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Development of a Zoning Instrument for Visitor Management in Protected Areas

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Introduction

PROGRESS (PROmotion and Guidance for Recreation on Ecologically Sensitive Sites) is an initiative co-funded by the EU Interreg IIIB Program. It's a four-year international project between the Forestry Commission (UK), Office National des Forêts (Fr), Research Institute Alterra (NL), the Country site Agency (UK) and Tourisme Seine et Marne (Fr). The project aims to reduce the impacts arising from the increasing demands of recreation on protected conservation areas; in this case the New Forest in the UK and the Forêt de Fontainebleau in France. Besides their designation as Natura 2000 sites these areas have in common that they are situated within reach of large centres of population attracting millions of visitors each year. Due to their popularity, some parts of both sites are coming under increasing recreation pressure and action is needed to help protect the habitats and wildlife these sites have been designated for. One of the project's main objectives therefore is to develop a zoning instrument which can serve as a management tool for the redirection of visitor flows.

Methods

The GIS-based models MASOOR and LARCH developed at Alterra are the basic elements of the zoning instrument. MASOOR stands for Multi Agent Simulation of Outdoor Recreation; agents being user-groups like walkers etc. MASOOR models the recreational use of a road/path network in an area. Input for the model are GIS-maps of car parks as a visitor starting point and the network of roads/paths to move around on. Input on visitor densities has been derived from car park capacities, the estimated car park turn over rate and the results of year round traffic counters. Input on visitor characteristics has been derived from interviews like the type of user-groups; group size; duration of the visit; walking distance etc. (Visschedijk et al. 2002). Interviews have been carried out near car-parks on several days throughout the year, in order to verify seasonal differences. GPS's were handed out to visitors in order to analyse the actual use of the area, to compare it with the interviews and consequently to validate the output of the model. Due to the scale of both sites, MASOOR had to be extended with a separate tool to allow for a quick scan on potential problem locations; a common scale problem which has also been recognised by Gimblett (2005).

The model LARCH stands for Landscape Assessment using Rules for Configuration of Habitat. LARCH determines ecological networks for specific species in a patchy landscape and assesses the potential sustainability of these networks (Opdam et al. 2003, Verboom & Pouwels 2004). The results of LARCH may differ from the actual species distribution due to external factors like visitor disturbance which affect the ecological carrying capacity. An intensive literature research on dose-impact relations of recreation and breeding birds has been carried out (Henkens et al. 2003) and laid down in a database easily accessible for modelling purposes.

Further modelling input required were GIS vegetation maps as a basis for analysing the breeding bird habitats. These maps have been validated through ground true observations.

Results

Figure 1 shows the vegetation map of the New Forest with an overlay by the MASOOR quick scan. The overlay shows different sized dots, encircled with bands. The dots represent car parks; the bigger the more visitors start from there. The bands represent the visitor density which generally decreases in relation to an increased distance from the car park.

Figure 1 among others shows that tarmac roads act as barriers to visitors, as can be seen from the triangular shaped structures (see arrow) which seem to be cut of by roads. The figure as well shows that the bands often seem to absorb a whole cluster of car parks (see oval), meaning that the impact of adding or closing car parks for nature management reasons within this cluster is disproportional to disturbance; there always is the influence of other car parks nearby. Images like fig. 1 give a first indication of bottlenecks while it also indicates the management action required to solve it. For the nightjar this resulted in a statistically significant negative relationship between visitor densities -using the quick scan tool- and breeding densities.

Figure 2 Output MASOOR; The density of the lines represents the intensity of visitor use.

The first analysis on bottlenecks has been followed up by a more detailed MASOOR analysis. Figure 2 gives the MASOOR output near a certain car-park in the New Forest. The lines' thickness represents the intensity of visitor-use, while this is a measure for the (species specific) disturbance distance along the path.

In an interactive process between park authorities, user-groups and scientists a range of potential management actions at locations like fig. 2 have been analysed using the zoning instrument. This has lead to redirection of visitor flows mutually agreed by all stakeholders involved.

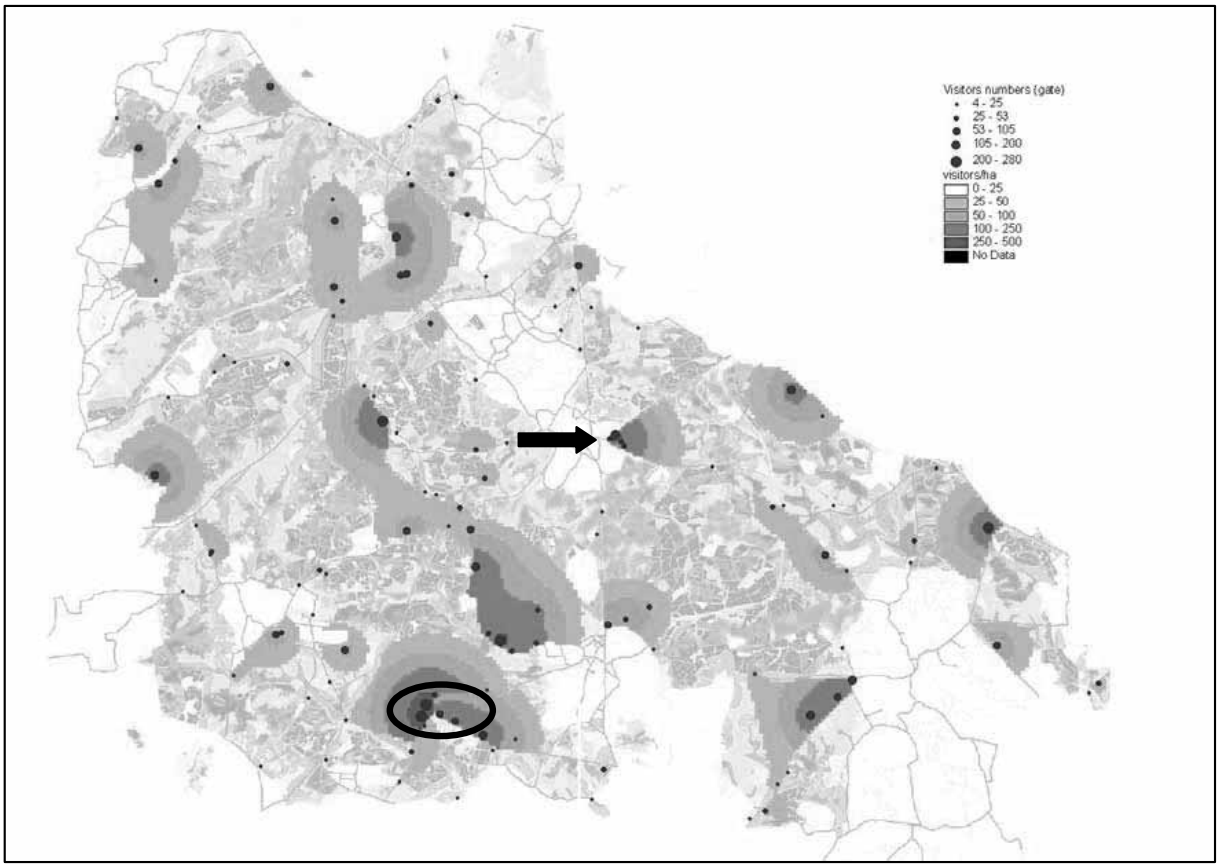

Figure 1: New forest vegetation map, road network and parking map with an overlay of the quick scan by MASOOR.

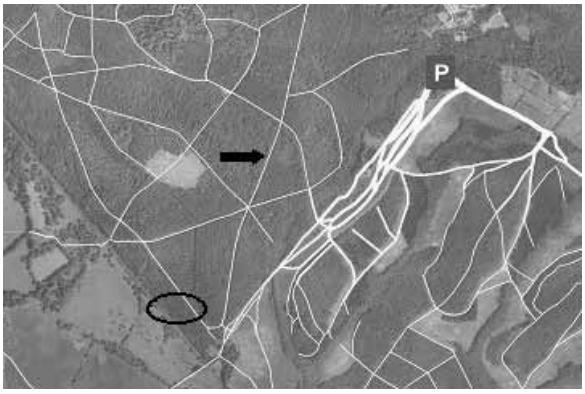

Figure 2: Output MASOOR; The density of the lines represents the intensity of visitor use.

Conclusions

- The GIS based zoning instrument proved to be a handy decision support tool for nature managers to identify locations where visitor disturbance suppresses the quality of birds' breeding habitat beyond a certain threshold and to find best ways to redirect visitor flows.
- A statistically significant negative relationship has been found between visitor disturbance and breeding densities of the nightjar.
- The participatory GIS approach built trust among stakeholders about data and tools that were used, which increased the acceptance of proposed actions to redirect visitor flows.
- Further scientific research should among others focus on dose-impact relations between visitor pressure and the breeding success of birds, or other biodiversity features concerned.

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