

Environmental GIS in the management of visitor flows

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Abstract: Besides monitoring visitor numbers and activities, spatial data on borders, restrictions, and environmental and natural characteristics is needed to manage visitor flows in recreation and protected areas. The Finnish Environment Institute (SYKE) compiles and provides data on the state of the environment and environmental trends, and acts as a national environmental information center; collecting, formulating and disseminating data to various interest groups. This data, including GIS databases and registers, consists of natural environment data (monitoring, modeling and inventories etc.) and also land use and planning data. Wide variety of data can be used through GIS methods to reduce negative ecological impacts and conflicts between different user groups in recreation and protected areas. Our poster will present a cross-section of the characteristics of some of the most useful GIS data supporting management of visitor flows. Closer look will be given on the GIS databases on land and water traffic restrictions and the GIS database on outdoor recreation opportunities (VIRGIS).

Keywords: GIS, outdoor recreation, environmental data, land use.

Information systems of environmental administration

To manage visitor flows in recreation and protected areas data on visitors and their activities is essential. In addition to that, spatial data on location and qualities of areas is needed to constitute a realistic view of areas and to consider the best practices of management.

The Finnish Environment Institute (SYKE) serves as the national centre for environmental data in Finland. The information systems and data banks of Finland's national environmental administration include a wide range of environmental information covering the whole country. This data is widely used for environmental monitoring, modelling, forecasting, and impact analysis.

Regarding land use SYKE particularly monitors and examines the spatial structure of communities, the functionality of land use patterns, the quality of residential environments, planning issues, opportunities to use natural areas for recreational purposes, and land use along shores. Other important fields of research and development include green areas in towns and cities, and the interrelationship between the built environment and the natural environment and landscape. Data from national statistics, registration systems and geographical information systems (GIS) is used in the monitoring of land use and the built environment.

Possible uses of environmental GIS in the management of visitor flows

Several types of environmental data are useful in the management of visitor flows (Table 1). We have found at least three main forms of use:

1. Land use and outdoor recreation planning

Environmental GIS includes various types of spatial data that make basic information for land use planning regarding outdoor recreation and nature tourism. Firstly, it is important to know what makes environment attractive and suitable for different forms of recreation. Features of flora, fauna, geology (valuable cliff areas and other geological formations), landscape, and cultural heritage are the basis for recreational attractiveness of an area. Threatened species are especially interesting for nature-oriented recreationists but exact geographical data on them is restricted to official use. In planning, however, data on their location is important to avoid causing harm to sensitive habitats and species. Secondly, it is important to know where nature conservation areas, recreation areas, and land and water traffic restriction areas are situated and what instructions on land use are given in regional and local master plans. When all this information is combined with information on e.g. road network and the spatial structure of densely populated areas it makes an illustrative picture of the accessibility and attractiveness of areas and the presumable pressure on them. Analysing this data helps to consider the evenness of available recreational

Table 1. Some of the most useful national monitoring data and data systems of the Finnish environmental administration regarding management of visitor flows.

Information system	Unit of information	Data content
Nature conservation areas, conservation program areas and NATURA 2000 areas.	Single area	Nature conservation areas (Nature Conservation Act, the Act on the Protection of Wilderness Reserves, the Act on the Protection of Rapids). EU's Natura 2000 protection areas that are comprised of sites compliant with the EU Habitats Directive or Bird Directive. Nature conservation programme areas (national parks and strict nature reserves, mires, wetlands, eskers, herb-rich woodland, shores, and old-growth forests). Valuable landscapes and national landscapes, nationally important cultural historical environments, national urban parks, traditional rural biotopes, and protected areas established on private land.
Threatened species database (TAXON)	Single point	Nationwide and regionally threatened plant and animal species, species mentioned in EU Habitats and Bird Directives and other international conventions, and some other species monitored by Finnish environmental administration. (Observations and observation sites).
Land use database (SLICES)	10 m or 25 m pixel	Land use data on built land, agricultural land, forest land, and water areas. All have several classes with subclasses.
The nationwide regional plan geographical database (VASEPA)	Single plan	Combination of planning information from regional councils on regional plans.
Local master plan raster database	Single plan	Scanned master plans which were ratified according to the old Land Use Act.
The monitoring system for spatial structure of urban regions (YKR)	250 m x 250 m grid	Different functional divisions (e.g. densely populated areas), information on e.g. population, buildings and housing, labor force and working (incl. workplaces). Long time series (1980 – present day).
The information system for monitoring living environment (ELYSE)	Municipality and the functional divisions within them	Quality of residential areas in densely populated areas. The indicators will cover the following themes: population, housing, buildings, services, traffic, land use and community structure, jobs, built cultural environment, natural environment and landscape, municipal infrastructure and energy, environmental hazards, and social environment.
Hydrological data systems	Single point, pixel	Hydrological information that contains up-to-date information on current or forecast water levels, snow cover, ice cover, water quality etc.
Algal blooms monitoring	Single point, pixel	Algal blooms in the Baltic Sea and Finland's inland waters. (Remote sensing methods and observations.)
Land and water traffic restriction areas	Single decision area.	Water traffic speed limits, restrictions on water traffic (vessel type, anchoring, wave forming etc.), and restrictions on off-road vehicle use. Decisions are made by regional environmental centers and Finnish Maritime administration.
Outdoor recreation opportunities database (VIRGIS)	Single area, route or service.	Recreation areas (polygons), trails (linear data), and recreation services (point data).

opportunities and connections between recreation areas through green belts (Figure 1). Connections are important to enable movement of people (and animals) for longer distances and to improve the quality of living environment. Carefully planned connections make it also possible to steer visitor flows in a desired way.

Motorized outdoor recreation can be managed by restrictions. Purpose of these restrictions is to guarantee the safety of land and water traffic and to reduce negative impacts on nature. This is done by

limiting speed of off-road motor vehicles and vessels, as well as by restrictions that prevent use of certain types of vessels or of any motor vehicle at all. Restriction areas are mainly located in densely populated areas but some are found in more remote locations where limitation of motor traffic is needed to protect natural values.

Hydrological data is useful both in planning and everyday management of recreational opportunities. Monitoring data on e.g. water quality (sight depth, concentration of harmful substances etc.) is important

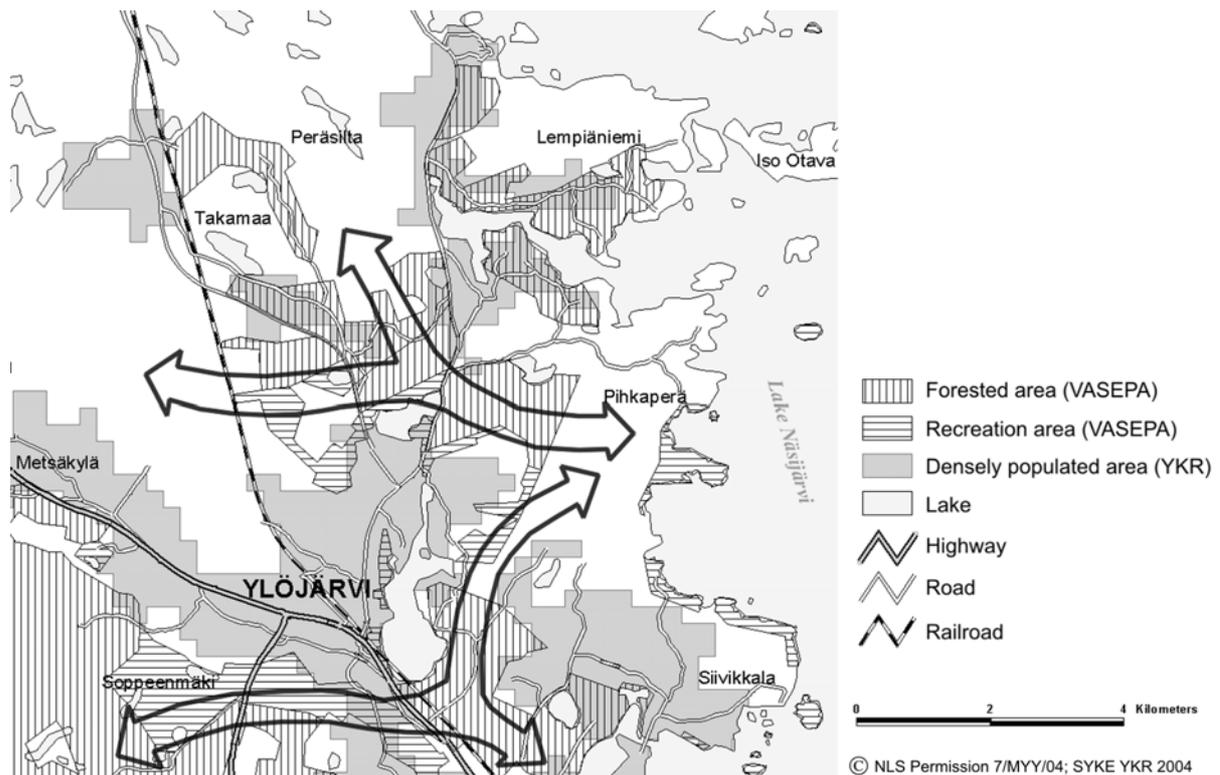


Figure 1. Regional plan data (VASEPA) on forested areas and recreation areas together with densely populated areas from the Monitoring system for spatial structure of urban regions (YKR) reveal important green belts connecting individual green areas (arrows). If not carefully monitored, these connections can become threatened by the sprawl of densely populated areas.

when planning for water based outdoor recreation opportunities.

A GIS data system focusing on outdoor recreation opportunities (VIRGIS) is under construction at SYKE. The basis for the database was made during the National outdoor recreation demand and supply assessment study in 1997–2000 (Kopperoinen & Shemeikka 2001a, 2001b). Collection of data has continued since then through the University of Jyväskylä. SYKE will work on this raw data to produce a nationwide GIS database of good quality on outdoor recreation opportunities. The database will be completed by 2006. VIRGIS is essential in land use, outdoor recreation and nature tourism planning. When comprehensive supply data is compared with demand for recreation opportunities it helps directing resources in right places and for right forms of recreation and thereby directing visitor flows.

Management of visitor flows in Finland is, however, more complicated than in many other countries. Tourism and outdoor recreational activities are greatly facilitated even in protected areas by everyman's right – the traditional and extensive right to roam in the countryside, no matter who owns the land. These rights come together with the responsibility not to disturb or harm natural surroundings or

other people's property. These rights apply to foreigners as well as Finnish citizens.

2. Media

Each summer, SYKE issues regular bulletins about algal blooms in the Baltic Sea and Finland's inland waters, in co-operation with Finland's 13 regional environment centres and the Finnish Institute of Marine Research. This information redirects visitor flows to lakes and seaside as algal blooms diminish attractiveness of a body of water for water based recreation.

Regularly monitored data on snow and ice cover and ice thickness is valuable e.g. in directing users of skiing and snowmobiling trails or jiggers. Outdoor recreation on ice covered lakes, streams and sea is very popular in Finland. SYKE gives bulletins on ice thickness and warnings of fragile ice. This data is indispensable when safety of outdoor recreation is in question.

To manage visitor flows and activities of visitors data on land and water traffic restriction areas should be well-known among planners (Figure 2). It should also be shown in outdoor recreation maps, parking lots by recreation areas, and along the routes.

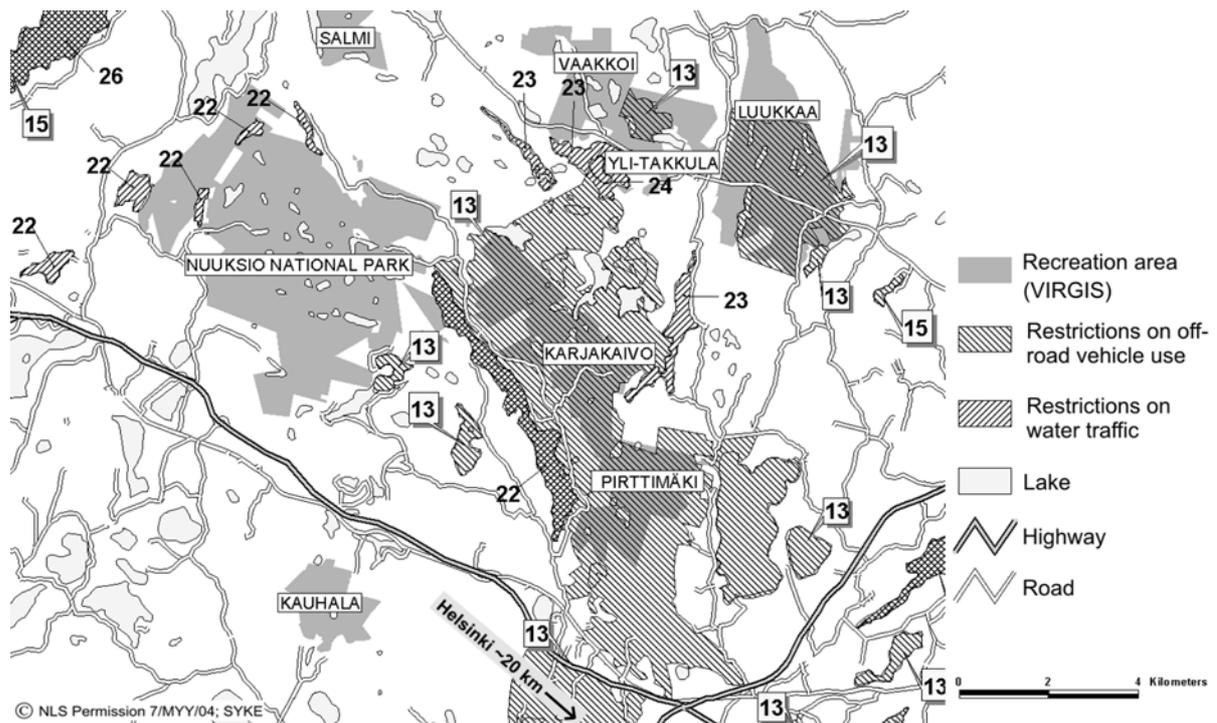


Figure 2. Areas close to major urban areas, such as Nuukio lake plateau (situated only about 20 km from the centre of Helsinki), are subject to strong pressure and therefore need careful planning. Nuukio area is widely covered with a net of recreation areas as well as restriction areas. This kind of information should be available not only for planners to use, but also for visitors, either on maps and/or on field. Place names on map refer to recreation areas (VIRGIS data, under construction), numbers refer to restriction types (framed numbers = restrictions on off-road vehicle use, plain numbers = restrictions on water traffic). [13 = "use of motorized vehicles on terrain and on ice-covered water-areas forbidden", 15 = "use of motorized vehicles on ice-covered water-areas forbidden", 22 = "use of motor-boats forbidden", 23 = "use of motorized vessels forbidden", 24 = "use of motorized vessels forbidden (exceptions on vessels with electric motors)", 26 = "use of motorized vessels forbidden (restrictions on maximum engine power)"].

3. Environmental education

One of the greatest educational challenges of our age is to provide people with enough basic knowledge about nature, and especially to make it possible for them to build a personal relationship to nature and a genuine interest in it.

When an individual has a personal relationship to nature he or she respects nature and knows how to roam outdoors without disturbing sensitive habitats and species. GIS, together with the wide variety of environmental datasets makes it easier to meet this challenge of education.

Access to environmental GIS

Environmental GIS is used by environmental administration (The Ministry of Environment, SYKE, regional environment centres). In addition to that, other ministries, regional and local authorities, researchers, and even members of the public may use it.

References

- Kopperoinen, L. & Shemeikka, P. 2001a. LVVI-tarjontatutkimuksen toteutus. Abstract: Outdoor recreation supply survey. In: Sievänen, T. (ed.). Luonnon virkistyskäyttö 2000. Metsäntutkimuslaitoksen tiedonantoja 802: 142–151, 201.
- Kopperoinen, L. & Shemeikka, P. 2001b. Virkistysmahdollisuudet Suomessa. Abstract: Outdoor recreation opportunities in Finland. In: Sievänen, T. (ed.). Luonnon virkistyskäyttö 2000. Metsäntutkimuslaitoksen tiedonantoja 802: 152–178, 201–203.