

Environmental impact of forest recreation in Estonia – results of ten years of research

Kaidi Maran, State Forest Management Centre, Estonia, kaidi.maran@rmk.ee
Kerli Karoles, State Forest Management Centre, Estonia, kerli.karoles@rmk.ee
Kalle Karoles, Estonian Environment Agency, Estonia, kalle.karoles@envir.ee

Introduction

Forest recreation has gained in popularity in recent decades and is becoming one of the most important activities of the multifunctional use of forests. It is controversial that the greatest danger to forest recreation is its increasing popularity, since overuse may change environmental conditions.

For the State Forest Management Centre (SFMC / RMK), the manager of state forests in Estonia, one of the objectives of nature management is to offer recreational possibilities in the wild and introduce sites of protection value through the nature tourism system based on everyman's right in recreational and protected areas.

Recreation management

In order to guarantee the recreational use of state forests in sustainable ways, the SFMC has applied a system of 13 recreational areas around the country with numerous nature trails, campsites, forest cabins and huts. In addition to its recreation areas, since 2009 SFMC is also engaged in visitor management in the five Estonian national parks and nearly 40 other protected areas.

In order to manage the recreational areas in sustainable ways an integrated monitoring system has been established and used since 2002:

- the interests and needs of users and changes in needs are periodically monitored (visitor survey);
- the number and distribution of visits are assessed (visitor counting) and
- the environmental impact of recreational activities is systematically (once in 4-5 year period) observed by:

- 1) regular monitoring (done by SFMC) and
- 2) periodic research (during last year's done by Estonian University of Life Sciences upon request by SFMC).

Environmental impact evaluation

Research for measuring the environmental impact of recreational activities on problematic and critical areas with higher recreational load was launched in 2002. The need for a regular monitoring method to observe the environmental condition of all recreational sites became evident and a condition class based monitoring of environmental impacts for almost all campsites started in 2008. A monitoring method for nature trails has yet to be established.

Regular monitoring

With a regularly implemented monitoring for every environmental criterion a rating of 1 to 5 is assigned based on visual observations and the condition of soil and undergrowth is measured. Based on the ratings, indexes are calculated, which give a good overview of environmental condition and may indicate a requirement for higher management attention and to include the site to periodic research.

Periodic research

In research a system of ecological indicators, characterising changes in ecosystems - condition of soil and undergrowth, area of bare mineral ground and ground vegetation cover, plant species composition and distribution, condition class of the trees and natural regeneration has been worked out and tested.

Different methods are used on:

- 1) campsites and
- 2) nature trails.

A permanent monitoring network has been established: this enables the condition of the areas, the changes occurring in them and the effectiveness of the protective measures taken to be measured and assessed.

In the process certain limits of acceptable change (LAC) (Stankey *et al.* 1985) have been worked out and implemented. The scope of environmental changes is regularly observed in order to prevent exceedance of LAC by using measures of visitor management and landscape protection in recreational areas.

Environmental impacts and landscape protection measures

The main forms of environmental impact by forest recreation in Estonia are as follows:

- 1) biota (fauna) is disturbed in their habitats;
- 2) damage to trunks and branches of trees and bushes, and deterioration of forest health;
- 3) damage to and trampling of natural tree regeneration, decreased natural regeneration capacity of forests or the emergence of unfavourable distribution patterns of tree species;
- 4) littering;
- 5) unauthorised trails and bonfire sites;
- 4) wildfires;
- 5) damage to ground vegetation, mosses and lichens;
- 6) soil compaction, water and wind erosion; and
- 7) exposed and damaged roots.

Based on research the main problem with tree condition in campsites is the small amount and unsatisfactory condition of young trees and natural regeneration, which may hinder the sustainable development of forests at campsites. In about half of the areas studied, the share of young pine trees and natural forest regeneration amounted to less than 10% of all trees.

The share of healthy older trees account for around half of all trees studied (abiotic, biotic and anthropogenic damages are valued), but only about one-fifth of all damaged trees have been directly damaged by visitors.

In campsites the main problems remain soil damage and erosion, especially in places where it is possible to drive by car into the forest. The issue is especially significant for coastal areas, where soil damage and erosion as well as damage to natural tree regeneration through trampling and driving are common. However, with different visitor management decisions implemented, the overall condition is in general improving: a positive trend in the soil and undergrowth condition has been achieved (Table 1).

The condition index (Almik *et al.* 2008) provides a good overview of soil and undergrowth conditions on campsites: the lower the index, the better the condition of the area (possible value from 1 to 6). For Estonian forest ecosystems the index value up to 3.3 is considered acceptable.

Table 1 Study results of soil and undergrowth condition index depending on different management decisions made.

Campsite	Condition index		Index variation	Main landscape protection measures used
Research years	2003	2007		

Kauksi	3.11	2.81	-0.3	Area reorganized; vehicle access limited.
Raadna	3.69	2.94	-0.75	Closed for 4 years, area reorganized.
Peraküla	3.63	3.64	0.01	(Site on sand dune.) Wooden pathways.
Krapi	3.05	3.33	0.29	Visitor guidance; vehicle access not limited.
Lemme	3.58	3.35	-0.22	Vehicle access limited.
Research years	2005	2010		
Valgjärve	3.20	2.55	-0.65	Parking limited on road next to site.
Mustjärve	3.34	2.84	-0.49	Vehicle access limited.
Kaljupealse	4.0	2.2	-1.8	Area reorganized.
Research years	2006	2012		
Tõrvanina	3.4	2.7	-0.7	Area reorganized.
Mägipä	3.6	2.9	-0.7	Area reorganized.

Conclusions

The integrated monitoring systems and research provide a combined result available for planning and management and enabling the manager to work out the best solutions for conditions where there are increasing numbers of visitors.

The best overall results on soil and undergrowth conditions have been observed in areas with organised in-area planning, establishment of a proper network of roads and parking areas, limited vehicle access to the forest, and proper visitor guidance.

In conclusion, it can be said that while the prevention of the negative environmental impact of forest recreation requires a lot of effort, a number of positive results have been achieved despite a significant increase in the visit popularity of recreational areas.

References

Stankey, G.H, Cole, D.N., Lucas, R.C., Petersen, M.E., Frisell, S.S., 1985. The Limits of Acceptable Change (LAC) System for Wilderness Planning. United States Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station Ogden, UT 84401, General Technical Report INT-176, January 1985.

Almik, A., Maran, K., Karoles, K., Rammo, M. Implementation of the results of visitor and environmental impact monitoring an example of Kauksi campsite of the recreational area along the northern coast of lake Peipsi of the Estonian State Forest Management Centre. Management for Protection and Sustainable Development. The Forth International Conference on Monitoring and Management of Visitor Flows in Recreational and Protected Areas. Montecatini Terme, 14 – 19 October 2008. Montecatini Terme, 2008, p. 463 – 467.