AESTHETIC EVALUATION OF FOREST LANDSCAPES WITHIN THE TRAINING AND EXPERIMENTAL FOREST RANGE (TEFR) YUNDOLA, R. BULGARIA

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ABSTRACT: The research focuses on understanding the scenic beauty of the landscape in the context of environmental planning, management focused on the forest landscape.Our landscape preferences are thought to be influenced by many factors: age, gender, ethnicity, regionality, recreational activity; some researchers even maintain there is an evolutionary basis behind certain landscape preferences. But of these factors, our dominant culture and history have played major roles in shaping our preferences for landscapes that are natural in character. Aesthetic appreciation of forest parks in the survey is made of the objective characteristics of the existing topography and vegetation. Data are taken from the map or text materials containing information about the terrain. The dominance elements and variable factors of landscapes appear in varying degrees, depending upon the viewing distance. The research automates aesthetic evaluation of forest landscapes using GIS.
Keywords: visual impact, scenic beauty, aesthetic, landscape preferences.

1 Theoretical Prerequisites for Aesthetic Evaluation of Landscapes

A number of research exist in which various methods for visual evaluation of the landscape are used. All these studies show that such an evaluation of landscape resources is a very important moment in determining the potential of recreational areas. Through spatial analysis, photographic, visual or psychological evaluation, individual territorial units should be classified to determine their emotional performance, despite the subjective element that can not be avoided.

The method of Seung-Bin (1984) is expressed in statistical analysis of evaluations of interviewed people who were shown pictures of 12 urban areas.

Survey methods are often used in evaluating the aesthetic qualities of landscapes. According to Rosenthal and Driver (1983) most of the respondents mainly appreciate the opportunity to enjoy beautiful scenery and is particularly marked overall demand for peace, solitude and rest in nature. According to Abello and Bernaldez (1986), all these surveys show that the aesthetic criteria of people depend on the nature, age, gender and their education and grades that they give the landscapes depend on their personal preferences for various forms of recreation. There are even those studies which have been specifically designed to prove weak authoritativeness and objectivity of the results of such inquiries. They apply the visual evaluation method of landscape using two groups of observers. The first group was previously aware of the existence of some clearly visible damage in the landscape and the other does not. The results show that dark observers did not notice the existing visible damage and provide better evaluation of these landscapes. Exactly this was conducted by Buhyoff (1982) experiment. "Gap" according to him is mainly due to the fact that the sites assessed are too large and it can no longer pay attention to all details and particulars, and the fact that the eye of a non-specialist is not trained to see everything.

According to Cooper, Murray (1992) a constructive method for visual evaluation of sites should include a description, analysis and classification of areas to create a structure within which to cover all landscape components. The biggest problem in the development of quantitative methods to evaluate the visual impact by Buhyoff, Riesenmann (1979) is to determine the coefficient of importance of individual landscape components in the overall evaluation. Unwin (1975) describes three stages in the evaluation of landscape: "measurement" of the landscape, formulation of landscape values through the survey of people's preferences, and finally an evaluation of the visual qualities of the landscape. Most sophisticated models in this regard he says are psychophysical which use first psychological impact, and after that objective quantitative and qualitative parameters of the landscape. The creation of such a model requires three sets of data: photos, survey data on people's preferences to landscape and landscape parameters.

The method of Shafer, Hamilton, Schmidt (1969) for determining psychophysical preference of people to the countryside is to predict how they will appreciate the natural landscape. Most important characteristics for the aesthetic appeal of landscape according to the authors are taken into account. Proportions are calculated between the quantitative values of landscape characteristics in practice.

Changing these proportions within a specific landscape creates a feeling of depth and perspective. Based on a mathematical formula involving perimeters and areas of forests, open spaces and water areas the authors define three types of ground cover: plant, non-vegetable and water, and outline the following areas at a distance.
Wherrett (1997) automates this model using GIS and conduct surveys to identify people's preferences for visual images of landscapes. The results showed that weather conditions and different focal lengths, where photographs were taken on the ground are not significant, but seasonal characteristics of vegetation and architectural elements have a significant influence in shaping those preferences.
Chiusoli (1977) offers a valid method to estimate parametric values of landscape and visual appeal of the plant component of the landscape called "integrated analysis of the landscape". It is based on analyzing aerophotos and panoramic images of the study area. By comparing the data obtained the author determined percentage ratios between the different landscape components. These ratios vary widely, thus achieving a just estimate. According to the author it has not yet developed a unified methodology for "parametric" visual evaluation of plant components in the landscape, because in practice the evaluation of its appearance is associated with too many subjective criteria. Therefore he considers the most appropriate first to analyze the landscape using aerophotos and territory be divided into homogeneous zones according to the most common characteristics of plant cover, and then to determine their area ratio. Appearance of landscapes, revealing to be monitored by the ground that what they learn from any point outside or inside them is totally different, so panoramic photographs reflect the real picture is revealed to him. Therefore the author considers most appropriate both method of analysis to unite and after processing the data from aerophotos to create a series of panoramic images for areas with established aesthetic values.
Pelt (1980) also recognizes that the perception of the landscape of the casual observer is implemented by the land and therefore pay particular attention to principles of felling and afforestation on different relief forms in order to avoid adverse visual effects resulting from the creation of unsustainable or geometric outlines of woodland. Forestry Commision (1994) examined much more detail this issue and defined some guiding principles of forest landscape design, designed to preserve the visual value of plantations and open spaces.
In Bulgaria most commonly used criteria for aesthetic evaluation of natural environment is developed by Bulev (1977). Evaluated as the unit area, he used a square side length, depending on the scale of the graphic material. For each of the square sections are determined grade evaluation, depending on the presence or absence in his range of different landscape elements (forests, rivers, rocks, agricultural areas, roads, power lines, etc.). The same criteria used Bezlova (1989) and adds them to apply locally for its development. She assesses areas as follows: dynamic of the relief, mosaic structure of plant cover, engineering network, availability of natural phenomena, natural sites and protected areas, and visual-spatial relationships. Then she sum of the ballroom evaluations as a percentage of the maximum value and then groupes territories.
In conclusion we can say that experiments, theories and summaries of the visual landscape evaluation has not yet reached the necessary universality of theoretical knowledge in order to establish a common scheme which will only be evaluated.

2 **Analysis of the Most Important Natural Components which Determine Aesthetic Properties of Landscapes within the Territorial Scope of the TEFR Yundola**

In conclusion of the analysis can be concluded that forest landscapes in the Yundola region can take a significant number of visitors. They should therefore be classified according to the opportunities offered for recreation. Then it is necessary the natural potential to be evaluated but differentiated for individual recreational activities, and these activities can be codified and classified in different levels of aggregation. The most synthesized unit having territorial scope must be the "forest subdivision", but in terms of recreational activities, must be the specific recreational activity.
In analyzing of the individual characteristics of relief and forest vegetation, first was reported their impact on recreational activities and established the practical feasibility of each of them as an evaluation indicator, depending on the impact that have on the main recreational activities. In this respect, are shaped some fundamental conclusions concerning the question of evaluation of recreational forest landscapes in general and of research subject in particular.
General conclusions:
1. When conducting landscape-recreation research is required to analyze taxological data of forest vegetation.
2. Analysis developing and design can be achieved only by additional field studies conducted during different seasons.
Specific findings:
1. In almost all parts of the Forestry range, the taxological data of forest stands evidence of their high productivity as well as of their very good outstanding artistic and aesthetic qualities and recreational function. Therefore:

a/ it can be expected that greater influence in recreational evaluation of the site will have a factor "relief" where the differences are very prominent;
b/ it is most appropriate to take into account only those taxological indicators that most influence the formation of the external appearance of the forest landscape, as well as fo its spatial structure.
2. The majority of forests in the area of the Forestry are accessible in all its parts. The development of mobile communications will make them more accessible and this will create prerequisites for economic development in general and for leisure in particular.
3. The main recreational activities practiced within the research area are: walking and stationary recreational in the nature environment, hiking, sunbathing, picking wild berries and mushrooms, villa holiday, outdoor games and winter sports.
4. In conclusion it should be said that forest landscapes in the vicinity of Yundola must first be classified according to their recreational opportunities and then to be evaluated all available resource potential that can be used for purposes of recreation, but differentiate for individual recreational activities. These activities themselves can be codified and classified in different levels of aggregation. The most synthesized unit in terms of territorial coverage should be “forest subdivision”, but in terms of recreational activities should be “specific recreational activity”.

3. Evaluation Mechanism

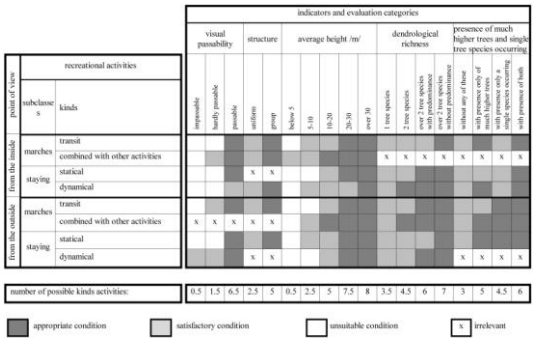
In this paper the **aesthetic evaluation of landscapes** is defined as a **grouping of predefined territorial units in some grade categories according to their positive or negative aesthetic qualities defined by pre-selected indicators and criteria**. The indicators and criteria are also systematic and have been elected in accordance with the conditions set by the main objective of the research or development project, for the purposes of that evaluation takes place. Aesthetic evaluation is based on the specifics of the landscape and is determined by visually dominant natural and anthropogenic components.

Table 1. The most common criteria for a high aesthetic evaluation of forest vegetation.

indexes	**gradation of categories and the most common criteria for an appreciation**
multilevelness and passability	**the passable stands** in the most general case, form a picturesque framework of open spaces and create greater psychological comfort as for the people watching them on side, and those who pass through them
structure	**the block spatial location** of trees definitely have a strong aesthetic impact on people especially during passing through forest plantations
average height	the forest stands with an average height **over 10 m** caused a strong emotional experience because it goes beyond the human scale
dendrologic richness of forest stands	the forest stands in the composition of which are involved **more than 2 tree species** create more expressive emotional and psychological effects arising from greater volume diversity in the space
presence of much higher trees and single tree species occurring in forest stands	**the much higher trees** as well as **the single tree species occurring** in forest stands presence a greater diversity in in the spatial structure and coloring of forest stands

It serves primarily to determine the visual qualities of open spaces, and in particular their advantages or disadvantages as places to stay static. Significant role in its forming play the relief, the forest vegetation and somewhat aquatic components of landscape, but in many cases could be setting some anthropogenic components.
The factors which most contribute to the aesthetic impact of forest vegetation and broad criteria for aesthetic evaluation of forest stands are classified in Table 1.

Table 2. Componential assessment for aesthetic valuation of the forest stands.



The Table 2 specifies the number of appropriate subgroups of most widely practiced recreational activities in certain values of taxological indicators. It is reported the fact that forest stands have a different visual impact when have been seen from side and when have been viewed as an immediate environment for recreation.
The indicator “*passability*” characterizes the possible of physical and visual intrusion into forest areas and depends on the structure of forest stands expressed by the location and by the different combinations of main component parts of the forest flora. Therefore it presents in both aspects of evaluation. The indicator “*construction*” determines primarily spatial structure of the forest stands, but has a major role in shaping their external appearance and diversity of the forest landscape. The *average height* is a very important indicator of psychological comfort of the recreational environment, which is determined by those in human genetic effects to the surrounding area determined by the so-called "human scale". The *dendrological richness*, and the *presence of much higher trees and single tree species occurring* in forest stands are a prerequisite for a greater vertical uneventness of forested areas and r foa greater variety in their coloring.
Factors contributing to the greatest extent for the aesthetic impact of open spaces are systematized in Table 3. *Vertical and horizontal indentation* of the relief considered separately determine the possibility of visual perception of space. Joint expression of these two factors determines the

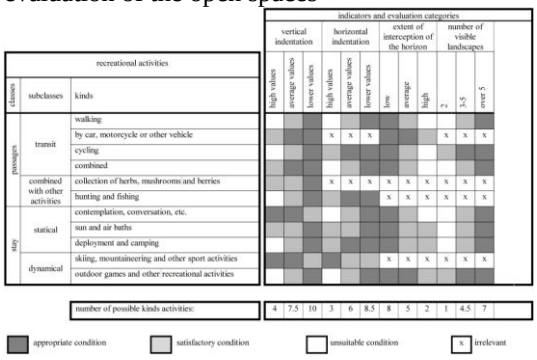
depth of the visible prospects, as the maximum values of this indicator are obtained by high values of vertical relief indentation and low values of horizontal relief indentation, which creates prerequisites for the detection of more distant panoramic views. The *extent of interception of the horizon* is determined largely by terrain features, but after reading the above parameters remain only the characteristics of forest vegetation, which can be a framework of perspectives or can be a barrier preventing their detection. The *number of visible landscapes* depends primarily on diversity of forest vegetation surrounded open spaces and determines in the most a picturesque variety in the foreground of the landscape. The *ratio between perimeter and area* of landscapes contributes much to the diversity of plastic-volume relationships. For the uniqueness and attractiveness of the mountainous landscape of the utmost importance are also the *degree of indentation of the visible horizon* and the presence of natural phenomena.

Table 3. The most common criteria for a high aesthetic evaluation of the open spaces.

indexes	**gradation of categories and the most common criteria for an appreciation**
vertical indentation of the relief	**strongly indented terrains** provide better opportunities to detect distant panoramic views, but **less indented terrains** are favorable to adopt landscape forgroun
horizontal indentation of the relief	**slightly** separated, in a horizontal attitude landscapes have a positive psychological impact because it allows the visual perception of vast spaces
extent of interception of the horizon	territory **low** on the horizon interception create better conditions for visual perception of landscape
number of visible landscapes	**higher values** of this parameter determine the variety of sights and scenery of the landscape
depth of the visible prospects	**maximum values** of this indicator are obtained by high vertical and low horizontal relief indentation and contribute to better visibility of landscapes
degree of indentation of the visible horizon	**high values** contribute to diversity, attractiveness and emotional-psychological impact of landscape
presence of obstacles	**low values** contribute to better visibility of landscapes
presence of natural phenomena	**presence** of interesting rock formations or other sculptural relief forms and phenomena influences strongly on visual perception and creates a unique and exotic landscape
ratio between perimeter and area of landscapes	**higher values** determine a great landscape diversity

To assess the visual impact of wooded areas is used species composition, but from an aspect called dendrological richness. Forest stands were divided into four groups depending on the number of tree species involved, whether they share in the total stock: forest stands consisting of one tree species; forest stands consisting of two tree species; forest standss consisting of three or more species with predominance of one of them; and finally consisting of three or more species without predominance. As a positive quality is reported the presence of much higher trees and single tree species occurring in the species composition. The passability, the construction and especially the average height of the forest stands are also taken into account in determining the visual evaluation.

Table 4. Componential assessment for aesthetic evaluation of the open spaces



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Thus, forested areas are grouped into three groups according to the visual impact of plantations due to their external appearance (table 5):

The results of forest standss assessment, as well as the open spaces assessment are presented on maps (fig. 1 and fig. 2) accompanied by photographs. Grouping of landscapes is made mainly based on visual characteristics of the terrain and vegetation component. Based on the results of these study it have been made a number of conclusions necessary for the development of functional zoning of the area. The aesthetic qualities of the natural conditions are assessed in the following indices:

for the forest stands:

• average height;
• passability;
• construction;
• dendrological richness;
• presence of much higher trees and single tree species occurring;

for the open spaces:

• vertical and horizontal indentation of the relief;
• degree of the horizon shelterness;
• number of visible landscapes;
• passability, construction, dendrological richness, and presence of much higher trees and single tree species occurring in the surrounding tree forest stands.

Table5. Evaluation of forest stands to their visual impact.

average height /m/	below 5				5-10				10-20				20-30				over 30				
presence of much higher trees and single tree species occurring / passability	consisting of one tree species	consisting of two tree species	consisting of three or more species with predominance of one of them	consisting of three or more species without predominance	consisting of one tree species	consisting of two tree species	consisting of three or more species with predominance of one of them	consisting of three or more species without predominance	consisting of one tree species	consisting of two tree species	consisting of three or more species with predominance of one of them	consisting of three or more species without predominance	consisting of one tree species	consisting of two tree species	consisting of three or more species with predominance of one of them	consisting of three or more species without predominance	consisting of one tree species	consisting of two tree species	consisting of three or more species with predominance of one of them	consisting of three or more species without predominance	distribution of trees
without much higher trees and single tree species occurring / impassable	10	11	12.5	13.5	12	13	14.5	15.5	14.5	15.5	17	18	17	18	19.5	20.5	17.5	18.5	20	21	uniformly
	12.5	13.5	15	16	14.5	15.5	17	18	17	18	19.5	20.5	19.5	20.5	22	23	20	21	22.5	23.5	in groups
hardly passable	11	12	13.5	14.5	13	14	15.5	16.5	15.5	16.5	18	19	18	19	20.5	21.5	18.5	19.5	21	22	uniformly
	13.5	14.5	16	17	15.5	16.5	18	19	18	19	20.5	21.5	20.5	21.5	23	24	21	22	23.5	24.5	in groups
passable	16	17	18.5	19.5	18	19	20.5	21.5	20.5	21.5	23	24	23	24	25.5	26.5	23.5	24.5	26	27	uniformly
	18.5	19.5	21	22	20.5	21.5	23	24	23	24	25.5	26.5	25.5	26.5	28	29	26	27	28.5	29.5	in groups
with presence only of much higher trees / impassable	12	13	14.5	15.5	14	15	16.5	17.5	16.5	17.5	19	20	19	20	21.5	22.5	19.5	20.5	22	23	uniformly
	14.5	15.5	17	18	16.5	17.5	19	20	19	20	21.5	22.5	21.5	22.5	24	25	22	23	24.5	25.5	in groups
hardly passable	13	14	15.5	16.5	15	16	17.5	18.5	17.5	18.5	20	21	20	21	22.5	23.5	20.5	21.5	23	24	uniformly
	15.5	16.5	18	19	17.5	18.5	20	21	20	21	22.5	23.5	22.5	23.5	25	26	23	24	25.5	26.5	in groups
passable	18	19	20.5	21.5	20	21	22.5	23.5	22.5	23.5	25	26	25	26	27.5	28.5	25.5	26.5	28	29	uniformly
	20.5	21.5	23	24	22.5	23.5	25	26	25	26	27.5	28.5	27.5	28.5	30	31	28	29	30.5	31.5	in groups
with presence only of single species occurring / impassable	11.5	12.5	14	15	13.5	14.5	16	17	16	17	18.5	19.5	18.5	19.5	21	22	19	20	21.5	22.5	uniformly
	14	15	16.5	17.5	16	17	18.5	19.5	18.5	19.5	21	22	21	22	23.5	24.5	21.5	22.5	24	25	in groups
hardly passable	12.5	13.5	15	16	14.5	15.5	17	18	17	18	19.5	20.5	19.5	20.5	22	23	20	21	22.5	23.5	uniformly
	15	16	17.5	18.5	17	18	19.5	20.5	19.5	20.5	22	23	22	23	24.5	25.5	22.5	23.5	25	26	in groups
passable	17.5	18.5	20	21	19.5	20.5	22	23	22	23	24.5	25.5	24.5	25.5	27	28	25	26	27.5	28.5	uniformly
	20	21	22.5	23.5	22	23	24.5	25.5	24.5	25.5	27	28	27	28	29.5	30.5	27.5	28.5	30	31	in groups
with presence of much higher trees and single tree species occurring / impassable	13	14	15.5	16.5	15	16	17.5	18.5	17.5	18.5	20	21	20	21	22.5	23.5	20.5	21.5	23	24	uniformly
	15.5	16.5	18	19	17.5	18.5	20	21	20	21	22.5	23.5	22.5	23.5	25	26	23	24	25.5	26.5	in groups
hardly passable	14	15	16.5	17.5	16	17	18.5	19.5	18.5	19.5	21	22	21	22	23.5	24.5	21.5	22.5	24	25	uniformly
	16.5	17.5	19	20	18.5	19.5	21	22	21	22	23.5	24.5	23.5	24.5	26	27	24	25	26.5	27.5	in groups
passable	19	20	21.5	22.5	21	22	23.5	24.5	23.5	24.5	26	27	26	27	28.5	29.5	26.5	27.5	29	30	uniformly
	21.5	22.5	24	25	23.5	24.5	26	27	26	27	28.5	29.5	28.5	29.5	31	32	29	30	31.5	32.5	in groups

structure

25 – 32.5 stands with high diversity and greatly emotional impact

17 – 24.5 stands with adequate diversity and emotional impact

10 – 16.5 stands with uniform character and less emotional impact

In conclusion we can say that the determination of aesthetic value of landscape is very complex process including the description, analysis and evaluation, expressed in the grouping of territorial units defined set of criteria associated primarily with sensory experiences.

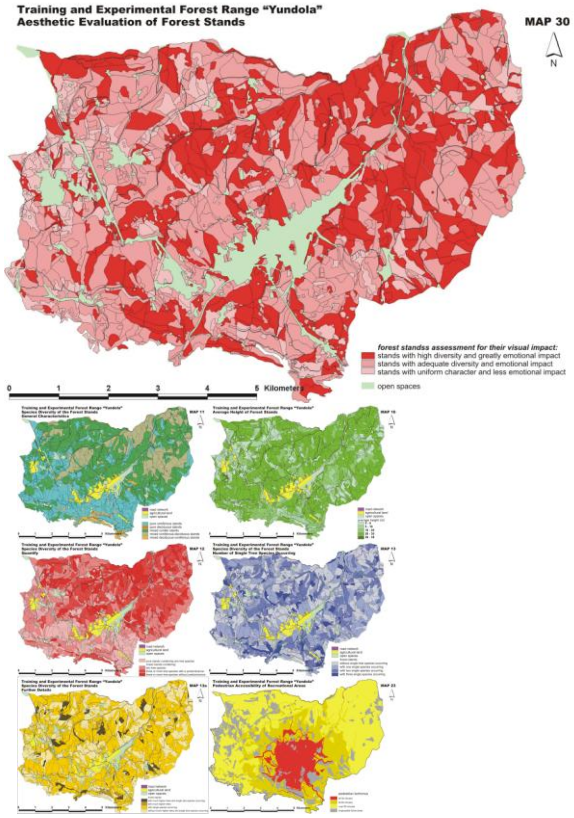

Fig. 1. Aesthetic evaluation of forest stands.

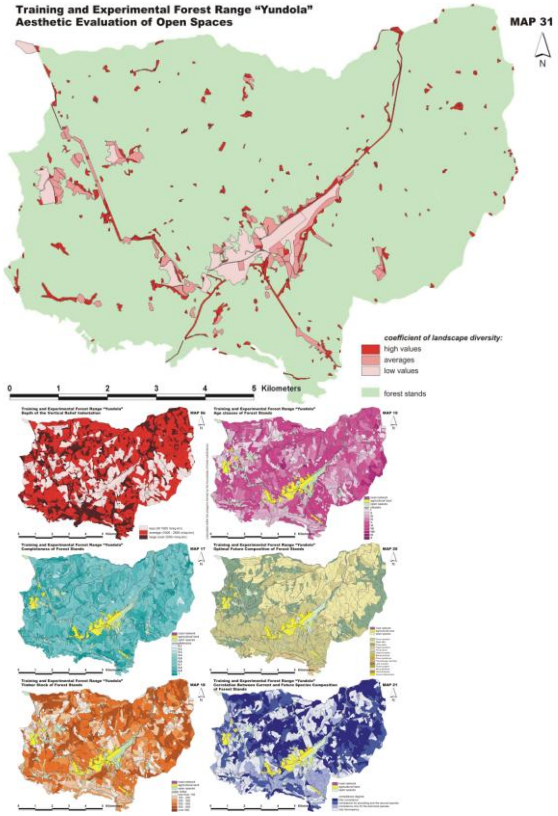

Fig. 2. Aesthetic evaluation of open spaces.

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