

## **Habitat Banking - how it could work in the UK**

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### **Summary**

The UK has until very recently been through a phase of significant development, in particular for housing and transport networks, but currently compensation for ecological impacts is often carried out poorly, if at all. Over the last 15 years support for habitat banking in environmental policy has grown rapidly, defined as the restoration, creation or enhancement of habitats for the purpose of providing similar resources through compensation for development impacts. It is an incredibly flexible tool, as demonstrated by the wide variety of situations in which it is applied, and it has already brought disparate parties together, including landowners, biologists, consultants, planners and developers. A common concern with the concept relates to the risk and uncertainty surrounding the restoration of habitat functions after the original habitat has been lost. Other concerns relate to the regulation of habitat banks, and the calculation of compensation requirements such as what should be the ratio of new habitat or resource created to environmental impact caused. We address these and other issues and propose two models for habitat banking in the UK, which could also be adapted for use elsewhere in Europe. We highlight numerous potential advantages for biodiversity, human welfare, and the economy, and argue that the most effective way to address doubts surrounding the habitat banking concept would be through one or a number of pilot projects, which need to be implemented now.

### **KEYWORDS**

Biodiversity offsetting;  
Compensation;  
Environmental economics;  
Habitat banking;  
Habitat re-creation;  
Mitigation;  
Sustainable development;

### **A note on terminology**

'Mitigation' refers to measures used to reduce adverse impacts, while 'compensation' refers to measures taken to offset or compensate for adverse impacts that cannot be fully mitigated. Ecologists and developers in the US (and occasionally in the UK) often use 'mitigate' to mean 'compensate', thus 'mitigation banks' should more accurately be described as 'compensation banks'. In other parts of the world the term 'offset' is also occasionally used in place of 'compensate'. In this document 'mitigation banks' or 'offsets' are described as 'habitat banks', and 'compensation' is used in place of the US meaning of 'mitigation'.

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## Problems with the current system of compensation

In the UK and European Union, obligatory compensation for loss of, or damage to, protected habitats or species is a relatively recent concept, and it applies to all sites designated as part of the Natura 2000 network. However, we believe that a far greater use for the mechanism exists for off-setting environmental impacts in the wider countryside, in areas not statutorily protected for conservation or landscape. Compensation is common practice in the US, where since 1972 such a 'no-net-loss' policy has been applied to all wetland ecosystems throughout the territory (and not only to designated sites). The UK has until recently been through a phase of dramatic development, in particular for housing and transport networks, but at present it is the responsibility of the developer to mitigate and compensate for impacts on a site-by-site basis. With the exception of some recent compensation projects on Natura 2000 SPAs and SACs, planning permission nearly always requires developers only to *mitigate* their impacts, and not to compensate. The process generally results in tiny habitat patches, and poorly coordinated projects, if it even occurs at all. Planning authorities often spend an inordinate amount of time prescribing mitigation requirements captured within Section 106 or similar agreements, only to fail in enforcing them once planning permission is granted.

Unfortunately the impacts of development projects on biodiversity are rarely reported in the literature, however Treweek & Thompson (1997) reviewed 194 environmental statements during the period 1988-1993 and found that in 20% ecology was not mentioned at all, only 11% recommended mitigation or compensation, and only 3% suggested moving the development away from the important ecological resource. Treweek (1999) suggested that schemes were generally inadequate because no monitoring or follow-up was proposed or undertaken, and because of a lack of enforcement by planning authorities and statutory agencies. Hill (2008) states that in the intervening decade the situation has not improved.

Similar problems with individual project-based compensation have led to the concept of habitat banking gaining support in other countries, including Qatar, Ghana, South Africa, Madagascar, New Zealand, Australia and the US. In this article we refer particularly to experiences in the US, which has the longest history of habitat banking and the greatest amount of reporting in the literature. Although the habitats, protected species and constraints differ in the UK, much can be learnt from the US experiences, where over the last 20 years an industry has rapidly built up around 'wetland banking', defined as 'the restoration, creation, enhancement and, in exceptional circumstances, preservation of wetlands and other aquatic resources expressly for the purpose of providing compensatory mitigation in advance of authorized impacts to similar resources' (Federal Register, 1995). In general a third party (the habitat banker) establishes a bank of wetland credits that can be sold or conveyed to a developer, who can spend the credits in compensation for wetland losses (the debits) resulting from development. The concept need not apply only to wetlands, and more recently 'conservation banking' of habitat used by endangered species has also become established in the US.

Habitat banking is an incredibly flexible tool, as demonstrated by the wide variety of situations in which it is applied, and it leads to collaborative partnerships between landowners, biologists, consultants, planners and developers, which rise above the antagonistic relationships usually associated with conservation and development. By transforming protected species and habitats into assets with direct monetary, as well as aesthetic, value, the practice of habitat banking seems to be enabling a future where wildlife conservation and economic success are no longer mutually exclusive (Fox & Nino-Murcia, 2005). The UK contains a higher proportion of man-made

### **Figure 1. Advantages of habitat banking**

- It contributes to an overall no-net-loss of habitat or protected species
- Temporal losses of habitat can be avoided (credits are put in place in advance of debits).
- Restoration is consolidated into large areas. From a conservation biology perspective, larger contiguous habitats are more valuable than the same acreage of habitat in a more dispersed spatial distribution (MacArthur and Wilson, 1967). Small islands of habitat are also more vulnerable to edge effects, and require a disproportionate effort of management in order to maintain their ecological interest. From a human perspective, larger reserves give more potential to combine recreational usage with wildlife conservation.
- Economies of scale are achieved in restoration/enhancement, expertise, financing, management/monitoring.
- Habitat restoration/creation is undertaken by suitably qualified professional ecologists rather than developers, resulting in higher quality habitats at lower cost.
- Permit processing times are reduced, and developers are released from the task of providing on-site compensation.
- Compensation costs are pre-defined. Developers are far happier with a known cost predicted for the term of a compensation project because they can roll this cost in as capital at the beginning of a scheme. By contrast, they dislike uncertainty that can lead to escalating costs and no exit strategy.
- It provides an effective mechanism for linking existing habitat patches into more coherent ecological networks.
- It provides a mechanism to integrate conservation into the investment plans of companies and into development planning at a time of growing pressure for resource development.
- It provides a significant new source of finance for biodiversity and landscape conservation.
- It leads to better relationships between developers, companies, local communities, government regulators, environmental groups and other important stakeholders.
- Landowners can benefit by using schemes as a means of diversification.
- Large schemes can cover their own income streams over time, by, for example, making landscapes more accessible to a wider range of people and attracting visitors.
- Larger compensation schemes, particularly those involving endangered species and incorporating public access, receive more public support (Bauer *et al.*, 2004).
- Schemes with public access can benefit human health and wellbeing.

habitats than does the US, many of which have the potential to be restored to a more natural state. Furthermore, areas of habitat are often small and patchy in the UK, and habitat banking offers a mechanism for linking these patches into larger networks (Hill 2005, 2008, Hill & Gillespie 2008). These characteristics, together with high development pressures now and in the future, make the UK particularly suitable for a habitat banking system. Various advantages of habitat banking are summarised in Figure 1, and later we describe two possible models for its use in the UK.

### **Suitable and unsuitable habitats for recreation**

The most common concern with the concept of habitat banking relates to the risk and uncertainty surrounding the restoration of habitat functions after the original habitat

has been lost (Reppert, 1992; Roberts, 1993; Zedler, 1996). Some habitats and their ecosystem functions can be restored, created or re-created with a high degree of success, whilst others are extremely difficult or impossible to replicate.

There are numerous examples of successful creation of saltmarshes, mudflats and freshwater reedbeds in the UK, on relatively short time-scales (Atkinson *et al.*, 2001, Morris *et al.*, 2004). Grassland creation has been of interest for some time, and certain types of semi-natural grassland are contained within the UK Biodiversity Action Plan (BAP), with targets for re-establishment. Neutral and calcareous grasslands that closely resemble ancient semi-natural grassland take a minimum of 100 years to develop naturally (Gibson & Brown, 1991; Gibson, 1998), but good imitations have been created in shorter time periods of a few decades or less using techniques such as the introduction of seed or plant material, top-soil translocation, and modification of the soil to reduce nutrient levels (Vecrin & Muller, 2003; Morris *et al.*, 2006). The re-assembly of invertebrate assemblages is much slower, however, and little is known about the development of numerous other ecosystem components and processes (Mortimer *et al.*, 2002; Walker *et al.*, 2004b).

Heathlands are a UK BAP habitat, and have been the subject of extensive re-creation efforts, although results have been mixed, depending on the original situation (Pywell *et al.*, 2002; Walker *et al.*, 2004a; Mitchell & Hare, 1999; Owen & Marrs, 2000; Dunsford *et al.*, 1998; Pywell *et al.*, 1995; Smith *et al.*, 1991; Ecoscope Applied Ecologists, 2000). The final habitat is not devoid of wildlife interest, but high concentrations of ruderal species and those adapted to disturbance and/or high nutrient levels are generally reported in ex-arable land. Higher levels of success have been attained on former mineral workings and in felled conifer plantations where humus has been stripped off, although longer-term monitoring is needed before a positive outcome can be confirmed.

Deliberate woodland creation has been carried out for centuries, and mature stands of native trees and shrubs can develop rich assemblages of plants and animals. However, the most valuable woodland sites tend to be the longest established (even more so than grassland and heathland sites; Morris *et al.*, 2006), and the distinctive features of individual ancient woods may be the result of centuries of management, which can never be replicated.

Certain habitats are unsuitable for habitat banking because of their abiotic uniqueness – e.g. habitat mosaics on complex geology, wetlands supplied by underground springs, or hibernation caves for bats. When locating sites for any habitat creation project, the abiotic environment must be matched as closely as possible to the desired outcome. The relationships between plants and geology and hydrology, and between animals and vegetation structure (and sometimes geology) are well established (Hopkins, 2003; Louseley, 1976; Morris, 1998; Gardner *et al.*, 1997; House & Spellerberg, 1983; Webb, 1989) and additional factors such as aspect (Key, 2000), and regional variation in rainfall and temperatures must also be considered.

At present there is relatively little ecological data to support the success of conservation banking for endangered or protected species (Wilcove & Lee, 2003; Fox & Nino-Murcia, 2005), however it may eventually prove even more effective than wetland banking, since it is generally easier to recreate suitable conditions for a particular species than to accurately recreate an entire habitat. For example, Petranka *et al.* (2003) created compensatory ponds for amphibians and found that they were colonized rapidly and supported significantly more species than natural reference ponds.

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## Calculating the number of compensation credits required

A common, if rather crude, method used to ensure that compensation is adequate for the habitat lost in development is to select a site that is ecologically similar and to conserve an area of the same or greater size than the area affected. Acknowledging that area is a very crude proxy for biodiversity, and that replacement habitats can never be an exact match for the original, larger areas are often restored to ensure a sufficient margin to say with confidence that the replacement habitat more than compensates for the losses on the area developed. In most cases the resulting compensation package is whatever is considered by all concerned to be 'most appropriate for the conditions'.

In the US a large number of different assessment techniques have been developed for the calculation of compensation ratios, based on location and differences in habitat function (Adamus, 1983; Hart, 1995; Stein & Tabatabai, 2000; Bonds & Pompe, 2003). In theory these techniques should allow for greater consistency and transparency in setting appropriate compensation, but the complications and difficulties in valuing habitat functions in the absence of environmental data means that these methods are rarely usable in practice. Furthermore, every individual development has its own share of accompanying social, political, legal, technical and economic constraints, which must be evaluated in conjunction with the physical and ecological parameters.

The majority of US wetland and species conservation banks sell 1 compensation 'credit' (i.e. 1 acre of restored habitat) for every acre of habitat lost (a 'debit'), although a few have higher ratios, depending on the quality of the habitat or the type of work being undertaken. Draft guidelines issued by the US Environmental Protection Agency in 1992 give the following compensation ratios: 1:2 for restoration, 1:3 for creation, 1:4 for enhancement, and 1:10 for preservation (Dennison & Schmid, 1996). We believe that *preservation* of existing good habitats should not be considered as a compensation strategy in the UK, because important wetlands are already protected as SPAs or SACs. In the US the use of this option is resulting in the continued loss of around 60,000 acres of wetland each year (Brown & Lant, 1999; Esty, 2007).

In Mexico, the area ratio varies depending on the proximity of the offset to the damaged site. One concern with the concept of habitat banking is that banks could in theory be sited a long distance from the original developments, and thus fail to be either ecologically compatible or to gain the support of the community. Although it will generally be advantageous to provide compensatory habitat as locally as possible, it is worth noting that in some cases the success of schemes may actually be compromised by close proximity to the development, e.g. by affecting species that are sensitive to anthropogenic disturbance or pollution.

In the case of Natura 2000 sites, the EU Habitats Directive is not explicit that replacement habitat must be as near as possible to the site from which it is lost, or that it should be exactly the same in all respects as that lost. It does, however, state that the measures must 'ensure that the overall coherence of Natura 2000 is protected'. This requirement will more easily be satisfied if a replacement habitat is of the same type, equivalent in quality and quantity, and as near as possible to the original site (coherence being judged not just by extent but by distribution). However because of the various development constraints described previously and the patchy nature of the UK's countryside there is often likely to be more scope to deliver habitat banking schemes using sites that are not necessarily connected to or even close to those being affected by development.

## Regulation of habitat banks

However scientific the basis for assessing the biodiversity affected and appropriate compensation, there is likely to be a strong subjective element involved, which highlights the importance of any arrangement being to the satisfaction of all key stakeholders including the local community, government agency, local authority, and companies involved.

It would be useful for the UK government agencies to adopt a system similar to that now used in the US, where the entire habitat banking process is overseen by a working group which includes the state and local resource planning agencies, the bank sponsor/owner, and the federal agencies. In the UK this would be equivalent to the Local Authority representatives, a sponsor/owner, and the appropriate government conservation agency (e.g. Natural England, Scottish Natural Heritage, or the Countryside Council for Wales) representatives. Amongst other things, these working groups can ensure that habitat banks meet rigorous standards for restoration, management and conservation of habitats.

The bank sponsor/owner can be any department, agency, entrepreneur, or group entity, and in theory (but not often in practice) they are responsible for securing sufficient funds to cover contingency actions in the event of bank default or failure. In addition, the sponsor is responsible for securing adequate funding to monitor and maintain the bank throughout its operational life.

In the US a Memorandum of Understanding (MOU) is written for the working group, which contains the following information:

- a) Bank goals and objectives
- b) Ownership of bank lands
- c) Bank size and classes of habitat proposed for inclusion in the bank
- d) Description of baseline condition at the bank site
- e) Geographic service area
- f) Habitat classes or other resource impacts suitable for compensation
- g) Methods for determining credits and debits
- h) Accounting procedures
- i) Performance standards for determining credit availability and bank success
- j) Reporting protocols and monitoring plan
- k) Contingency and remedial actions and responsibilities
- l) Financial assurances
- m) Compensation ratios
- n) Provisions for long-term management and maintenance

Thus far, habitat banking in the US has not resolved all the problems associated with site-by-site compensation. If habitat quality is used as a measure of compensation success (rather than area), a low proportion of projects can be considered successful (Sudol & Ambrose, 2002; Spieles, 2005). Problems stem from poor project management, and often include inadequate design, failure to implement the design, lack of proper supervision, lack of ongoing habitat management, and failure to protect projects from on-site and off-site impacts such as sediments, toxics, and off-road vehicles. Castelle *et al.* (1992) found that follow-up studies indicate an average rate of compliance with permit conditions of only 50%.

Without careful regulation, habitat banks could offer low-cost compensation as a result of cutting corners on conservation, and the market would reward poorly managed banks and thus harm conservation efforts. Successful projects in the US have all involved reasonably strict safeguards, including both quality control by

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relevant authorities, the requirement of insurance bonds from habitat banking organisations, and regular ongoing monitoring.

When habitat banking becomes established in the UK, it should be mandatory that MOU's include performance standards based on habitat quality as well as area restored. The workings and operation of the compensation delivery would be overseen by the sponsor, but the bank could be created and managed in conjunction with, for example, a wildlife trust or other appropriate conservation NGO, which would eventually take on the ongoing management of the site (funding for which would be included within the cost of credits) when restoration is complete. The working group would include a representative from this NGO, who would have a strong vested interest in maximising the quality of the site, as well as contributing additional technical expertise in habitat creation/restoration.

The value of such a system is that all parties in the working group would have a strong incentive for the project to be successful – the developer for cost-effectiveness and reduced responsibilities, the banker for economic success, the wildlife trust/NGO for effective wildlife conservation and funding, the local authority for economic growth and more open space with public access, the government agency for many of the above reasons, and all parties for the positive exposure resulting from the projects.

One of the advantages of habitat banking is that credits can be put in place in advance of debits. However, if sites are restored in advance, and meet the criteria relevant for the designation of Natura 2000 sites, it could be argued that they should themselves be designated as European sites, and hence not be made available as credits. In order to maintain incentives for habitat banking organisations to create banks in advance of development, the competent authority must allow sufficient flexibility to allow them to be used for compensation.

### **Evaluating success**

Success criteria for habitat banks created for protected species (e.g. for self-sustaining populations of *Triturus cristatus* [Laurenti, 1768], some breeding birds and mammals, or as feeding grounds for over-wintering waterfowl) would potentially be relatively straightforward because the measures of success could be readily quantified and reported. This is especially true if there are baselines of numbers displaced that could be correlated with survey data for the new habitat over a particular timeframe. Part of the costs of the credit purchase would go into a rigorous monitoring programme.

For protected habitats it would be more complicated, and should be based on vegetation surveys and comparisons of community structure, species diversity and species richness. Plant communities could be compared using the National Vegetation Classification system (Rodwell, 1991a&b, 1995, 2000). An approach based around the Favourable Condition model for SSSI's could be adopted.

In the past, even with carefully defined success criteria, post-project monitoring and reporting has rarely been completed (Edgar *et al.*, 2005). Any UK habitat banking MOU must include a long-term monitoring and reporting programme. The habitat banking company would be responsible for independently facilitating/commissioning the monitoring work. The design of SMART targets and key performance indicators for projects would help to establish measurable and meaningful indicators of conservation outcomes.

## Calculating the cost of compensation credits

The method for calculating the cost of compensation credits needs to be transparent and simple to use in different scenarios. Although purchasing credits from a habitat bank would be far more straightforward for a developer than going through the current compensation system, it should also be a cost-effective option. The cost of compensation credits would be calculated using the following information:

- a) The cost of buying suitable land (for habitat restoration/creation/enhancement) in the area concerned.
- b) The cost of creating/restoring different habitat types (including the costs of design, management planning and implementation).
- c) The cost of managing habitats and nature reserves of various sizes. The compensation price must be high enough to enable conservation and management of the site over a long time horizon. Information about the earnings made from visitors to nature reserves would also be valuable; it is recommended that in many cases compensatory habitats eventually become financially self-sustaining.
- d) The cost of project management and monitoring, i.e. a transaction fee. Assuming habitat banking operates as a market-based instrument rather than via a top-down regulatory approach, transaction fees would not increase, and they would be equivalent and comparable to the fee paid to consultancy firms for managing the ecological aspects of development projects affecting Natura 2000 sites.
- e) The cost of current compensation procedures. It is important that the cost of credits does not significantly exceed the current cost of individual-site compensation on an equivalent scale. It is highly likely, however, that there will be some uplift since historically many individual-site, developer-led, schemes have failed to be properly resourced and delivered. The principle of paying 'the true cost of the use of land' would be applied.
- f) The cost of a return on investment dependent on the structure of the investment model and the period of time over which the investment return is paid. Whilst short return periods would be initially more costly, when spread over an 'in perpetuity' period of 25 years, the cost of credits would be realistic for the market and considerably less expensive than an equivalent area of developable land.

## Two models for habitat banking in the UK

### *[A] The Regional Bank*

Habitat banking could work very effectively at the scale of the region (which might go down to the scale of borough or district) by pooling compensation credits from multiple local developments, primarily those for example from new housing or businesses. Environmental impacts would most commonly affect terrestrial or mixed terrestrial/aquatic habitats, and compensation would typically be required because of the existence of protected species on development sites. Since the size of these developments would generally be relatively small, habitat banking would be hugely advantageous in terms of economies of scale and could result in one or a few flagship nature reserves within the region, which as well as providing a valuable natural habitat, could become a resource used by local people for recreation and education. Such a model could also help fund the UK's 50-year Wetland Vision, recently launched by government and NGO partners (July 2008).

The model would work best if a single habitat banking organisation were to make a long-term (e.g. 10-year) agreement with the Local Authority (LA) to the effect that all developments with an unavoidable environmental impact would be compensated for by that organisation. This agreement would provide the assurance needed for the banking organisation to purchase and commence restoring habitat, the extent of which would be determined by an estimate of the likely extent of development over the period of the agreement (using information from the LA about existing and historic development proposals).

The site(s) purchased and habitats created/restored would be determined by the locally important habitats and species likely to be affected by developments in the area. Given the likelihood of much housing-related compensation relating to protected species such as newts, reptiles and bats, the habitat bank could be principally designed with these in mind. Regular monitoring of these species would take place before, during and post restoration to determine the success of the bank. If the model proved successful, the agreement could be extended after the initial period, with additional habitat being purchased either alongside or separately from the existing bank.

Development proposals affecting habitats that cannot be recreated effectively would be rejected or relocated at the outset. Any approved developments affecting Natura 2000 sites, or unusual habitats not held in the 'bank' would need to be compensated for on an individual basis through the existing Article 6 assessment process (either by the same organisation or sub-contracted to another consultancy; see model [B] below). The whole process would be overseen by a Habitat Banking Working Group and all practical works carried out in conjunction with the NGO sector (e.g. the wildlife trust or a conservation organisation such as the RSPB or WWT), which would also act as quality control (for example through independent species and habitat monitoring) working with the bank. Once restoration was complete, they could take over the ongoing management of the reserve, the costs of which would be incorporated into the price of compensation credits discharged by the bank. Alternatively, the habitat banking company could retain ownership of the land and charge a small rent for it to be managed by the NGO sector or equivalent with the relevant expertise.

All compensation would be carried out at a minimum ratio of 1 hectare habitat lost to 1 hectare habitat replaced. Although this ratio is lower than in some US habitat banks it reflects: a) the lower degree of uncertainty in being able to recreate suitable habitat conditions for many of the protected species commonly affected by development in the UK, b) the permanent preservation of the new site (whereas the original site was not protected, despite holding protected species), and c) the conservation value and cost of having the site managed in perpetuity. We believe that schemes will be far more effective if priorities lie in the effective restoration and long-term management of habitats, rather than in the purchase of as much land as possible, though of course the best solution would involve both a high ratio and a well resourced management plan.

The siting of the compensation habitat would aim to connect existing nature reserves in the region where possible. In the case of housing developments, input from the new Community Infrastructure Levy (CIL)\* could be used to fund either land purchase and restoration work, or the ongoing management and extension of the nature reserve.

At the scale considered in this model, habitat banks would provide a visible and accessible amenity, and a clear public perception of replacement of valued natural resources. They would be unlikely to encounter problems relating to the ecological

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incompatibility of sites, and would also avoid any political and administrative problems arising from habitats being recreated outside set regional boundaries.

Using this model a significant amount of restoration could be undertaken, and hence compensation credits made available, by the time many local developments commence on the ground. However, if there were instances where credits were not yet available for purchase it might be possible to enter into an agreement with the appropriate statutory regulator (e.g. Natural England), who could then demonstrate to the respective planning authority that the relevant undertakings had been entered into and that appropriate compensation was likely to be obtained.

### *[B] The SPA/SAC wetland Bank*

The EU Habitats Directive 92/43/EEC (implemented under UK law through the Habitats Regulations 1994) requires that the condition of individual SPA and SAC sites be maintained, as well as the coherence of the Natura 2000 network as a whole. Compensation will be required for any development impacting on a Natura 2000 site which is approved for imperative reasons of over-riding public interest. It is unlikely that compensation for such a development could take place either *in situ* or across the Natura network, hence the use of off-site compensation, i.e. habitat banking, offers an attractive possible alternative. A high proportion of the UK SPA and SAC sites are wetlands, which is the habitat type that can be most effectively and rapidly recreated (Kustler & Kentula, 1990; Morris *et al.*, 2006), though it has to be stressed that the original functionality of the wetland may take time to be achieved.

A small number of large developments such as ports on Natura 2000 site estuaries have recently taken place in the UK and most are in the early stages of being compensated for, although thus far compensation has always been the responsibility of the developer rather than of a third-party organisation. Given the scale and more dispersed nature of many of the industrial-type developments that have the potential to negatively impact wetland habitats (for example port developments in the Thames Gateway area, or flood defence schemes), in this model habitat banks would function most effectively for individual (or very few) developments, so that they could be tailored to the specific requirements of the project. Even for individual developments, the use of a habitat banking organisation would offer a number of advantages: the habitat restoration/creation work would be undertaken by suitably qualified professional ecologists rather than developers (resulting in higher quality habitats), permit processing times would be reduced, the developer would be released from the task of providing compensation, costs of compensation would be pre-defined, and the site would be managed for wildlife (and visitors if appropriate) in the long-term. Interest in and influence over the compensation land by the developer would cease on the purchase of credits.

Habitat banks should be located close to the proposed development site, and preferably directly contiguous. However, if it was not possible to find or secure a suitable location for compensatory habitat in the immediate vicinity, there is nothing in the Habitats Directive to prevent the search from being widened further, subject to the point of 'coherence'. If the proposal relates to a site designated for a population of a particular species (as is often the case for SPAs), this 'coherence point' may be very close-by, since the bank will need to function as replacement habitat for use by that same population. Alternatively 'coherence' could also be maintained by creating an area of habitat sufficiently large and attractive to support internationally important numbers in its own right.

Since in this model habitat banks only compensate for isolated or very small numbers of development projects, the advantage of economy of scale is diminished. For this reason, and because the affected site may not be returned to favourable condition, the scale of compensatory measures should be increased by increasing the ratio of habitat created to habitat lost. Inevitably, every development will involve a large number of ecological, practical, and social considerations, thus the precise level of compensation will need to be decided on a case-by-case basis. However, we recommend that the following *minimum* ratios are used, depending on the circumstances:

A ratio of at least 2:1 for compensation provided for easily restored/created habitats contiguous to the development site or on similar physical terrain;

A ratio of at least 3:1 for higher risk restoration/creation options, where there is less certainty in being able to closely replicate lost habitats;

A ratio of at least 4:1 for habitat enhancement options.

Any delay ('integrity gap') between habitat loss and restoration must be avoided by appropriate measures. Compensatory habitat should be purchased either by the developer or banking organisation at the time of a development proposal being approved, and be restored to a certain pre-defined quality before the development work is allowed to proceed. If for some overriding reason development work needed to proceed before compensatory habitat had been created, the developer would be required to post a substantial bond to cover additional costs should compensation prove unsuccessful. The land would be deeded to a suitable conservation organisation for long-term management facilitated by the bank rather than the developer, or owned by the habitat banking organisation (it would not remain in the ownership of the developer).

## Conclusions

Over the last 15 years a growing ecological and economic literature has supported habitat banks and market mechanisms in environmental policy (Anderson & DeCaprio, 1992; Lewis, 1992; Etchart, 1995; Albrecht & Wenzel, 1996; Dennison & Schmid, 1997; Neal, 1999; Stein *et al.*, 2000; Farber, 2004; ten Kate *et al.*, 2004). With increasing concerns over the loss of biodiversity (Natural England 2008), and a greater appreciation of the importance of natural areas for human wellbeing, there is likely to be a trend towards compensation being required for impacts to habitats and species, including those not currently listed for statutory protection but that nevertheless contribute to the nation's biodiversity and landscape quality.

Riddell & Fargher (2000) are positive about the use of habitat banking in the UK and are keen to establish a trial system. Certainly the most effective way to address the many doubts that surround the concept would be through one or a number of pilot projects. By documenting the design, implementation and evaluation of pilot studies, they can be used to advise the development of appropriate guidelines and methodologies for habitat banking in the UK. This work needs to start now.

It is crucial to remember that although habitat banks are a potentially very useful alternative to site-by-site mitigation/compensation, their existence should not affect the initial decision process of conservation versus habitat loss. Developers will continue to be required to first avoid, minimise and mitigate the harm their projects cause to biodiversity (where mitigate means to alleviate any residual harm after

minimising, to the extent possible), and only then should they compensate for the residual unavoidable impact of the project on biodiversity. Unfortunately, the evidence shows that developers are currently failing even to mitigate effectively for impacts (Hill 2005, 2008, Hill & Gillespie 2008). Habitat banking offers a more robust, consistent and independent delivery mechanism to ensure that further biodiversity degradation in the countryside is avoided and that the road to recovery of the UK's wildlife is assured.

\*The Community Infrastructure Levy (CIL) will be a standard charge decided by designated charging authorities and levied by them on new development. It may be levied as a certain amount per dwelling or per square metre of development.

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