A novel GIS –based approach to reconcile the needs for nature conservation, tourism and recreation

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Introduction

Nature-based tourism is considered important cultural ecosystem service, which can have indirect positive impacts on biodiversity through nature protection (Balmfordet al. 2015). However, thedirect impacts of tourism on nature are negative (Cole &Landres 1996; Tolvanen &Kangas 2016)challengingthe land-use planning of tourism areas. Sustainable land use planning should ensure conservation of biodiversity, social acceptability of land management actions and use of nature resources in an economically sustainable way.Therefore, there is a need for multidisciplinary approach that simultaneously considers ecological and socio-economic values.Our aim was to develop a GIS-basedmethod, whichcan increase social acceptability and ecological sustainability of land-use planning. Itbenefits from existing spatial ecological data and combines it to spatial informationon people's values and needs concerning the use of the area. The study was carried out in a project "Socio-ecological tools for the planning of tourist destinations in Kainuu (VAAKA)" in North-Eastern Finland (Tolvanen et al. 2014).The project's pilot areas were tourism resorts, which are located close to protected areas.

Methods

Wecompiledexisting spatial ecological (e.g. species, habitats) and cultural information (e.g. traditional landscapes,nationally remarkable relics) ofthe study area to calculate ecological and cultural value. For calculationswe divided the study area to 1ha cells. To calculate the social value we collected spatial social knowledge through internet-based Public participation GIS (PPGIS)–survey (e.g.Brown &Kyttä 2014). In the survey participants were asked to mark important places for their activities on the map and indicate the frequency of the activities, mark pleasant and unpleasant sites and reason for the sites being selected, and mark development proposals regarding land uses (tourism, forestry, conservation). Survey was open for everyone. To recruit local as well as tourist participants we advertised the surveyin newspapers, social media, through local project partners, and specific campaigns arranged

in the study area. A paper format of the survey was also available, to increase the response rate of those participants who did not want to use the internet version. The ecological, cultural and socialinformation was combined with spatial analyses tolocate ecologically, culturally and sociallyvaluable areas with possibly conflicting land-use pressures. Based on the assessed values and their joint analysis we created a classification system which can be used to rate different areas into different land use classes based on their suitability.

Results

Approximately 36% of the study area obtained ecological value (fig 1.). The sites with highest ecological values were located in conservation areas, but there were more 1ha cells obtaining ecological value outside than inside conservation areas. Based on the available spatial data altogether 221 culturally valuable sites were located in the study area and were used in calculation of cultural value. Altogether288 persons replied to the survey and provided 682 markings. Of the respondents, approximately60% were tourists and the rest were local residents. Respondents marked 278 important places for their activities, most common activities beingsports, hiking and nature observation. There were 270 markings for pleasant (fig 1.) and 40 markings for unpleas-

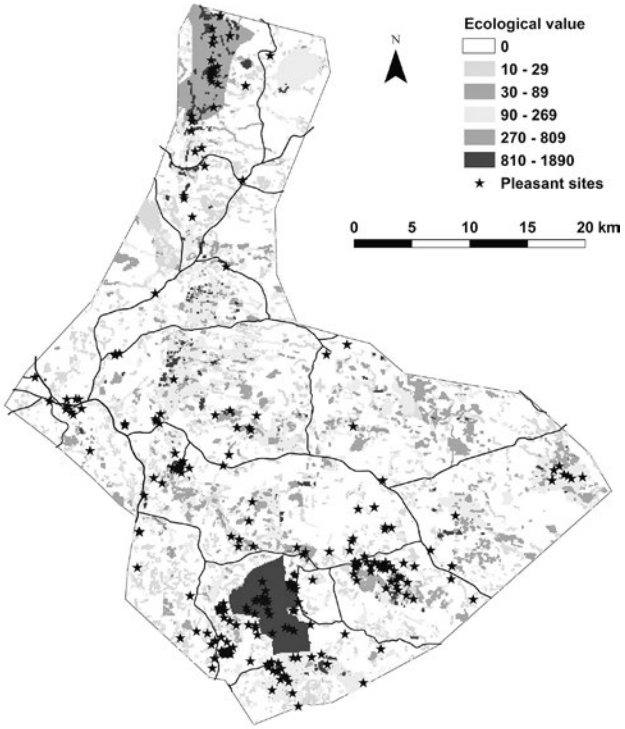

Figure 1. *Ecological value and pleasant sites in the study area.Ecological value indicates the conservation and biodiversity value of different sitesranging from 0 (no value) to 810-1890(very high). Pleasant siteswere mapped by local and tourist participants in PPGIS-survey.*

ant sites. Beautiful scenery was the most common reason for a sitebeing pleasant and damagedenvironment for unpleasant sites. Nearly 100 markings involved suggestions on the land uses. Most commonly respondents marked areas where they don't want forestry or tourism infrastructure.The social values markings were mostly concentrated near tourism resorts and recreational areas. Pleasant siteswere often located in the sites with ecological values (fig 1). Based on the joint analysis of different data layers each 1ha cell could be classified to one of 4 categories describing its suitability for tourism development based on ecological, cultural and social values. The sites that had all three values and also high intensity of use were regarded most suitable for tourism development. The sites with highest ecological values were regarded unsuitable for tourism development to safeguard their biodiversity values.

Discussion

We developed a GIS-based methodthat considerssimultaneously ecological, cultural and social values.Locating ecologically valuable areas is important for preventing biodiversity loss. However, the use of ecological data is often constrained, as the data is scattered among several actors and may require expertise.Our study gives promising resultson the joint-use of multiple ecological datasets and further linking them to spatial information on cultural and social values.PPGIS method offers a participation tool to collect spatial information on values and needs (Brown &Kyttä 2014).The method proved suitable for collecting data from different stakeholders in rural tourism development area. The results indicated that ecologically valuable areas were also important for recreation and can provide cultural ecosystem services. We encourage the use GIS-based method in land use planning as the spatial overlay of different valuescan reveal potential synergies and conflicts between land uses, which is important for the coordination and reconciliation of land uses.

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