GEOECOLOGICAL ASSESMENT OF THE SOSKOVCHETO RESERVE

Z. Roupetsova, H. Nikolov
Plovdiv University „Paisii Hilerndarski"- Branch Smolyan

ABSRTACT. The Soskovcheto reserve are also one of the territories in Bulgaria with the highest degree of naturalness and are home to typical and representative ecosystems, including some pristine, untouched forest landscape. In this study are searched new possibilities for an ecotourism which do not contradict nature conservation.

KEY WORDS. geo-ecological state, landscapes, habitats, nature-conservation preservation.

INTRODUCTION

Geographical clusters of key importance for the development of eco-tourism in Bulgaria have been identified in the National Strategy on Eco-Tourism (NSET), in order to cover Bulgaria's biological and landscape diversity (NSET–2003). The present study is focused on the Soskovcheto Reserve, part of the Western Rhodopes eco-region. The study aims at identifying the geo-ecological status of the reserve, related to key elements – landscape and biodiversity, management tools and initiatives for sustainable development of eco-tourism. The expediency of this study is determined by the fact that the Western Rhodopes eco-region has been classified as the country's second most important eco-region – consisting of mountain landscape and compact wood formations including mainly coniferous forests (71 %), more than 70 % of which are natural. There are 100 protected areas, covering a total area of 16 881,55 ha, including: 15 reserves, 25 protected sites, and 60 natural landmarks, remarkable for their uniqueness. They are part of the project for the designation of the Western Rhodopes Nature Park (Petrov et all., 2004), being prepared at the moment and supported by GEF/UNDP, as well as part of the European Ecological Network, which is being established in Bulgaria.

MATERIAL AND METHODS

The Soskovcheto reserve was established by Order 508 of 28.03.1968, issued by the ministry , and supplemented by Order 1094 of 03.12.1986, issued by the Commission for conservation of environment by ministerial council, designating the buffer zone around the reserve. The main conservation value of the Soskovcheto reserve is determined by the remarkable mid- and high-mountain landscape, combining rhyolite sheer cliffs, talus cones, and a beautiful river valley with numerous waterfalls and unique flora and fauna. According to the physico-geographical zoning in Bulgaria, the Soskovcheto reserve belongs to the southeast part of the Western Rhodopes, Perelik-Prespa ridge. As for the administrative aspect, the reserve falls within the territory of Smolyan Municipality, Smolyan District – south-central region of the National Plan for Regional Development.

The Soskovcheto reserve is an exclusive state property by virtue of the Protected Areas Act, i.e. it cannot be expropriated or transformed into other property type, as it is managed by the Ministry of Environment and Waters (MOEW) and its regional unit – the Regional Inspectorate of Environment and Waters (RIEW), Smolyan. The National Nature Protection Service (NNPS), a department to the MOEW, has coordination and control functions related to the protected areas management, while the immediate management and implementation of the state policy, as far as the reserve is concerned, is fulfilled by the RIEW, Smolyan. According to the calculation based on the digital model, the reserve covers an area of 177.6 ha, while according to the designation order the area is 177.5 ha, including sections 1045, 1046, and 1047 of the Forest Management Plans of the State Forestry Department – Smolyan. The buffer zone covers an area of 104.4 ha (as of 1986). A dirt road leads to the northern side of the reserve, where the approach is. In 2004, an extremely attractive eco-path was tracked and marked within a project of the Ministry of Environment and Waters. As the Soskovcheto reserve and its surroundings have not been subjected to specific studies, there are significant gaps in the information, i.e. the complete species composition is not known, there is no data of the population density and state, and no assessment of concrete habitats in terms of their distribution in the territory of the reserve.

The field study was carried out in the period July-August 2004 by a team of specialists of the RIEW and Paisiy Hilendarsky Plovdiv University, covering the whole area, divided in three sectors with starting points 1, 2, 3 (Fig.1). Evaluation forms and tests were filled in for each of the sectors, providing data gathered during the field studies. The research focused on the following major issues:

1. Identification of landscapes, through the assessment of abiotic and biotic factors, and the preparation of a landscape map, according to the stipulations in art.6 of the European Landscape Convention. The taxonomy of the landscape was identified by means of the taxonomic system of the geo-ecological classification of Bulgaria's landscapes (Popov, A., 2001). GPS was used to determine coordinates and altitude; statistical methods in the office work.

2. Geo-ecological assessment of the socio-economic efficiency, using the rating for attractiveness (Brambarov, I 2001) and a quick environmental assessment,

by summarizing the eco-tests of the studied period. The assessment of the situation and the possibilities for development of eco-tourism was made following the methodology used in the Rilsky Monastery Nature Park in 2001. Eco-tests are used to objectify the assessment of the state of the environment at a certain time. They make possible the comparison with previous assessments (Peev, D., 2003).

RESULTS AND DISCUSSION:

1. Identification of landscapes – landscape identification is based on the preliminary characteristics and assessment of abiotic and biotic factors, i.e. landscape synthesis of major natural components (geological structure, relief, climate, water, soils, flora and fauna), through field (Bachvarov, G., 2001) and office work.

As for the geological aspect, the region consists of the following litho-stratigraphic units: rhyolites, rhyodacites, and trachirhyolites. The rhyolite tuffs are typical, with pillar-like, horizontal or vertical, or state or pyramidal clefts. The cleaving and weathering have resulted in specific rock formations, some of which resembling earth pillars, and others – talus. The rhyolites make the landscape extremely beautiful and unique.

The relief of the Soskovcheto reserve is mid- to high-mountain. It is steep, characterized by intense incision and segmentation, steep slopes, crests, and deep river canyons. Its highest point is 1862,7 m, and the lowest one is 1289 m, as 44% of the area is situated between 1601 – 1700 m.

The climate is mountainous, influenced by the transition-continental area, characterized by lower summer temperatures. The average monthly temperature of the air in January is between 2 and 0 ^{o}C, and in August from 14 to 18 ^{o}C; the average annual temperature of the air in the low areas is up to 10 ^{o}C, and in high areas – 2 ^{o}C; the average annual temperature amplitude is 16–19 ^{o}C. The average annual temperature of the soil is 13 ^{o}C at 2cm depth. The volume of precipitation is about 600mm. The average duration of the snow-retention is 4 months, from the beginning of December till the end of March. The average annual wind speed is 2.5 m/sec. The winds are gentle, mainly northerly and north-easterly, but in 1983, forest section 1046, covering an area of about 0,4 ha, was hit by a wind throw, which necessitated partial gathering of wind-thrown mass. Yearly, there are more than 92 sunny and 21 foggy days. The vegetation period is about 7 months (RIEW).

The Soskovcheto reserve falls within an area of extremely high affluent of water, with high effluence coefficient and relatively abrupt fluctuations of the effluence. The area is characterized by April-May maximum values, and light secondary Fall-Winter high water. There are numerous ravines in the reserve territory, running into the Gerzovska River.

The soils are: dark-colored to light brown forest soils – 41.2 ha/23% – *Humnic Cambisols*; saturated brown mountain-forests soils – 135.3 ha/76.2% – *Eutric Cambisols*; and rocks – 1.1 ha/0.6%, which is 177.6 ha/100.0% in total. Referring to the mechanical composition, the soils are clay-sandy (information from „Soil Map of Bulgaria" 2000).

The afforested area within the reserve territory is 170.3 ha, or 95.9% of the total area, including mainly coniferous forests. The tree vegetation consists mainly of natural seed plantations typical of the region. The forest composition includes spruce, white pine, fir, and beech, with an average forest age 112 years. Woodless area is 7.3 ha, or 0.6% of the total area, including: glades – 2.8 ha; rocks – 1.1 ha; barrens unfit for afforestation – 3.4 ha.

190 plant species, including also three sub-species, have been found in the territory of the Soskovcheto reserve. The species are classified in 138 genera, belonging to 48 families. The *Asteraceae* family has the most numerous representation – 21 species, followed by *Lamiaceae* – 17 species, and *Rosaceae*, *Poaceae*, and *Cariofilaceae* each represented by 12 species. Geographical location, natural conditions, and peculiarities of the paleogeographic development of the Soskovcheto reserve determine the significant diversity of floristic elements: Eurasian – 25 species, Boreal – 22 species, European-Mediterranean – 22 species, and sub-Boreal – 21 floristic elements. Sixteen plant species of conservation status have been found. There are four species of those included in the Bulgarian Red Data Book, all belonging to the „Rare" category. There is a high percentage of availability of endemic species – 13 Balkan and one Bulgarian endemic species.

The species of economic significance are relatively few. This includes mainly traditional medicinal plants and forest fruit species. 95 medicinal plant species belonging to 42 families have been found in this typically forest reserve. Only *Angelica pacicii*, a Balkan endemic species, included in the Red Data List under „Rare" category, has been found to be of nature-conservation status.

95 vertebrate species have been registered in the territory of the Soskovcheto reserve and the surrounding areas. Three fish species inhabit the Gerzovska River, and the rest of the small rivers in the Cherna River catchment area – Common minnow and Rainbow trout, as well as 2 amphibian species, including caudated – Salamander, and anuran – Common frog; and 4 reptile species: lizards – Slow worm, Viviparous lizard, Wall lizard, and snakes – Viper. There are also 43 bird species: Falconiformes – 4 species, Galliformes – 2 species, Columbiformes – 1 species, Cuculiformes – 1 species, Piciformes – 4 species, and Passeriformes – 30 species. Mammals – 44 species, including: Insectivora – 5 species, Chiroptera – 16 species, Leporidae – 1 species, Rodentia – 9 species, Carnivora – 10 species, and Artiodactyla – 3 species.

A Synthesis table has been prepared for landscape identification (Table 1), and landscapes have been marked on a map of 1:10 000 scale – Fig.1. Landscapes have been classified in one class, 3 sub-classes, 3 types, 4 sub-types, 2 genuses, 4 sub-genuses, 2 species and 2 sub-species. The landscape structure consists of landscapes with high aesthetic qualities.

2. Research of the socio-economic efficiency, through rating of attractiveness. Evaluation maps have been developed for the three points – 1, 2, 3, using the following rating system:

0 – unfavorable conditions for eco-tourism;

1 – slightly favorable;	3 – favorable;
2 – fairly favorable;	4 – most favorable

The evaluation map of each point enables the assessment of: 1) landscape attractiveness for tourists, through relief peculiarities – rock formations, talus cones, moraines, peaks, glades, etc.; 2) climate attractiveness, through slope exposure and altitude; 3) hydrological attractiveness, in terms of banks, waterfalls, spring (drinking fountains); and 4) bio-attractiveness – forests, pastures, forest fruit, and herbs. Indicators of the aesthetic-emotional impact, such as remoteness from the tourist path, settlement, and accessibility, were used as basis in the quantity evaluation, as they are of crucial importance for eco-tourism. Summarized results are given in Table 2.

The attractiveness rating helps to locate the busiest points and possible routes, as well as new points taking the anthropogenic burden and decentralizing the tourist flow in various directions to stimulate conservation sustainability. After allocating quantity indicators to individual elements, the total rating was formed, hence the attractiveness coefficient. Point 3 has the highest attractiveness coefficient, receiving the highest possible mark on eight indicators. Second comes point 1, marked 3.23, and then point 2 with the lowest coefficient 2.84. The attractiveness coefficient will be used when determining the carrying capacity of the reserve. Choosing sites for eco-tourism means finding the best combinations of nature conservation and use, and is directly dependent on the attractiveness of the site and the sustainability of the landscape and biodiversity. The combination of a lovely landscape and forest vegetation is considered to be the best possible combination, as the average daily attendance is as follows: for coniferous forests – 36 persons/ha, for meadows – 200 persons/ha, and for pastures – 300 persons/ha (Bartman, E., 1970, acc. to Brambarov, I., 2001).

The assessment of the socio-economic efficiency is based on the ecological situation, through eco-tests on the tourist route within the protected area. Applying the eco-test system enables the objectification of the environmental quality assessment and its conversion in a digital value. Thus, the impact of the specter of threats within the studied area can be summarized more easily. The following rating system has been used:

0.0 – 3.0 Very poor state – seriously deteriorated environment; lots of domestic waste.

3.1 – 5.0 Satisfactory state – non-critical deterioration of environment; main populations preserved; restoration of the regime results in restoration of the normal ecological cycle.

5.1 – 8.0 Good state – slightly affected environment; no domestic waste piling up; high percentage of reproductive viability of the main populations.

8.1 – 10. Very good condition – practically, no human interference is seen; smoothly running natural ecosystem cycle.

Six tests have been filled in during the study period, and the summarized data of the processed eco-tests for quick environmental assessment is presented in Table 3.

The total ecological rating is 7.3. The overall state is good – the environment is either unaffected or only partially affected; there is domestic waste and unregulated fireplaces, but the landscape and main populations are characterized by sustainability and viability. This necessitates serious monitoring and usage of eco-tests in a good practice.

We can draw the conclusion that the geo-system of the Soskovcheto reserve is in good state, the carrying capacity is an appropriate pre-condition for development of eco-tourism; and socio-economic efficiency is guaranteed by the good ecological status. We would recommend endorsement of the reserve management plan as soon as possible, as the site is included in Smolyan District Development Strategy, through alternative forms of tourism and in conformity with the new tourism market trends and the policy of the MOEW for sustainable development of protected areas.

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Table 1. Synthesis Table of the Landscape Identification

№	Average altitude	Relief	Rock	Im	Vegetation	Soils	Conservation significance
1	1005	Mid-mountain	rhyolite	C1	Coniferous spruce forests	brown	good
2	1796	High-mountain	rhyolite	C1	rocks	rocks	good
3	1205	Mid-mountain	rhyolite	C1	Mixed forests	Dark-colored, brown	Good, eco-tourism

Table 2. Rating of attractiveness

Point	Coefficient	Landscape attractiveness			Climate	Hydro-attractiveness		Bio-attractiveness			Anthropogenic changes and attractiveness			
№		A	B	C	attractiveness	D	E	F	G	H	J	K	L	M
1	3.23	4	4	2	4	3	2	4	3	4	2	4	2	4
2	2.84	3	4	1	3	3	2	4	2	3	2	3	3	4
3	3.30	4	4	1	4	4	3	4	2	4	4	3	2	4

Legend: Point №: 1; 2; 3 – coefficient of attractiveness, based on the total rating depending on the number of indicators.
- Landscape attractiveness: A – rocks, B – peaks and slopes, C – glades.
- Hydro-attractiveness: D – rivers, waterfalls, E – springs, drinking fountains,
- Bio-attractiveness: F – century-old trees, glades, G – herbs, mushrooms, forest fruit, H – rock vegetation.
- Anthropogenic changes and attractiveness: J – anthropogenic objects, K – accessibility, L – forest road,
  M – eco-path.

Table 3. Summarized data of the eco-tests for assessment of the ecological situation

| Indicators	State	Mark
1. Approximate route duration in hours	3 hours	8
2. Types of ecosystems traversed by the route	Forest ecosystems, rock and water ecosystems	8
3. Number of fireplaces	4 non-regulated	5
4. Camping in the wild, etc.	no	8
5. State of the area surrounding the water sources	good	8
6. Habitats of rare and threatened species	Sixteen. Four of which in the Red Data List, one in the Biodiversity Act,thirteen Balkan and one Bulgarian endemic species.	9
7. Cutting areas and fires	no	10
8. Pastures and fires	No fires	8
9. Toilets	no	5
10. Domestic waste	satisfactory	4
11. Total ecological rating	good	7.3 /73:10/
12. General notes	Domestic waste is the major negative factor	
13. Recommendations	Introduction of a waste gathering system and new fireplaces	
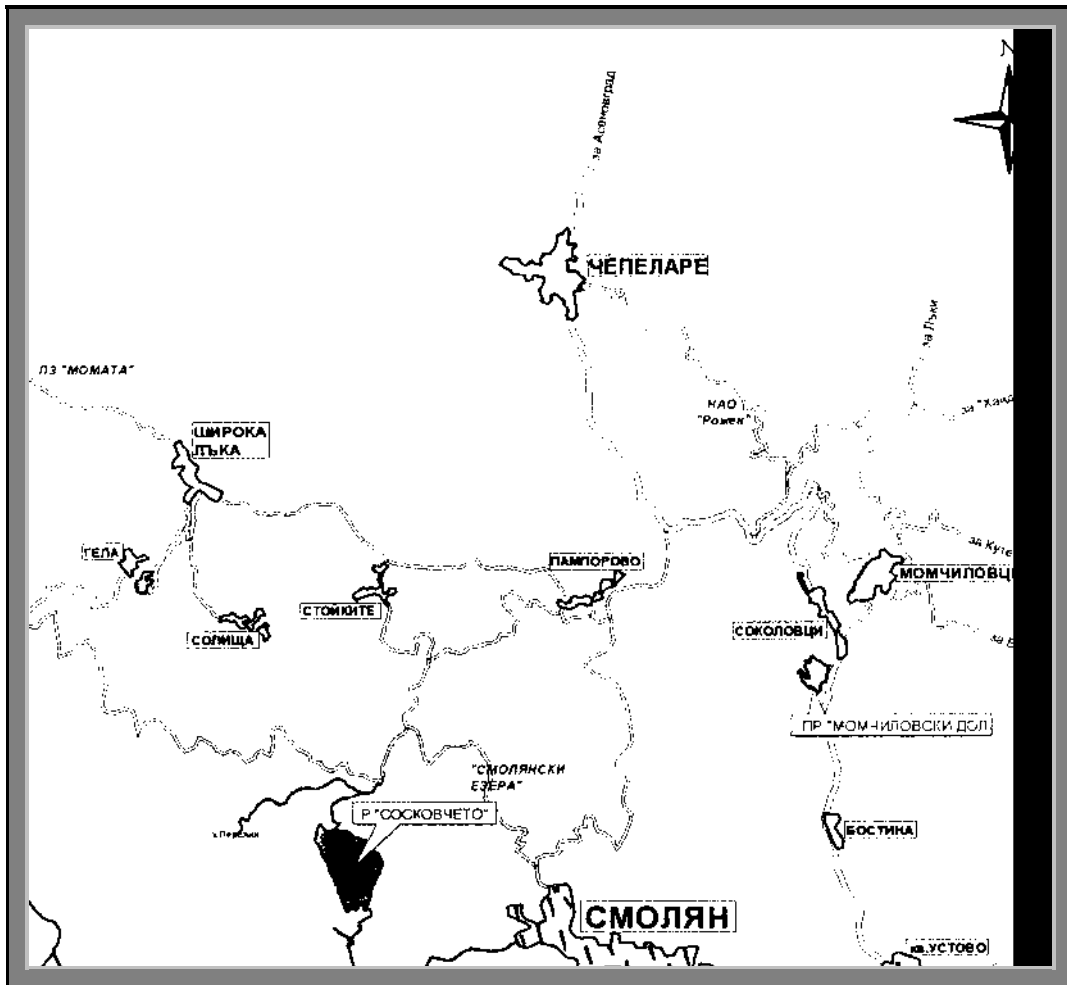
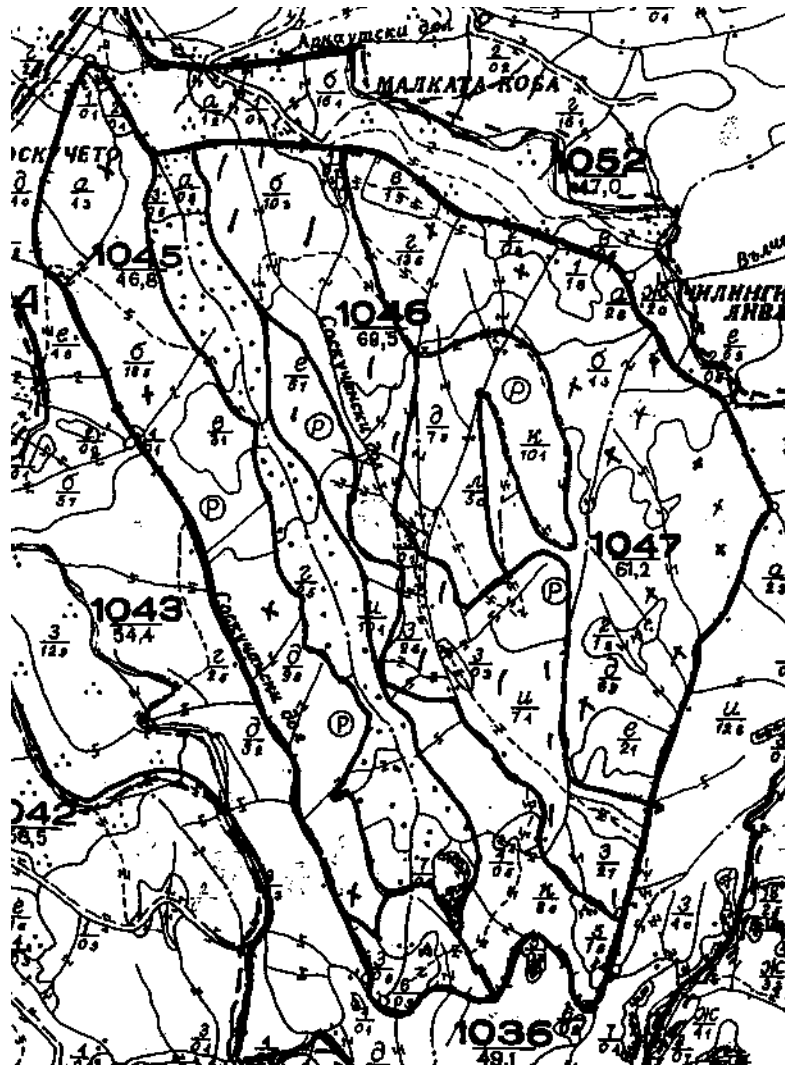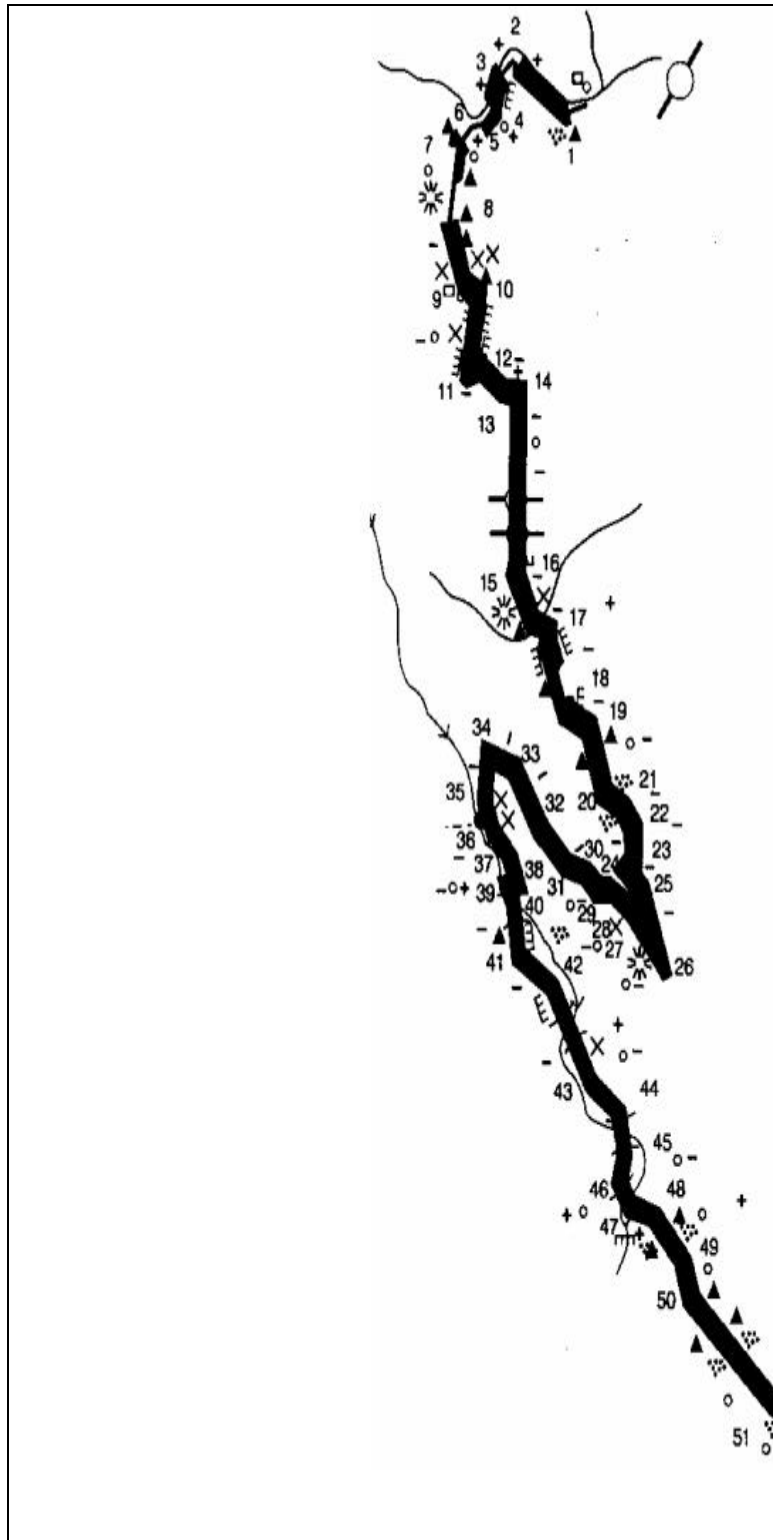**Fig.1.** *Location of the Soskovcheto reserve in Smolyan District*

Fig.2. *Landscape map of the Soskovcheto reserve*

Fig.3. „Waterfall Canyon" Eco-path in the Soskovcheto reserve