b>X</b>	70	√
	<b>L</b>	≥0,867h2+175	180	180	180	340	√	330	<b>X</b>	270	<b>X</b>	445	√

h4:Seat height, h5:Side space, h2:Chain height, C:Distance swing leg-seat, S:Distance between seats, L:Fall distance, R.A:Research Area, √:Suitable, X:Not suitable(measurments are cm)

There must be a gap in front of the swings at least as much as L value. Swing 1 and 4 are suitable swings on the playground according to the safety criteria, Swing 2 and 3 are not suitable.

Swings which have more than two seats, structure should be divided with intermediate elements. The three-seater swing in the research area is not suitable for use as structural because it is not divided with an intermediate element.

Each swing must be provide in Table 1's all the criteria mentioned at the same time. It is determined that only one two-seater swing ( Swing 1) fulfills TS EN-1176-2's safety criteria from the four swing in the resarch area, other three swing-mentioned reasons, it is not suitable for use.

USCSPC standards were examined in this study as the purpose of information. Because there is no distinction age group in TSE safety standards. In the area any swing are not appropriate according to USCSPC standards safety criteria. For USCSPC (2008), swings for children ages 06 months-2 years are required to be seat safety belt in the triple (full bucket) in order to prevent children from falling down the sliding. This is a successful application not to be our country standards in terms of child safety.

One free slide and one tunnel slide in unified structure located in Barış Manço children's playground were examined according to TS EN 1176-3 (2010) (Additional Specific Safety Requirements And Test Methods For Slides), safety standards and are shown in Table 2. Accordingly, in front of the slides must be found a space at least 100cm (R). In front of the two slides have 150cm space. Therefore, from this perspective slides are suitable to safety standards.

It stated that this standard slide slip angle must be smaller than 40°. In the research area, the slip angle were measured and was found 30° as average. The slides are suitable according to the standard in terms of these characteristics mentioned.

Start section which allow the user to slide slip section for the specified, is also stated that a portion at least 35cm in the TS EN 1176-3 standards. Because of free slides have 40cm start section in the study area, this slide is suitable to standards. However, tunnel slide does not have any start section and it does not comply with safety standards. Due to corporate structure, slides as a whole examined, it is understood that not provide the EN 1176-3 security criteria.

General observations and measurements about slides in the research area, metal surfaces of stairs and railings on slides was determined that it is rusty. Taking into account children's age groups, average 20cm height of the stairs to be done in a lower height will be more convenient.

USCSPC standards were examined in this study as the purpose of information. Because there is no distinction age group in TSE safety standards. Unified slides in the playground are not appropriate according to USCSPC standards. For USCSPC (2008), transparent sections should be on the tunnel slides. This application, in terms of supervision and control of children is a good practice.

**Table 2.** Assesment of slides to TS EN-1176-3 (2010) ve USCSPC (2008) safety dimensions

		TS EN-1176-2	USCSPC			Free Slide		Tunnel Slide	
		Age group	Age group			R.A.	√ X	R.A.	√ X
		0-12	0-2	2-5	5-12				
Safety criterias	W	≤ 70cm	≥58,4	≥58,4	≥58,4	44	√	70	√
	Ω	≥40°	24°	30°	30°	30 °	√	30 °	√
	A	≥35cm	--	--	--	35	√	--	X
	p	≥10cm	10	10	10	13	√	--	--
	R	≥100cm	91	182	182	150	√	150	√

W: Slip section width, Ω : Slip angle, A: Start section, p : Side barriers, R: Fall space, R.A:Research Area (measurements are cm),

One carousel located in Barış Manço Children's Playground was analyzed according to TS EN 1176-5 (2010) (Additional specific safety requirements and test methods for carousels safety standards). Type B Carousel was found in the research area. This carousel does not have a protective skirt and this carousel's height from floor is 30cm. There are two rules to provide safety criteria for this type of carousels. The first of these rules, to provide a smooth floor, the second rule, the distance between the bottom rolling surface and floor(b) must be  $6\text{cm} \leq b \leq 11\text{cm}$ . The b value of the carousel is 10cm. This value with this property is suitable to TSE standards. Around the carousel's falling space must be at least 200cm to TS EN 1176-5 (L). From this perspective, the carousel's measurement is suitable to these criteria. As a result, carousel located in the area has all safety criteria to TS EN 1176-5 (Figure 3).

USCSPC standards were examined in this study, as the purpose of information. Because there is no distinction age group in TSE safety standards. According to USCSPC (2008), the carousel especially while in motion may cause some danger for pre-school age children. Therefore, it is recommended that this equipment use under the supervision by aforementioned age group. Also it is not recommended for 06 months-2 years age group. Carousel located in the area is suitable for use by pre-school age to USCSPC.

The swinging elements in the research area were evaluated according to TS EN 1176-6 (2010) (Additional Specific Safety Requirements and Test Methods for Rocking Equipment). Accordingly, the research area have one vertical axis moving seesaw-Type 1 (with support point) and two rocking equipments (Figure 3). However, one of the rocking equipment was broken and can not be used.

Seesaw must be have footrests to the standarts. It is not found footrests on the seesaw in the research area. In addition, the end position of the seesaw when measured from the periphery of the element, falling space must be minimum 100cm. The seesaw fall gap height is 130cm and this feature is suitable. According to the aforementioned standard, slope seat of seesaw in the highest position must be no more than 20°. The seesaw in the research area is suitable in terms of this criteria. When TS EN 1176-6's all criteria examined, although the seesaw measurements are suitable all criteria, resulting from it doesn't have footrests, it is not suitable to TSE standarts.

USCSPC standards were examined in this study as the purpose of information. Because there is no distinction age group in TSE safety standards. According to USCSPC (2008), "the typical seesaw consists of a board or pole with a seat at each end supported at the center by a fulcrum. Because of the complex way, children are required to cooperate and combine their actions, fulcrum seesaws are not recommended for toddlers or pre-school age children". In addition, in this standard, in the part of touching the ground surface of seesaw should be use shock-

absorbing material or should be buried tires there to prevent children legs's crushed between the floor and seesaw. In the research area, part of seesaw's touching the ground are used rubber materials.

Rocking equipments don't have footrests and hand-holding part (specified in TS EN 1176-6) in te research area. According to the standard, it must be least 100cm fall gap distance around this elements. This distance was measured 80cm in the playground. The rocking equipments are not suitable to standards.

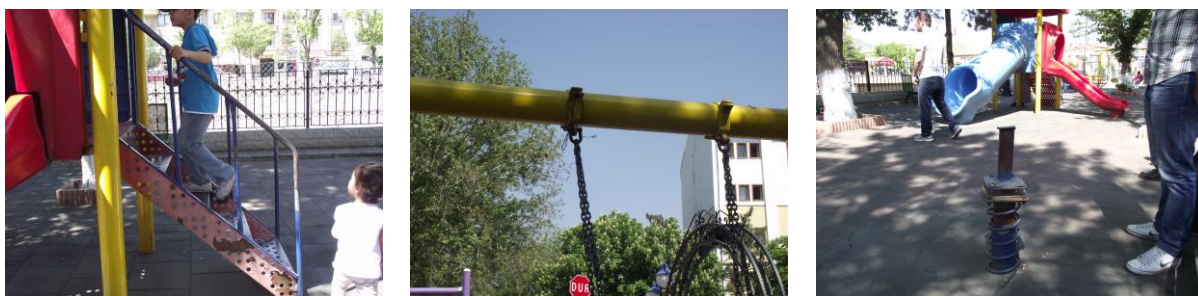
USCSPC standards were examined in this study as the purpose of information. Because there is no distinction age group in TS EN safety standards. According to USCSPC (2008), "toddlers and preschool-age children enjoy the bouncing and rocking activities presented by rocking equipments (spring rockers), and they are the primary users of rocking equipment". There is at least 273cm between equipment when adjacent designated play surfaces are more than 45cm high. The seat should be between 30 and 41cm high for toddlers. The seat should be between 35 and 71cm high for preschooler. Rocking equipments which existed our research area, are not suitable according to USPCSC.



**Figure 3.** Carousel, seesaw and rocking element in the playground (Original, 2013)

### **Maintenance Status and Evaluation of Hazards in the Playground**

The metal parts in the area of the game elements were appeared rusty and unpainted, it is understood that wasn't done regularly maintenance. One of the swings's screw had been out of, metal wire was connected to the chain instead of screws. Fractures swinging element (rocking element) part have been left the area, this is creating a danger to running children (Figure 4).



**Figure 4.** A view of neglected game equipments (Original, 2013)

Electricity transformer in the area, disrupting both vision as well as pose a danger to children. In the same way, the empty concrete planter in the field poses visual pollution and danger to running children (Figure 5).

Also stemming from the lack of supervision on the playground, while forbidden eating in the area, some peddlers were appeared in the area and they sell unhealthy foods to the children. This situation create health risks for children.





**Figure 5.** Elements which create danger in the playground (Original, 2013)

### Evaluation of the Other Outfit Equipments and Plants in the Playground

There are five binary lighting element in the research area so that the area can be used in the evening. There isn't a staff officer in the area for auditing purposes. Children often are playing games under the supervision of parents. Six metal, five made of wood total of 11 seating element serves for families of children. Metal benches pose problems for the summer because of sun can heat up the benches. In addition, there are five trash on the playground. There is a fountain in the area as water element. Fence element's materials (plastic and iron) in the playground vary like sitting elements on the playground (Figure 6). This leads to complicated appearance in the area.

USCPSC (2008), said to be one of the most important factors is used surface element under and around the game elements for reducing the possibility of threatening the life of the child. Rubber paving stone was used in Barış Manço Children's Playground as a surface element that is suitable to TS EN 1177 (2011) in terms of flexible and shock absorbing properties. However, staircase surface of two entries in the playground was made from marble. This poses the risk of slipping on rainy days. Having neglected of staircases will be cause children's to fall (Figure 6).



**Figure 6.** Outfit equipments in the playground (Original, 2013)

One of the safety issues is plants which used in the design of children's playground. The selections of plants in the playgrounds consider toxicological and allergenic properties of plants in terms of children health and safety (Pekin Timur, 2013).

There are eight *Pinus nigra* as coniferous tree species, one *Platanus orientalis* and one *Acer negundo* as deciduous tree in Barış Manço Children's Playground. According to Yılmaz et al. (2006), *Pinus nigra* and *Acer negundo* have toxicological substances that could affect negatively of children health, so these species are undesirable species to use in children playgrounds. Uluğ (2007), noted that *Acer negundo* has significantly pollen allergen and *Platanus orientalis* has moderate pollen allergen. Therefore, warning signs should be put indicating period of the pollen of these trees (Pekin Timur, 2013).

Trees to be planted in the playgrounds for children should be used as hillside and in the background, to be protective against sunlight, yet, not to deprive children completely of sunlight. The sunlight requirements of children should not be hampered by large plants and plants with wide petals, particularly in the playgrounds with moving equipment. When the Barış Manço Children's Playground was established, trees were found in the area. The *Platanus orientalis* tree species cover the entire field and block play in playground (Pekin Timur, 2013).

#### 4. CONCLUSIONS

Safety is an important element which affects children's health and the quality of the game in children's playgrounds. When safety doesn't consider in the planning and design stage, may occur several dangers for children. To minimize of these dangers, primarily selected area should be analysed in terms of the various factors (transportation, sun, traffic, proximity to lakes, proximity to rivers, the slope and drainage). Then must be taken to care the design of the game elements and age groups in terms of their suitability standards and use the appropriate surface material.

In our country, according to European Union TS EN 1176 and TS EN 1177 standards were developed, in order to comply with the European Union since 2010. These standards apply to all children older than 3 years. According to USCPSC in the America, children age group distinction is clearer. The children age group distinction is made randomly in the research area.

Just one swing was appropriate to TS EN 1176 series from the 3 two-seater swings and 1 three-seater swing in the playground. There is one unified structure consisting of the free and tunnel slides in the playground. The combined slide does not show conformity to TS EN 1176 series. Seesaw in the research area is not suitable to TS EN 1176 series. One of two rocking equipments in the field is unavailable, the other is not suitable to standards for lack of hand-holding and footrest. Carousel in the playground is suitable to standards. As a result, 78% of the game elements in Barış Manço Children's Playground were determined that not suitable to the Turkish Standards. Elements that do not meet the standard should be replaced with the appropriate property in terms of children's health and safety.

Rubber paving stones was used in Barış Manço Children's Playground as a surface element that have used widespread in recent years in the world. This element is suitable to TS EN 1177 standards. Broken stairs made of marble entry to the area must be replaced with a suitable material. Broken stairs create danger for children. Also marble is slippery material and children may shift in rain and snow on this material.

Need to be barrier in front of enter and exit doors of Barış Manço Children's Playground to prevent sudden jump to road of children. In addition, must be made crosswalk to this point.

Game and other outfit elements to be maintained regularly is extremely important to ensure the children's safety. to be neglected of these elements, may cause injury in the playground. It is determined that not make regularly maintenance in accordance with the standards in the research area. Rusty and paint peeled metal parts of game elements should be maintained in the field, broken and rusty swing element (spring rocker), metal wire that connects to the swing should be repaired. Threatening the safety of children in the playground area, the electrical transformer that may create a danger of death and empty concrete planter needs to be removed from the area. Metal parts of game elements and metal benches could produce the burning surface due to heating up in the sun. It should be specified with warning signs.

Also, the pollen period of trees which contain important and moderate pollen should indicate with warning signs in terms of children health. In the section of the playground area which was made in 2011, It is important to be planted mid-crown deciduous tree species to protect children from the negative effects of the sun.

It is effective in reducing accidents and injuries to children's play under the supervision of a parent or the personnel in playgrounds. Children often play in family control in Barış Manço Children's Playground. Vendors and people which come to use fountain should be prevented. In addition, although stated that the playground area

for children 0-7 age group, during the research, to be used by children older than 7 years were observed. Take consideration these reasons and to used area at night, has to be taken security personel in the playground. End of the research, it was seen that Barış Manço Children's Playground didn't meet TSE criterias. In the light of these assesments, all playgrounds should be checked by own municipalities in Turkey.

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# The Effects of Different Sowing Dates of Fiddleneck (*Phacelia tanacetifolia*) During the Autumn and Spring Sowing Periods on the Forage Yield and Quality

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## Abstract

The objective of this study was to determine the best sowing period and sowing dates for fiddleneck in Western Black Sea Region and in similar ecologies. The study was conducted at the Akmanlar village of the city of Bartın during the autumn and spring vegetation periods of 2012-2013 and 2013-2014 with randomized block design with three replications. This research was conducted in the autumn and spring sowing periods. At the end of the study, the highest amount of dry matter (8.97 t ha<sup>-1</sup> –September 30 and 8.96 t ha<sup>-1</sup>- September 15) and crude protein yield (1.10 t ha<sup>-1</sup> September 15 -1.09 September 30 t ha<sup>-1</sup>) were obtained in September from the sowings conducted during the autumn period, whereas for the spring period the highest dry matter was obtained beginning of March sowing date (4.07 t ha<sup>-1</sup>). The fiber ratios of fiddleneck were determined on average as ndf 44.14%, adf 37.79%, adl 23.91% during the autumn sowing period and as ndf 42.51%, adf 34.63%, adl 22.82% during the spring sowing period. As a result, it is suggested to prefer autumn sowing period for hay and to carry out the sowing in the months of September and October during this time frame.

**Keywords:** ADF, crude protein, NDF, spring and autumn, Western Black Sea Region



## Introduction

Fiddleneck is a plant that belongs to the *Phacelia* genus under the Hydrophyllaceae family and has a wide range of usage areas. Fiddleneck (*Phacelia tanacetifolia* Benth.) is an important source of high quality nectar and pollen for honeybees (*Apis* spp.) and bumblebees (*Bombus* spp.). Besides, it is used for forage, ornamental and cover crops (Ateş et al. 2010).

Fiddleneck is mostly cultivated in North America and Europe for bee forage use and it was determined as a result of various different ecological studies in Turkey that it can also be cultivated as a fodder plant (Ateş 2012; Ateş et al. 2010; Karadağ and Büyükburç 2003a; Geren and Kaymakkavak 2007; Başbağ et. al. 2001; Uçar and Tansı 1996; Sağlamtimur et.al. 1989). Karadağ and Büyükburç (2001) determined that the highest plant height, fresh hay, dried hay, seed and biological yield was obtained for 40 cm row spacing. Karadağ and Büyükburç (2003a) investigated the effects of 4 different sowing dates (March 5-March 20 –April 5 –April 20) on hay yield in fiddleneck as well as on various other agricultural properties thus putting forth that sowing dates have significant effects on fresh and dried hay yields while also stating that the highest values were obtained for March 5 sowing period.

Pastures are under intensive grazing pressure and fodder plant cultivation is conducted in very limited areas in the Western Black Sea region; thus, production and demand are not in balance for coarse fodder in the region. Since the fiddleneck plant that is mostly used for bee forage purposes is an alternative plant for the Western Black Sea region in terms of its ecology and agricultural activities as well as for apiculture and cattle, its potential as a plant should be emphasized by putting forth its fodder yield and quality. It was determined as a result of studies conducted on fodder yield and quality of fiddleneck that it can be used as a fodder plant and that it provides fodder for animals that is balanced and nutritious (Karadağ and Büyükburç 2003a; Ateş 2010) In western Turkey Ateş et al. (2010) determined the yield and feeding values of fiddleneck at different growth stages. In this research was obtained, NDF 45.43%, ADF 36.40%, ADL 22.43%, crude protein %10.21, dry matter yield 9.87 t/ha at ½ blom stage. Ateş 2012, was to determine the yield and forage quality of field pea (*Pisum arvense* L.), fiddleneck (*Phacelia tanacetifolia* Benth.) and their mixtures under dry land conditions. Highest NDF 44.0-44.7% and ADF 37.1-38.1% were determined respectively 25% field pea+75% fiddleneck mixture and pure fiddleneck. Pure fiddleneck yield was recorded 7.8 t ha<sup>-1</sup>.

The use of fiddleneck for different agricultural activities is an important potential for the region. Putting forth the current potential of fiddleneck as well as the fact that there was no previous study for the region were the starting points of the study. To this end, the best sowing period and sowing date in terms of fiddleneck fodder yield and quality for the Western Black Sea region and regions with similar ecology were determined in this study.

## Material and Method

This study was conducted at the Akmanlar village of the city of Bartın during the autumn and spring vegetation periods in 2012-2013 and 2013-2014. Soil samples obtained from the study area were subject to analyses. The soil was loamy and moderately calcareous (7.01 % CaCO<sub>3</sub>), was rich in organic matter (3.20%) and had nitrogen content % 0.29 as well as slightly alkaline characteristic (pH 7.54). The rain data for the years during which the study was conducted as well as a long term annual rainfall average are given in Figure 1 for the study region. Long term annual rainfall average was 1033 mm, temperature average was 11.4 °C and the moisture value was 78.5 %.

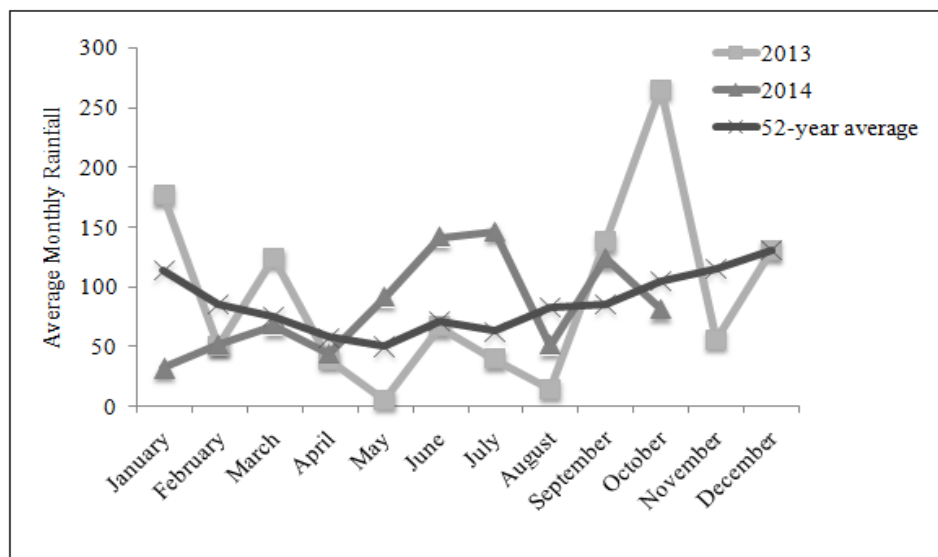


Figure 1. Monthly rainfall data for the study region for 2012, 2013, 2014 and long term data

The study was conducted with randomized block design with three replications. 12 different sowing dates were determined in two different periods as autumn and spring. The study area consists of 6 autumn sowing plots x 6 spring sowing plots x 3=36 plots in total. Each plot is 5x2=10 m<sup>2</sup>. The total study area covers 476 m<sup>2</sup> including the distances between the plots and blocks. Sowings were conducted in autumn starting from September 15 ( A1) in 15 day intervals as September 30 (A2), October 15 (A3), October 30 (A4), November 15 (A5) and November 30 (A6). The spring sowings were conducted starting from March in 15 day intervals as March 1 (İ1), March 15 (İ2), April 1 (İ3), April 15 (İ4), May 1 (İ5), May 15 (İ6). No emergence was obtained during the two years of the study for the sowing on May 15 (İ6) despite the fact that irrigation was continued. Italian origin Stala cultivar was used. The seeds were sown at a rate of 20 kg ha<sup>-1</sup> (Karadağ and Büyükburç 2003b). Row spacing was 40 cm. Irrigation was continued in both sowing periods when there was no rainfall until emergence and water need was met via natural rains during the vegetation period. During the sowing, DAP fertilizer was given with the calculation of 100 kg ha<sup>-1</sup>. The harvesting was conducted when the plants were at the % 50 flowering period by sawing the area within inside

the 1 m<sup>2</sup> quadrant after leaving 0.5 m edge effect (Geren and Kaymakkavak 2007). The hay samples taken during fresh hay harvest were dried in 70 °C oven until they reached a fixed weight after which they were weighed and the parcel dry matter weights were determined (Martin et al. 1990), these values were converted into hectare and dry matter yields (t ha<sup>-1</sup>) were calculated. All dried samples were ground to small (<2 mm) pieces and were used for the analyses. The crude protein ratio was determined via the Kjeldahl metod. Dry matter yield was multiplied with crude protein ratio after which crude protein yield (t ha<sup>-1</sup>) was calculated by dividing this value with 100 (Altınok and Karakaya 2002). The NDF, ADF and ADL ratios of ground samples were determined in accordance with the method developed by Van Soest et.al. (1991).

The results obtained from the trials were evaluated in accordance with the General Linear Model of the Statistical Analysis Software (SAS) with significance levels of % 5 and % 1 (Anon. 1988). Duncan Test was applied in cases when interaction was observed between years and applications.

## Results and Discussion

An active graph especially in terms of rain data (Figure 1) was determined during the years 2013 and 2014 when the study was conducted. This resulted in the acquisition of different results for both sowing periods. Even though the changes in rain regime between the years did not have significant effects on the autumn sowing, almost twice the values of the previous year were obtained in comparison with yield during the spring sowings S3-S4-S5 (Table 1).

The fact that rainfall was greater in the first year during the period from the sowing until harvesting resulted in higher yield from autumn sowing resulted in higher yield from autumn sowing. Whereas in the second year, rainfall was significantly greater than the average amount during the months of July and August following a dry winter and spring period. This resulted in the fact that the yields of sowings conducted during the spring period were higher than that of the first year.

Table 1. Dry matter yield, crude protein ratio and yield values for fiddleneck plant cultivated in different sowing periods

	Autumn								
	dmy t ha <sup>-1</sup>			cpy t ha <sup>-1</sup>			cpr %		
	2013	2014	Ort.	2013	2014	Ort.	2013	2014	Ort.
A1	9.43a**	8.50	8.96a*	1.18a**	1.06	1.10a**	12.49	12.45	12.47
A2	8.98ab	8.95	8.97a	1.09ab	1.09	1.09a	12.25	12.15	12.20
A3	7.73bc	8.70	8.21ab	0.95bc	1.05	0.99abc	12.22	12.04	12.13
A4	8.75ab	8.18	8.47ab	1.04ab	0.99	1.01ab	11.86	12.17	12.02
A5	6.30c	8.55	7.43bc	0.73c	1.07	0.89bc	11.52	12.46	11.99
A6	6.17c	7.66	6.97c	0.77c	0.97	0.87c	12.48	12.52	12.50
Ort.	7.89	8.44	8.17	0.96	1.04	0.99	12.14	12.30	12.22
SD	1.68	1.38		0.22	0.15		0.99	0.60	

Spring									
	2013	2014	Ort.	2013	2014	Ort.	2013	2014	Ort.
S1	3.77a**	4.37a**	4.07a**	0.47a**	0.53a**	0.50a*	12.37	12.18	12.28
S2	3.05b	4.19a	3.62b	0.38b	0.52ab	0.45b	12.34	12.46	12.40
S3	1.95c	4.11a	3.03c	0.25c	0.48b	0.36c	12.62	11.62	12.12
S4	1.64d	2.60b	2.12d	0.19d	0.31c	0.25d	11.79	11.83	11.81
S5	1.28e	1.63c	1.46e	0.16e	0.20d	0.18e	12.09	12.15	12.12
Ort.	2.34B	3.38A**	2.86	0.29B	0.41A**	0.35	12.24	12.05	12.14
LSD	0.152	0.508		0.023	0.053		1.02	0.66	

A:Autum, A1:September 15, A2:September 30, A3:October 15, A4:October 30, A5:November 15, A6:November 30, S:Spring, S1: March 1, S2: March 15, S3:April 1, S4:April 15, S5:May 1, dmy: dry matter yield, cpy:crude protein yield, cpr:crude protein ratio. \*P<0.05 \*\*P<0.01

The highest dry matter and crude protein yield values were obtained for September sowings among the autumn sowing dates. Lowest yield values were obtained on November sowings for both years. Whereas a difference was observed in terms of dry matter yield and crude protein yield between the applications in the first year, there was no statistically significant difference in the second year. As a result, the difference between the years was determined to be statistically significant. No statistically significant difference was observed between the sowing date applications in the second year, however as was the case in the first year, highest yield was obtained from the sowing in September and the lowest yield was obtained from the sowing in November (Table 1). Sağlamtimur et.al. (1989) determined the dry hay yield of fiddleneck that is cultivated in Çukurova as a winter interval crop as 7.68 t ha<sup>-1</sup>. Geren and Kaymakkavak (2007) state that under Mediterranean climate conditions at Bornova-İzmir, a dry matter yield of 4,57 tons per hectare is obtained for fiddleneck cultivation as a winter interval crop. The dry matter yield obtained in this study is much lower than that of our study. The differences in these results might be due to the facts that the different fiddleneck cultivars were used, different row spacings applications effected and that the annual rainfall average (about 650 mm) is lower than our region. Karadağ and Büyükburç (1999) determined that the dry hay yield of fiddleneck cultivated under arid climate conditions at Tokat is 1.97 t ha<sup>-1</sup>. Ateş 2010 conducted a study in the Marmara Region with has transition climate characteristics between the Black Sea and the Mediterranean climates determined that the crude protein ratio of fiddleneck is between 13.22-9.65% and that the dry matter yield is between 9.22-9.77 t ha<sup>-1</sup>.

Crude protein ratios were not affected from sowing periods and sowing date applications. The crude protein values obtained in our study are in accordance with those obtained by Ateş 2010. Geren and Kaymakkavak (2007) determined that the crude protein ratio for different fiddleneck cultivars varies between 11.4-14.9 and that the crude protein yield is 7.44 t ha<sup>-1</sup> which is the highest value in comparison with the two year average.

Lower dry matter yield and crude protein yield values were obtained in the spring sowing period than the autumn sowing period; whereas no statistically significant difference was observed between crude protein ratios. There were differences between the two years in terms of yield due to the rainfall amount differences between the first and

second year in the spring sowing periods. In the first year, the rainfall amount was above average due to early rains in the winter and early spring, which was followed by very low amount of rainfall in April and May. This had direct effects on the spring sowing period yields. Highest dry matter yield in the first year was obtained as 3.77 t/ha<sup>-1</sup> in S1 sowing date. The reason for the increase in the second year yield values in comparison with the first year might be due to the rainfall amount in April, May and June to be close to or above the long term average value. Highest dry matter yields were obtained respectively for S1-S2-S3 sowing dates. Highest value of crude protein yield was obtained for the S1 sowing date. Karadağ and Büyükburç (2003a) researched 4 different sowing dates for the fiddleneck they cultivated in semi-arid climate conditions and determined that the highest values in terms of dry hay yield were obtained for the 5 March sowing date. The results that the researchers obtained are in accordance with the results of our study.

When the fiber values of fiddleneck are analyzed, a statistically significant difference was observed between the adf and adl values between autumn sowing dates, whereas there was no statistically significant difference between the ndf and ash values (Table 2). Ateş (2010) conducted a study that was different harvest times for fiddleneck in Tekirdağ. In this study fiber ratios were determined as the ndf values varied between 41.42-45.60 %, adf values varied between 36.20-37.33 %, adl values varied between 16.41-23.70 %. The same researcher conducted another study in 2012 during which the ndf value and adf value for fiddleneck respectively were obtained as 44.7%, and 38.1% (Ateş 2012). Geren and Kaymakkavak (2007) reported that the average crude ash ratio in fiddleneck species varies between 10.2-9.4%. The results obtained by the researchers are in accordance with our study.

Table 2. Fiber ratios and ash ratios of fiddleneck plant cultivated in different sowing periods

	Autumn											
	ndf %			adf %			adl %			ash %		
	2013	2014	Ort.	2013	2014	Ort.	2013	2014	Ort.	2013	2014	Ort.
A1	44.55	44.44	44.49	38.36a**	38.35ba*	38.35	23.46c**	23.26c**	23.36b*	10.47	10.45	10.46
A2	43.48	44.33	43.90	37.50b	37.76bc	37.63	24.18ab	24.44a	24.31a	10.33	10.15	10.23
A3	44.19	44.37	44.28	37.49b	37.57c	37.53	24.56a	24.40ab	24.48a	9.93	9.97	9.95
A4	44.11	43.77	43.94	38.32a	38.60a	38.46	23.60bc	23.81bc	23.70b	9.73	10.00	9.86
A5	44.18	44.19	44.19	37.29b	37.34c	37.32	24.83a	23.52c	24.17a	10.22	10.10	9.86
A6	44.56	43.50	44.03	37.49b	37.42c	37.46	23.47c	23.40c	23.44b	9.38	10.45	10.16
Ort.	44.18	44.10	44.14	37.74	37.84	37.79	24.02	23.80	23.91	10.00	10.19	10.09
LSD	0.68	0.72		0.49	0.77		0.65	0.60		1.02	0.99	

<b>Spring</b>												
	<b>2013</b>	<b>2014</b>	<b>Ort.</b>	<b>2013</b>	<b>2014</b>	<b>Ort.</b>	<b>2013</b>	<b>2014</b>	<b>Ort.</b>	<b>2013</b>	<b>2014</b>	<b>Ort.</b>
S1	42.83b**	42.15bc**	42.47b**	34.65	35.46a**	35.05a*	23.56	22.82b**	22.92	8.70b*	9.21a*	8.95b**
S2	42.40b	41.62d	42.01c	34.25	35.42a	34.84ab	22.48	23.19a	22.84	8.82ab	8.66b	8.74b
S3	42.59b	41.82dc	42.21bc	34.53	34.42b	34.47b	23.29	22.29b	22.79	8.29b	8.81ab	8.55b
S4	42.60b	42.47ab	42.54b	34.23	34.42b	34.32b	23.15	22.57b	22.86	8.50b	8.61b	8.56b
S5	43.83a	42.83a	43.33a	34.38	34.55b	34.46b	22.85	22.54b	22.69	9.43a	9.25a	9.34a
Ort.	42.84A**	42.18B	42.51	34.41B	34.85A*	34.63	23.06A**	22.57B	22.82	8.79	8.91	8.83
LSD	0.57	0.45		0.57	0.96		1.03	0.36			0.68	0.44

ndf: neutral detergent fiber, adf: acid detergent fiber, adl: acid detergent lignin, \*P<0.05 \*\*P<0.01

Fiber and ash values were lower in spring sowing applications when compared with the autumn sowing values. The vegetation duration in spring sowing period is shorter than that of the autumn sowing which might be the cause of a difference between the fiber ratios. A statistically significant difference was observed between years of Ndf, adf and adl values. The highest ndf ratio was determined as 42.83% for S5 sowing date, the highest adf ratio was determined as 35.05% for S1 sowing date, whereas the highest ash ratio was determined as 9.34% for S5 application (Table 2).

## Conclusions

It was determined for the Western Black Sea region and regions with similar ecologies that at least twice the yield is obtained for autumn sowing periods in comparison with the spring sowing periods for fiddleneck cultivation. Higher yields were obtained from sowings conducted in the months of September and October in the autumn sowing period. It was observed that the sowing date did not cause significant changes in terms of fodder quality, but that there were significant differences between sowing periods. Lower yield values were obtained in the spring sowing period; however this can be turned into an advantage in April sowings by using them as sources of nectar and pollen for the bees since the number of flowers in the region decrease. As a result, autumn sowing period can be suggested for fiddleneck plant when it is cultivated for hay and spring sowing period when it is used as bee forage as well as for hay.

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# EVALUATIONS ON THE DEVELOPMENT OF SUSTAINABLE TOURISM IN AMASRA'S URBAN LANDSCAPE

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## ABSTRACT

This study examines Amasra district which is a small tourism center in the West Black Sea Region in Turkey. The natural and cultural landscape heritage of the city has been effected by the unplanned urban development and misuses based on tourism. Amasra's landscape heritage should be served to meet needs of current people for tourism and also be passed to feature generation with minimum disruption.

In this scope, the natural and cultural landscape values of Amasra are examined under the light of the questionnaires applied on local people and visitors, face to face interviews with experts, written and oral information obtained, literature review and observations made in the field. As a result of the evaluations, it is found that an effective sustainable tourism development is necessary because such negative factors as the rapid urbanization, loss of historical values, visual pollution, noise, lack of infrastructure and lack of environmental awareness are dominant in the district compared to economic, social, cultural and environmental positive impacts of tourism. This study offers suggestions to improve the positive effects found in Amasra urban landscape and recommends corrective actions and programmes towards the negative effects to the government, local administration, voluntary environmental institutions and visitors.

**Keywords:** Sustainable tourism, urban landscape, planning, management, Amasra, Bartın.

## AMASRA KENT PEYZAJINDA SÜRDÜRÜLEBİLİR TURİZM GELİŞİMİ ÜZERİNE DEĞERLENDİRMELER

### ÖZET

Araştırmada, Türkiye'nin Batı Karadeniz Bölümü'nün küçük turizm merkezlerinden biri olan Amasra kenti incelenmiştir. Zamanla kentin doğal ve kültürel peyzaj mirası, plansız kent gelişimi ve turizme dayalı yanlış kullanımlardan etkilenmeye başlamıştır. Amasra'nın peyzaj mirası bugünün hizmetine sunulmalı ve aynı zamanda en az bozulma ile gelecek kuşaklara aktarılmalıdır.

Bu kapsamda makalede Amasra kentinin doğal ve kültürel peyzaj değerleri, sürdürülebilir turizm gelişimi açısından yerel halka ve ziyaretçilere uygulanan anket çalışmaları, uzmanlarla yapılan yüz yüze görüşmeler, elde edilen yazılı ve sözlü bilgiler, literatür taramaları ve alanda yapılan gözlemler ışığında değerlendirilmiştir. Yapılan değerlendirme sonucunda Amasra'da hızlı kentleşme, tarihi değerlerin kaybı, görsel kirlilik, gürültü, altyapı eksikliği ve çevresel duyarlılığın azlığı gibi olumsuz etkiler, turizmin yöreye kazandırdığı ekonomik, sosyal, kültürel ve çevresel açıdan olumlu etkilerden baskın bulunduğu için etkili bir sürdürülebilir turizm gelişiminin gerekliliği belirlenmiştir. Araştırmada bu çerçevede Amasra kent peyzajında belirlenen olumlu etkileri geliştirecek öneriler sunulurken, diğer yandan olumsuz etkileri giderecek hükümete, yerel yönetime, gönüllü çevreci kuruluşlara ve ziyaretçilere yönelik düzeltici eylem ve programlar önerilmiştir.

**Anahtar Kelimeler:** Sürdürülebilir turizm, kent peyzajı, planlama, yönetim, Amasra.



## 1. INTRODUCTION

Tourism provides significant contributions to global, national, regional and local economies. Compared to other sectors, it is more dependent on and sensitive to the quality of natural and cultural landscape. Therefore, long-term practicability of tourism depends on the sustainability of natural, cultural and historical heritage (Paçacı, 1994). Due to its close relation to natural and cultural environment tourism reveals the necessity of the harmony of development and environment. At this point, the concept of sustainable tourism which includes such comprehensive objectives as;

- To develop environment, economy and tourism as part of one another and with an increasing importance,
- To improve the quality of environment,
- To improve the quality of life of the local people,
- To provide high quality standards for tourists,
- To integrate tourism to other economic sectors,
- To ensure equality in development,
- To guarantee the protection of environment for future generations comes up (Gezici, 1998).

With the increasing importance of the environment dimension of tourism, the classical tourism understanding comprised of sea, sun and sand started to lose its domination. The environmental problems caused by mass tourism led to the emergence of different tourism types which are called in such different names as sustainable tourism, green tourism, alternative tourism but basically have the same meaning (Güleç, 1998; Himmetoğlu, 1996). The term sustainability in tourism is stated as the protection and development of natural, historical, cultural, social and aesthetic values, which are the sources of tourism, and thus to ensure the sustainability of their attraction (Oral ve Şenbük, 1996). Tourism and environment, which have a very close relationship, are considered within the scope of nature-based planning and sustainable tourism planning today (Anonymous, 1991; Yücel, Altunkasa ve Yılmaz, 1996).

Basically, sustainable tourism includes the same components as tourism. Here, each component formed of society/local authority, tourism industry and environment is in unity with its own objectives. Due to the overlapping of the expectations and demands of each group in time, common objectives started to be determined. Thus, the necessity of improving the cooperation between the components for the development of tourism towards ensuring a better living environment became clear. In order to reach the objectives for sustainable tourism it is necessary to evaluate the approaches and expectations of different components towards the development of tourism and to ensure consensus among the expectations. As a result of this consensus, the expectation of tourists, tourism entrepreneurs and local people to live in a better environment will be realized and in line with these objectives, development of sustainable tourism, which includes guaranteeing the environment, will be ensured (Figure 1) (McIntyre, Hetherington ve Inskeep, 1993).

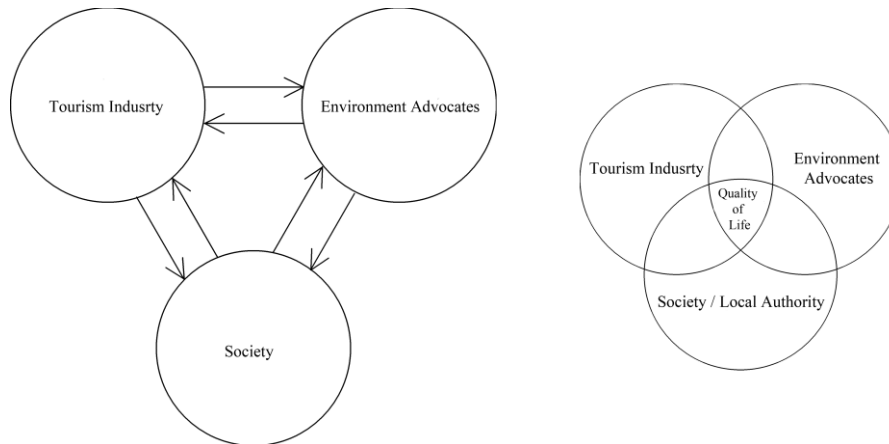


Figure 1. The collaborative and partnership relations of the three components which are effective in the development of sustainable tourism (McIntyre et. al., 1993).

The development of sustainable tourism should be considered within the scope of;

- The fact that natural environment creates a resource for tourism,
- The management of tourism and nature in the protection of environment,
- Including protection-oriented activities,
- Ensuring environmental training via tourism in order to develop local people and the society. These four main issues should be included in the policies and strategies with regards to the planning and development of sustainable tourism (Jafari & Wall, 1994).

In this study, Amasra, a small tourist attraction in the West Black Sea Region of Turkey, was examined. Natural and cultural landscape heritage of the city has been affected from unplanned urban development and wrong utilizations depending on tourism in time. However, these problems should be discussed under the light of the development of sustainable tourism; in other words, the landscape heritage of Amasra should be offered to the people and should be transferred to the future generations with minimum corruption.

Aim of this study has been the evaluation of tourism in Amasra's landscape with regard to sustainable development. As a result of evaluation based on the findings of the study, a number of negative effects on tourism have been determined such as rapid urbanization, loss of historical values, visual and noise pollution, insufficient infrastructure and inadequate environmental awareness. It has been understood that there was not a reasonable sustainable tourism development policy because these negative effects were more dominant than economically, socially, culturally and environmentally positive effects of tourism. In this context, in the study, suggestions have been offered to the government, local responsible, voluntary organizations and environmentalists in order to improve positive impacts and on the other hand, to eliminate negative effects identified on tourism in Amasra's urban landscape.

## **2. MATERIAL AND METHOD**

### **2.1 Material**

Various materials were used in the study in order to examine the natural and cultural landscape values belonging to the urban landscape in Amasra from the perspective of sustainable tourism. Among these materials, the maps used in the study are;

- 1/25000 and 1/50000 scale topographic map,
- 1/25000 and 1/200000 scale Bartın province administrative division map and
- 1/100000 Turkey road map.

The written and oral information obtained concerning the research area and the subject includes;

- Information on the resources regarding the geographical location, topography, geology, climate conditions, natural vegetation, historical, cultural, touristic, social, economic and infrastructural properties of the area,
- Books, theses and articles obtained from the university libraries,
- Notes and photographs obtained by field observations and examination studies,
- Oral information obtained from competent authorities and local people,
- Questionnaires implemented on the local people living in the Amasra city center and the visitors,
- The results of the questionnaires evaluated using SPSS package programme.

#### **2.1.1 Research Area**

In the study, Amasra district, which is a significant tourist attraction in the West Black Sea Region in Turkey, was examined. Figure 2 shows the location of the research area. Among the main reasons behind choosing Amasra district, located within the provincial borders of Bartın, as the research area are;

- The fact that the number of tourists is much more than any other settlement in Bartın province,
- The fact that it is the first place that people coming from other cities visit first in Bartın,
- The need for an effective planning and management for the sustainability of tourism as well as the natural and cultural landscape properties in the region.

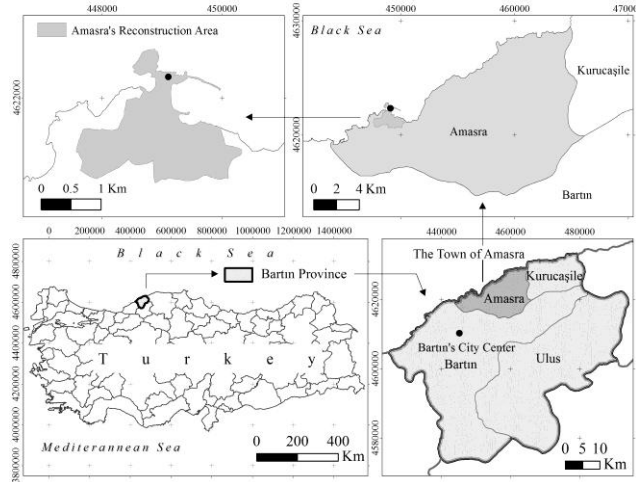


Figure 2. The location of the research area (Sarı, 2001).

Defined by Sakaoğlu (1999, p.1) as “A peninsula with five islands and two bays”, Amasra rises as a small peninsula in the West Black Sea coast. Amasra city center and its environs, which has a different look in terms of coast geomorphology on the coast of Bartın city, is founded on small plain which emerged with the union of four of the five small islands on the mountain foot of Black Sea coast mountains and on the hills and mountain foos of this plain (Sakaoğlu, 1999; Sarı, 2001; Sarı Nayim, 2014). The natural vegetation of Amasra, its bays and beaches, its landscape characteristics such as the geomorphological features in the form of islands and peninsula are the most significant elements that attract visitors to this region (Sarı Nayim, 2014).

The coast of Amasra has a unique geomorphological structure. The coastal geomorphology in neritic limestone structure led to the emergence of rare landscape elements. Amasra/Boztepe peninsula, Tavşan Island, Major Port and Minor Port natural bays, landscape forms emerging in the form of steep cliffs, submarine rock blocks, alluvial plains and mountainous terrains serve as a biotope for the various types of vegetation and wild life. These different landscape forms, which have significant contributions to the urban ecology and aesthetics in Amasra and bring an identity to the district, are under the pressure of such different area utilization as house settlement, transportation, tourism and recreation (Sarı Nayim, 2014).

Amasra has a coastal climate unique to the Black Sea. It rains during all seasons in this climate and summers are chilly while winters are not very cold. Between 15 October-15 March wind flows towards north-east wind. It is also open to north, south-west and north-west winds (Anonymous, 2001a; Sarı, 2001). The number of clear days in June, July and August rises up to 13 days (Anonymous, 2001a; Sarı, 2001). In this context, it is understood that June, July and August are the best months for tourism. Besides, there are days in April, May, September and October which are convenient for tourism (Atik, 1992; Sarı, 2001).

The district and its environs reflect the characteristics of the Black Sea Region in terms of the natural vegetation. In a flora study Yatgın (1996) carried out in Amasra, 265 natural plant taxon were determined here. In another study carried out by Sarı Nayim (2010) a total number of 521 natural plant taxon were determined in Amasra and its environs.

Amasra district center is a small intermediate port district between Zonguldak and Sinop provinces on the Black Sea Coast of Turkey. Amasra district which is a small touristic settlement in Black Sea bears the traces of a history of 3000 years (Anonymous, 2001b). Its natural location and strategic place in history resulted serving as a host to many civilizations as a coastal city. With its historical places it is one of the most attractive destinations in Black Sea in terms of tourism. During the period of Queen Amastris, who gave her name to the district, magnificent houses and mansions were built in the center. And the Roman Emperor Claudius, on the other hand, made such architectural buildings as Castle, Covered Bazaar, Antique Theatre, Public Bath, Kuşkayası (Bird'

Rock) Monument, Antique Cemetery be built in the district as well as the road network that connects the city to Sinop over Tekkeönü and to Filyos over Bartın (Anonymous, 2001c).

The birth of tourism in Amasra dates back to the 1940-1960s. During the period, Amasra and its environs had been discovered by both domestic and foreign visitors with its natural and cultural landscape values. With the increase in the number of visitors in its development years between 1960-1965, tourism started to be considered as a source of income. Unplanned urbanization, which effects the development of Amasra as a tourist attraction, also emerged during this period. After 1965, there had been a period of recession in Amasra in terms of tourism. In political statements, it was said that tourism would not be a source of income in the long-term and that the district should be coal district in order to develop and this caused to an irreparable natural and historical destruction (Sakaoğlu, 1999; Sarı, 2001).

An intense settling can be observed in the city center. Most of the houses serve as hostels and motels for the visitors. Amasra is one of the first tourist attractions where house hostels developed (Anonymous, 2000a). Another significant cultural feature of Amasra is traditional wood engraving. Wooden goods produced and sold in Çekiciler Bazaar attract great attention from the visitors.

## 2.2 Method

A three-stage method was followed in the study. These stages are;

- Data collection,
- Analysis of data gathered,
- Evaluation of analysis results and offering suggestions for future tourism developments with regard to sustainability.

Data in general have been collected via questionnaires, face to face interviews with experts and site surveys. In this study, the questionnaires have formed the most important data collection method. Data collected with questionnaires have been as follows:

- Characteristics of local public and people who visit Amasra,
- Natural and cultural urban landscape values,
- Opinions and expectations of visitors about positive and negative effects on these values important for tourism.

In determining the method of the study and preparing the questions in the questionnaire, the studies of Davidson (1970), Gülez (1979), Pehlivanoglu (1987), Gökçe (1992), Bell (1993), Gülez (1994), Açıksöz (2001) and Sertkaya (2001) were utilized. Simple random sampling method was used in determining the number of people who will answer the questionnaire forms. Sample size 125,5 was calculated in terms of 2% of city population. It was taken as 150 and questionnaires were implemented on 120 local people and 30 visitors. The people who answered the questionnaires were chosen randomly. Questionnaire forms were filled through face to face interviews. Personal comments of the subjects were attached to the forms.

The answers to the questionnaire and the variables were determined, coded and transferred to the computer using SPSS package programme. Cross tabulation analyses which enable to compare questions with a single answer and frequency table analyses were used in questions with more than one answer. Taking the numbers and per cents into account, the results of the analyses were given in tables. Burton's (1996) study was used in analyzing the results of the questionnaire with SPSS package programme.

The analyses of the data obtained from the questionnaires implemented to the local people and the visitors were evaluated together with the visual analyses in the area and the resource analyses carried out using the written and oral literature. The results obtained contributed to the protection of the natural and cultural landscape values of Amasra district within the scope of the development of sustainable tourism and thus, to their utilization by today's and future generations; and to the development of solutions for possible problems.

### 3. RESULTS

The questionnaires were implemented on 120 residents of the district and 30 visitors chosen with random sampling method.

#### 3.1 The Results of the Questionnaires implemented on Amasra Residents

According to the results of the questionnaires implemented on 120 residents in Amasra, of whom 81 were male and 39 were female, 58,3% of them said they were not originally from Amasra. Among the group who said they were not originally from Amasra, 25,4% of them said that they were living in Amasra for 10-15 years while 23,9% said that they were living in Amasra for over 20 years. Local people stated that the highest number of visitors arrive the county with 44,6% in July, with 33,1% in August and with 14,2% in June. September with 3,8% and May with 2,7% follow them (Table 1).

Table 1. Distribution of the months in which Amasra hosts the highest number of visitors.

<b>When does the district receive the highest number of visitors?</b>		
	<b>Number</b>	<b>%</b>
<b>July</b>	116	44,6
<b>August</b>	86	33,1
<b>June</b>	37	14,2
<b>September</b>	10	3,8
<b>May</b>	7	2,7

30,1% of the residents in Amasra stated that among the attractions of Amasra and its environs as a tourist destination, the natural beauties of the place ranked the first. Among the people who answered the question, 28,8% said that the second reason behind choosing the attraction of the district was that it is a coastal city. The answerers said that the third reason was the historical monuments and buildings the district owned. These are followed by traditional handicrafts. Local people do not think that the traditional architectural structure of Amasra was enough to attract tourists here. Apart from what is given above, the local people think that the fact that the district is close to the big cities, it is a quiet and comfortable place, it has dining facilities, fresh air, it offers the opportunity to get rid of the busy city life and the chance to feel like home due to the house hostels make the district an attraction for tourists (Table 2).

Table 2. Distribution of the things that attract tourists to Amasra.

<b>What do you think are the most significant attractions of Amasra and its environs for tourists?</b>		
	<b>Number</b>	<b>%</b>
<b>Natural beauties of Amasra</b>	98	30,1
<b>The fact that Amasra is a coastal district</b>	94	28,8
<b>The fact that there are historical monuments and buildings in the district</b>	66	20,2
<b>Traditional handicrafts</b>	51	15,6
<b>Traditional architecture</b>	4	1,2
<b>Other</b>	13	4,0

In order to get solid and reliable results from the questionnaire, first of all the questionnaire was preferred to be implemented on high school, college and university graduates. So, 45% of people questionnaire implemented on were university graduates and 28,3% of them were high school graduates. According to the results of the questionnaires, 67,5% of the people think that the new constructions are not in harmony with the natural and historical structure of the district. When an evaluation is made based on the level of education, it is seen that 83,3% of college or university graduates stated that the new constructions were totally incompatible with the natural and historical structure of Amasra (Table 3).

Table 3. Distribution of the answers related to the natural and cultural values of Amasra by educational background.

		Educational background				
		College/ University	High School	Secondary School	Primary School	Total
		%	%	%	%	%
<b>To what extent do you think the new constructions are compatible with the natural and historical structure of the district?</b>	Highly compatible	-	8,8	5	25	5,8
	Reasonably Compatible	13	20,6	20	8,3	15,8
	Adequately compatible	1,8	8,8	5	16,7	5,8
	Certainly not compatible	83,3	55,9	65	33,3	67,5
	No comment	1,9	5,9	5	16,7	5
<b>Do you think that the natural vegetation is destroyed?</b>	Yes	35,2	17,6	20	25	26,7
	No	27,8	50	65	66,7	44,2
	Slightly	37	32,4	15	8,3	29,2
<b>Do you think that necessary maintenance and repair is carried out to transfer historical monuments and places to future generations?</b>	Yes	7,4	20,6	50	33,3	20,8
	No	85,2	73,5	40	58,3	71,7
	No comment	7,4	5,9	10	8,3	7,5

According to the results of the questionnaire, 44,2% of the people living in the district stated that the natural vegetation was not destroyed due to such factors as unconscious behaviors of the people, unplanned settlement etc. When an evaluation based on the level of education is made, 37% of the people who graduated from university or college stated that the natural vegetation was slightly destroyed while 35,2% of those people stated that the natural vegetation was destroyed and 27,8% of the people stated that the vegetation was not destroyed (Table 3). 71,7% of the people living in the district stated that the necessary maintenance and repair work for the transfer of the historical monuments and places to the future generation was not carried out. When a comparison based on the educational background is made, it is seen that 85,2% of those college or university graduates stated that the necessary maintenance and repair work for the transfer of the historical monuments and places to the future generation was not carried out (Table 3). When the people who answered the questionnaire were asked: "To what extent do you think the new constructions are compatible with the natural and historical structure of the district?" 44,7% of the people said that they found the new constructions reasonably compatible. 21,3% of the people who answered this question said that they found the new constructions adequately compatible while another 21,3% stated they the new constructions were certainly not compatible (Table 4). The local people believe that the repaired castle walls and Kemere Bridge totally lost their historical characteristics.

Table 4. Distribution of to what extent people think the maintenance and repair work are compatible with the natural and historical structure of the district.

<b>To what extent do you think the maintenance and repair work are compatible with the natural and historical structure of the district?</b>		
	Number	%
Highly compatible	6	12,8
Moderately compatible	21	44,7
Slightly compatible	10	21,3
Not compatible	10	21,3

64,2% of the local people living in Amasra stated that there were negative environmental factors that could hinder the development of tourism activities in the district. Among the people who answered the questionnaire, 27% of the people stated that the water pollution hindered the development of tourism activities in the district while another 27% stated that the visual pollution in the district hindered this development to a large extent. And 16,1% of the people considered that noise pollution was among the negative factors effecting environment (Table 5). The subjects particularly stated that large trucks with heavy tonnage entered side-streets and caused to noise pollution; and that they did not consider such negative factors as air pollution and transportation security as important environment factors. 20,4% of the subjects who answered the questionnaire stated that the damage that the thermal power plant considered to be founded in the district in the future, unplanned settlement which rises among the historical fabric in the district, the fact that the summer season, the tourism season, lasts short, the fact that the staff in the touristic facilities do not have the necessary educational background would effect the development of tourism in Amasra negatively. In addition to above-stated, the subjects stated that the transportation to the district was difficult, the settlement areas were narrow, the number of social facilities was inadequate and there were not enough investment for the protection of natural and cultural resources as negative factors. According to the answers to the questionnaire, the people living in Amasra stated that the foundation of Amasra Hardcoal Enterprise's facilities in the district caused to visual and cultural pollution which would impact the development of tourism in the district negatively.

Table 5. Distribution of negative environmental factors which are believed to hinder the development of tourism in Amasra.

<b>Are there any negative environmental factors that might hinder the development of tourism activities in Amasra and its environs?</b>		
	<b>Number</b>	<b>%</b>
<b>Water Pollution</b>	37	27
<b>Visual Pollution</b>	37	27
<b>Noise Pollution</b>	22	16,1
<b>Air Pollution</b>	10	7,3
<b>Insecure Transportation</b>	3	2,2
<b>Other</b>	28	20,4

### 3.2 Results of the Questionnaires Implemented on the Visitors

In the study, the questionnaire was implemented on 30 visitors. 80% of the visitors who answered the questionnaire said that it was not their first time in the district (Table 6). Half of the people who did not come to the Amasra for the first time said that they visited the district every year. 41,7% of the visitors stated that they visited the district a few times in a year or once in every 2-3 weeks. The remaining 8,3% of the visitors stated that they visited the district in every 2-3 years (Table 6). According to these results, those visitors who visit the district upon the suggestion of a friend or just because they wonder etc. stated that they wanted to come again.

Table 6. The distribution of visit characteristics of visitors.

<b>Is it your first time in Amasra?</b>		
	<b>Number</b>	<b>%</b>
<b>Yes</b>	6	20,0
<b>No</b>	24	80,0
<b>How often do you visit Amasra?</b>		
	<b>Number</b>	<b>%</b>
<b>Every year</b>	12	50,0
<b>Once in every 2-3 years</b>	2	8,3
<b>Other</b>	10	41,7

According to the results of the questionnaire, as is seen in Table 7 73,3% of the visitors stated that they came Amasra from Ankara while 16,7% of the visitors came from İstanbul. 56,7% of the visitors stated that they

visited Amasra with their friends while 36,7% of the visitors stated that they visited the district with their families.

Table 7. Distribution of visitors in terms of the places they come from.

<b>Where do you come from?</b>		
	<b>Number</b>	<b>%</b>
<b>Ankara</b>	22	73,3
<b>İstanbul</b>	5	16,7
<b>Other</b>	3	10,0

35,3% of the visitors stated that the natural beauties of Amasra impressed them a lot. In the 27,9% of the answers, it was stated that the sea was one of the things that made the district attractive. 11,8% of the people stated that they loved the historical places. Another 17,6% of the subjects stated that the way people lived, the unique atmosphere of the district, the calmness of the district and the attitudes of the people were among the things they liked most in Amasra (Table 8).

Table 8. Distribution of the things that visitors like most in Amasra.

<b>What do you like most about Amasra and its close environment?</b>		
	<b>Number</b>	<b>%</b>
<b>Natural beauty</b>	24	35,3
<b>The fact that it is located on the seaside</b>	19	27,9
<b>The fact that there are historical places</b>	8	11,8
<b>Traditional architecture</b>	3	4,4
<b>Traditional handworks</b>	2	2,9
<b>Other</b>	12	17,6

When the visitors were asked “What kind of recreation and touristic activities you do here?”, 24,6% of the subjects stated that they participated in the activities of exploring the nature. 21,1% of the subjects said that they did trekking. 21,1% of the people added to the questionnaire forms that they rested, engaged in photography and enjoyed the food and beverages. And among the remaining, 17,5% of the subjects stated that they explored historical places and 15,8% of the subjects said that they swam (Table 9).

Table 9. Distribution of the recreational and touristic activities that visitors in Amasra do.

<b>What kind of recreational and touristic activities do you do in Amasra?</b>		
	<b>Number</b>	<b>%</b>
<b>Exploring the nature</b>	14	24,6
<b>Trekking</b>	12	21,1
<b>Exploring historical places</b>	10	17,5
<b>Swimming</b>	9	15,8
<b>Other</b>	12	21,1

60% of the visitors stated that they were not able to benefit from the recreational and touristic activities sufficiently (Table 10). Among these people, 37,8% stated that the fact that there were not enough accommodation facilities in the district hindered the use of touristic potential as much as desired. Equal percent of visitors (10,8%) stated that recreation and tourism were adversely effected by difficulty of accessibility, visual pollution, transportation security and water pollution. In the visitor questionnaires it was stated that the agglomeration caused by heavy crowd did not pose an obstacle to the utilization of recreational and touristic opportunities. Rest of visitors (13,5%) stated that some other factors, such as financial impossibility and so on were main obstacles (Table 10).



Table 10. The Breakdown of the evaluations of the visitors on Amasra in terms of recreational and touristic activities.

<b>Can you benefit from the recreational and touristic opportunities in Amasra sufficiently?</b>		
	<b>Number</b>	<b>%</b>
<b>Yes</b>	12	40,0
<b>No</b>	18	60,0
<b>What are the obstacles that prevent you from benefiting these recreational and touristic opportunities?</b>		
	<b>Number</b>	<b>%</b>
<b>There are not enough accommodation facilities</b>	14	37,8
<b>Transportation is difficult</b>	4	10,8
<b>Water pollution</b>	4	10,8
<b>Visual pollution</b>	4	10,8
<b>Transportation is not safe</b>	4	10,8
<b>Noise pollution</b>	2	5,4
<b>Other</b>	5	13,5

#### 4. DISCUSSION AND SUGGESTIONS

In the research area, which was examined in terms of sustainable tourism, the existing state of the natural and cultural values serving as a source to tourism was attempted to be presented via questionnaires. This section includes first the results of the questionnaires and the evaluations. Secondly, results of face to face meetings and observations in the area were assessed together and the natural and cultural values of Amasra district were, then, discussed in terms of sustainable tourism. The positive and negative effects of tourism on natural and cultural environment were discussed within the context of sustainable tourism and solution suggestions were developed.

##### 4.1 Evaluation of The Questionnaire Results Implemented on The People Living In Amasra District

- The questionnaire was implemented on 120 people- 81 males and 39 females.
- It was found that most of the people who stated that they were not originally from Amasra had been living in the district for over 10-15 years.
- The district hosts the highest number of visitors in July, August and June (Table 1). During these months, with the improvement in weather conditions and the warming of the sea water, there could be agglomerations in the district.
- Most of the visitors come from Ankara. Today, such small districts as Amasra are like places to escape from the stressful lives of the big cities. The fact that Amasra is close to such big cities as Ankara and Istanbul makes it easy to travel here.
- The most outstanding attraction in Amasra for both domestic and foreign visitors is its natural beauties. This is followed by the fact that it is located on the seaside and has historical areas (Table 2). In the study of Gülez (1994), most of the subjects who answered the questionnaire implemented stated that the natural beauty ranked in the first place. When the two studies are compared, it is seen that the visitors consider natural values in the first place. In this context, the sustainability of the natural values in Amasra is significant for the future of tourism in this area.
- The new buildings that are being built in Amasra center were found to be totally incompatible with the natural and historical fabric of the district (Table 3).
- According to the results of the questionnaire, it is found that the maintenance and repair works for the transfer of historical monuments and places to future generations was not adequate (Table 3). As it is understood from these results, protected old spaces that have been hosting many different cultures for ages with the unique archeological values have been spoiled by insusceptible use until today. These desolated places finally caught the attention of the officials but this time, practices that do not comply with natural texture were encountered.

- A large number of university and college graduates stated that they thought the sea in Amasra was polluted. According to the sea water test reports taken from the Provincial Directorate of Health, it is seen that sea pollution is seen in Amasra due to external factors (Anonymous, 2000b).
- The people living in the district did not think that the maintenance and repair works carried out in the district in order to transfer the historical monuments and places to future generations was compatible with the natural and historical fabric of the district. Protection of historical and archeological values as well as cultural elements in tourist destinations is as important as the protection of natural values. Because historical environment, as natural environment, serves as a source for tourism and is effected from it (Table 4).
- The people living in the area stated that there were negative environment factors that could hinder the development of tourism activities in the district. Among these factors are water pollution, visual pollution resulting from inadequate settlement area and unplanned urban development, noise pollution, short tourism season, inadequate investment, the possible negative effects of the thermal power plant planned to be built, inadequate number of social facilities, difficult transportation, the lack of educational background in the staff working in touristic facilities (Table 5).
- Because the center of the district is very limited for settling, settlements extended over to the places outside the center and the number of multi-storey buildings increased in steep slopes with rich plant cover. Actually, first clearance on vegetation cover was started with construction of Amasra Hardcoal Enterprises. Based on these results, the people living in the area think that although there is not an urgent threat for the vegetation in the area, the destroying elements will pose problems for Amasra in the future (Table 3).

#### 4.2 Evaluation of The Questionnaire Results Implemented on Visitors

- Most of the visitors stated that it was not their first time in the district. When the results are analyzed, it is found that those visitors who did not come to the district for the first time visit the district a few times a year or in every 2-3 weeks (Table 6).
- Most of the visitors stated that they came from Ankara. That Amasra hosts the highest number of visitors from Ankara and Istanbul can be explained with the fact that it is close to those big cities geographically (Table 7).
- Visitors mostly prefer to visit the district with their friends or families.
- Like the people who live in Amasra, the visitors of the district stated that the natural beauty of Amasra ranked in the first place as an attraction. That the district is by the seaside and has historical values ranked in the second place (Table 8). Natural beauty was also the first attraction in Amasra in the study that Gülez (1994) carried out.
- 24,6% of the visitors stated that they participated in the activities of exploring the nature. 21,1% of the subjects said that they did trekking. 21,1% of the people added to the questionnaire forms that they rested, engaged in photography and enjoyed the food and beverages. And among the remaining, 17,5% of the subjects stated that they explored historical places and 15,8% of the subjects said that they swam. Moving from the answers, it is understood that people mostly do recreational activities here (Table 9).
- It is revealed that most of the visitors could not benefit from the recreational and touristic resources in the region. According to visitors, the first reason behind not being able to benefit from the recreational and touristic resources in the region is the inadequate number of accommodation facilities in the district. And it is followed by financial impossibilities, difficult transportation, the fact that transportation system is not safe, water pollution, inadequate time, visual and noise pollution factors (Table 10).

Since 1960s, Amasra has entered a period in which tourism is taken seriously and in which there is an influx of tourists. This rapidly growing tourism tendency in the district resulted in some positive and negative effects on the natural and historical environment. These are:

##### *The positive effects of the rapidly growing tourism on Amasra's natural and historical environment*

The district forms an important part of the tourism potential of Bartın province. This results in attaching more importance to Amasra district in Bartın province. What is important at this stage is to use the benefits of the positive effects to improve the life quality of the local people and to increase visitor satisfaction, to preserve an

develop environmental values which serve as a resource for tourism. The positive effects of the growing tourism on urban landscape are listed below:

- New labor resources are created.
- When the fact that tourism is important in economic terms is understood in the district, the awareness and sensitivity towards protecting natural and cultural values increased.
- Tourism showed the necessity to protect the archeological and historical places in Amasra, the architectural characters and natural areas as well as to keep traditional handicrafts and traditions. Therefore, first of all, the areas that are required to be protected in the district were announced as protected areas by the Ministry of Culture. Historical buildings were taken under protection by registry decisions.
- In line with the growth of tourism, the renovation work of historical and archeological protected areas as well as monuments gained importance.
- Importance is attached to infrastructure and superstructure works for further growth of tourism.

#### *The negative effects of the rapidly growing tourism on Amasra's natural and historical environment*

Based on the analysis of the results of the questionnaire implemented and the observations made and opinions of the people, there are some negative effects which are inconsistent with the protection-utilization principles in the natural and cultural environment in the district. These are listed as below:

#### *Visual pollution*

- First of all, the biggest visual pollution in Amasra is caused by Amasra Hardcoal Enterprise's Energy Production Facility. This facility contradicts with Amasra, which has unique natural beauties and is covered in green.
- That Amasra is under protection did not prevent the increase of unlicensed buildings, houses that are not renovated pursuant to the rules, multi-storey and second houses. The fact that the center of the district has limited growth opportunities led to the building of adjacent buildings. The settlement in Kaleiçi and Boztepe districts which include both modern and old buildings caused to the occurrence of a view that is far from aesthetics.
- It is seen that necessary maintenance and repair work for the protection of buildings with historical and architectural value is not carried out; and among those whose maintenance and repair work is done, the compliance with environmental fabric in terms of color, the material used and flat height are not considered.

#### *Rapid urbanization*

- In the entrance of the district center, at Kaleiçi, Boztepe and Bedesten Settlements, the increasing number of unlicensed buildings create an incompatible view.
- Because the settlement area is limited, there is an intense settlement in the center. There are scarcely any open space. Therefore, multi-storey buildings are built in the steep slopes covered with natural plantation outside the center of the district, which contradicts with the traditional housing in Amasra.
- Scarcely any open green space exists in the district center, where there are too many buildings. That the open green spaces are scarce limits recreational uses.
- Due to the influx of visitors to the district based on the classical sea-sand-sun system during the summer months, there could be agglomerations up to ten times of the residents of the district and this exceeds the capacity of the district. As a result, it is seen that such problems as lack of water, hygiene problems, noise pollution, traffic jam, parking problems and destructions in historical places occur.

#### *Loss of historical and cultural values*

- Due to certain interests and the insensitivity of the people a very small number of historical buildings in Amasra survived until present day. These historical buildings are replaced by multi-storey concrete houses which are far from the look of the previous historical houses.
- Illegal housing around the castle widely damage the historical fabric of the district.
- The renovated houses are built in a modern style which is far from their original look.
- The castle walls which are under the intense pressure from both the local people and the visitors are abandoned since the necessary maintenance work is not done.

- The maintenance and repair work in historical places is not enough. And the maintenance and repair work that is done does not comply with the natural and historical fabric of the area.

#### *Solid waste problem*

- Solid waste in Amasra is stored under improper conditions. And that results in bad smell and sometimes dangerous blasts and noise pollution. The wastes left in the forest area in the 5th km of Bartın-Amasra highway causes to the loss of natural habitats.

#### *Infrastructure problem*

- Because there is not sufficient purification system, the pollution caused by the coal washing unit in Amasra Hardcoal Enterprise's facilities made it impossible to swim in the Small Port.
- All the waste water in Amasra is emptied to the sea without being processed.

#### *Destruction of the plant cover*

- There are destructions observed in the plant groups around Amasra Hardcoal Enterprise's Facilities.
- The fact that the city center is narrow led to the settlements to extend to the environs. There are openings in the green steep slopes surrounding Amasra and the number of settlements has began to increase in these areas.

#### *Loss of agricultural lands*

- With the development of tourism as of 1960s, the settlements started to extend over to agricultural lands.
- The limited agricultural land due to the sloping structure has been lost with such activities as the opening of new roads as a result of new settlements and mines etc.
- There are eroded areas due to such factors as water and wind erosion over the road going to Kaleşah Settlement.

#### *Other negative factors*

- Especially during the tourism season toilets, shower, changing rooms, benches, bins etc. are not able to meet the users need due to over use.
- The low quality in accommodation facilities and the fact that the number of trained staff speaking a foreign language is not enough have a negative impact on visitor satisfaction.

### **4.3 Suggestions for The Development of Sustainable Tourism**

For a successful tourism development in Amasra, an effective management plan should be accepted to eliminate the negative factors that obstruct sustainability of natural and cultural resources. The responsibility of the government, local authorities, voluntary environment institutions and visitors within the framework of this management plan are listed below:

#### **4.3.1 The Responsibilities of The Government and Local Authorities for The Development of Sustainable Tourism**

- Voluntariness and training programs should be organized and implemented for the local people and visitors in the development of sustainable tourism.
- In order to prevent the construction of buildings which do not comply with the natural and cultural fabric of the district in terms of their color, material and storey height, building bylaws that limit the color, material used and storey height should be implemented. Design and building standards should be developed and implemented.
- The historical urban fabric of the center of Amasra should be protected; and the historical buildings should be utilized for accommodation, dining, meeting or exhibition halls and as museum, club etc. Rules that control whether the registered building's renovation works are carried out according to the relevant regulations should be formed (Anonymous, 1999).
- Creating parking lots in limited spaces in the city center does not provide a solution to the problem. Large parking lots with a large capacity should be built around Fatih District.
- Development of sustainable tourism should include the utilization and activities that is convenient with the opportunities that the district offers. House hostels should be encouraged and generalized. Woodworking and woodcarving should be supported for the continuity of local traditions in Amasra.

- This job which does not descend from father to son today should be encouraged through training programmes.
- It is necessary to take precautions against solid waste problem in Amasra where the tourism potential is high and storage is difficult due to lack of space.
- The Antique Theatre that is under the ground and used as a cemetery should be excavated and necessary work to reintroduce it to tourism should be carried out.
- Restrictive regulations for multi-storey buildings and the quarries that largely destroy the plant cover and topography should be prepared. Legal regulations that will make it obligatory to arrange the surrounding of the existing buildings with endemic plant species should be introduced.
- Woody plant covers those drop leaves in winter months and herbaceous plants worth protection. Utilization of these species, which grow well under the ecological conditions of the area, in landscape works in the district will increase the change of success in the practices.
- The available spaces between the buildings in the center of Amasra, which has a narrow settlement area, should be used for recreational planning. Neglected parks in the shore line should be rearranged and used. The green spaces in the center should be increased and plantation works should be carried out by using the species that is convenient for the plant cover in the area. Children's playgrounds and recreational sites should be built.
- More spaces for public use should be included in planning for coastal areas. Buildings should be planned far from the coast and green spaces with endemic plant species should be formed in the coastal line. While arranging green spaces, inclusion of pedestrian roads and cycling paths, touristic facilities and stopovers, recreational and sports facilities should be concentrated on. While planning the coastal line, sitting areas, changing rooms and shower cabins should be planned as well. The negative effects of the firm ground in the Big Port should be softened with plant arrangements.
- In order to increase tourism investments to the desired level and to enhance the standards of the existing facilities the awareness of the investors should be raised and they should be supported as well. Besides, in-service trainings for the improvement of the professional knowledge and skills of the staff.
- The tourism activities should be diversified with alternative tourism activities and thus, extended over to the whole year. Alternative tourism activities as yacht tourism, cultural tourism, mountain and nature tourism and recreational activities such as bird watching, photography, trekking, cycling and boat trips should be developed as well. Climbing-trekking and cycling routes should be set under nature tourism. Resting areas should be built on the old Bartın-Amasra highway. This 5-km highway, on which there are ruins of Bedesten, Antique Roman Road, Kemerdere Bridge and Kuşkayası Monument, should be arranged as a climbing-trekking road. Bakacak point should be the meeting and resting area. In addition, boat trips from Amasra to the bays in the environs should be organized.
- The advertisement and billboards on the roadsides should be standardized.
- While choosing the fitting equipment, the ones that are compatible with the natural and cultural fabric of the environment in terms of their color and fabric should be chosen.

#### **4.3.2 The Responsibilities of The Voluntary Environment Institutions for The Development of Sustainable Tourism**

- These institutions should organize training seminars towards raising the awareness of the local people and the visitors on tourism and they should cooperate with local authorities in this process. In these seminars, first the importance of the development of sustainable tourism in terms of economics should be highlighted; and then what is required for the protection of natural and cultural landscape values as well as the proper behaviors of the government, tourism industry and tourists concerning sustainable tourism should be explained.
- These institutions should provide local support for the development of sustainable tourism and should stand against unplanned tourism activities.
- Brochures and other promotional materials which are prepared towards contributing to the introduction of natural and cultural values of Amasra and which are supported by local authorities should be distributed.
- Cleaning campaigns also supported by local authorities should be organized in tourist attractions

### 4.3 The Responsibilities of The Visitors for The Development of Sustainable Tourism

- The visitors should not disturb local people during their visit.
- They should respect the traditions, laws, regulations and natural and cultural values.
- To ensure that respect, the visitors should get introductory visual materials and documents about the traditions, natural, historical and cultural values of the district before they visit.
- The visitors should prefer the touristic and recreational activities that give the minimum damage to the natural and cultural environment.

The tourism industry, local authorities and environment institutions are to work in harmony for the development of sustainable tourism in Amasra, for the solution of abovementioned problems and for the implementation of what is suggested. It should be kept in mind that natural and cultural environment serve as a source for tourism in all phases and instead of maintenance, environment protection-oriented activities should be concentrated on.

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# CLIMATE CHANGES IN PROSPECT FOR THE WEST BLACK SEA FORESTS

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## Abstract

The paper deals with the changes of annual temperatures and precipitations in West Black Sea Region of Turkey. The of climatic features of the region for the forest growth is analyzed by the distribution of different climatic types of years (CTYs) and classes according to the standardized precipitation index (SPI) for 1901 – 2009. Based on the obtained trends of temperature and precipitation curves for 43 years, the future climate changes are predicted. According to the survey it was found that in almost all studied sites the climate was dominated by the warm - dry climatic type. The established trend of increasing of average annual temperatures and reducing of annual precipitations will expose a high risk to the forest growth and economy in the region. Certain basic recommendations for forest management are given by the authors.

**Key words:** temperature precipitation, trend curve model, climate type of year, SPI, West Black Sea Region

## Introduction

As well as around the world, the effects of climate change are also significantly manifested in Western Black Sea Region. Those climate changes show themselves as increases or decreased from normal climatic conditions.

Both of retrospective and predictive studies in Turkey have obtained various results. As well as those results are different in different regions, there are also different results for the same region in some studies. The climate dominating the shore line of all Black Sea Region is named “Black Sea Climate”. In the Black Sea climate, all of the seasons are rainy along the Black Sea shore and the effect of the sea is seen obviously, the annual mean temperature is 8 - 12<sup>0</sup>C. The rainiest region of Turkey is Black Sea region and most of the precipitation is seen in autumn and winter seasons (Anon. 2007). The regions in inner of Black Sea or the regions located behind the mountains display lower precipitation and colder air temperature than shore regions. But when determining the city-based climate types in Black Sea Region, it would be better to consider each of cities separately. In 5<sup>th</sup> climate change report of Turkey published in 2013, it was stated that there was a cooling trend of Black Sea Region climate. Again considering the previous data, it can be said that the rainiest regions of Turkey are shore and mountainside regions of Black Sea and Mediterranean. Evaluating the distribution of disaster events between 1940 and 2000 among Turkey, the leading region being affected from storm water in March-July period is Black Sea one rather than other parts of country. According to the 5<sup>th</sup> climate change report of Turkey, it is expected for future that the hydro-meteorological based landslips and rock falls will increasingly continue in inner parts of Black Sea Region (Anon. 2013).

Various results have been presented about Black Sea Region in recent studies focusing on climate of Turkey. In a study where the climate data of 2010 have been evaluated, while the average temperature values in Spring are above the normal values in other parts of country, those of Black Sea Region was within the normal limits. Again, while the regional annual mean precipitation in terms of agriculture/water year was normally 867 mm, it was 906 mm during 2009 - 2010 period. The precipitation has increased by 4.6% in 2010 in proportion to normal values. The precipitation level was below the normal limits in Giresun, Hopa, İnebolu and Zonguldak, within the normal limits in Artvin, Çorum, Düzce and Ordu, and above the normal limits in all other cities (ANON3 2011).

At the end of 2011, in an annual evaluation study about the climate of Turkey, it has been stated that the precipitation was below the normal limits in western Black Sea Region while most of Turkey have obtained normal or higher level of precipitation. While the mean temperature values in May 2011 were within the normal



limits in most parts of our country, it was below the normal limits in a part of western Black Sea Region. In October 2011, while the mean temperature values were below the seasonal normals around western Black Sea Region, the mean temperature in summer was within normal limits in most of Turkey but above the seasonal normals in Black Sea Region (ANON4, 2012).

In all of studies about the future estimations, an increase in temperatures in 21<sup>st</sup> century is expected for Turkey. According to the results of 5<sup>th</sup> Turkey climate change declaration in 2013, it has been estimated that the decreases will occur in winter precipitation in Mediterranean region of Turkey, while increases have been estimated for Black Sea region. At the result of study, slight increases have been predicted for surface temperature of all of Turkey between 2011 and 2040. But the real increases have been predicted for second period (2040 - 2070) in that study. The increase in this winter is approximately 1.5°C, and approximately 2.4 °C in summer. The increases in surface temperature are expected to reach at 3.5°C in winter and 6°C in summer towards the end of 21<sup>st</sup> century. The spring precipitations are expected to decrease in central and southern parts of Turkey in future. Despite that, it is predicted that the precipitation will increase in both of two seasons in northern parts of Turkey. Again for first 30 years, it is estimated that the surface flows will increase in western Black Sea region in both of two seasons (spring-autumn). From the forest growing environment, it is estimated that the upper forest level in southern parts of mountain series parallel with Black Sea shore will reach at 2800 m, and the forest lines of coniferous trees and coniferous + broad-leaved tree mixture are expected to enlarge in future (ANON2 2013).

In the next study based on meteorological data between 1961 and 1990, no significant trend could be detected for Turkey in precipitation series normalized according to averages. Considering the precipitation regions in terms of area, an increase has been detected in precipitation of Continental Eastern Anatolian region and the Black Sea region. While a slight decrease trend is observed in mean values of winter in general, a significant cooling trend was observed in temperatures in Sinop, Zonguldak and İnebolu (Demir et al. 2008).

According to another research on climate of Turkey, the most significant decreased in future precipitation will be observed in south-west coast. On the other hand, eastern Black Sea region is expected to obtain more precipitation in future (ANON1, 2007).

In another study of Türkeş et al. in 2002, they have stated that significant cooling trends have been found in mean temperature values of Black Sea Region and Eastern Anatolia's middle parts (Türkes et al. 2002). Also in a study of Türkeş et al. evaluating the long-term meteorological data of Turkey, differently from recent meteorological evaluation reports, it has been concluded that there were significant amount of stations with decreasing trend in winter and annual precipitation amount in rainy regime of Black Sea regions and Mediterranean regions. In precipitation density analysis in same study, besides the strong decrease trend in Black Sea rain regime region almost in every season, it has been found that the rate of decrease in all other rain regime regions are much higher (Türkeş et al. 2007). In this investigation, it was aimed to determine and discuss the changes in annual mean precipitation and mean temperature trends in Western Black Sea Region. The obtained results will compared with recent meteorological studies in Turkey. As a result of this study, we will be able to reveal the precipitation and temperature trend of Western Black Sea Region since 1970 and to make some prognoses about the future climatic variations.

## Material and Methods

The object of study is Western Black Sea Region of Turkey. Six cities in the region were selected for the investigation of climate changes – Fig.1.,

The mean annual temperature and total annual precipitation have been calculated by using the meteorological data for 43 years (1970 - 2012). Required climate data have been taken from General Directorate of Meteorology. Taking the data of this period as basement, the mean annual temperature and annual total precipitation amounts until 2025 were calculated applying a trend curve model.



Fig. 1. Objects of investigation

Time trend curves are applied as method for climate parameters prediction. This model has been used in a similar study of Bahadır (2011). The structuring of analysis was carried out via R -Package software (<http://act-r.psy.cmu.edu/software/>). Climatic types of years (CTYs), as well as the climatic background for forest vegetation (predominance of CTYs) were defined for the period 1901 - 2009 using SPPAM software. The climatic type of year is described by the deviation of average annual temperature ( $dT$ ) and annual sum of precipitation ( $dP$ ) of year from the respective climatic norm. The average annual temperature ( $T_{avg.}$ ) and precipitation ( $P_{avg.}$ ) and their confidence intervals ( $\mu_{ti}$  and  $\mu_{pi}$ ) at the level of significance -  $\alpha = 0.05$ ) for every 30 years were calculated, starting from 1901. The confidence interval,  $\mu$ , is calculated by the formula -  $\mu = 1.96 \frac{\sigma}{\sqrt{n}}$ , where  $\sigma$  is the standard deviation of average values of  $T$ ,  $T$  and  $P$ . Values inside the intervals:  $T_{avg.} \pm \mu_{ti}$  and  $P_{avg.} \pm \mu_{pi}$  respectively are considered as climatic norms for temperature and precipitation (Lyubenova et al. 2014). The used climatic types of years are: hot (H) -  $dT > \mu_{ti}$ , cold (C) -  $dT < -\mu_{ti}$ , wet (W) -  $dP > \mu_{pi}$  and dry (D) -  $dP < -\mu_{pi}$ . The year is with normal (N) average temperature, when  $-\mu_{ti} \leq dT \leq \mu_{ti}$ , and with normal sum of precipitation, when  $-\mu_{pi} \leq dP \leq \mu_{pi}$ . The standardized precipitation index (SPI) was also calculated (Naresh et al. 2009). The CTYs and SPI classes of cites climate for the period 1991 - 2009 was discussed. The climatic database CRU - TS was used as a source of temperature and precipitation for 1901-2009.

## Results

The climate for 109 years in the western Black Sea region of Turkey is characterized by the predominance of HD climatic types for most of the studied cites, except in Bartın, where CW prevails. The studied sites have arranged in the following order of decreasing percentage participation of dry climatic types: Zonguldak, Bolu, Karadak, Duzce and Kastamonu (respectively 40 - 35% from all types). The cold CTYs tacked the second place (38 - 35%) respectively for the sites: Karadak, Zongurlak, Balu and Duzce. In Bartın (39%) and Kastamonu (37%) the second place by participation was taken by the hot CTYs - Fig. 2. The significant and variable local role have had also cold - dry, cold - wet, cold and dry years. According to SPI, most years belonged to the normal class. The participation of mildly dry and mildly wet classes was noticeable and in most cases mildly wet class prevailed, except Zongurlak and Kastamonu. In Duzce the participation of extremely and severely dry classes and in Bolu - of very wet and extremely wet classes was found.

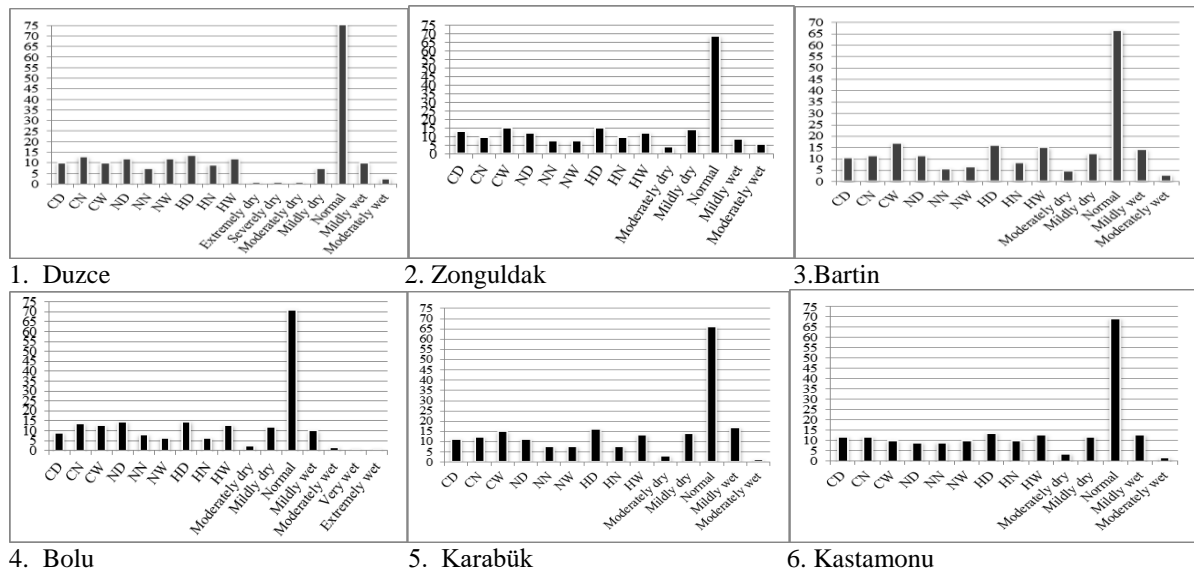


Fig. 2. Ratio (%) between CTYs and SPI classes for 1901 – 2009 in studied cites

Although the cities located in the same region, the climate has local features and the obtained results have been very different. Considering the city-based temperature values, increase is estimated for Kastamonu, Düzce, Bartın, Zonguldak and Karabük until 2025, and it is estimated that the increase in Bolu between 1970s and end of 1980s which transformed into decrease between 1990s and today will become increase again until 2025 – Fig.2.

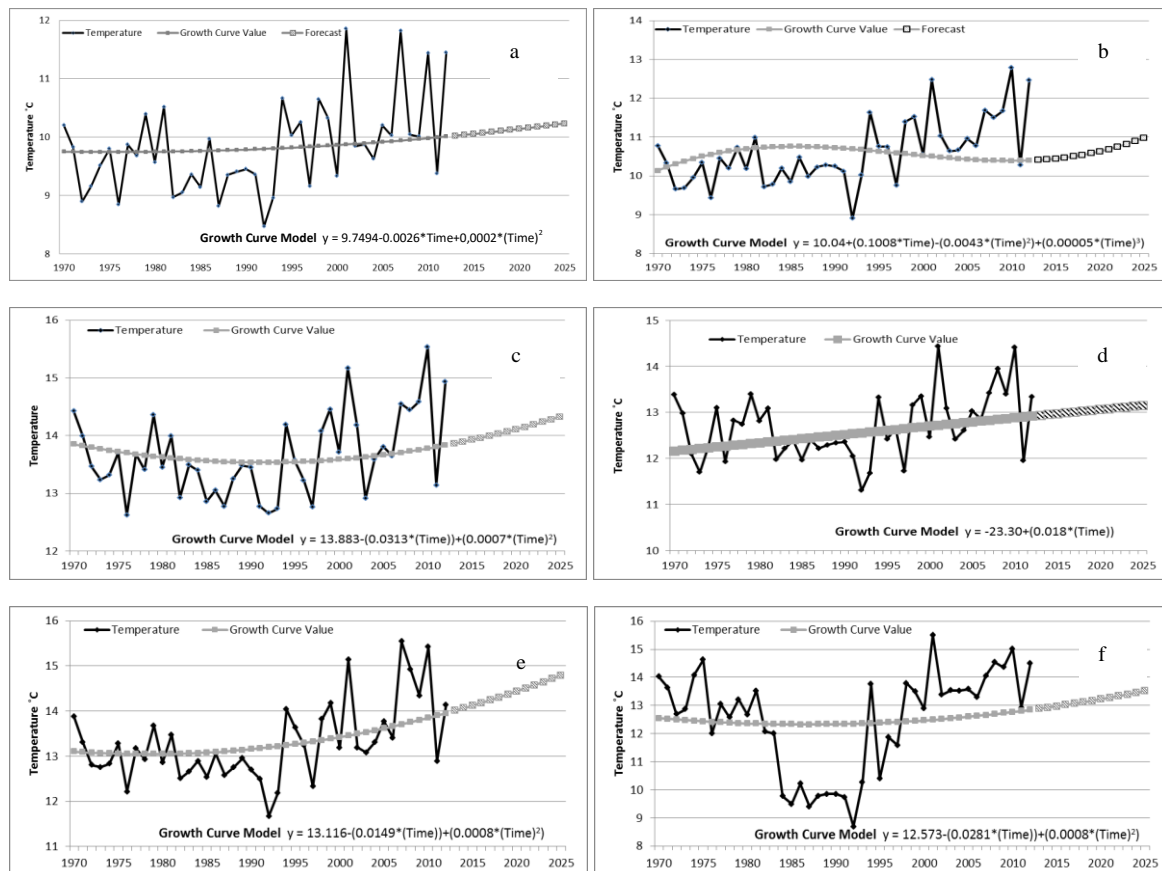


Fig. 3. Trend model of mean annual temperature variation for investigated cities (a: Kastamonu, b: Bolu, c: Zonguldak, d: Bartın, e: Düzce, f: Karabük)

For precipitation, while an increase is estimated in Kastamonu, the decrease is estimated for Bolu, Bartın, Zonguldak, Karabük and Düzce. Considering the trend curves, the lowest annual mean temperature of Kastamonu belongs to year 1992, while other lowest values belong to 1993, 1987, 1982, and 1976. A below-average trend has been observed between 1981 and 1994 especially in temperatures – Fig.3. But in following 20 years, a continuously above-average trend has been observed in mean temperature values. The hottest years were 2007, 2010 and 2012. But while there has been a fluctuating course in precipitation curve without extreme fluctuations in long term, the lowest precipitation value during 43 years of data belongs to 2007, while the highest annual mean precipitation value belongs to 2010. Differently from other 5 cities in study, an increase trend in precipitation is observed only in Kastamonu.

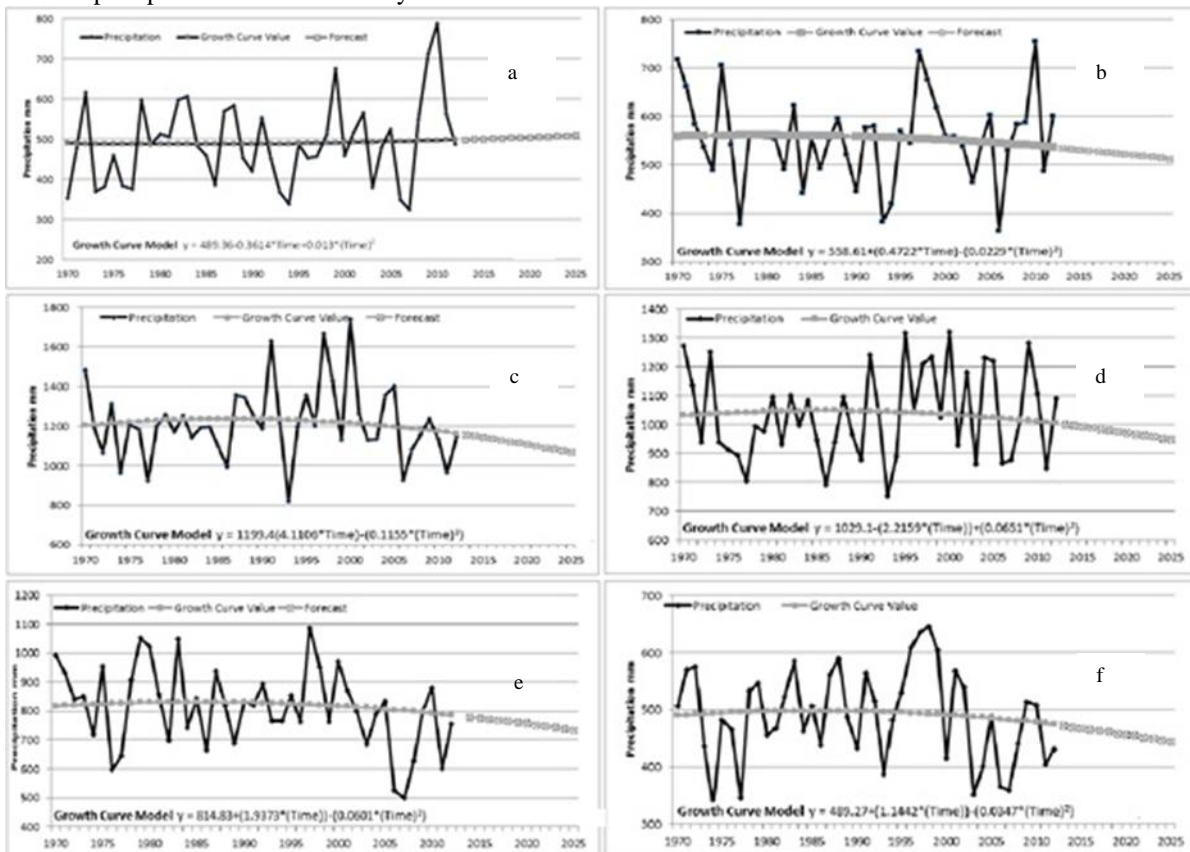


Fig. 4. Trend model of mean annual precipitation of investigated cities (a: Kastamonu, b: Bolu, c: Zonguldak, d: Bartın, e: Düzce, f: Karabük)

By averaging the mean values of all of the monthly data during 1970 - 2012 period, the annual mean temperature values were 12.75<sup>0</sup>C for Bartın, 10.58<sup>0</sup>C for Bolu, 13.32<sup>0</sup>C for Düzce, 13.54<sup>0</sup>C for Karabük, 9.8<sup>0</sup>C for Kastamonu, and 13.64<sup>0</sup>C for Zonguldak. The annual mean precipitation values during those 43 years are as follows: Bartın – 1035 mm, Bolu -554 mm, Düzce - 822mm, Karabük – 486 mm, Kastamonu – 490 mm and Zonguldak – 1222 mm.

According to data of previous years, a floating course is observed in temperature values of Bolu. The lowest temperature among the years belongs to 1992, while the highest value belongs to 2010 and 2012. During the 43 years of study, the annual mean temperature values have exceeded 12<sup>0</sup>C only in these two years. Also since 1998, the mean temperatures have never fallen under 10.5<sup>0</sup>C. Although there was a decreased trend seen since early 1990s in Bolu's growth curve analysis, it is estimated that the increase trend will be seen in the period until 2025. Considering the historical graphic of Bolu in terms of precipitation, positive extreme values were seen

between 1970 and 1975 and negative extreme values were observed between 1977 and 1993, while the lowest annual mean precipitation value belonged interestingly to 2006 and the highest one - to 2010.

Evaluating the temperature graphic of another investigated city, Zonguldak, it is seen that the highest temperature values belong to 2010 and 2012 although the temperature trend follows a narrow course. When evaluating the precipitation graphic, it is seen that the extreme values were negative in 1993 and positive in 1991, 1997 and 2010. Although the temperature values haven't showed a high fluctuation, the hottest year was interestingly 2010 despite of decrease trend. Considering the precipitation status of Bartın during 43 years, it is seen that the lowest precipitation belonged to 1993, while the highest precipitation belonged to 1995 and 2000. Considering the trend curve, it is seen that there is a decrease in precipitations and also there is a very low amount in 2011 despite of high annual mean precipitation values in recent years.

Table 2. The mean annual temperature estimations for cities

YEARS	BARTIN	BOLU	DUZCE	KARABUK	KASTAMONU	ZONGULDAK
2013	12.93	10.41	14.01	12.89	10.02	13.86
2014	12.95	10.42	14.07	12.93	10.04	13.89
2015	12.97	10.44	14.12	12.97	10.05	13.92
2016	12.99	10.47	14.18	13.02	10.07	13.96
2017	13.01	10.50	14.24	13.07	10.09	13.99
2018	13.02	10.54	14.31	13.12	10.10	14.03
2019	13.04	10.58	14.37	13.17	10.12	14.07
2020	13.06	10.63	14.44	13.22	10.14	14.11
2021	13.08	10.68	14.50	13.28	10.16	14.15
2022	13.10	10.75	14.57	13.33	10.17	14.19
2023	13.11	10.82	14.64	13.39	10.19	14.23
2024	13.13	10.90	14.72	13.45	10.21	14.28
2025	13.15	10.98	14.79	13.51	10.23	14.33

Table 3. The annual total precipitation value estimations for cities

YEARS	BARTIN	BOLU	DUZCE	KARABUK	KASTAMONU	ZONGULDAK
2013	1000.57	535.05	783.72	472.44	498.63	1156.66
2014	996.99	533.49	780.31	470.49	499.42	1150.49
2015	993.28	531.87	776.77	468.48	500.24	1144.09
2016	989.44	530.22	773.12	466.40	501.09	1137.46
2017	985.47	528.51	769.35	464.24	501.96	1130.60
2018	981.37	526.76	765.46	462.02	502.86	1123.50
2019	977.15	524.97	761.45	459.73	503.79	1116.18
2020	972.79	523.13	757.31	457.37	504.74	1108.63
2021	968.30	521.24	753.06	454.94	505.72	1100.84
2022	963.68	519.31	748.69	452.44	506.72	1092.82
2023	958.93	517.33	744.19	449.87	507.75	1084.57
2024	954.05	515.31	739.58	447.23	508.81	1076.10
2025	949.04	513.24	734.85	444.53	509.89	1067.39

When the temperature graphic of Düzce was evaluated, the significant increase draws attention, and it is estimated that this trend will continue until 2025. Considering the aspect of temperature, the lowest temperature belonged to 1992, while the highest temperatures have been seen in recent years, as well as other cities. The decrease trend in precipitation is seen also. Considering the aspect of extreme values, while the extremely high precipitation values have been obtained especially in 1979, 1980 and 1983, the significant decrease in annual mean precipitation amount of Düzce draws attention in recent years.

Having more continental climate structure in proportion to other cities in western Black Sea Region, Karabük's mean annual temperature values show increasing trend. Considering especially recent years, it is seen that temperature values have showed above-average course continuously after late 1990s. The mean annua

temperature of Karabük in 2010 has exceeded 15<sup>0</sup>C, the highest level of 43 years of study data. In contrast with temperature, the precipitation values are in decrease trend. It is estimated that this situation will continue until 2025.

Evaluating the tables presented for future of those 6 cities via trend curve analysis, it is seen that there is a general increase trend in temperature and decrease trend in precipitation in western Black Sea Region – Table 3 and 4. First of all, when considering the cities where the increases are observed in temperature, the highest increase is in Düzce (0.78<sup>0</sup>C). Although this value is not seen to be very high, when considering that it is estimated for 13 year, it draws attention that there will possibly be a very high increase until the end of century. The temperature increase of Düzce is followed by Karabük (0.62<sup>0</sup>C), Bolu (0.57<sup>0</sup>C), Zonguldak (0.47<sup>0</sup>C), Bartın (0.22<sup>0</sup>C) and Kastamonu (0.21<sup>0</sup>C).

In precipitation table decrease is estimated for 5 cities of western Black Sea region and increase is estimated for 1 city. The estimated decreased are as follows: 89.27 mm for Zonguldak, 51.53 mm for Bartın, 48.87 mm for Düzce, 27.91 mm for Karabük and 21.81 mm for Bolu. From the aspect of precipitation, among those 6 cities, the increase is estimated for only Kastamonu. That increase is 11.26 mm for the end of 2025.

## Discussion

The analyzes of regional climate for 109 years by the distribution of climatic types of years provides an opportunity to assess the risk of predicted changes as the vegetation cover of area and the agricultural practices are largely adapted to this climate background. The predominance of hot - dry climatic type along almost all the cities, despite differences in the proportion of other climatic types, will put at a risk the area, if the trend of temperatures increasing and precipitation reducing will continue. Most affected will be the sites with high participation of dry CTYs and the sites where there was found the presence of Extremely dry SPI class – Duzce.

The climate change is a frequently spoken situation affecting the entire world. The changes in climate of our world don't show itself only in temperature and precipitation but also in natural life, drought, agriculture, forestry, human health, sea water level, and many other fields in long-term. This change occurs especially due to human-originated CO<sub>2</sub> and other sera gases. The chemical signature of natural sera gases is different from that of human-originated gases. The heating trend in recent decades is estimated to continue increasingly if the required measures are not taken (Nychka et. al. 2008). In IPCC report in 2013, it has been stated for the first time that there is climate change, it arises mainly due to human-originated activities, and continue increasingly (Mackenzie 2008).

Climatologists and mathematicians use various methods for estimating our future climate. Mathematic plays the major role in climate estimations (URL1 2014). For this purpose, it was aimed to estimate possible changes in temperature and precipitation in near future by profiting the existing climate data of western Black Sea region which can be accepted as a small area.

The analyses evaluated show a temperature increase for 5 out of 6 cities, while precipitation decrease is also estimated for 5 out of 6 cities, in parallel with trends seen in western Black Sea region in recent years.

When evaluating the data of previous years, it is seen that a milder change has occurred in temperature of western Black Sea region in proportion to southern and western parts of Turkey. It draws attention that there is an inconsistent trend in same region in proportion to previous years; rather than a balanced rain regime, an excessively rainy month follows a drought month.

Considering from the aspect of forest fires, western Black Sea Region is an area which has not been well studied because it is relatively secure region. But because of gradually increasing temperature, summer droughts, and black pine fields, there can be large forest fires in and around Karabük. Becoming a potential fire area with the effects of factors mentioned above, Karabük will possible face with bigger forest fires in future if the trends in temperature and precipitation will continue in same way.

Eastern Black Sea region is thought to be affected from global warming because of its geographical structure, but in recent years it is seen that winters are warmer and the duration of snow cover on surface is getting shorter. It is stated that the temperature of region increases by  $0.54^{\circ}\text{C}$  annually (URL-2 2014). The frequency of local but destructive floods increases, the annual precipitation distribution varies depending on precipitation index. An increase is observed in downpours with short duration. As a result of rapid melting of snow because of vaporization increase depending on temperature, the above-/below-surface water resource balance is affected negatively. Even though the precipitation amount won't decrease, the inconsistent and excessive precipitation increases the risk of landslide and flood in region.

In coordination of public institutions, universities, non-governmental organizations, and manufacturer representatives, the early warning system based on estimation of actual and future meteorological events out of seasonal normal limits should be prepared and the agricultural production should be planned. In Black Sea region where the out-of-season excessive precipitation increase is expected, the implementations which harm the natural structure and superficial soil cover must be avoided in soil processing, infrastructure and industry investments. As a result of wrong and unconscious implementations, the erosion, mass soil movements and consequently destructive floods in slopes and agricultural areas having destroyed balance will inevitably lead to live and capital losses. Within this scope, as a result of cooling in recent years and consequently the precipitation, there are many advantages for the protection of mixed stands. The resistance of mixed stands against especially flood, avalanche and landslide is higher than that of pure stands because the inter-individual cooperation is at maximum in mixed stands. So, in order to ensure the sustainability of mixed stands consisting of needle-leaved and broad-leaved trees and light-shadow tree species, the natural and artificial regeneration efforts should be continued via combined group methods by considering the age-length superiority determined according to ecological actual conditions.

Also, depending on the growth phases, it is very important to sustain mild and continuous maintenance effort in form of frequent maintenance and spacing in both of pure and mixed stands. The implementation of regular selective lumbering activities in pure abies stands which is suitable for selection business in higher altitudes (forest border-tree border) in all western Black Sea Region and being operated according to vertical closure and diameter classes can protect the middle and bottom covers, and is one of the leading natural silvicultural measures against climate change.

As well known, forests are not only a natural resource consisting of trees. Besides the trees, forests are dynamic creatures changing continuously and consisting of above- and below-surface micro and macro fauna and vegetation structure. That's why; the protection of species in underbrush of forests such as common burdock, heder, holly, scarlet firethorn, woadwaxen, sword fern, rose hip, boxwood in bush form, and taxus in shrub form is very useful for both of protection of biological diversity and for tolerating the harmful results of climate change.

## Conclusion

The evaluated analyses demonstrated that the temperature will increase for 5 out of 6 cities, while precipitation will decrease also for 5 out of 6 cities, in parallel with trends seen in western Black Sea region in recent years. The studied sites are in the same geographical area, but there are local variations in regional climate. However, in investigated 109-year period prevailed hot and dry climatic types and SPI classes in almost all sites. The forecasted increase in temperature and decrease in precipitation will affect a stress on the forest ecosystems – a reduction of the forest production, also an amendment in the species composition, a reduction in the biodiversity, a reduction of the total forest area and thus affect the economy of area. Most at risk are the forests along the sites with higher participation of dry CTYs and these near Duzce where it was detected the existence of Extremely dry SPI class for a period of 109 years.

In relation to the the predicted climate changes, the maintenance of mixed stands and complicated form of tree layer (multi-species and multi-aged stands) for greater sustainability of natural and cultural forest ecosystems will be of a great importance. The regular fellings must be planned so as to preserve the environment-forming role of trees in first and second Krafts classes, which is essential to maintaining the productivity of forest stands

The retaining of shrub and herbaceous layers will contribute to the conservation of biodiversity, forest ecosystem itself and to mitigate the climate changes.

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# LUCIS MODELİ İLE KONUT YERLEŞİMİNE FİZİKSEL AÇIDAN UYGUN ALANLARIN BELİRLENMESİ, BARTIN KENTİ ÖRNEĞİ

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## ÖZET

Günümüzde hızlı nüfus artışına bağlı olarak, kentler hızla gelişmekte ve kentsel alanlar kırsal alanlara doğru genişlemektedir. Kentsel peyzajdaki bu değişim, daha çok yeni konut yerleşimlerine duyulan talep ile ortaya çıkmakta ve bu talebin plansız bir şekilde karşılanması da çarpık kentleşmeye neden olmaktadır. Özellikle deprem ve sel gibi doğal afetler ya da çevre kirliliği vb. insan kaynaklı problemlerin tehdit ettiği kentlerde, biyolojik, fiziksel, sosyal ya da ekonomik kriterlerin bir kısmını göz ardı eden planlama kararları alan kullanım sorununu daha da arttırmaktadır. Araştırma alanı olarak seçilen Bartın kenti de 1991 yılında il olduktan sonra hızlı bir gelişme sürecine girmiş ve nüfus artışına paralel olarak ortaya çıkan konut talebine cevap verebilecek uygun alan tercihleri gündeme gelmiştir. Özellikle son yıllarda planlarcı tarafından yoğun olarak kullanılan GIS tabanlı uygunluk analizleri, planlama aşamalarına önemli katkı sağlamaktadır. Bunlardan biri de ArcGIS araçlarını kullanılarak 2007 yılında geliştirilen ve Florida eyaleti için uygulanan LUCIS modelidir. Bu araştırmada uygunluk analizlerinde yeni bir yöntem olan LUCIS modelinin ilk üç aşaması kullanılarak, Bartın kenti mücavir alan sınırları içerisinde, konut yerleşimine fiziksel açıdan uygun alanların belirlenmesi amaçlanmıştır. Yöntemde, amaç-tabanlı LUCIS modeli, çalışma alanı için uyarlanarak uygunluk analizleri gerçekleştirilmiştir. Bu kapsamda ilk önce, alana özgü konut yerleşimini etkileyebilecek fiziksel faktörlere ait amaçlar (kriterler) belirlenmiştir. İkinci aşamada, envantere ait harita altlıkları kullanılarak, ArcGIS ortamında, analizler için gerekli olan veri katmanları hazırlanmıştır. Daha sonra, amaç ve alt amaçlar için GIS modelleri oluşturulmuş ve bunlar çalıştırılarak uygunluk analizleri gerçekleştirilmiştir. Elde edilen haritalar, atanan ağırlıklara göre birleştirilerek, konut yerleşimine fiziksel açıdan en uygun alanlar belirlenmiştir. Son bölümde ise, analizlerden elde edilen bulgular değerlendirilerek mekânsal sonuçlar ortaya konulmuştur.

**Anahtar Kelimeler:** Konut yerleşimi, uygunluk analizi, fiziksel uygunluk, LUCIS modeli, Bartın.

## ABSTRACT

Nowadays with parallel to increase in population size, settlements develop rapidly and urban areas continuously expand towards the countryside. This change in urban landscapes usually comes into light with demands for new residential areas and efforts to meet these demands result with unplanned urbanisations. Planning decisions ignoring some of biological, physical, social or economical criteria of the land increase land-use problems much more especially in cities that threatened by natural disasters such as earthquake and flood or problems caused by human beings such as environmental pollution and so on. Settlement of Bartın, the study area, started to develop rapidly after becoming a city in 1991. On the other hand, fast population growth has increased peoples demand for new residential areas. Recently, GIS based suitability analyses that are extensively used by planners all over the world, provides important contribution to planning stages. One of them is LUCIS model (Land Use Conflict Identification Strategy) developed in recent years by use of ArcGIS tools and applied to the State of Florida. In this study, it was aimed to find out physically suitable areas for residential development in adjacent area of The City of Bartın with using the only first three steps of LUCIS model that is forming a new method of suitability analysis. In the methodology, goal driven model of LUCIS was adapted for study area and suitability analysis were carried out. Firstly, objectives (model criteria) belonging to physical factors of study area were defined. Secondly, required data for analyses were created and combined together with using ArcGIS tools with use of map layers collected in inventory stage. Then, suitability analysis were carried out by running GIS models that were already created for each objective. All suitability layers were combined together with regard to assigne

weights to find out lands physically suitable for residential use. Finally, findings of analysis were evaluated in respect to existing land uses and conclusions were drawn on the spatial allocation of land uses.

**Keywords:** Residential land use, suitability analysis, physical suitability, LUCIS model, Bartın.

## 1. GİRİŞ

Gelişmekte olan ülkemizde ekolojik temele dayalı sürdürülebilir bölge ve kent planları, ülkesel ve yerel yönetimlerde henüz geçerli bir planlama aracı olarak görülmemektedir (Nayim, 2010). Kiemstedt (1998)'in de belirttiği gibi mekansal gelişimin titizlikle ve akılcı olarak yönlendirilmesi ve bu bağlamda çevreye özgü ekolojik verilerin daha fazla ağırlık kazanması, dünyadaki tüm ülkelerin uyması gereken bir zorunluluk olarak ortaya çıkmaktadır.

BM Çevre ve Kalkınma Komisyonu'nun 1987 yılında hazırladığı 'Ortak Geleceğimiz' konulu raporunda doğa korumanın kalkınmaya engel teşkil etmediği, aksine doğal çevreyi korumanın sürdürülebilir kalkınma için önemli olduğu belirtilmektedir (Anonim, 1991). Sürdürülebilir kentsel gelişim, sürdürülebilir kalkınma ile birebir ilişkilidir. Temelde aynı ilkeler benimsenmektedir. Ekolojik, kültürel ve ekonomik özelliklerin bir arada uyum içinde olduğu gelişmeler, tüm kalkınma politikalarının ortak dayanağını oluşturmaktadır.

Türkiye'nin de dahil olduğu Avrupa Peyzaj Sözleşmesi'nde sürdürülebilir gelişimin sosyal, ekonomik ve çevresel özellikler arasında uyumlu bir ilişkiye dayandığı vurgulanmıştır (Url-5). Bu nedenle yakın zamana kadar sadece ekonomik hedeflere öncelik veren, kent ve bölge planlama anlayışı son yıllarda yerini doğal çevrenin korunmasına yönelik akılcı ve geniş kapsamlı bir planlama kavramı olan ekolojik planlama anlayışına bırakmıştır (Yılmaz, 2001).

Ekolojik planlama, sürdürülebilir gelişimin temelini oluşturmaktadır. Kentlerde ekolojik hedeflere yönelik fiziksel faktörlere dayalı düzenlemeler, ekolojik planlamanın konusuna girmektedir. Ekolojik planlama yöntemi, en uygun alan kullanımı uygulamasının nerede olacağını belirleyebilmek için alanın biyofiziksel ve sosyokültürel sistemlerinin incelenmesini içermektedir. (Steiner, 2000). McHarg (1992) ise ekolojik planlama yönteminde potansiyel alan kullanımı için en uygun alanların belirlenmesinde, kullanımları etkileyen ve birbirini izleyen bir dizi faktörün değerlendirildiğine dikkat çekmektedir.

Türkiye'deki tüm kentlerin ana sorunu, yerleşim alanları planlanırken, fiziksel ve doğal özelliklerden daha çok ekonomik ve sosyokültürel faktörlerin dikkate alınmasıdır. Mekânların fiziki şartları doğru bir şekilde analiz edilmeden, uygun olduğu tam olarak belirlenmeyen alanların yerleşime açılması kullanıcılar açısından olumsuz sonuçlar doğurmaktadır. Son zamanlarda ülkenin çeşitli bölgelerinde yaşanan sel felaketleri, deprem, heyelan gibi doğal afetlerin, birçok insanın ölümüne, uzun vadeli maddi ve manevi kayıplara neden olduğu görülmektedir. Yaşanan kentleri, sorunlu birer mekân haline getiren sürecin sebepleri şu şekilde açıklanabilir:

- Ülkesel ve bölgesel boyutta ekolojik, biyolojik ve fiziksel envanter çalışmalarına dayanan veritabanlarının eksikliği,
- Bu verilerin ülke, bölge ve kent ölçeğinde politikalar ile beraber değerlendirilerek bir plan çerçevesine yansıtılmaması,
- Alan kullanımı taleplerini karşılarken, alanın gelecek ile ilgili hedefleri ile alanlara ait veriler arasındaki bağlantıyı sorgulayan uygunluk analizlerinin gerçekleştirilmemesi,
- Kullanımların yerel düzeyde alınan kısa vadeli ve ekonomik çıkarın ön plana çıktığı çözümlere dayanması,
- Doğa korumaya önem vermeyen ve canlı yaşamını tehlikeye atan kullanımlara göz yuman yönetim anlayışı.

Son zamanlarda alan kullanım planlamasında sıklıkla uygunluk analizlerinden faydalanılmaktadır. Kullanılan kriterlere ve analiz yöntemlerine göre farklılıklar bu modellerden birisi de Florida Üniversitesi'nde geliştirilen LUCIS modelidir. Alan kullanım kategorileri için belirlenen amaçlara (kriterlere) bağlı olarak gerçekleştirile

uygunluk analizleri sonucunda, gelecek alan kullanım uyumsuzluklarının mekânsal olarak ortaya konulabilmesi için, ArcGIS ortamında oluşturulan, beş aşamalı bir modeldir (Carr and Zwick, 2007).

Bu çalışmanın amacı, Bartın kenti mücavir alanında, LUCIS modelinin ilk üç aşamasını kullanarak konut yerleşimleri için fiziksel açıdan uygun alanları belirlemektir. Dolayısı ile çalışmanın bir diğer amacı LUCIS modelini Bartın kenti özelinde uyarlayarak uygunluk analizlerini söz konusu alan için denemektir. Bu kapsamda fiziksel faktörlere bağlı olarak oluşturulan amaçlar için uygunluk analizleri yapılmış, bulgular değerlendirilerek, denemeye ilişkin sonuçlar ortaya konulmuştur.

## 2. MATERYAL VE YÖNTEM

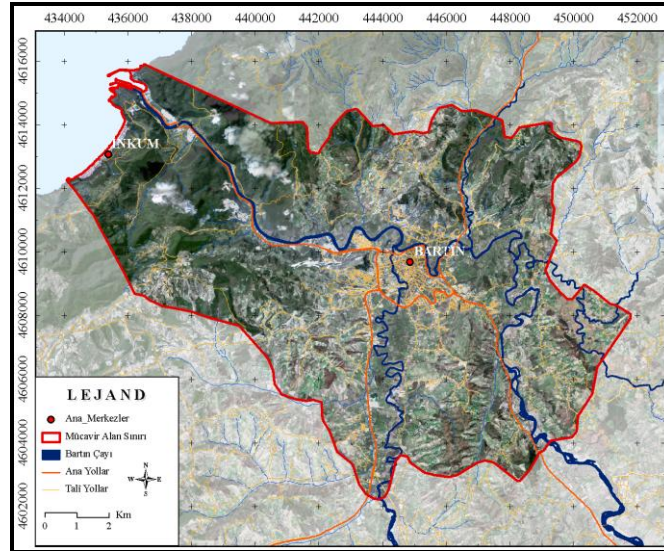
### 2.1 Materyal

Araştırmada yararlanılan materyaller:

- araştırma konusuna ve yöneme temel oluşturan literatür bilgileri,
- konut yerleşimi gelişimini etkileyen araştırma alanına özgü fiziksel özellikler ve alanı etkileyen risk faktörlerine ait çeşitli kurumlardan alınan haritalar, planlar, raporlar ve uydu görüntülerinden oluşturulan veri katmanları,
- modelin çalıştırılması ve uygunluk analizleri için gerekli olan ve çeşitli yazılımlar yardımıyla oluşturulan harita altlıkları,
- araştırma boyunca yoğun bir şekilde kullanılan ArcGIS 9.3, ERDAS 8.6 vb başta olmak üzere, çeşitli bilgisayar yazılımlarıdır.

#### 2.1.1 Çalışma Alanı

Çalışma alanı, Batı Karadeniz Bölümü'nde Bartın il sınırları içinde yer almaktadır. İl kuzeyde 59 km'lik kıyı şeridi ile Karadeniz'e, doğuda Kastamonu, güneydoğuda Karabük, batıda Zonguldak illeri ile komşudur (Bartın Valiliği, 2008). Çalışma; Bartın kent merkezi ve çevresi için uygulanmış, mücavir alan sınırları içindeki kısmı ele alınıp yorumlanmıştır (Şekil 1). Mücavir alan sınırı, 1:25000 Bartın ili Nazım İmar Planı'nda elde edilmiştir (Bartın Belediyesi, 2004). Toplam yüzölçümü 13641 ha'dır. Kent merkezine ait konut yerleşimleri, Karadeniz'den 15 km iç kesimde, Bartın nehri çevresinde ve tepelik arazilerde yoğunlaşmaktadır.



Şekil 1. Bartın kenti mücavir alan sınırı (Url-2).

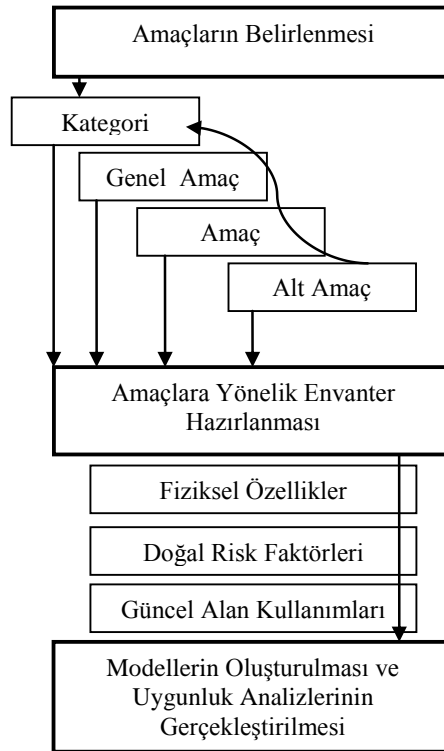
## 2.2 Çalışma Yöntemi

Çalışmada temel alınan LUCIS (land use conflict identification strategy) modeli amaç eksenli bir GIS modelidir. Florida için gerçekleştirilen çalışmada arazi kullanımları tarım alanları, koruma alanları ve yerleşim alanları başlıkları altında sınıflandırılmış ve analizler bunlara göre yapılmıştır (Carr and Zwick, 2005; Carr and Zwick, 2007). Modelin hedefi, belirlenen ana alan kullanım kategorileri altında oluşturulan amaçlara göre uygunluk analizleri yaparak gelecekte alan kullanım uyumsuzluğu ya da çatışması görülmesi muhtemel alanları tespit etmektir. Modelin çalışması 5 aşamaya dayanır:

- Modelde uygunluk kriterlerine dönüşecek olan amaç ve alt amaçların belirlenmesi,
- Envanter çalışması ve GIS modellerinde kullanılacak olan vektör ve raster harita katmanlarının oluşturulması,
- GIS modellerinin oluşturulması ve uygunluk analizlerinin gerçekleştirilmesi,
- Uygunlukların ağırlıklı olarak kombine edilmesi ile nihaî alan kullanım tercihlerinin ortaya konulması,
- Alan kullanım kategorileri arasında gelecekte görülmesi muhtemel uyumsuzluk alanlarının belirlenmesi.

LUCIS modeli birkaç alan kullanım kategorisine bağlı olarak karmaşık analizler yapmaya imkân vermektedir. Bu analizler, her amaca yönelik olarak ArcGIS ortamında ModelBuilder araçları ile oluşturulan modellerin çalıştırılması ile gerçekleştirilmektedir.

Bartın kenti konut yerleşimine fiziksel açıdan uygun alanları belirlemek amacıyla yürütülen bu çalışma; Bartın kentinde tarım, koruma ve yerleşim alan kullanımına bağlı olarak uyarlanan LUCIS modeli için yerleşim kategorisi altında oluşturulan bir bölümü içermektedir. Yöntemin bu kısma ait parçası, yerleşim alanları içinde 'konut yerleşimlerine fiziksel açıdan' uygunluğu belirlemek amacıyla oluşturulan genel amaç, amaç ve alt amaç hiyerarşisi içinde sadece 'alt amaçlara' ait analizleri içermektedir. Yöntemin Şekil 2'de verilen ve uygunluk analizlerine kadar olan genel kısmını içeren bölümünde amaç hiyerarşisi görülmektedir.



Şekil 2. Araştırma yöntemine ait aşamalar

Bu çalışmada yöntemle ait aşamalar, konut yerleşimine fiziksel açıdan uygun alanların belirlenmesi amacı için ele alınan 7 adet alt amacın oluşturulmasını, alt amaçlara yönelik envanterin hazırlanmasını, GIS modellerinin oluşturulmasını, uygunluk analizlerinin gerçekleştirilmesini ve bulguların değerlendirilmesini kapsamaktadır.

### 3. MODELİN UYGULANMASI

#### 3.1 Model Amaçlarının Belirlenmesi

Amaçları oluşturmadan önce Bartın kentindeki konut yerleşimini sınırlayan başlıca şu fiziksel faktörler belirlenmiştir:

- Sel riski
- Zemin özellikleri,
- Arazi eğimi,
- Trafikten kaynaklanan gürültü vb.,
- Zararlı atık alanlarına yakınlık,
- Hava kalitesini etkileyen unsurlar,
- Deprem ve heyelan riski.

Ana başlıklara karar verilirken kentin;

- 1968 yılında geçirdiği deprem olayı,
- 1998 yılında yaşadığı büyük sel felaketi,
- heyelan riski taşıyan eğimli topografyası,
- hassas jeolojisi ve
- yağışlı iklimi gibi fiziksel özellikleri yanı sıra;
- ulaşım, katı ve sıvı atık depolama alanları ve sanayi alanları gibi güncel alan kullanımlarına dayalı sorunları, konut yerleşimlerinin gelişimini sınırlayan fiziksel faktörler olarak ele alınmıştır.

Bu başlıklar ışığında Bartın'da konut yerleşimine fiziksel açıdan uygunluğu araştırarak amaç hiyerarşisi oluşturulmuştur. Burada hedeflerden alt amaçlara doğru hiyerarşik bir sınıflandırma oluşturulmuştur. Model çalıştırılırken ise tümevarım prensibi ile alt amaçlardan yukarı doğru analizler gerçekleştirilmiştir.

LUCIS modeli kapsamında çalışmada ele alınan ve aşağıda altı çizili olarak gösterilen amaç ve alt amaçlar, bağlı oldukları üst amaçlarla birlikte hiyerarşik olarak şu şekildedir:

Alan Kullanımı: Yerleşim (Y)

Kategori Amacı: Yerleşim için en uygun alanların tanımlanması

(YGA1) Genel Amaç 1: Konut yerleşimi için uygun alanların belirlenmesi

(YGA1A11) Amaç 1.1: Konut yerleşimine fiziksel açıdan uygun alanların belirlenmesi.

(YGA1A11AA11) Alt Amaç 1.1.1: Sel açısından riskli olmayan alanların belirlenmesi.

(YGA1A11AA12) Alt Amaç 1.1.2: Zemin özellikleri bakımından konut yerleşimine uygun alanların belirlenmesi.

(YGA1A11AA13) Alt Amaç 1.1.3: Eğim özellikleri bakımından konut yerleşimine uygun alanların belirlenmesi.

(YGA1A11AA14) Alt Amaç 1.1.4: Trafikten kaynaklanan fiziksel olumsuzluklar (gürültü, vb) bakımından konut yerleşimine uygun alanların belirlenmesi.

(YGA1A11AA15) Alt Amaç 1.1.5: Katı atık alanlarına olan mesafe bakımından konut yerleşimine uygun alanların belirlenmesi.

(YGA1A11AA16) Alt Amaç 1.1.6: Hava kalitesi bakımından konut yerleşime uygun alanların belirlenmesi.

(YGA1A11AA17) Alt Amaç 1.1.7: Deprem ve heyelan riski bakımından konut yerleşimine uygun alanların belirlenmesi.

### 3.2 Amaçlara Yönelik Envanterin Hazırlanması

Bu aşamada alana yönelik olarak daha önce belirlenen fiziksel özelliklere ait envanterden, özellikle ArcGIS ortamında farklı araçlar kullanılarak, model amaçları için gerekli harita altlıkları hazırlanmıştır. Söz konusu envanter ve onlardan elde edilen katmanlar Tablo 1’de verilmiştir.

Tablo 1. Envantere bağlı olarak modeller için oluşturulan harita katmanları

<b>Kullanılan Haritalar</b>	<b>Oluşturulan Katmanlar</b>
Topografya haritası – Yükseklik grupları	Sel riski olan alanlar
Jeoloji, toprak	Zemin özellikleri
Yükseklik grupları	Eğim grupları
Topografik harita, uydu görüntüsü, güncel arazi kullanımı (ulaşım)	Trafik (ulaşım) ağı
Güncel arazi kullanımı, uydu görüntüsü	Atık alanları
Güncel arazi kullanımı, uydu görüntüsü	Aritma tesisleri, sanayi alanları
Deprem haritası, fay hatları ve heyelan alanları	Deprem ve heyelan riski olan alanlar

### 3.3 Amaçlara Uygun Modellerin Oluşturulması ve Uygunluk Analizlerinin Gerçekleştirilmesi

LUCIS modeli yukarıda belirtildiği gibi ArcGIS yazılımı içerisinde modelbuilder araçları kullanılarak oluşturulan modellerin çalıştırılması ile yapılan uygunluk analizlerini kapsar. Aşağıdaki analizlere ait şu detayların belirtilmesi gerekmektedir:

- GIS ortamında vektör ve raster tabanlı verilerle çalışılmasına rağmen bütün analiz sonuçları raster (hücre tabanlı) katmanlar olarak elde edilir. Bu nedenle bütün verilerin birbiri ile karşılaştırılabilmesi ve hücresel sınıflandırma yapılabilmesi için çözünürlüklerin yani alanı temsil eden piksel boyutlarının bütün katmanlarda aynı olması gerekmektedir. Bu çalışmada hücre boyutları 25mx25m olarak belirlenmiştir.
- Uygunluk analizlerinden elde edilen katmanlardaki yeşilden kırmızıya doğru değişen renkler ya da 9 ile 1 arasında azalan değerler, yüksek uygunluktan düşük uygunluğa doğru azalışı temsil etmektedir.
- (YGA1A11) kod numaralı ‘Konut yerleşimine fiziksel açıdan uygun alanların belirlenmesi’ başlıklı amaca, Modelbuilder ile 7 alt amaç için ait oluşturulan GIS modelleri çalıştırılarak ulaşılmaktadır. Aşağıda söz konusu amaca ve alt amaçlarına ait analizler verilmiştir.

(YGA1A11AA111) Alt Amaç 1.1.1: Sel riski bakımından konut yerleşimine uygun alanların belirlenmesi.

Kullanılan veri katmanı: Yükseklik grupları

Değer atama kriteri: Sel risk haritası verilerine göre risk taşıyan 0-18 m arasındaki yüksekliklere 1, geri kalan yüksekliklere 9 değeri verilmiştir.

Bartın kentinde, 1998 yılında yaşanan sel felaketinde sular 13 m yükselmiştir. Nehrin bulunduğu ortalama yükseklik yaklaşık +5 m olunca, büyük selde kentin +18 m kotuna kadar olan bölümü sular altında kalmıştır (Tüysüz vd., 2001).

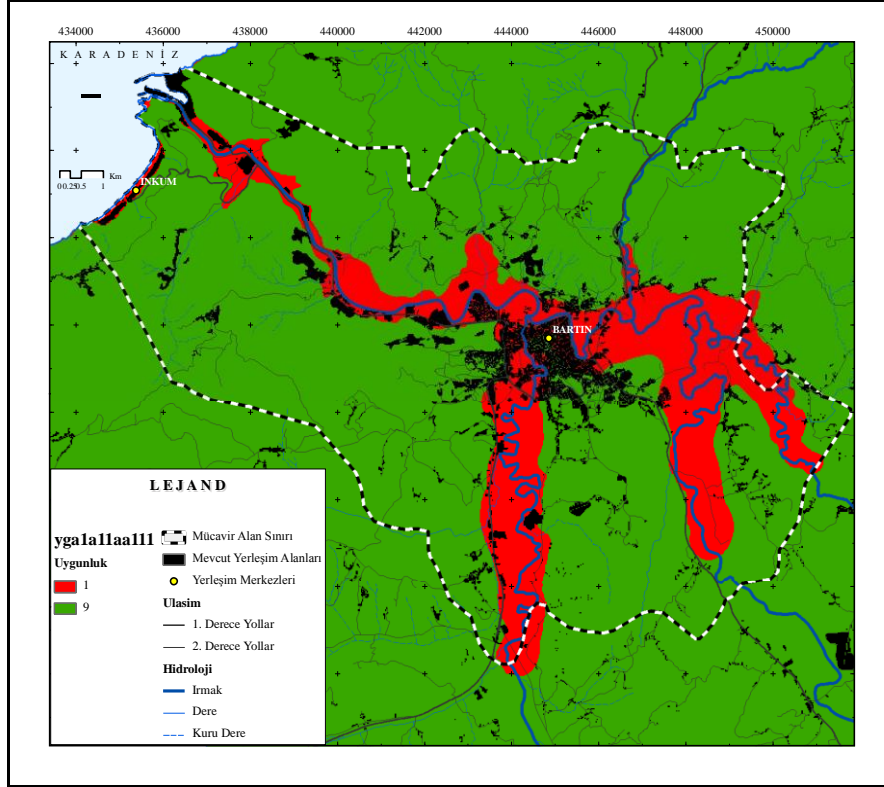
Değer atama gerekçesi: Nehir çevresindeki sel riski altında olmayan alanlar konut yerleşimi için uygundur.

Kullanılan GIS modeli: Şekil 3’de verilmiştir.



Şekil 3. Alt amaç 111 için oluşturulan model.

Elde edilen harita: Şekil 4’de görülen yeşil renkli alanlar, konut yerleşimine sel riski açısından uygun alanları göstermektedir. Buna göre mevcut kentsel yerleşim ile ırmak ana kolları çevresindeki alüvyal düzlüklerin konut yerleşimi için uygun olmadığı görülmektedir.



Şekil 4. Sel riski açısından konut yerleşimine uygun alanlar.

(YGA1A11AA112) Alt Amaç 1.1.2: Zemin özellikleri bakımından konut yerleşimine uygun alanların belirlenmesi.

Kullanılan veri katmanı: Jeoloji

Değer atama kriteri: Riskli alanlara 1, diğer alanlara 9 değeri atanmıştır.

Değer atama gerekçesi: Zemin özellikleri açısından riskli olmayan alanlar, konut yerleşimi için daha uygundur. Nehir kenarındaki taban suyu yüksek genellikle alüvyal yapıdaki alanlar konut yerleşimi için sakıncalıdır.

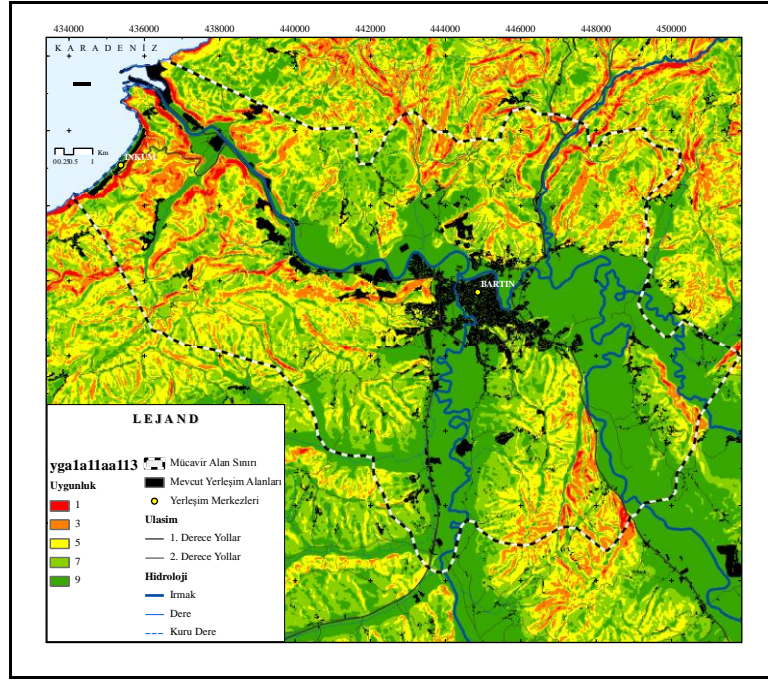
Kullanılan GIS modeli: Şekil 5’de verilmiştir.



Şekil 5. Alt amaç 112 için oluşturulan model.







Şekil 8. Arazi eğimi bakımından konut yerleşimine uygun alanlar.

Tüysüz ve diğerleri (2001)'e göre Bartın kentinde yerleşim için uygun eğim sınırı % 36 (20<sup>0</sup>) olarak verilmiştir. Eğim grupları üzerinde uygunluk kriterlerine göre yapılan analiz sonucunda, alanda % 36 eğimin üstündeki alanlar yerleşime uygun olmayan alanlar olarak bulunmuştur. Bu bölümlerde herhangi bir yapılaşmaya gidildiğinde önlem alınması zorunlu olmaktadır.

Konut yerleşimine ait gelişmeyi, sadece doğal özelliklere dayalı fiziksel faktörler sınırlamamaktadır. Aynı zamanda Bartın kentine ait güncel alan kullanımına dayalı fiziksel sorunlar da konut yerleşimlerinin gelişiminde önemlidir. Bunlara ait analizler aşağıda verilmiştir.

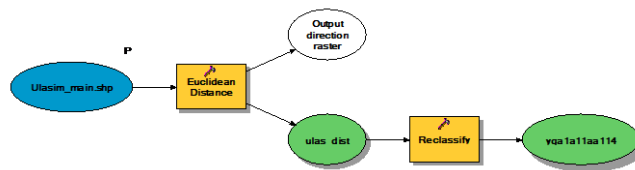
(YGA1A11AA114) Alt Amaç 1.1.4: Trafikten kaynaklanan fiziksel olumsuzluklar (gürültü, vb) bakımından konut yerleşimine uygun alanların belirlenmesi.

Kullanılan veri katmanı: Ulaşım alanları

Değer atama kriteri: Florida örneğinden yararlanılarak ulaşımına ait ana yollara 0-100 m arası yakınlık için 1, 100-250 m arası için 2 ve geriye kalan mesafeler için hücrelere 9 değeri atanmıştır.

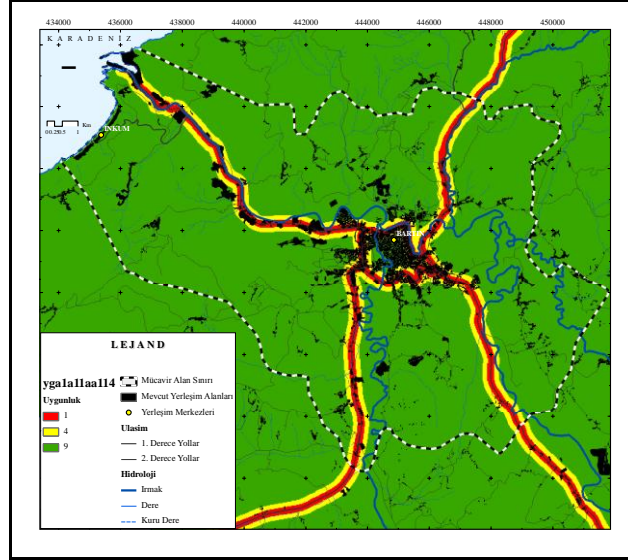
Değer atama gerekçesi: Konut yerleşimlerinde sessiz alanlar daha çok tercih edilir. Eğer fiziksel değil ekonomik uygunluk için analiz yapıyor olsa idi ana yollara yakınlığın tercih sebebi olacağı belirtilmesi gerekmektedir.

Kullanılan GIS modeli: Şekil 9'da verilmiştir.



Şekil 9. Alt amaç 114 için oluşturulan model.

Elde edilen harita: Konut yerleşiminde trafikten kaynaklanan gürültü, hava kirliliği gibi olumsuzluklar oldukça önemlidir. Buna göre, Şekil 10’da görüldüğü gibi, ana yollara yaklaşıldıkça konut yerleşimine uygunluk azalmaktadır.



Şekil 10. Trafikten kaynaklanan olumsuzluklar bakımında konut yerleşimine uygun alanlar.

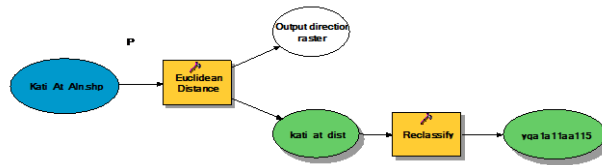
(YGA1A11AA115) Alt Amaç 1.1.5: Katı atık alanlarına olan mesafe bakımından konut yerleşimine uygun alanların belirlenmesi.

Kullanılan veri katmanı: Güncel arazi kullanımı.

Değer atama kriteri: İlk önce, katı atık alanları için öklit uzaklıkları gösteren raster harita elde edilmiştir. Daha sonra, mevcut konut yerleşimleri ile katı atık alanları arasındaki ortalama uzaklığı ve standart sapmayı belirlemek için ‘zonal istatistik’ uygulanmıştır. Buradan elde edilen değerlere göre yapılan yeniden sınıflandırmada, 0 ile ortalama değer olan 2600 m arasında kalan hürelere 1 değeri atanmıştır. Daha sonra her çeyrek standart sapma değeri kadar (350 m) artan mesafelerdeki hücre aralığına 2-8 arasında artan değerler verilmiştir. 5050 m’ den uzaktaki geriye kalan hürelere ise 9 değeri atanmıştır.

Değer atama gerekçesi: Katı atık alanlarına uzak yerler konut yerleşimi için daha uygundur.

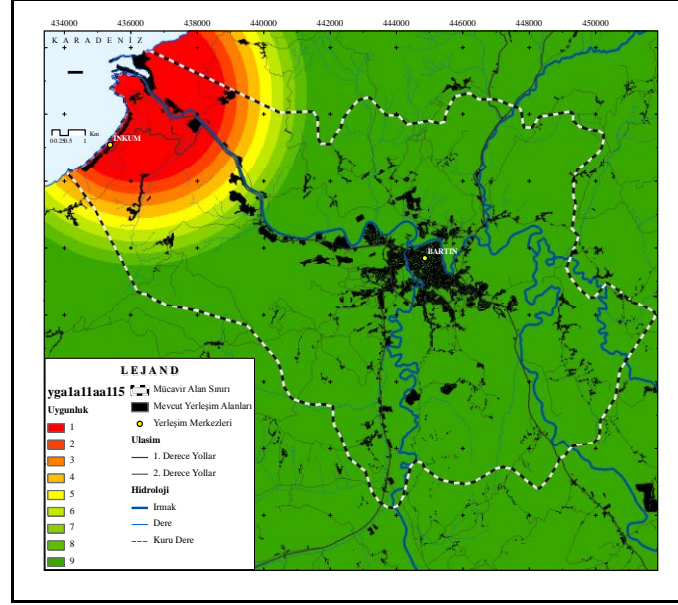
Kullanılan GIS modeli Şekil 11’de verilmiştir.



Şekil 11. Alt amaç 115 için oluşturulan model.

Elde edilen harita: Kentin kuzeybatısında Bartın Limanı ile İnkum turistik yerleşimi arasındaki doğal bir alanda depolanan katı atıklar, kent sağlığını tehdit etmektedir. Katı atık alanları ile konut yerleşimleri arasındaki ortalama mesafe değeri olan 2600 m içerisinde kalan alanlar, en fazla etkinin hissedildiği alanlar olarak ortaya çıkmıştır. En uygun alanların ise katı atık alanından 5050 m mesafe dışındaki alanları kapsadığı tespit edilmiştir.

(Şekil 12). Buna göre, İnkum'daki ve Boğaz mevkiindeki mevcut konut yerleşiminin katı atık alanından yoğun bir şekilde etkilendiği anlaşılmaktadır.



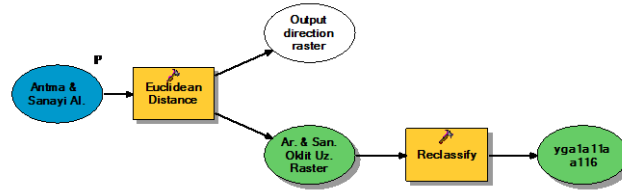
Şekil 12. Atık alanlarına yakınlık bakımından konut yerleşimine uygun alanlar.

(YGA1A11AA116) Alt Amaç 1.1.6: Hava kalitesi bakımından konut yerleşimine uygun alanların belirlenmesi. Kullanılan veri katmanı: Güncel arazi kullanımı.

Değer atama kriteri: İlk önce, sanayi ve su arıtma tesisleri için öklit uzaklıkları gösteren raster harita elde edilmiştir. Daha sonra, mevcut konut yerleşimleri ile su arıtma tesisi arasındaki ortalama uzaklığı ve standart sapmayı belirlemek için 'zonal istatistik' uygulanmıştır. Buradan elde edilen değerlere göre yapılan yeniden sınıflandırmada, 0 ile ortalama değer olan 1750 m arasında kalan hücelere 1 değeri atanmıştır. Daha her sonra çeyrek standart sapma değeri kadar (250 m) artan mesafelerdeki hücre aralığına 2-8 arasında artan değerler verilmiştir. 3500 m' den uzaktaki geriye kalan hücelere ise 9 değeri atanmıştır

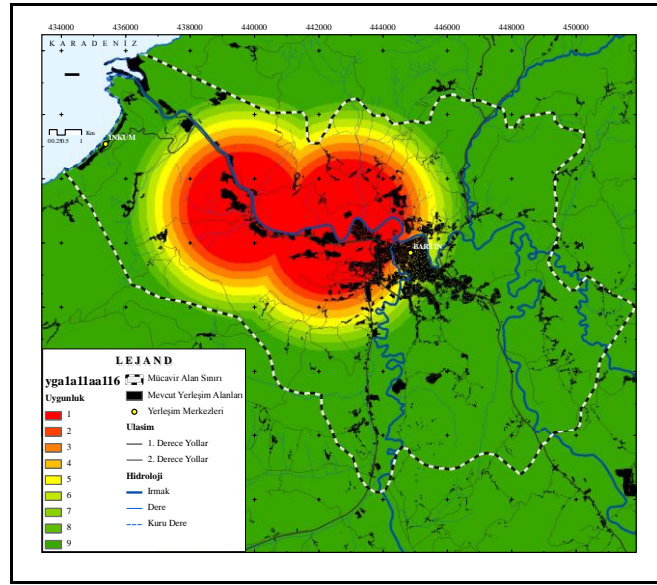
Değer atama gerekçesi: Mevcut sanayi alanları ve su arıtma tesisi, hava kalitesini olumsuz etkilemektedir. Bu tesislere uzak olan alanlar konut yerleşimi için daha uygundur.

Kullanılan GIS modeli Şekil 13'de verilmiştir.



Şekil 13. Alt amaç 116 için oluşturulan model.

Elde edilen harita; Kentin kuzeybatısındaki Bartın-İnkum karayolu üzerinde yer alan çimento ve kireç fabrikaları ile nehir kenarında yapılması düşünülen atık su arıtma tesisi, konut yerleşimlerini hava kalitesi açısından etkileyen unsurları içerirler. Sanayi alanlarının hava kalitesi açısından etki altında bıraktıkları alanlar Şekil 14'deki analiz haritasında görülmektedir. Koyudan açığa doğru değişen renk skalası, aynı zamanda yerleşim için düşük uygunluktan yüksek uygunluğa doğru geçişi de göstermektedir.



Şekil 14. Hava kalitesi bakımından konut yerleşimine uygun alanlar.

(YGA1A11AA117) Alt Amaç 1.1.7: Deprem ve heyelan riski bakımından konut yerleşimine uygun alanların belirlenmesi

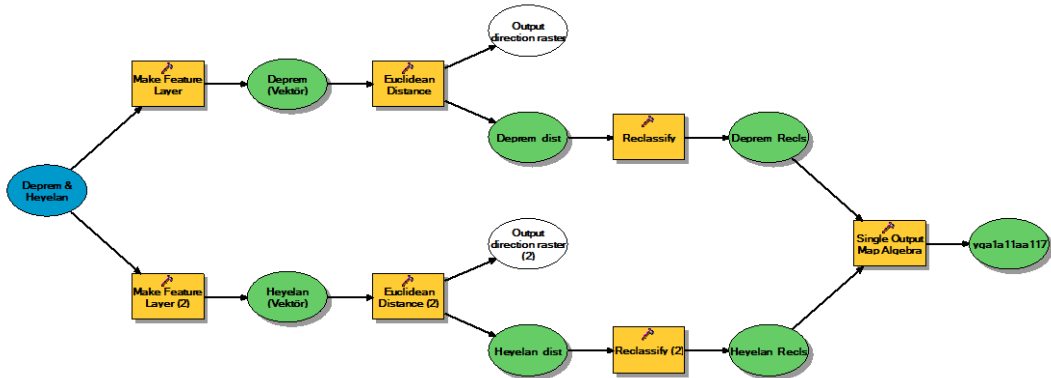
Kullanılan veri katmanı: Deprem dereceleri, fay hatları ve heyelan alanları.

Değer atama kriteri: Deprem fay hatlarına 0-50 m mesafe için 1, 50-150 m için 3, 150-250 için 6 ve 250 m mesafeden sonrası için 9 değeri verilmiştir. Heyelan riski olan alanlar için ise 0-50 m için 1, 50 metreden sonrası için 9 değeri verilmiştir. Deprem ve heyelana ait katmanlar yapılan bu sınıflandırmadan sonra iki katmandaki en düşük değere sahip alanlar korunacak şekilde ArcGIS içerisinde şöyle birleştirilmiştir:

CON (Heyelan\_R EQ 1, 1, Deprem\_R)

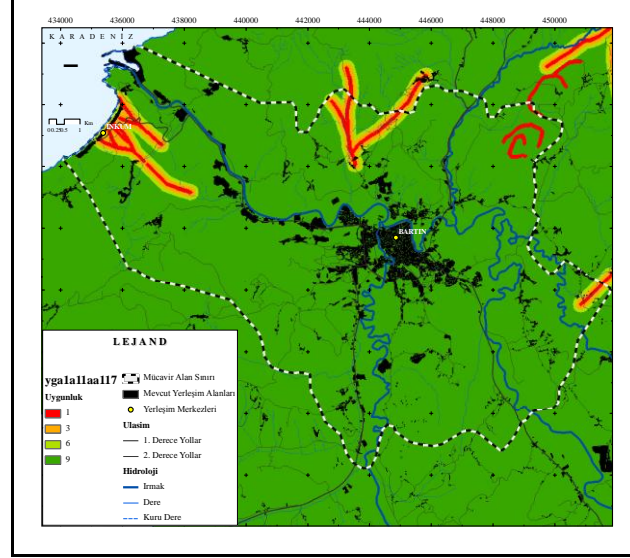
Değer atama gerekçesi: Fay hatları ve aktif heyelan alanları üzerinde bulunan alanlar, yerleşim için tehlike arz etmektedirler ve bu alanlar konut yerleşimi için uygun değildir.

Kullanılan GIS modeli Şekil 15’de verilmiştir.



Şekil 15. Modelbuilder ile oluşturulan GIS modeli.

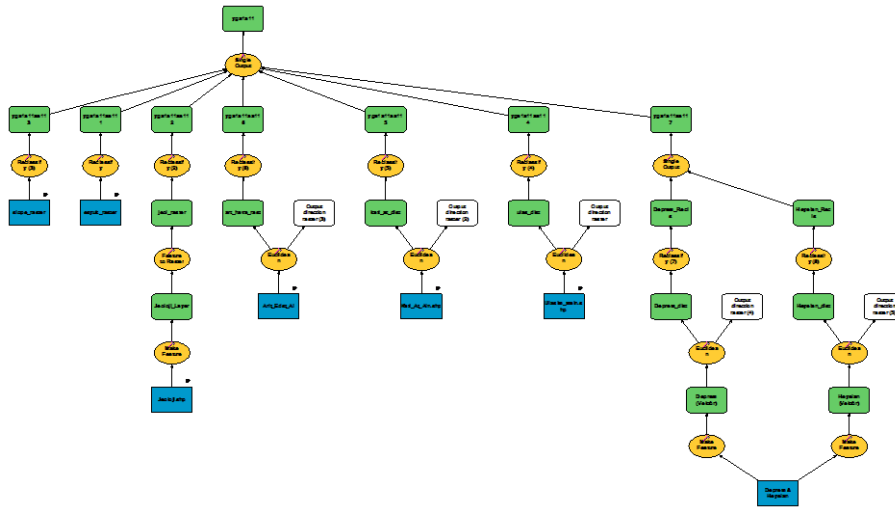
Elde edilen harita: Şekil 16’ da, İnkum ile kent merkezinin kuzeydoğusundaki Akpınar, Kirlık, Saraydüzü kırsal yerleşimlerinden geçen ya da onlara yakın olan aktif fay hatlarının ve heyelan alanlarının bulunduğu kesimlerin konut yerleşimi için uygun olmadığı görülmektedir.



Şekil 16. Deprem ve heyelan riski bakımından konut yerleşimine uygun alanlar

#### 4. AĞIRLIKLI UYGUNLUKLARIN BELİRLENMESİ VE SONUÇLARIN DEĞERLENDİRİLMESİ

Yukarıda alt amaçlara yönelik olarak elde edilen yedi harita, GIS ortamında ModelBuilder ile yga1a11 amacı için oluşturulan model (Şekil 12) yardımıyla ‘ağırlıklı olarak’ bir araya getirilmiş ve konut yerleşimine fiziksel açıdan uygun alanlar tespit edilmiştir. Söz konusu şartlı birleştirme işleminde alt amaçlar için farklı ağırlıkların belirlendiği aşağıdaki eşitlik kullanılmıştır.

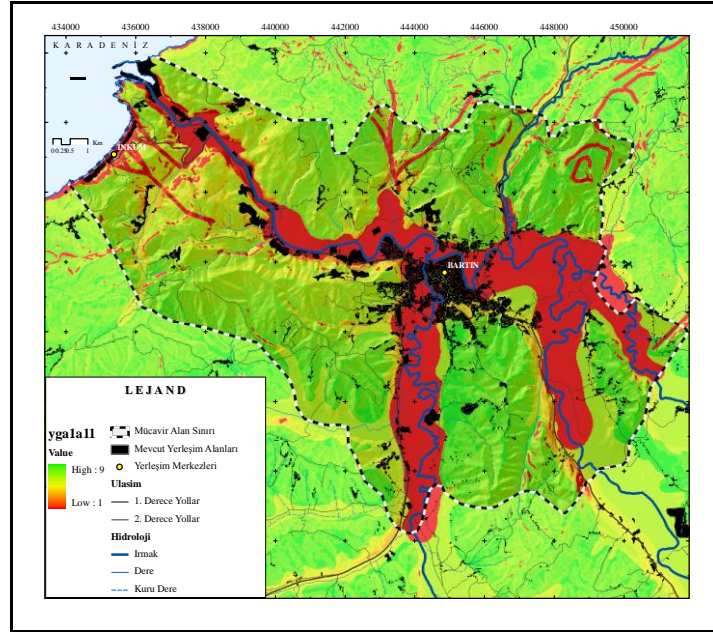


Şekil 12. YGA1A11 amacına ait GIS modeli.



CON (ygalal1aa111 EQ 1 OR ygalal1aa113 EQ 1 OR ygalal1aa117 EQ 1, 1, ((ygalal1aa112 \* 0.25) + (ygalal1aa113 \* 0.30) + (ygalal1aa114 \* 0.15) + (ygalal1aa115 \* 0.15) + (ygalal1aa116 \* 0.15)))

Buna göre araştırma alanında sel, tehlikeli eğim, deprem ve heyelan riski bulunan alanlar için 1 değeri korunmuş, geriye kalan alanlarda ise zemin özelliklerine %25, eğim gruplarına %30, trafikten kaynaklanan olumsuzluklara %15, katı atık alanlarına yakınlığa %15 ve hava kalitesi bakımında uygunluğa %15 ağırlık verilmiştir.



Şekil 17. Ağırlıklı uygunluk haritası

Şekil 17'ye göre, Bartın mevcut kent merkezinin büyük kısmının, konut yerleşimine belirlenen fiziksel faktörler açısından uygun olmadığı görülmektedir. Ayrıca, Bartın nehri boyunca uzanan alüvyal sahalar ve Bartın kent merkezi ile İnkum arasındaki hat boyunca uzanan yaklaşık 7 km alanın da aynı şekilde konut yerleşimine uygun olmadığı anlaşılmaktadır. Doğu, güney ve güneybatı yönlerinde bulunan ve mevcut kent merkezine nispeten uzak olan ve ayrıca tehlikeli eğim riski taşımayan tepelik alanların ise ele alınan analiz kriterlerine göre konut yerleşimine diğer alanlara nazaran daha uygun olduğu belirlenmiştir.

Sonuç olarak bu makalede uygunluk analizlerinde yeni bir yöntem olarak ortaya çıkan LUCIS modeli, seçilen alana uyarlanarak denenmiş ve sınırlı kriterlere göre uygunluk analizi yapılmıştır. Amaçlar artırılarak ya da değiştirilerek istenilen çalışma konusu ve alanına ait farklı analizler yapmak mümkündür. Bu anlamda LUCIS modeli kapsamlı araçlar sunmaktadır.

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