Transactional Environmental Support System Design:

Global Solutions

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Chapter 19

Biodiversity and Ecosystem Services in the Frome Catchment, Purbeck District, United Kingdom

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ABSTRACT

A map for valuing ecosystem services in the 480 km² Frome catchment, to investigate scenarios of change in land use, was internet crowd-sourced. Scouts mapped deer habitats in 15% of the 30 km² Arne Parish, while 143 residents volunteered data on deer sightings in the 5-year community survey.

INTRODUCTION

The River Frome feeds from a 48,000 ha catchment in the south of the county of Dorset, on the UK south coast, about 60 km long and 17 km wide near its westerly origin at about 225m above sea level (See Figure 1). It drains from chalk downland with steep slopes and sheltered valleys to flat-bottomed open valleys with clay and alluvial deposits in the lower reaches. More than 74% of the catchment supports either improved grassland or arable farms, with nearly 4% developed as housing and gardens, the remainder being forest and heathland.

Arne is a Parish of 1,260 citizens, which in 2006 had €28,285 average income and only 2% unemployment. Of its 29.6 km² area, with 40% farmland, 13% woodland, 18% water or wetland and most of the remainder heathland or coast (See Figure 1), 65% is designated for conservation. Extensive lowland heaths have international conservation priority (See Figure 2), with rare

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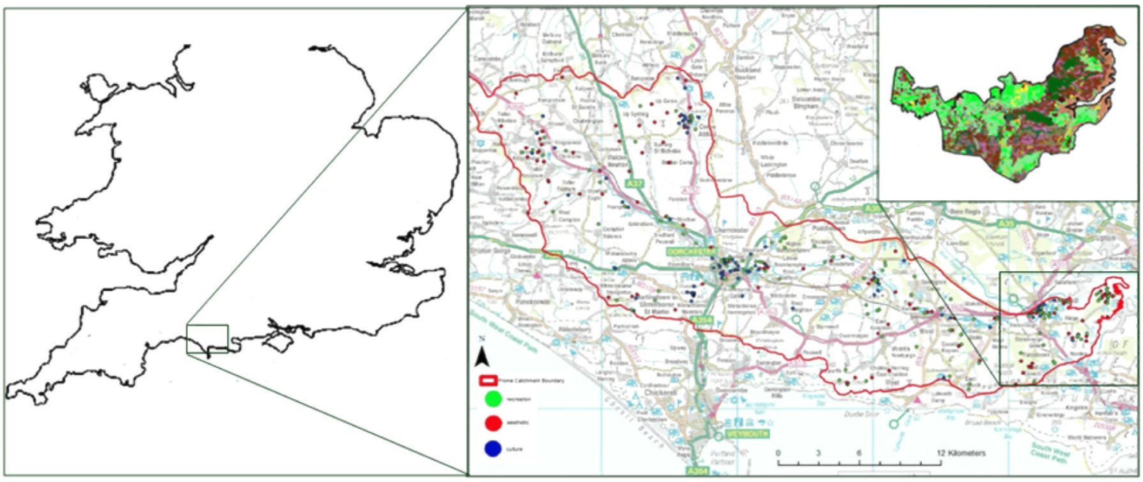
Figure 1. The River Frome catchment in Dorset on the UK south coast (left), with points used for recreational ecosystem services as registered by local people (right). East (downstream) is Arne Parish, inset to show pale peripheral grassland, dark central conifers and extensive heathland.



plants, invertebrates, reptiles, amphibians and birds that have long been a UK Biodiversity Action Plan priority (DOE, 1995). Both main residential areas, Stoborough and Ridge, are within a 10km² quadrat containing the UK's highest plant diversity.

THE SOCIO-ECONOMIC PROJECT IN THE FROME CATCHMENT

The key objective of this project was to examine the linkages between human well-being and the benefits derived from ecosystem services as perceived by the local community and other stakeholders. Participatory rural appraisal (PRA) techniques were used to elicit the relative importance of the benefits identified to the different societal sectors and to develop suitable indices to measure recreation and aesthetic value of landscapes from the community perspective. The study involved assessment of the provision of selected ecosystem services as identified by local stakeholders, a stakeholders' workshop and an online survey designed to engage the wider community. Outputs include an assessment of the spatial variation in provision of ecosystem services and their associated values, both under the current situation ('business as usual', BAU), and under a scenario of potential land cover change, focusing on ecological restoration at the landscape scale.

More specifically the objectives were to:

1. Provide a measure of the value of the environment to local people, and how this varies across the landscape.
2. Identify synergies and trade-offs between different ecosystem services, and between ecosystem services and biodiversity.
3. Illustrate the impacts of potential land-use decisions on biodiversity and benefits derived from ecosystem services.

Methodology

For Objective 1, participatory rural appraisal techniques were used to elicit views of local stakeholders in two ways: (a) stakeholder workshop for decision makers (b) Internet-based survey. The online survey used the Drupal Content Management System (CMS) 6.16 and Webform 6.x-3.0 Beta 4. The survey was piloted at the Stakeholder

Figure 2. A stretch of the River Frome (left) and deer on heathland in Arne Parish (right)

Workshop for decision makers in March 2010 and then uploaded to a dedicated website which led the respondent through the sections of the survey, with the incentive of entering a draw to win local produce hampers. To promote the survey, project flyers were displayed in local libraries, tourist offices, museums and on parish notice boards, with coverage in local community newsletters, magazines, and on the websites and e-message systems of community and interest groups.

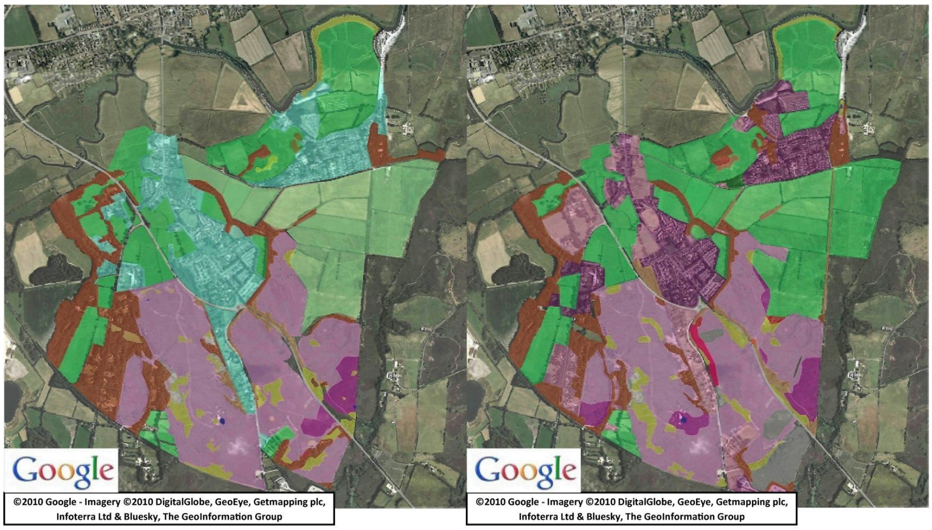
For Objective 2, the value of benefits, as measured in the online survey, were used to estimate potential change in value from nature restoration. Alternative scenarios were compared to the current landscape (the UK LCM2000 map) for 23 Strategic Nature Areas (SNAs) in the Frome catchment, with restoration of (i) 30% of the area of each SNA covering the target habitat, (ii) 60% and (iii) a combination of 30% and 60% based on Brenman (2005:43).

For Objective 3, Spatial Multi Criteria Analysis (MCA) was used to bring all the benefits expressed in different measurement units (monetary and non-monetary) together into one common unit. MCA was then used to explore the impacts of alternative future scenarios (representing a change in land cover) on the relative provision of different ecosystem services as perceived by the local community (Newton et al. 2012). To investigate trade-offs identified in the scenarios, we also considered the Integrated Valuation of Ecosystem Services and Tradeoffs tool developed by the Natural Capital Project (Nelson et al. 2009; Tallis & Polasky 2009). InVEST is a suite of spatially explicit models that map and value ecosystem services to enable local, regional and national decision makers to assess how alternative policy scenarios may affect the delivery of multiple ecosystem services and find potential trade-offs.

Stakeholders and Data

Representatives of key local organizations involved in managing the environment in the Frome catchment were included in a stakeholder's workshop. These included environmental NGOs (e.g. Dorset Wildlife Trust), government agencies (e.g. Natural England and the Environment Agency) and others. The wider community also contributed to the project through involvement in the online survey and mapping project.

Figure 3. Mapping by the Scout team (left) and by the biologist (right)(Google copyright)



The first data collected included the standard TESS questionnaires. The Parish Council supported a survey of all parishioners for TESS on condition that the TESS team organised the more extensive Parish Plan survey, in which TESS questions were 20% of the total, and 335 responses were obtained. There were 98 Frome Catchment surveys completed online, of which 78 also completed the interactive mapping element, mapping 782 points of value.

Problems

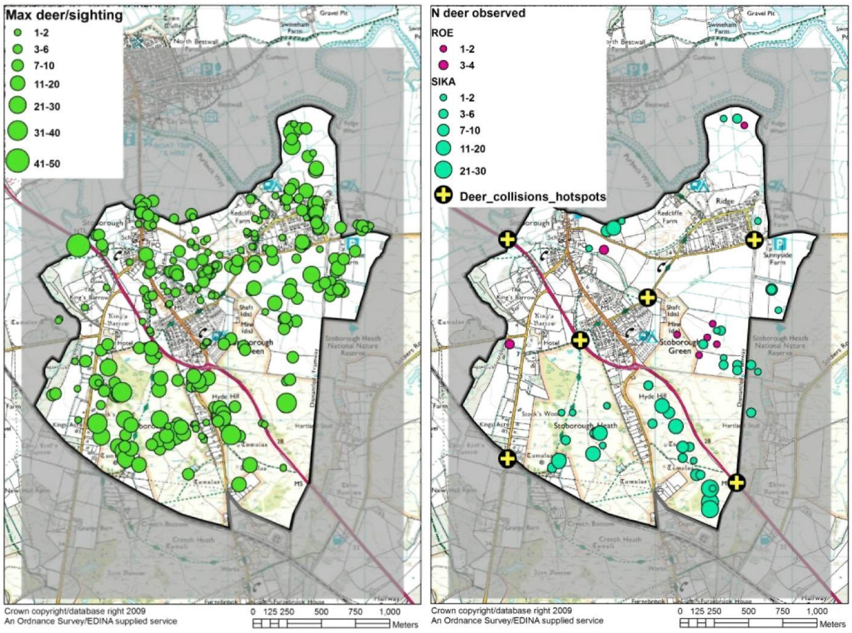
Recruitment to the online survey was limited, with a potential bias towards nature conservation interests. There were a number of problems with ecosystem valuation owing to the lack of a standardized methodology. This uncertainty was explored through scenario building and sensitivity analyses. These indicated that monetary valuation is particularly sensitive to benefits transfer and carbon values.

The InVEST software proved inappropriate for use in the Frome catchment project. A major problem was the limited number of suitable modules in the 2010 InVEST 1.005 Beta package. Access to modules currently unavailable (such as flood mitigation, agricultural production, timber production, recreation, tourism, and cultural benefits), would have been useful (see also Chapter 5). A further major problem in the use of InVEST was inability to incorporate declining discount rates, which were used here in line with UK guidelines for a projected time horizon of this length. Other limitations included a tendency for the software to round up values (e.g. not allowing decimal values for finance) and bugs in early carbon model versions.

MAPPING DEER AND THEIR HABITATS IN ARNE PARISH

In the survey for Chapter 3, Arne Parish recorded "Deer damage: crops, gardens, road accidents" as the environmental issue with highest frequency of attention required by the local council. Deer numbers have increased recently in the area (Putman 2008), with large herds of introduced sika (*Cervus nippon*) finding refuge on protected heathland and then foraging in nearby fields and gardens, which often involves crossing roads.

Figure 4. Deer sightings mapped by 143 parish residents (left) and by the post-doc biologist (right)



The mapping project tested whether local people can map deer and deer-damage hotspots in a way that helps deer managers, and also map habitats in ways that could be used to model deer populations in the future. Field work was planned in June-July 2010 and conducted during August-September 2010, mapping the western 4.6 km^2 of Arne Parish, including 2 settlement areas with more than 90% of the population. Mapping of habitats was arranged through the Scoutmaster (a local farmer's son) for a group of 6 local Adventure Scouts (the senior scout category), cooperating with an expert local deer manager/hunter, supported by farmers, foresters, and reserve managers. The two leading scouts were given 3 hours of field training with the software and then worked in groups to do sections which they allocated themselves.

Mapping of deer by local residents was part of the Parish Plan survey for all voters. For each location where a resident saw deer, they were asked to mark the route they were following and to record how many times they saw deer there during the year, the maximum number seen and whether there was damage; they also marked on the map the route they were following when they saw the deer and how often they followed that route each year. The data were compared with independent route counts at 105 locations through the area conducted on 5 mornings and 5 evenings in July and August by a deer biologist, who also mapped habitats.

RESULTS

For the catchment-scale study, main conclusions and recommendations were (i) stakeholders hold a wide diversity of views regarding the relative value of different habitat types for recreation and aesthetic value; these do not necessarily accord with how the landscape may be valued for biodiversity or habitat quality; (ii) the are few opportunities or tools available to foster dialogue between stakeholders regarding conflicting values of different land cover types nor land uses.

Accuracy of habitat mapping was very similar between Scouts and the professional biologist (See Figure 3). Categorisation differed for some habitats (needing better definition of categories), but neither the scouts nor the biologist were consistently more correct. Contiguity of adjacent shapes was poorer for Scouts due to less familiarity with the snap-to tool in the software.

There were 289 records estimating >8,000 deer sightings from 143 Arne residents (See Figure 4). This gave many more data than in 5 surveys at dawn and 5 at dusk to a standard developed by the biologist (Uzal 2010). However, these data will require much more processing to assign probable species and total numbers than the more systematic surveys by the professional.

CONCLUSION

The crowd-sourced Frome Catchment data proved adequate for a refereed publication that compared three land-use change scenarios in terms of the values expressed (Newton et al. 2012). Cumulated species sightings by Arne residents appeared more effective than limited counting by professionals, although analysis techniques require attention. Mapping by enthusiastic volunteers at secondary school level (Scouts) was as effective as work by a professional deer biologist. Moreover, training and incentives for the Scout mapping were estimated at 20% the cost of mapping by the biologist.

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