ECOTRADE – INVESTIGATING THE SUITABILITY OF TRADABLE PERMITS FOR BIODIVERSITY CONSERVATION IN CHANGING LANDSCAPES

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Abstract: Habitat restoration has been employed in the context of ecological compensation, to offset negative impacts on ecosystems as a result of development projects. Compensation measures are aimed at maintaining the size and quality of ecological networks. These measures are decided on a case-by-case basis, as a response to development. Traditionally, there is a preference to restore the same type of habitat near the location of impact. This practice ignores three main issues however: 1) the current spatial configuration of ecological networks may not be sufficient to maintain species at the long term, given ecosystem dynamics and climate change, 2) conservation budgets are perhaps more effectively spent on restoration of other, scarcer habitat types, and 3) restoration costs and potential differ per location, for which there is scope to achieve conservation targets more cost-efficiently. Furthermore, the current reactive nature of compensation practice does not stimulate a strategic approach to conservation that is flexible in response to ongoing changes.

Market-based policy instruments like tradable permits have characteristics that could them make suitable for cost-effective biodiversity conservation in landscapes subject to economic development. The EcoTRADE project investigates the potential of tradable permits and habitat banking for achieving conservation targets in intensively-used landscapes such as Europe. An international, interdisciplinary team investigates policy, economic and ecological aspects of such instruments. The ecological questions concern the trade-offs in habitat network size, spatial configuration and temporal fluctuations in habitat suitability (resulting of market activity) on species persistence. Also the role of habitat development time is investigated.

Keywords: land-use change; identifying appropriate conservation and restoration objectives; biodiversity policy; socio-economics of nature restoration; tradable permits; cost-effective conservation

Introduction

Intensively-used landscapes have limited space to meet society's economic, social and environmental needs. Hence, it is impossible to prevent collision between biodiversity conservation and economic development at all times. Economic development at the cost of (inter)nationally important areas for biodiversity conservation is in particular cases considered acceptable, on the condition that the impact is offset. Offsets can be realised by by providing habitat compensation measures (European Commission 2007). Legal requirements for habitat compensation generally state that the quality and connectivity of the ecosystem network should be maintained (No Nett Loss; VROM 2004; European Commission 2007). In practise, this results typically in restoration of the same habitat type as was destroyed, at a location near to the place where the impact takes place (Fig. 1A).

The current biodiversity conservation policy has a goal to maintain or improve the status of species and ecosystems. It is therefore that damages are prevented where possible, or offset by compensation measures where economic development is given priority. Since habitat loss is the main driver of biodiversity decline worldwide, protection seems a logical and necessary policy tool to safeguard remaining natural

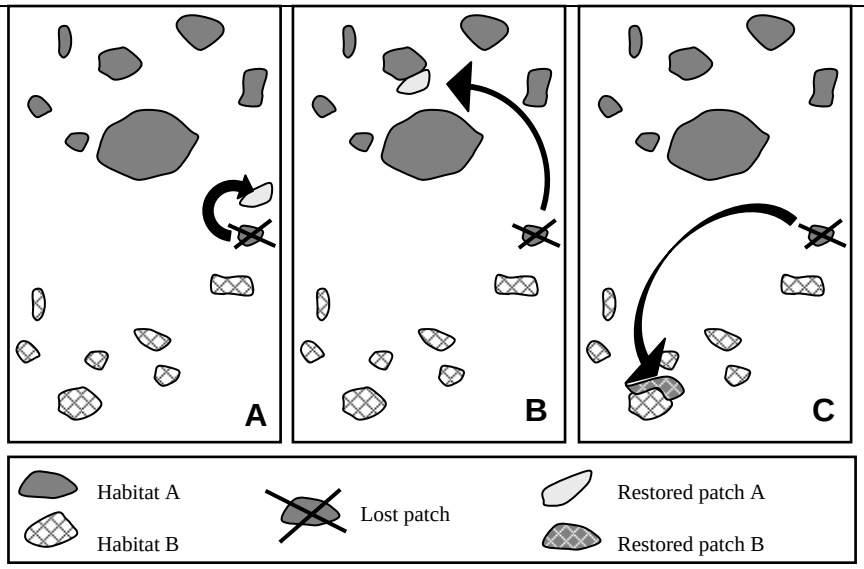

Figure 1. Examples of ecological offsets. A) Offset near impact location, same habitat type (standard compensation strategy). B) Offset at preferable location, same habitat type. C) Offset at preferable location, different habitat type.

areas. The policy to restore similar habitat near the place of impact aims at maintaining a status quo of current conditions. However, this practice ignores three main issues:

1) The current spatial configuration of natural sites may not be sufficient to maintain species at the long term. Individual sites may not be large enough or of sufficient quality to support sustainable populations. In addition, the connectivity between the patches of the network may not be sufficient for species to (re-)colonise sites; a prerequisite for regional persistence in the presence of local extinctions. Hence, restoration of similar sites close to the lost site (Fig. 1A) may be less effective than improving site area or connectivity elsewhere in the network (Fig. 1B).

2) Conservation budgets may be spent more effectively on restoration of other, scarcer habitat types. Some ecosystem networks may be large and well connected, while others are small and dispersed. In-kind compensation (i.e. restoring the same habitat type in the same network; Fig 1A and 1B) may not be required for persistence of species in a large network, while increasing the size or connectivity of a different, small network may enhance the persistence probabilities for species depending on that network (Fig. 1C).

3) Restoration costs and potential differ per location (spatial heterogeneity), for which there is scope to achieve conservation targets more cost-efficiently. Instead of compensating for a site in a region with large urban pressure (high land prices) or of low potential, the same budget could be spent on the restoration of more habitat at cheaper, or more suitable locations.

According to the No Nett Loss principle, compensation should be realised before habitat is lost elsewhere (Fig 2A). In practise however, compensation areas are often only established simultaneously or after the impact has taken place. This causes a drop in habitat availability over time (Fig. 2B), which can be detrimental in small networks. Together with the fact that the outcome of restoration exhibits uncertainty (Moilanen et al. 2008), the rate of success of compensation can only be assessed after a given amount of time.

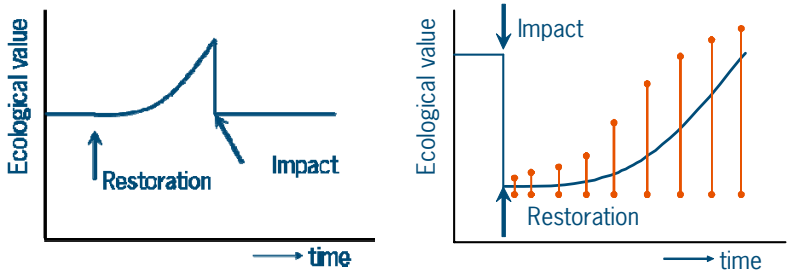

Figure 2. The effect of habitat loss and restoration on ecological value (e.g. habitat area, population viability) over time. A) Habitat banking, no nett loss in ecological value due to realisation of compensation areas before the impact is allowed to take place. B) Habitat borrowing, a drop in ecological value due to delays in restoration, which occurs simultaneously with impact. The bars indicate the uncertainy in restoration outcome over time.

Given these points, the current compensation practice can be characterised as being reactive, only responding to development and aiming at maintaining status quo. In intensively-used landscapes economic development is an ongoing process and conflicts between conservation and economic growth are not limited to a few cases. Therefore, a reactive approach to conservation is not likely to achieve conservation benefits cost-effectively. Instead, conservation strategies could anticipate to a given level of habitat turnover, and aim for robust habitat networks that are resilient to such turnover. This requires a proactive, strategic and flexible conservation policy.

The EcoTRADE project

The limitations of current static conservation practices, the notion that species and ecosystems are essentially able to adapt to changing conditions, and the ongoing demand for economic development has resulted in the EcoTRADE project (http://www.ecotrade.ufz.de). The 3-year project (2007-2009) is part of the EURODIVERSITY programme of the European Science Foundation. An international team of experts in ecology, economy and ecological-economic modelling aims to investigate the feasibility of market-based policy instruments (in short, ‘tradable permits’) for cost-effective biodiversity conservation.

Tradable permits have been successfully applied in other fields of environmental protection, and they are gaining increasing attention for biodiversity conservation, in relation to biodiversity and habitat banking systems (see e.g., Carroll et al. 2008).

Potential benefits of tradable permits compared to current top-down planning include: 1) Cost-effectiveness (reaching conservation goals at lower cost); 2) Reaching a fixed ecological target (if rules are strict); 3) Increasing ecological value or area (depending on the habitat exchange rates); 4) Higher stakeholder acceptance; 5) Flexibility to changing economic or ecological conditions. EcoTRADE aims to identify under what conditions these potential benefits may be realised.

From the ecological perspective, the following questions are to be addressed:
What are the relationships and potential thresholds between species viability and: a) Spatial network characteristics (carrying capcity, connectivity) and b) Temporal network characteristics, due to habitat loss and restoration (disturbance extent, spatial dependency in disturbance, disturbance intensity and frequency)? How are these relationships affected by: 1) differences in species characteristics (dispersal capacity, fecundity, area requirements, longevity), and 2) differences in habitat properties (the restoration time, habitat life time (before it becomes unsuitable, due to e.g. succession)?

Insight in these relationships would allow to identify for which habitat types and species a more flexible conservation approach would be feasible. Furthermore it would provide criteria for the design of tradable permit markets. Although the political interest in such instruments is on the rise, there is at present little knowledge on the nature of the relationships described above (Van Teeffelen et al. in prep). This highlights the need to further investigate the relationships between spatio-temporal habitat turnover and species viability, simultaneously incorporating state-of-the-art knowledge on ecological restoration processes.

Conclusions

Current conservation policy is aimed at maintaining a static habitat network, while intensively-used landscapes are characterised by turnover in habitat suitability (habitat areas are lost and restored). As a result, conservation targets are not met cost-effectively, and the policy does not allow for strategic conservation decisions adapting to change. Within EcoTRADE we investigate ecological and economic conditions under which tradable permits could provide a cost-effective, flexible policy instrument to meet conservation goals.

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