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A Visual Landscape Assessment of Forest Roads: 'Case of Kafkasör-Mersivan Route, Artvin'

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Abstract

Aim of study: Roads, which are the effective landscape elements in relationship between people and nature, potentially divide the landscape into pieces. Forest roads are corridors which have visual functions that impress travellers' memory with different experiences as well as their basic functions. Visual landscape assessment of these corridors is required and they need to be planned accordingly. Also in this study, it was aimed to reveal the visual landscape value of a forest road.

Area of study: This study was carried out on Kafkasör-Mersivan route which linked two different recreational areas in Artvin.

Material and Methods: In visual landscape assessment of this route, a photo-based questionnaire was conducted with 230 people who knew the route, consisted of different user groups (public, forest engineers and landscape architectures).

Main results: Results showed that this route has an important visual value in the region. Some suggestions were provided about assessing the data obtained from the study in forest road planning.

Research highlights: Determining the routes which have visual value in forest road planning process and ensuring public participation in visual assessment process will be useful to contribute protection and sustainability of these ecosystems.

Keywords: Visual landscape, Visual quality, Vistas, Forest roads, Artvin.

Orman yollarının görsel peyzaj değerlendirmesi: 'Kafkasör Mersivan rotası (Artvin) örneği'

Özet

Çalışmanın amacı: İnsan ile doğa arasındaki ilişkilerin kurulmasında etkili peyzaj elemanları olan yolların; içinden geçtikleri peyzajı parçalara ayırma potansiyeli mevcuttur. Orman yolları; temel fonksiyonlarının yanı sıra seyahat edenlerin belleğinde farklı deneyimler bırakan görsel işlevlere de sahip koridorlardır. Bu koridorların görsel peyzaj değerlendirmesinin yapılması ve bu doğrultuda doğru bir şekilde planlanması gerekmektedir. Bu çalışmada da bir orman yolunun görsel peyzaj değerinin ortaya konulması amaçlanmıştır.

Çalışma alanı: Çalışma iki farklı rekreasyon alanını birbirine bağlayan Kafkasör- Mersivan (Artvin) mevkii arasındaki orman yolu güzergâhı boyunca yürütülmüştür.

Materyal ve Yöntem: Bu güzergâhın görsel değerlendirmesinde fotoğraf temelli anket çalışması, yol güzergâhını kullanan farklı kullanıcı gruplarından oluşan (halk, orman mühendisleri, peyzaj mimarlarına) 230 kişiye uygulanmıştır.

Sonuçlar: Sonuçlarda bu rotanın bölgede önemli bir görsel değere sahip olduğu görülmüştür. Çalışma sonucunda elde edilen verilerin orman yolu planlama sürecinde değerlendirmesine ilişkin önerilerde bulunulmuştur.

Araştırma vurgular: Orman yolu planlama sürecinde görsel değere sahip rotaların belirlenmesi ve görsel değerlendirme sürecine halkın katılımının sağlanması bu ekosistemlerin korunmasına ve sürdürülebilirliğine katkıda sağlaması açısından faydalı olacaktır.

Anahtar kelimeler: Görsel peyzaj, Görsel kalite, Vistalar, Orman yolları, Artvin.

Introduction

Landscapes are important in our everyday activities and their condition affects our quality of life (Scott and Moore-Colyer, 2005; Dupont et al., 2015). Landscapes are the central attraction in nature-based tourism and an appealing landscape can attract other livelihoods and new residents to rural areas (Store et al., 2015). People prefer natural environments to those in urban areas (Kaplan and Kaplan, 1989; Staats and Hartig, 2004), and they find natural environments as restorative from stress or attention deficit (Hartig et. al., 2003; Chiang et. al., 2014). De Groot et al., (2010) stated that humans find great opportunities for recreation and leisure in natural ecosystems (Schirpke et al., 2013). Using green areas, especially forests for their physical and mental health-promoting qualities is becoming a more significant element of public policy in many countries (Nilsson et al., 2011; Hansson et al., 2012). Studies even suggest that the experience of nature itself is important over and above the effects of physical activity and social interaction (Ryan et al., 2010; Eriksson and Nordlund, 2013).

Needs for areas where people experienced nature and communicated with it were increased day by day. Designed routes in forests are responsive to these needs. Forest roads established for different purposes. Hasdemir and Demir (2000) indicated that one of them was also open to traffic of touristic and recreational areas in forest.

Forest roads presented unique and breathtaking vistas. Assessment of these natural visual resources is required.

There are also different landscape assessment approaches. Daniel (2001) stated that the scenic beauty of a landscape comes from the interaction between its biophysical features and the human observer which has led to perception-based and expert-based methods for scenic beauty assessments and perception-based assessments have a high level of reliability. Perception-based methods assess community perceptions and analyse perceived scenic beauty on-site or by presenting photographs (Arriaza et. al., 2004; Grêt-Regamey et. al., 2007; Schirpe et al., 2013).

To ensure visual quality and the sustainability of the natural areas, the needs and expectations of visitors for the area should be determined and it is important to analyse how they perceive and assess the landscape. In this study, photographs were used to determine the public's visual preferences. The study was carried out Kafkasör-Mersivan route in Artvin. Main goals of this study were;

- Which landscapes are preferred by users?
- Will preferences differ among respondent groups (local residents, forest engineers and landscape architectures) and according to gender?
- Which landscape types result in higher preferences for all respondent groups?

Material and Methods

Study area

Artvin is located in northeast of Turkey, near the Georgian boarder. The study was performed in a 9.3 km route corridor that links the Kafkasör Urban Forest and Atabarı Ski Centre (Mersivan) in Artvin (Figure 1).

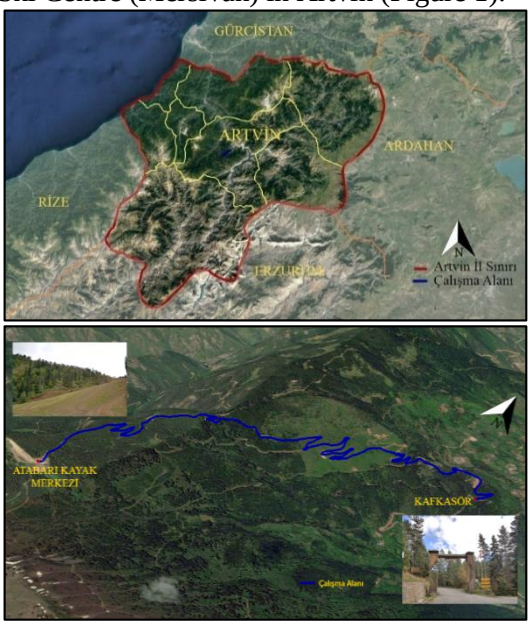

Figure 1. Location of the study area (above) and route (below) in the study area

The selected corridor offers unique scenic views to the users and Kafkasör provides them with different recreational experiences (i.e. picnic, camping, hiking, etc.). This area is intensively used especially in summer, while Atabarı ski centre (Mersivan) is highly

preferred for winter activities like ski, picnic, etc. This corridor, links these two recreational areas, is used only as a transit route in spite of its unique beauties. User can also see different plant species such as *Picea orientalis*, *Pinus sylvestris*, *Abies nordmanniana* subsp. *nordmanniana*, *Ouercus petrea*, *Fagus orientalis*, *Viburnum opulus*, *Vaccinium arctostaphylos*, *Rhododendron ponticum*, *Colchicum speciosum* etc. and their seasonal changes in this corridor (Figure 2) and some animals such as birds (i.e. sparrow hawk, hawk), squirrels, roe deer, colourful butterflies as well as wild animals (i.e. wolves, bears, weasels etc.)

Figure 2. A view of the route and some plant species around it in autumn

Sampling and questionnaire design

Questionnaires, defined as a research material, consist of a series of questions included living conditions, beliefs, attitudes and behaviours of people (Thomas, 1998; Büyüköztürk, 2005) and means of making descriptive assertions about preferences of a sample population (Othman, 2011). Karjalainen (2006) stated that landscape preference studies typically consist of surveys, questionnaires or interviews using photographs or computer visualisations to investigate public preferences and many previous studies (Chen et. al., 2009; Barrosa et. al., 2012; Hofmann et. al., 2012; de Vries et. al., 2012; Karaşah, 2014; Jiang et. al., 2015; Dupon et. al., 2015; Filova et. al., 2015) used photographs to determine the preferences.

In this study, a photo-based questionnaire was conducted to determine the landscape preferences of respondents and landscape photographs were used as stimuli in questionnaire survey. First of all, number of people participated the questionnaire was determined according to the formula of Kalıpsız (1981) given below.

$$n = \frac{Z^2 NPQ}{ND^2 + Z^2 PQ}$$

Where "n" is sample size, "Z" is confidence coefficient, "P" is probability (95% confidence level), Q=1-P (probabilities in a binomial distribution), "N" is population, "D" is accepted sampling error (5%).

It was revealed that minimum 73 subjects should participate into the questionnaire. However, the study was conducted with 230 subjects in order to decrease the probability of experimental error. All subjects know the study route well.

In field study, 32 photographs were taken in sunny weather using a Canon EOS 550 D camera with an EFS 18-55 mm lens between 10:00 a.m. and 14:00 p.m. Then, panoramic photographs were created via ArcSoft Panorama Maker 4.0 software. Finally, 24 of them were used because of better representation of the study area (Appendix 1).

An electronic online questionnaire was used in the study. The questionnaire was divided into two sections. First section included socio-demographic information of the respondents (gender and profession) and the second section included landscape preferences of respondents. In the second section, respondents were asked a judgement: 'Visual value of the landscape photo number ….. is high'. The selected photographs were evaluated through Likert 5-point scale with the choices of ''very disagree, disagree, neutral, agree, and very agree''.

To reveal objective assessments as well as subjective ones, fractal analysis of photographs which are the most preferred by all respondent groups were conducted. In this study, fractal box count was used as one of the most used methods in fractal analysis.

Data analysis

The following data obtained from questionnaire were entered to Excel spreadsheets:
Very disagree – 1 point,
Disagree – 2 point,
Neutral – 3 point,

Agree – 4 point,
Very agree – 5 point.

Then, visual preference on 24 photographs was used to calculate average scores. These scores were used to determine the which landscape photograph most preferred and compare the respondent groups' (public, forest engineers and landscape architecture) preferences.

Image J 1.42 software was used to calculate the fractal dimension (D_b) scores of most preferred photographs.

Results and Discussion

Participants

About 56.5% of participants were male and 43.5% were female. Participants consist of 3 different groups: 60% were from public, 26.9% were from landscape architectures, and 29.1% of them were from forest engineers.

Landscape preferences

At this stage of the study, participants were asked to give their judgements and then the participant's preferences and visual scores of the landscape were determined accordingly.

Using photographs to represent landscapes in an Internet-based experiment generates valid results with regard to scenic beauty and visual impact (Roth, 2006; de Vries et. al., 2012). In this study, visual preferences of landscape photographs were determined via an electronic online questionnaire.

Aesthetic value is linked with a number of factors such as a person's level of education, previous experiences with natural landscapes, age and sex (Tyrväinen et al., 2005; Golivets, 2011; Özkan and Özdemir, 2015). Howley et. al. (2012) indicated in their study that age and gender have a statistically significant effect on individuals' landscape preferences. Kalivoda et al. (2014) stated that results highlighted a significant difference in judgment variances within each investigated respondent (hikers) characteristic (gender, age, education level, occupational classification, and respondent's type of residence). Results also showed that males' preferences were different from females' (Table 1).

Table 1. Distribution of visual preferences according to gender

Gender	Preferences				
	1	**2**	**3**	**4**	**5**
Male	PN9	PN3	PN19	PN18	PN7
Female	PN18	PN3	PN19	PN16	PN9

Similarly, previous studies found that preferences were different among respondent groups. Tveit (2009) stated that student preferences do not reflect the landscape preferences of the wider public. Kearney and Breadly (2011) noted differences among groups (foresters, public, rural people, recreationists, educators and environmentalist) and the most scored photos were green/natural views. Barrosa et. al. (2012) indicated that results showed that differences among respondent groups (hunters, owners, rural residents and eco-tourists). The most interesting spaces were shrubs for hunters and eco-tourists. Hofmann et al. (2012) stated that preferences of landscape planners and public were different from each other. Dupon et. al. (2015) indicated that experts and laymen may not perceive the same features in a landscape and might not even see the same landscape. Massoni et al., (2016) stated that some differences in the visual landscape preferences among respondent groups (local resident and tourists). Similar results were obtained from the questionnaire. It was found that visual preferences of respondent groups (public, forest engineers and landscape architectures) were different.

For example, the most preferred 2 photographs (Photo number (PN3 and PN9) were the same for each subject groups. However, the most preferred photograph of public was PN19, followed by PN3, PN9, PN18 and PN21, while forest engineers' the most preferred photographs were PN16, PN9, PN18, PN8 and PN3 and the most preferred photographs of landscape architectures were PN3, PN18, PN9, PN16 and PN19 (Table 2).

Table 2. Distribution of visual preferences according to respondent groups

Respondent groups	Preferences				
	1	2	3	4	5
Public	PN 19	PN 3	PN 9	PN 18	PN 21
Forest engineers	PN 16	PN 9	PN 18	PN 8	PN 3
Landscape architectures	PN 3	PN 18	PN 9	PN 16	PN 19
All groups	PN 3	PN 18	PN 9	PN 19	PN 16

Visual preference scores of the 24 photographs were also different among respondent groups. For example, the average visual score of PN1 was 3.67 for forest engineers, 3.37 for public and 3.65 for landscape architectures, while the average visual score of PN7 was 3.70 for forest engineers, 4.36 for public and 3.98 for landscape architectures, and lastly average visual score of PN23 was 2.77 for forest engineers, 3.51 for public and 3.39 for landscape architectures (Figure 3).

Sklenicka and Molnarova (2010) found that the most preferred habitat type was coniferous forest and followed by deciduous forest. It was found that the most preferred 5 photographs by all groups contain combination of deciduous and coniferous trees (Figure 4). Besides, it was thought that texture and colour of trees have an effect on respondents' preferences.

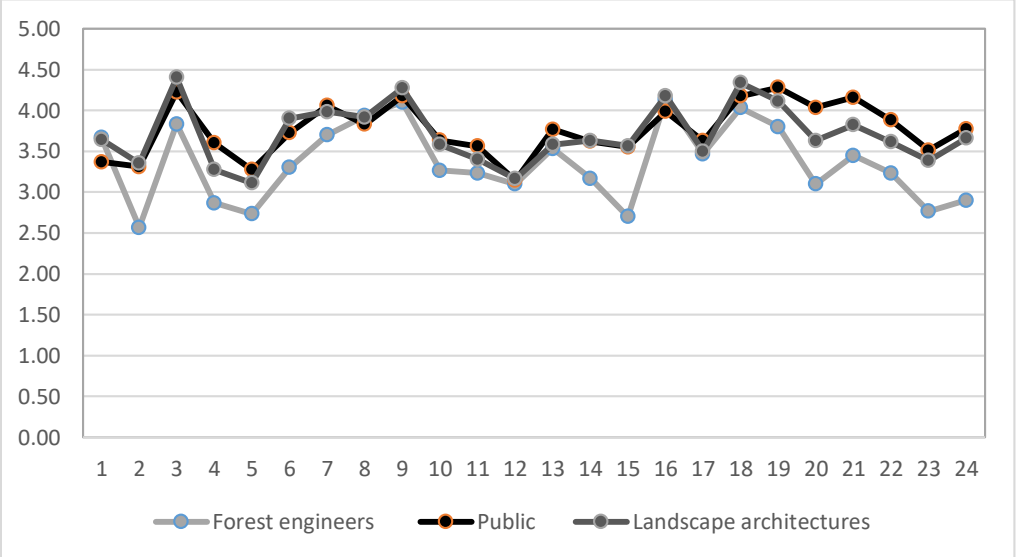

Figure 3. Distribution of visual preferences according to respondent groups

PN 3

PN9

PN16

PN18

PN19

Figure 4. The most prefered 5 photographs

Lastly, fractal dimensions of the most prefered 5 photographs were calculated to reveal objective assessments as well as potential subjective assesments. It was found that there was a significant relationship between visual scores and fractal dimensions of photographs. When the visual score of the photograph was high, fractal dimension of this photo was also high. For example, while the visual score of PN3 was 4.22, fractal dimension (D_b) score of this photo was 1.9817. Similarly, the visual score of PN16 was 4.06, fractal dimension score of this photo was 1.9926 (Table 3).

Table 3. Visual scores and fractal dimension scores of the most prefered 5 photographs

	Photo Numbers				
	PN3	**PN9**	**PN16**	**PN18**	**PN19**
Visual scores	4,22	4,19	4,06	4,20	4,17
Fractal dimesion scores	1,9817	1,9848	1,9926	1,9888	1,9863

Conclusion

In this study, a visual assessment of a forest road was carried out. It was found that this road has an important visual value in the region. Almost, all of the photographs taken from the route were received an above-average score (>2.5). Visual landscape character has a significant role on preferences of spaces and user satisfaction. Word of mouth is an effective information achievement way about a space. Hence, these spaces will be a tourist destination and so they will benefit people as well as region economy. Also this road can be used as a scenic road and some facilities can be established (observation platforms, portable traditional gift shops etc.).

This study was conducted in summer, but the selected corridor also offers different views in autumn, winter and spring. Thus, the views in different seasons should be also taken into consideration and the most preferred points should be determined. Results from this study showed that Kafkasör - Mersivan route offer different views and has significant visual value. This result revealed that forest roads have visual value and may be an attraction centres for tourists both local and foreign ones. Maps of spaces which have high visual value should be created and included in planning decisions.

Data obtained from this study will contribute to visual quality and sustainability of the ecosystem along the route. Ensuring public participation in visual assessment process will be useful to protection and sustainability of these ecosystems as well. It cannot be generalized but the results obtain from this study can be an essential base for road planners and researchers for potential future studies.

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Appendix 1. Landscape photographs used in questionnaire

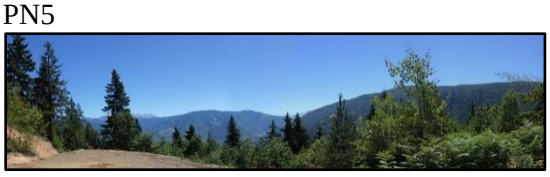

PN1


PN2


PN3


PN4


PN5


PN6


PN7


PN8


PN9


PN10


PN11


PN12

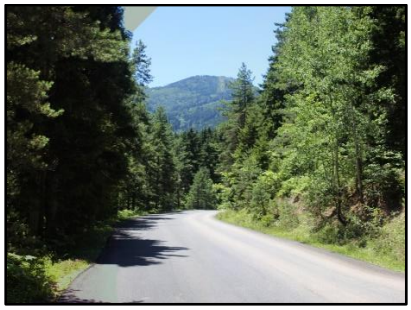

PN13


PN14


PN15


PN16


PN17


PN18


PN19


PN20


PN21


PN22


PN23


PN24