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Executive Summary

What are Habitat Banks?

Habitat Banking can be a useful tool to implement complementary and compensatory remediation measures in a cost-efficient way while gaining ecological benefits. The concept of habitat banking seeks to ensure the availability of appropriate areas for the implementation of complementary remediation measures for damage, such as the construction of new infrastructure. A habitat bank operates like a bank account with debits and credits. Credits can be both areas and measures that have been accumulated before the impact or damage occurs. The main advantage of trading habitats is that a higher rate of success is assumed since only areas with high potential of successful ecological upgrading are considered.

Nevertheless, *habitat banking* should only be considered in those cases where primary remediation is not feasible or all on-site compensation options have already been explored.

What is the practice of Habitat Banking?

A single type of habitat banking does not exist, though similar practices are used throughout the federal states in Germany to calculate debits and credits. The areas that are included in the habitat bank should not be subject to other nature conservation development plans. Furthermore, remediation measures should be integrated into a coherent habitat network. Thus, habitat banking offers the opportunity for more coherent nature conservation planning and, as a result, the measures taken appear to be more sustainable and (cost-) effective.

Areas associated with a habitat banking system are best managed by a specific land register. The register can be managed by either an administrative body or a private entity such as a foundation or a private agency.

How are debits and credits calculated and compared?

Within the practice of habitat banking in Germany, the concept of eco-scores is considered to be the most practical way to assess the damage and the necessary remediation. This concept is based on the conditions and features of the habitat.

The valuation under the eco-scores approach is based on four criteria which include vulnerability, likeliness of remediation, and similarity to the ideal habitat and its disturbance level. Habitats are assessed according to these criteria before and after the damage. The banking is recorded in the land register.

What are the limitations of the *eco-scores*?

While eco-scores concept is rather simple to use, it has its limitations. Habitat Equivalency Analysis (HEA) provides, in comparison to eco-scores, a more detailed and accurate calculation of debits and credits, and draws on calculation data such as baselines, service loss

and number of species present. This procedure should be used in the event that unique habitats or habitats of high value are impacted.

When comparing these two approaches it must also be pointed out that remediation actions developed in response to a specific incident involves the risk that planned remediation measures may not be fully realised or may not achieve the expected result.

How does Habitat Banking fit into the Environmental Liability Directive?

There are two important points to consider: 1) the ELD focuses in particular on the prevention and remedying of environmental damages caused by waste management operations, discharge of pollutants etc. (as defined in Annex III of the ELD) whereas habitat banking has primarily been considered a remediation tool in cases of building and infrastructure projects so far and 2) remediation through a habitat bank can only be considered as an option in places where primary remediation is not feasible or in addition to primary remediation. A habitat bank is a pool of complementary of compensatory areas that available before the areas are needed. As a result, these areas will most likely not be at the site of the damage.

Habitat banking is not in any of the relevant directives of the European Union and it contains some specific attributes that need to be taken into consideration. However, this tool can potentially be incorporated into several directives, including the Habitats Directive, the Environmental Impact Assessment and the Environmental Liability Directive.

1 Introduction

Habitat Banking was introduced in Germany in 1993 as a restricted tool for remediation measures taken under the German Federal Building Code. With the revision of the German Nature Conservation Act in 2002, federal states (Laender) were empowered to introduce habitat banking for any impact under the impact remediation regulation[1] for urban development plan. Habitat banking became a more and more widespread tool for mitigation processes in Germany. The importance of habitat banking and the need to provide areas for remediation increased since the necessity arose to aggregate high-density areas in the urban environment, the rising costs for the acquisition of appropriate areas as well as nature conservation requirements. In order to meet the requirements of urban planning, many municipalities, who are the Competent Authorities for the implementation of the impact remediation regulation, introduced the concept of habitat banking. Nevertheless, habitat banking can only be considered where primary remediation, i.e. on-site, is not feasible.

In general, habitat banking is seen as one option to ease the implementation of environmental remediation in respect to the transaction costs as well as the effectiveness. Nevertheless the concept is discussed quite controversially. Hence this study discusses the potential of habitat-banking focussing on Germany, where habitat-banking like approaches for remediation have been successfully in place for more than 10 years. On the basis of a broad literature review as well as interviews with stakeholders, this case study explores the question of habitat banking as a useful conception and instrument to improve nature conservation and biodiversity benefit and assesses the pros and cons of habitat banking.

Section 2 presents the main types of habitat banking.

Section 3 is dedicated to the question "How does habitat banking work?" considering institutional and management issues. Special emphasis is put on the concept of eco-scores, a practical procedure to calculate credits and debits of a habitat bank on the basis of the so-called biotope value procedure. In addition, advantages as well as disadvantages of biotope value procedure are discussed critically.

The correct set-up of a habitat bank is a crucial pre-requisite for a successful implementation of future remediation measures. Section 4 thus asks which criteria and requirements need to be fulfilled to ensure appropriate and successful habitat banking (considering the ELD context). In the beginning of this section, main benefits and risks of habitat banking as discussed in the literature are briefly presented.

[1] The impact remediation regulation (*Eingriffsregelung*) is a regulation on the required measures to prevent, reduce and offset the significant adverse effects on nature and landscape. This regulation is part of the authorisation for project development and it determines, from the nature conservation point of view, whether the authorisation is granted or denied as well as measures for prevention and the compensation and complementary measures necessary for the remediation of adverse effects of the project.

After drawing the conclusions of this case study and identifying further needs for research in Section 5, there are three Appendixes, including information on experiences with habitat banking in Germany (Appendix I) and the legal and institutional background of habitat banking in Germany (Appendix II). Appendix III is dedicated to the issue of distance between the impacted site and the remediation site investigating potential or experienced problems of the distance decay factor in Germany.

2 The Concept of Habitat Banking

2.1 Types of Habitat Banking

Habitat banking is a concept that ensures the availability of appropriate areas for the implementation of complementary remediation measures of damage, for example, the construction of a new infrastructure. A good and appropriate definition is provided by Gillespie and Hill (2007) who define habitat banking as "an entity that restores, creates, enhances or preserves a habitat. It sells tangible units of habitat (or facilitates land purchase and creation of habitat), termed credits, to a developer to use as compensation for equivalent units that a development would impact upon, termed debits."

There are three general types of habitat banking, providing compensatory benefits, that can be distinguished: simple stockpiling of areas that have a potential for up-grade, a pool of areas which are integrated into a coherent nature conservation plan (comprising implementation and maintenance of measures in some cases) or areas whose ecological value has already been upgraded (see Figure 1).

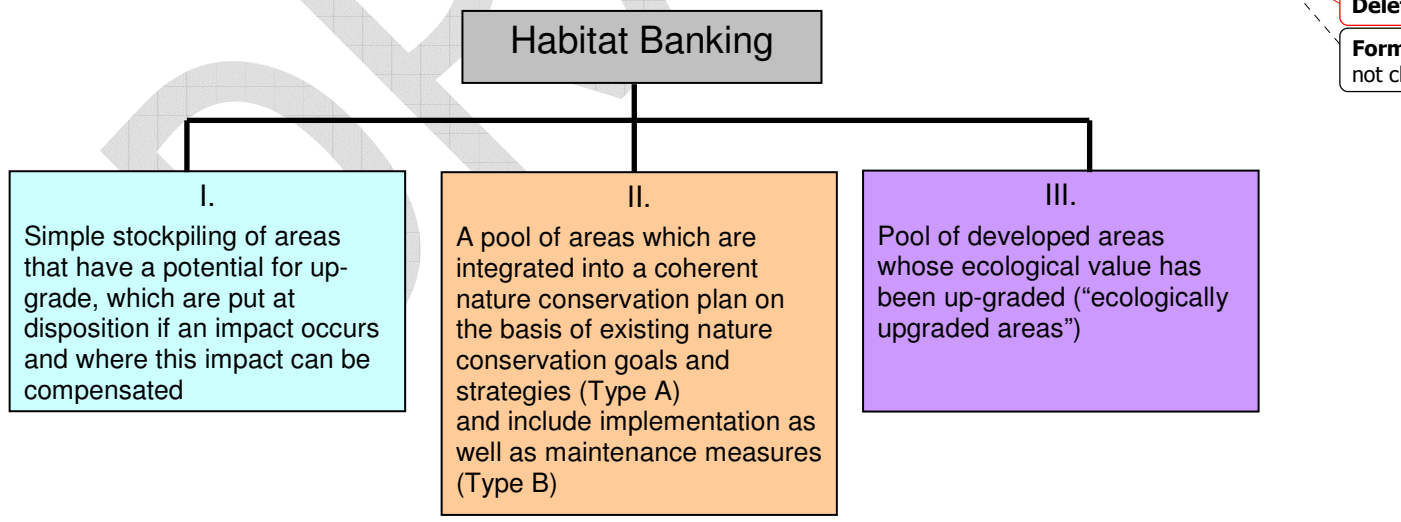

Figure 1: Types of Habitat Banking

While type I is considered as the simplest form of habitat banking, type II.B is more complex and can be further subdivided in the national specific case (i) if the management of measures consists of development plans for the areas that will be implemented concomitantly to the

impact event and (ii) if the habitat bank includes a set of measures on the selected areas that are realised ex-ante of the damage (mixture of II.B and III). The function of this type is similar to that of a bank account. Measures that have already been realised are entered on the credit side. If a project or other interventions with an estimated damage is envisaged, the damage will be entered on the debit side of the so-called "eco-account" (see Section 3.4.1).

Most habitat banks in Germany are operated at the municipality level. Before introducing a habitat bank local authorities have to consider its pros and cons. The long history of experiences with habitat banking since 1993 resulted in the evidence of a wide range of advantages but also disadvantages that will briefly be listed and discussed in Section 3.

2.2 Applicability of Habitat Banking in the Frame of EU Directives

So far habitat banking in Germany has been limited for remediation of impacts considered under the impact remediation regulation and thus the experiences may not be directly applicable to the European legal framework such as the Habitat Directive or the Environmental Liability Directive (ELD). However, considerations exist to apply the impact remediation regulation with some amendments also to the Habitat Directive as well as possibly to the ELD. Habitat banking may also offer the opportunity to pooling remediation measures in the context of these directives and to creating complex as well as coherent structures.

According to the latest released EC Guidance Document on Natura 2000 Management (in part. on Article 6(4) of the 'Habitats Directive' 92/43/EEC, Jan. 2007) "The option of habitat banking as compensatory measure under Article 6(4)[2] is of very limited value due to the tight criteria mentioned in relation to the need for compensation to ensure the protection of the coherence of the network. Nevertheless, there could be a potential use of the concept of habitat banking in a constraint regime linked to Article 6(1). For instance, where a development is foreseen it might be appropriate to consider and implement within the management plan designed for the site or integrated into other development plans, the necessary compensatory measures that would be required in the context of such development and consequently before any decision is made by the competent authorities".

Still, habitat banking offers many positive options, of which practitioners should take advantage. The task will be to define solid criteria for the application of a habitat bank that have to be met in regard to the implementation of the different European Directives.

[2] Article 6(4) was applied in the case of the Mühlenberger Loch (see the relevant D12 report).

3 Habitat Banking: How does it work?

A functional habitat bank needs a clear and simple assessment of the impacts and the remediation measures. Most German Federal States established a scoring system for habitats, which will be explained in the following section.

3.1 Establishment of a Habitat Bank

In preparation for the establishment of a new habitat bank and/or over the course of the maintenance of an existing bank a pre-assessment of the expected damage in the area related to the bank is needed (Spang et al., 2005). References for this pre-assessment are programmes and plans of regional and land use planning. While it is not possible to determine the exact damage at this stage, the assessment can give valuable estimations of how much area will be needed in the near future and also which kind of habitats will be most affected, so that suitable land for remediation measures can be acquired. In terms of the precaution principle the pre-assessment also offers the possibility to avoid time lags between impact and remediation. If sufficient (financial) resources are available, habitat banking opens up the opportunity to implement remediation measures ex-ante of the impact (Bunzel et al., 2002).

3.2 Responsible bodies for Habitat Banking

Both the urban development planning and the detailed planning for nature conservation (with exception of state conservation areas such as national parks) fall under the competence of municipalities in Germany. Consequently the municipalities are in most cases also in charge of the impact remediation regulation. In Germany most of the habitat banking pools are under the management of municipalities. This arrangement appears to be the most practical for the following reasons:

- The management can be integrated into existing municipal administrative and organisational structures and thus the economic and political risk of establishing a new organisation can be minimised;
- Existing communication structures as well as work routines can be used; and
- The pool management can be combined with ongoing planning and financial competences.

Beside these more organisational aspects there might be other reasons arguing for other solutions (Böhme et al., 2005).

In Germany some habitat banking systems already go beyond the administrative boundaries of a municipality. Reasons can be the necessity to create a pool for remediation for larger infrastructure projects such as railways or motorways, or the fact that single municipalities decide to join forces and create an inter-municipal habitat bank. In these cases the pool management might be better allocated at a higher administrative level. In general authorities competent for nature conservation and natural resources as well as authorities competent for urban and spatial planning provide a good knowledge base for the management of habitat banking.

In addition to the organisational integration into existing administrative structures, there also exist solutions under private management. These could be foundations, companies with limited liability, associations and others. Private solutions might be a good choice if the areas needed for compensation are in property of private landowners (see Figure 2). In order to illustrate these different choices two examples are stated below (see Boxes 1-2).

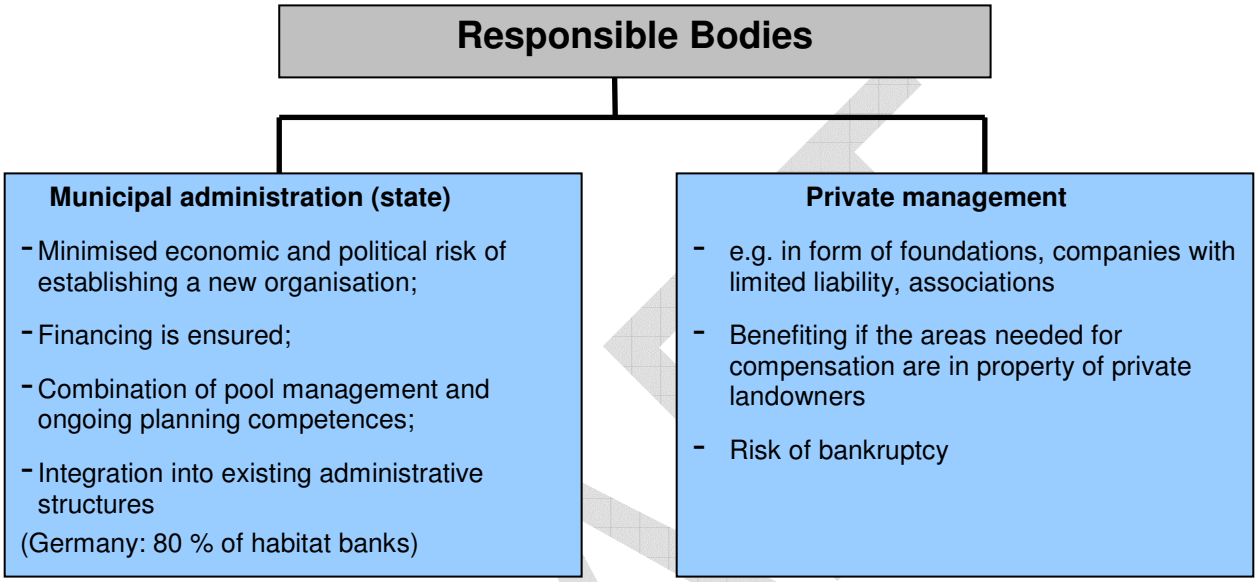

Figure 2: Possible responsible bodies for the management of a habitat bank

Box 1: The Model of the municipality of Mainz

The municipality of Mainz established habitat banking in the urban development planning system. In this context each building area has to be associated with a remediation area. The remediation areas are pooled together in order to enable a coherent planning of green space in the municipality.

The municipality is the Competent Authority of the habitat bank. In the phase of establishment of the habitat bank a complex change of land had to be carried out. Private landowners with plans for development in general provide land for remediation measures closed to the development site. The municipality changes land with private landowners in order to acquire a larger area that will be designated for the remediation measures in the pool. The principle of this land reallocation is that the monetary value of owned land has to be equal. In this way it was possible to achieve a land use pattern that allows for high-density areas with sufficient green belts, which are partly formed by the remediation areas. The areas for remediation, however, remain in the property of the landowners. The municipality is responsible for the implementation of the remediation measures and the maintenance. Nevertheless all related costs remain with the landowner. This concept also allows for an anticipated implementation of measures, if it is determined in the urban development plan, which is legally binding for all involved parties. (Rommel et. al, 2005)

Box 2: Hof Hasemann

The area of the Hof Hasemann in Lower Saxony in Germany is a former farm. At the end of the 1990s the owner of the farm, Wilhelm Hasemann, decided to test a new concept for his land and established the not-for-profit foundation "Hof Hasemann" in February 2000. Since then all 86 ha of the Hof Hasemann have been the property of the Foundation. The foundation's objective is nature conservation and preservation of historic monuments. The family Hasemann are beneficiaries of parts of the foundation's revenues. The whole territory of the Hasemann Foundation is a designated habitat bank with the purpose of compensatory remediation of impacts that happened elsewhere. In co-operation with the nature conservation authority a nature conservation development plan has been elaborated for the area. The municipality of Bramsche, a small town app. 15 km away, was very much interested to find appropriated areas for remediation of its construction activities. The concept of the Hasemann Foundation requires that the whole management of the habitat bank beginning with the development plan, the implementation of measures, the maintenance as well as the monitoring remains with the Foundation. Public administrations are not involved into the management. The municipality of Bramsche is the major contracting party to the Foundation. The assessment of the remediation potential of the area of Hof Hasemann resulted in 895,000 credit points. The assessment was based on a similar scoring principle to the one applied in North Rhine-Westphalia (see Section 3.4.1). The municipality of Bramsche agreed to buy 450,000 credit points. The acquisition of these points will be completed after approx. 10 years with a minimum annual acquisition of 45,000 credit points. The advantage for the municipality of Bramsche is that there is no need for an anticipated investment and that they do not have to consume their administrative capacities for the management of the bank.

3.3 Management of Habitat Banking

The area that will be provided in the framework of a habitat bank has to be secured for the long term. The municipalities generally have extensive instruments for the acquisition of land. In other cases a reallocation of land can be appropriate for example if the available plots are sufficient but fragmentised. If costs for the acquisition of land are too high then long-term leasing can be an option too. The leasing status however should be explicitly determined in the cadastral register in order to make sure that the status will not change in case of a sale.

The habitat bank consists of a pool of areas that are available for remediation measures. The set-up of such a pool should be based on a specific conceptual framework. Spang et al. (2005) state the following essential elements that need to be considered:

- Analysis of the expected demand of areas for remediation;
- Assessment of the potential or possible up-grade of these areas;
- Credits should be incremental to baseline (e.g. areas that would have been protected anyway cannot be counted as credit in a habitat bank);
- Qualified planning instruments for the development of the pool areas;
- Implementation of sustainable and long-term mechanisms for maintenance;
- Set-up of a monitoring system; and
- Transparent financial accounting.

This short list already gives an impression of how complex the management tasks of a habitat banking administration could be. A country wide survey of habitat banking practices in Germany emphasised that the solutions for the habitat banking management are nearly as

numerous as the number of banks. The cases of Landkreis Altenburger Land and the Flächenagentur Mittlere Havel shall give two examples of current best practice in Germany.

According to Böhme et al. (2005), appropriate areas for habitat banking should:

- Have a high potential for ecological development and upgrading;
- Be secured for remediation use on the long-term;
- Have a functional coherency with the impacted site;
- Not be competing with other uses;
- Be cost-effective in implementation and maintenance, and
- Not lie within current and future development areas that are exposed to projects and interventions with adverse effects on the natural environment.

The nature of areas that are included in a habitat bank can be very different. In general the habitat banks comprise a variety of different habitats that occur in the radius where damages are expected (see Annex III). A crucial factor for the consistence of the bank is the preliminary estimation of these expectations. In other cases it could also be that a private landowner is willing to establish a foundation to organise a habitat bank of his land property (see Box 2 above). In short, a habitat bank could have any imaginable size, composition and distribution of areas.

Areas associated with a habitat banking system are best managed in a specific land register. Today many habitat banks in Germany use land registers on the basis of geographic information systems. This land register contains information on location, ownership and size of the area, currently existing habitats and their status, the potential of up-grading the area and finally to which impact event the area is attributed (Spang et al., 2005).

In general for each habitat banking a specific development plan (Pflege- und Entwicklungsplan) will be elaborated. This element represents the main opportunity but also a major threat of the habitat banking concept. The positive factor is that habitat banking offers the opportunity to coherently develop a set of measures in the context of habitat networks and the regional nature conservation planning, which is not possible with isolated measures here and there. The major threat is that in times of harshly restricted budgets the traditional task of nature conservation development plans is now substituted with habitat banking development plans. The best instrument for enforcing the opportunity and for mitigating the threat is the use of accurate planning instruments.

In Germany the municipalities have the obligation to issue nature conservation development plans (Landschaftsplan) on a regular basis. On the higher administration landscape framework plans exist. In addition to this, plans for the coherent habitat network under the European Habitat Directive give guidance to the development for habitat banking systems. The two cases illustrated below will give some details of how habitat banking could be developed in best practice (see Boxes 3 and 4).

Box 3: Administrative District of Altenburg (Landkreis Altenburger Land)

The habitat bank of Altenburg is a co-operation between six different municipalities. The municipalities are responsible for the assessment of the remediation demand, the management of the areas, the implementation of the measures and the maintenance. The nature conservation authority has taken over the responsibility of keeping the database of the impacts and the allocation of remediation sites and measure. It also assesses the up-grade potential of the remediation areas and the allocation of measures to the impact events. Users of the pool are the municipalities to compensate for their urban development plans.

Box 4: Middle Havel Agency (Flächenagentur Mittlere Havel)

The Middle Havel Agency is a private service agency, which is organised as a limited liability company and which offers the organisation of habitat banking. Services of this agency include:

- Procurement of areas for remediation for investors;
- Acquisition and long-term protection of appropriated remediation areas;
- Projection and implementation of remediation measures, potentially including an anticipated implementation;
- Long-term maintenance of the redeemed areas; and
- Long-term administration and monitoring of the areas.

The procurement includes the evaluation of baseline of potential areas and the possibility for upgrade, which will be determined in the habitat bank database. The agency is providing legal advice in the process of negotiation and contracting for the areas. This service is charged on the basis of common fees of estate agents. The assessment in regard to nature conservation objectives are charged as additional costs. The implementation of the measures as well as the maintenance is usually contracted to third parties. Normal contracts for maintenance are issued for 25 years.

3.4 Calculating the remediation measure

Most German Laender issue guidance documents on how to calculate the benefits, which will be gained by implementing complementary and compensatory remediation projects. The most common approach to calculating the service gains in habitat banking is to evaluate the difference between the ex-ante and ex-post status of the habitat. On the basis of existing habitat mappings the habitats in the pool are classified on the basis of the ex-ante conditions. A certain value (often expressed in scores) will be attributed to the current status of the habitat. The development plan for the habitat banking system contains explicit descriptions of the desired future conditions of the habitat; also to this final condition a score is attributed (ex-post). The difference between the ex-ante and the ex-post conditions represents the value of the benefit.

There are different approaches to determine and quantify the damage of an impact within habitat banking in Germany. Habitat banking systems are pools of available areas and set of measures that are provided for remediation of impacts. Thus it could be assumed that they only enter the scene when it comes to the determination of remediation measure. However, in order to ensure the coherency of impact, damaged site and identification of appropriate remediation within the pool, there is a growing tendency in habitat banking practice in Germany to identify standardised procedures for the determination and quantification of damage.

The identification of impacts of single projects or interventions to resources, habitat and species has always been assessed on a case by case basis. Many German Laender have issued special guidance documents (see Table I.1 in Appendix I) for the assessment of damage under the impact remediation regulation. Most of them have appointed a system of eco-points. This system is helpful in order to calculate the damage and determine the potentially equivalent remediation measures.

3.4.1 The concept of eco-scores (Ökopunkte)[3]

Habitat banking is based on the general principle that remediation may take place in a different time and space to the damage. As a result a practical procedure is needed for the comparative assessment of impact and remediation. Among German administration bodies the concept of eco-scores for the evaluation of credits and debits in a habitat bank is widely recognised as an easily applicable procedure. It has however to be noted that there is not one concept of eco-scores but rather many variations of it dependent on the specific conditions of the region, the preparedness of staff, capacity of administrations, availability of guidance documents etc.

Eco-scores are calculated on the basis of the so-called biotope value procedure (Biotopwertverfahren). This procedure is distinguished by the use of biotope types as indicators for complex ecosystem situations, an assessment of the impact through balancing equivalents and a kind of numeric accounting. The central tenet of the biotope value procedure is the evaluation of biotopes on the basis of validated biotope lists. Such a list exists in Germany for each Federal State. These lists are state-wide biotope mappings and are supplemented with specific guidelines that allow for the classification of the biotopes under consideration of the impact and the remediation site.

Based on the state-wide (Laender level) biotope mappings, values (scores) or value intervals are allocated to the units of the biotope lists. Most of the federal State specific guidelines for the assessment of eco-scores allow for intervals. Even if the biotope lists assure an exact mapping of the biotope type, the site still may vary in certain components, such as abiotic factors, which result in a higher or lower value.

Whereas it is difficult to assess the absolute value of a habitat, the scores of the habitat assessment in reality represent ordinal metrics. As a result it is not possible to compare the value of different habitats with this method. A comparison is only feasible for biotopes of the same habitat type. For the latter comparison however a numeric parameter is needed. Therefore the size of the habitat in question represents an important additional component in the assessment. To summarise a biotope is assessed as follows:

- The biotope is identified according to a biotope list;

[3] Eco-scores are not designed to account for full ecological equivalency scaling as is described in the REMEDE Toolkit. The concept of Habitat Equivalency Analysis (HEA) provides, compared to the concept of Eco-scores, a more detailed and accurate calculation of debits and credits and draws on calculation data such as baselines, service loss and presented number of species. Such procedure should come into force in case rarely presented habitats or habitats of high value are affected by any impacts.

When comparing these two approaches it must also be pointed out that HEAs are connected to the risk that planned remediation measures will not be realised as proposed or do not achieve the expected result.

- The value of the biotope according to this list may be in addition subject to an individual case assessment;
- The final score will be multiplied by the area of the habitat; and
- This value is the basis for the further assessment of impact and remediation.

3.4.2 How to evaluate a biotope? (Example from North-Rhine Westphalia)

Most German Federal States have developed guidelines for the evaluation and classification of biotopes. These guidelines include in most cases biotope lists that allocate a specific value to the identified biotope types. The comparison of the different lists of biotope type shows that a common understanding of the classification of biotope types exists, but that there are some variations due to regional particularities (Bruhns, 2007).

North Rhine-Westphalia (NRW) introduced a numeric assessment of habitats on a scale from 0 to 10 (see Table 3.1). The following biotope list, which the State Institute for Ecology, Soil Protections and Forestry elaborated in 2006 (LOBF, 2006), is based on the following nature conservation criteria:

- Level of disturbance;
- Vulnerability;
- Likeliness that remediation of the habitat is possible; and
- Completeness of components of the habitat in comparison to the ideal habitat.

These criteria are of the same value and the scores in the habitat list are the result of the arithmetic mean of all four values. For most of the NRW habitat the guideline for habitat evaluation already prescribes designated scores. The assessment has to be done on an individual basis only for a few habitats that exist in too many variations. The habitats are mapped on the basis of a habitat identification key for NRW. According to the actual status of the habitat in consideration in regard to the four assessment criteria the score may differ at a range of up to two points.

If there is for example a brook that is conditionally pristine but with a poor species inventory that is unusual for this category, the biotope value would be set at 7 instead of 8.This brook shall be channeled in order to allow for better drainage of the agricultural land in the neighborhood (see Figure 3). The affected section of the brook covers an area of 4.5 ha.

Table 3.1: Excerpt of a Biotope list in North-Rhine Westphalia

Biotope type	Biotope Value
Source, brook, River	
Not natural	2
Conditionally not natural (not natural, but containing several elements of the pristine habitat)	5
Conditionally pristine (Not pristine, but close to the conditions of the pristine habitat)	8
Pristine	10

(Source: LÖBF NRW 2006)

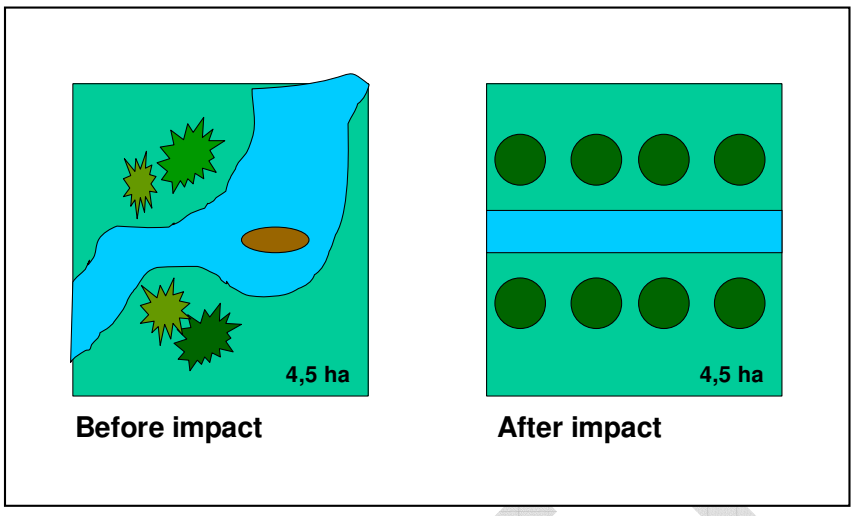

Figure 3: Example of an impact event

The calculation of the impact and the resulting need for remediation is the difference of the value of the biotope before and after impact on the one hand and the difference of the value of the redeemed biotope before and after remediation. The process of this calculation is depicted in Figure 4.

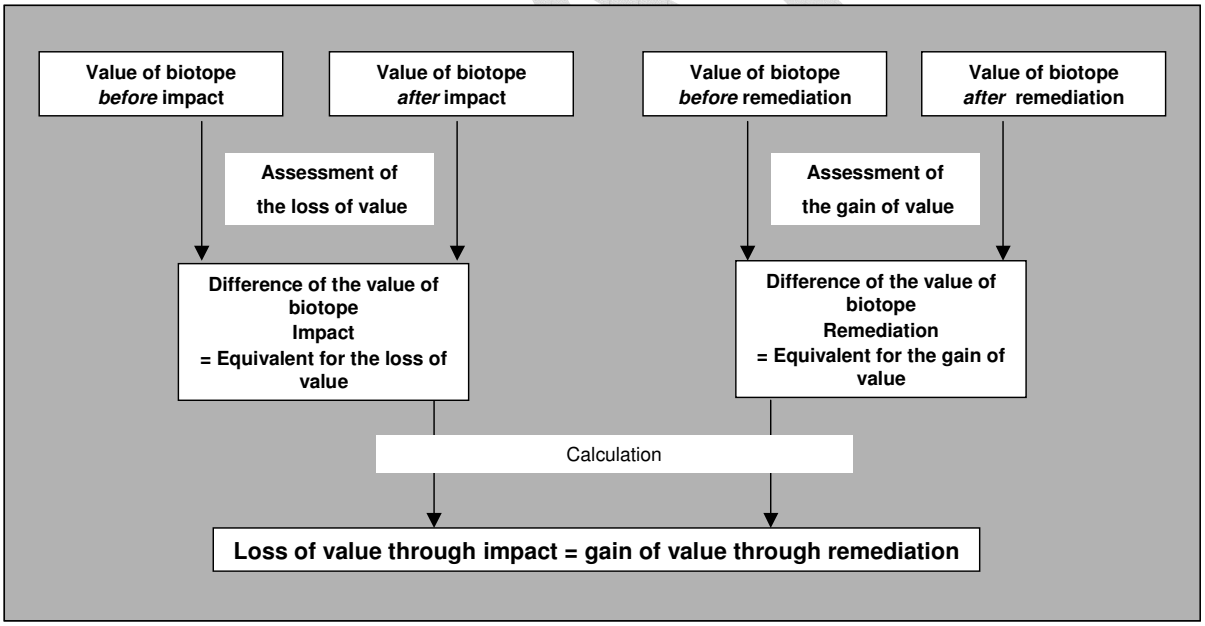

Figure 4: Calculation of impact and remediation (source: Bruhns 2007)

Tables 3.2 and 3.3 are very simplified examples of the accounting process. In this virtual case of the brook the loss of value amounts to 22.5 points. The remediation measure should consequently cover an up-grade of a brook with the minimum value of 22.5 eco-points.

Table 3.2: Value of damaged habitat (damage)					
Type of habitat	**Area in ha**		**Factor of value**	**Value of habitat**	
	Before damage	After damage		Before damage	After damage
Conditionally pristine brook	4.5	-	7	31.5	-
Non natural brook		4.5	2	-	9
			Difference = the damage		**22.5**

Table 3.3: Value of upgraded habitat (credit)					
Type of habitat	**Area in ha**		**Factor of value**	**Value of habitat**	
	Before upgrade	After upgrade		Before upgrade	After upgrade
Not natural brook	10	-	2	20	-
upgraded brook		10	5	-	50
			Difference = the credit		**30.0**

Since the impacts and remediation measures receive a numeric value, the habitat bank is able to be operated like a bank account with debits and credits. Deposits can be both areas and measures that have been accumulated before the impact happens. If the impact becomes reality then the value of the damage is accounted as debits on the account (see Figure 5). In the given example of Table 3.2 and 3.3, the deposit is 30.0 credit points, the debit is accounted for 22.5 credit points, thus the balance results in remaining 7.5 credit points, that are at disposition for another impact event. The areas and measures are recorded in a special cadastre that in most cases is maintained by the municipality.

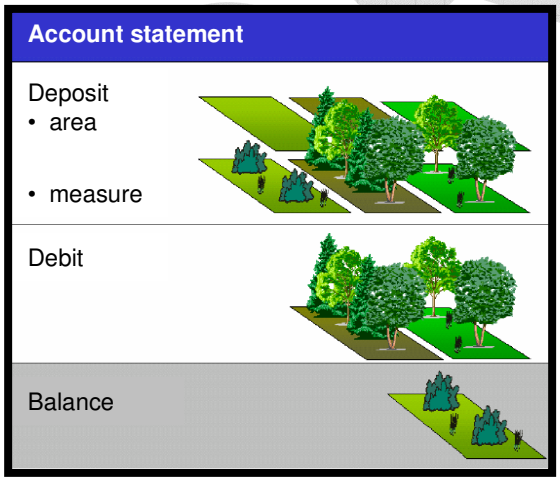

Figure 5: Accounting credits and debits (Source: Bavarian State Ministry of the Environment, Public Health and Consumer Protection, 2003)

3.4.3 Critical aspects of the concept of Eco-scores and the biotope value procedure

Two main criticisms have been raised with regards to the biotope value procedure:

- The value assessment is methodologically not very accurate, because it combines ordinal scores with numeric values, and
- Biotope types do not exhaustively describe the functions and services of the natural environment, an assessment on the basis of biotopes would thus remain incomplete. Especially abiotic functions are not sufficiently represented (Bruhns, 2007).

Bruhns (2007) postulates that these criticisms could be addressed if the following standards are respected:

- The biotope key and the biotope lists have to be differentiated according to the cartographic scale of the project;
- The biotope key has to be adapted and extended to regional situations;
- Intervals of scores offer the possibility to further include specifics of the site, such as particular characteristics of the habitat such as a particular composition of species, special geomorphological features or noteworthy physical conditions etc.; and
- The quantitative assessment of the remediation has always to be accompanied by a fact-orientated description of the impacts as well as a literal justification of the remediation measures.[4]

Even if the concept of eco-scores and the biotope value procedure incorporates significant risks of false evaluation, it represents a procedure that is easy to apply and that achieves a broad consensus among practitioners. The pros and cons in this respect are represented in Table 3.4.

[4] Another issue is that the ecoscores allow for trade offs between very different characteristics of the area such as vulnerability and the ability for remediation. Since all of the attributes are of equal weight and summed together – these allow for direct trade-offs across these attributes which may not be desirable in the ELD.

Table 3.4: Advantages and disadvantages of the Biotope value procedure	
Advantages	**Disadvantages**
• High legal certainty, especially if other factors (such as abiotic factors) are considered as well; • Procedure with wide acceptance within government bodies in Germany; • Application of indicators that can be well distinguished in the area and that provide for complex parameters that are phenotypically easy to assess; • Easy to apply for the assessment of areas; • The procedure requires little effort in comparison to the relatively precise space-oriented evaluation; • Good availability of necessary data (in Germany) (remote sensing, state-wide biotope type mappings), and • Comprehensive approach for calculations related to area and space.	• Limited consideration of habitat elements that are not represented at the whole area of the habitat but that are single spots, linear elements or only temporarily represented; • Limited consideration of effects of fragmentation; • Limited consideration of interrelations in area and space that are independent from the biotope as well as functions not related to the biotope itself; • Risk of critical methodological allocation of the biotope value (ordinal score) with the dimension of the area (numeric value); • Inflexibility respectively lacking ability to adjust on individual cases if biotope types are only roughly categorised; • The extension of the basis for the assessment (inclusion of other aspects) is not adequately linked to operational terms (such as impact on values and functions of particular importance), and • There is a risk that the application of scores could lead to compensation of one habitat with a complete different one.

4 How to ensure effective Habitat Banking

4.1 Risks and benefits of Habitat Banking

There are several benefits as well as risks when using habitat banking, discussed in the literature. In this section main issues will be briefly presented, before providing some guidelines on how to gain all those benefits and how to ensure an effective and successful habitat banking (see Table 4.1).

First of all, the introduction of habitat banking can contribute to enhancing the **sustainability of remediation measures associated with ecological benefits**. In this context the following effects are often mentioned:

- Habitat banking offers the opportunity for strategic nature conservation planning;
- Reduced habitat fragmentation through pooling of remediation measures and creation of complex structures;
- Reduced interim losses;
- Reduced deficits in the implementation of remediation measures, and
- Increased awareness and visibility of habitat improvement projects by the general public because of their larger scale.

Moreover, habitat banking offers much potential for more **cost-efficiency**, the most important ones being:

- Acquisition of land at a time when the planned impact is not yet present to the public, so that prices are comparable to the cost of land for agriculture;
- The existence of areas ready for remediation and/or already completed measures increases the likeliness to quickly identify an area appropriate for remediation, this reduces time and cost consuming search after the damage has occured;
- The coherent development plan for habitat banking also offers the opportunity to combine the implementation of measures with appropriate land-uses as well as implementation and maintenance at a larger scale, which can often be provided at lower costs, with better timing and higher efficiency, and
- Economies of scale ensure that the proportion of financial resources spend for planning and implementation decreases as the area in habitat increases so that there are either more resources available for the actual measures or the measures are less expensive for the polluter.

Nevertheless, there are also some potential risks of habitat banking to bear in mind such as **possible adverse effects to ecology and nature conservation objectives** as listed in the following:

- Risk of undermining the principle of primary remediation, because there is the pool at hand and the investment is already done;
- Potential for significant cumulative negative environmental impacts in locations such as urban areas if on-site compensation is not required and larger projects from the habitat bank are approved at alternate locations;

- Unfavourable accumulation of valuable habitats/remediation measures in a specific region;
- Risk of damaged and remediated habitat not being equivalent (e.g. lake for meadow);
- The "diversity" of an ecological "portfolio" (putting all conservation "eggs in one basket") could potentially be reduced by concentrating remediation in one location or when focusing too much on one habitat/community type;
- Risk for developers to see the habitat banking concept as a license for destruction or as a tool to pre-approve a project that will result in habitat destruction, and
- Risk of social inequity in case the habitat bank is established in a "wealthy" neighbourhood, providing nice opportunities to walk, observe nature, provide a buffer against light/noise, whereas damages occur in "poor" neighbourhoods. In this instance, the "rich get richer and the poor get poorer" because the efficient solution is to pollute the poor areas and compensate through habitat banking in rich areas.

In addition, attention must be paid to some difficulties that might result from **organisational and financial aspects** in managing a habitat bank as for example:

- Maintenance of detailed files for tracking the creation and use of habitat banks is critical to avoid double crediting;
- There may be difficulty in identifying who would manage the habitat bank if it goes beyond administrative boundaries and involves different administrative bodies, and
- Habitat banks managed by private entities could be put at risk in cases of bankruptcy and the municipalities would have to carry the financial burden.

4.2 Features for successful Habitat Banking

In order to receive the benefits that habitat banking can provide and to deal with potential risks some general guidelines will be described in the following. There are several features that have to be considered and fulfilled in order to ensure effective and successful habitat banking, also considering the context and requirements of the ELD. Table 4.1 lists the most important criteria that have to be met and provides guidelines on appropriate measures to address these criteria.

Table 4.1: Appropriate measures/features to deal with potential problems of Habitat Banking	
Criterion	**Appropriate measures/features**
Primary remediation is a priority and habitat banking does not replace primary remediation	• Clear legislation and guidelines that do not allow for irregularities in the decision cascade. - The Hierarchy of Compensation Options must be followed when considering use of the bank.[5] • Careful investigation of the potential for primary remediation at the impacted site. - All on-site compensation options must be explored before using the habitat bank.
Identification of areas that are appropriate for remediation • Credits should be incremental to baseline (e.g. areas that would have been protected anyway cannot be counted as credit in HB	• The sites should be worthy of restoration or enhancement and issues of land ownership and access should be clear. • A habitat bank site must be evaluated and acknowledged prior to its creation; the competent authority for nature conservation should be involved in this acknowledgement procedure. • The selection of remediation areas should consider options for remediation of all natural assets such as species, habitats, soil, water, climate/air etc.
Correct allocation of remediation measure to impact • be subject to quantitative assessment as in an equivalency analysis • the geographical linkage to the damaged site	• The proponent should provide adequate information describing the state of the habitat before enhancement/creation work is begun. • Correct application of the method for the assessment of the value of impact and remediation: - Make sure that all features of the impacted site are considered in the assessment, thus enrich the biotope value procedure with other assessment methods; - Use validated methods for the estimation of the potential for up-grade of the remediation site.
Identification of the correct remediation measure	• The measure has to correspond to the requirements of nature conservation planning. • The competent authority for nature conservation has to agree on the planned remediation measures. • The measure has to be implemented before the impact or at the same time • Habitat banks that provide for anticipated implementation of measures are ideal to reduce the risk of interim losses as much as possible.

[5] Hierarchy of Remediation Options (Köppel and Peters, 2004):
1. Avoidance of negative impacts;
2. Create similar habitat at the development site;
3. Create similar habitat near the development site within the same ecological unit;
4. Create similar habitat in a different ecological unit; and
5. Increase the productive capacity of existing habitat in a different ecologic unit.

Criterion	Appropriate measures/features
Credits drawn from the habitat banking should be the same habitat as that in debits	• The set-up of a habitat bank should take the estimated impacts into consideration and select the remediation sites accordingly. • Incorporate detailed descriptions of the habitat type and other relevant features into the habitat banking cadastre.
Have security of success over time	• The areas that are part of the bank have to be secured on the long-term (minimum 30 years); • Use integrated planning methods such as regional and local nature conservation planning tools for the designation and development of the habitat bank areas; • Anticipated implementation of remediation measures assure that the measure is feasible; • Long-term monitoring should be included into the management structures of the habitat bank; • Reporting and documentation on the functioning of the bank, eg. Development of credits and debits, overall state of the "account", and • A habitat bank has to be financially secured in the long-term.
Cost-effectiveness of measures	• Prepare the set-up of a habitat bank on the long term - Buy land when it is cheap - Use options for land exchange (land consolidation, re-allocation) • Choose the most-effective structure for the administration of the habitat bank - Use synergies with other administration bodies - Evaluate the potential of private agencies and consultancies • Evaluate the potential of selling "remediation options" to large scale investors, in order to pre-finance remediation measures **Make sure that primary remediation remains the first option!** • Combine efforts for the maintenance of remediation measures • The existence of a habitat bank reduces the time length and costs of the search for potential complementary remediation sites
Coherency of the habitat network	• The identification of remediation areas should also include buffer zones and the network of especially valuable and protected areas. • In areas with higher population density combine highly developed areas with free spaces

5 Conclusions

So far, habitat banking in Germany is only applied under the impact remediation regulation, but could potentially also be considered as a remediation tool in some European Directives such as the Habitat Directive or the ELD. Habitat banking may also offer the opportunity to pooling remediation measures in the context of these directives and to creating complex as well as coherent structures.

The great advantage of habitat banking is its practicability. Indeed, highly populated countries such as Germany have growing difficulties to compensate the impacts of infrastructure close to the impacted site. Further, the already existing fragmentation of habitats aggravates the integration of single remediation measures into a coherent habitat network. Against this background, habitat banking offers the opportunity for a more coherent nature conservation planning and as a result the measures taken appear to be more sustainable and (cost) effective. Further significant advantages of habitat banking can be seen in the reduced deficits of execution of remediation measures. In the past a certain number of remediation measures were not realised due to the lack of available areas for remediation Germany (DLR, 2007).

In addition, the practice of habitat banking in Germany also resulted in more practical approaches to the calculation of impacts and remediation. "Eco-scores" can be a useful instrument to operationalise this assessment. Especially smaller municipalities need instruments that facilitate their work on a daily basis.

In the context of habitat banking, municipalities also have different options regarding the administration of impact remediation. They have the option to join forces in inter-municipality co-operation, they can handover the administration to sectoral government bodies such as nature conservation administration or they can even hand over the management of the habitat bank to third parties (e.g. a foundation or agencies).

Nevertheless the concept of habitat banking also includes significant risks. The existence of a habitat bank challenges the necessity of primary remediation. Especially in the case of anticipated remediation there might be a pressure to "sell" first the previous investment, instead of thinking about options for primary remediation. In addition a habitat bank may not always offer the "right" remediation measure. The numeric assessment of impacts and remediation may foster the comparison of "apples and oranges". These risks however can be minimised with the meticulous application of sound nature conservation planning instruments.

Future research on this issue can contribute to minimise risks of habitat banking. In particular the following questions should be investigated:

- Has there been an increasing number of off-site remediation (realised within habitat banking procedures) instead of on-site remediation since habitat banking has been introduced as a tool of compensatory and complementary remediation in Germany? (Is the principle of primary remediation undermined, resulting from the fact that there is a pool at hand and the investment is already done?)

- Is there a significant drift of habitats? Investigation should be made on whether the number of types of damaged habitats corresponds to the number of habitats that have been created within the remediation process (e.g. woods instead of meadows?).
- Have remediation measures been accumulated in a unfavorable way in a specific region (e.g. 10 ponds were created at one place (1 km^2) in order to compensate destruction of several ponds within an area of 10 km^2)?

Further additional research could focus on the following issues:

- Do compensatory and complementary remedial measures always correspond to impacts?
- What have compensatory payments been used for within the municipalities (in those cases where compensatory measures could not be realised)?
- Are there cases within the ELD where remediation in the context of habitat banking has been applied?

In short, habitat banking can be characterised as a simple and practical tool to realise compensatory and complementary remedial measures to a certain extent[6]. It is well established in Germany.

Nevertheless, consequences of habitat banking still need to be investigated. This could probably be done by conducting an assessment (monitoring) beginning from now up to 2010 or 2012 in order to gain evaluation data on this still very new tool. Such a time frame would ensure the achievement of first relevant and reliable monitoring data.

[6] Habitat banking should only be considered in those cases where primary remediation is not feasible or all on-site compensation options have been explored before (see also table 4.1).

6 References

Anger, C. (2002), *Die ökologische Bevorratung*, Hamburg.

Böhme, C., Bruns, El. et al. (2005), *Flächen und Maßnahmenpools in Deutschland*, Bonn.

Bruns, E. (2007), Bewertungs- und Bilanzierungsmethoden in der Eingriffsregelung – Analyse und Systematisierung von Verfahren und Vorgehensweisen des Bundes und der Länder, Technische Universität Berlin, download at http://opus.kobv.de/tuberlin/volltexte/2007/1565/pdf/bruns_elke.pdf.

Bunzel, A., Böhme, C. (2002),*Interkommunales Kompensationsmanagement*, Bonn.

DLR – Deutscher Rat für Landschaftspflege(2007), 30 Jahre naturschutzrechtliche Eingriffsregelung - Bilanz und Ausblick, Meckenheim.

Hasemann, H., Interview in Bramsche on 12.09.2007.

Jessel, B., Schöps et al (2006), Flächenpools in der Eingriffregelung und regionales Landschaftswassermanagement, Bonn.

Köppel, J., Peters, W. (2004), *Eingriffregelung, Umweltverträglichkeitsprüfung, FFH-Verträglichkeitsprüfung*, Stuttgart.

Landesanstalt für Ökologie, Bodenordnung und Forsten (LÖBF) (2006), Numerische Bewertung von Biotoptypen für die Eingriffsregelung in NRW, http://www3.lanuv.nrw.de/Willkommen/Infosysteme/Numerische_Bewertungsverfahren/Num-Bew-Biotoptypen_Eingriffsregelung-NRW.pdf.

Landesanstalt für Umweltschutz Baden-Württemberg (2005), Empfehlungen für die Bewertung von Eingriffen in Natur und Landschaft in der Bauleitplanung sowie Ermittlung von Art und Umfang von Kompensationsmaßnahmen sowie deren Umsetzung (Teil A: Bewertungsmodell), http://www.lubw.baden-wuerttemberg.de/servlet/is/12697/allgemeine_bewertungsempfehlungen_teil_a.pdf?command=downloadContent&filename=allgemeine_bewertungsempfehlungen_teil_a.pdf.

Planungsbüro Dehling & Twisselmann (1999), Pflege- und Entwicklungsplan für den geplanten Ersatzflächenpool der “Stiftung Hof Hasemann”.

Planungsbüro Dehling & Twisselmann (1999), Pflege- und Entwicklungsplan für die erste Änderung des Ersatzflächenpools der “Stiftung Hof Hasemann”.

Rommel et. al, (2005), Wer soll das bezahlen?“ in Spang, Werner Dieter; Reister, Sven (2005) Ökokonten und Kompensationsflächenpools in der Bauleitplanung und der Fachplanung, Berlin.

Spang, W. D., Reister, S. (2005), Ökokonten und Kompensationsflächenpools in der Bauleitplanung und der Fachplanung, Berlin.

Appendix I: Resources of experiences with Habitat Banking in Germany

Table I.1: Laender - websites on impact remediation regulation and habitat banking in Germany		
Federal State	**Content of the website**	**Internet resource**
Baden-Wuerttemberg	Short introduction to habitat banking in Baden-Wuerttemberg and provision of guidance documents to its application	http://www.lubw.baden-wuerttemberg.de/servlet/is/12697/
Saarland	Short introduction to habitat banking in Saarland and provision of guidance documents to its application	http://www.saarland.de/8880.htm
Rhineland-Palatinate	Short introduction to impact remediation regulation in Rhineland-Palatinate and provision of guidance documents to its application	http://www.mufv.rlp.de/?id=412
Hesse	1. Short introduction to habitat banking in Hesse and provision of an information brochure to its application 2. Website of an Agency with the legal form of a limited liability company, that organises habitat banking in Hesse	1.http://www.hmulv.hessen.de/irj/HMULV_Internet?cid=2f0d81893e152138faa2c38ebaa69926 2.http://www.oekoagentur-hessen.de/
North Rhine-Westphalia	1. Short introduction to the concept of eco-scoring including the provision of two guidelines on its application. 2. Explanations on the establishment of compensation areas in North Rhine-Westphalia.	1.http://www3.lanuv.nrw.de/Willkommen/Infosysteme/Numerische_Bewertungsverfahren/ 2.http://www3.lanuv.nrw.de/Willkommen/Infosysteme/Kompensationraeme/index.html
Lower Saxony	1. Guidance document on the organisational aspects of a habitat bank. 2. Introduction to the impact mitigation regulation in Lower Saxony	1.http://cdl.niedersachsen.de/blob/images/C584604_L20.pdf 2.http://www.umwelt.niedersachsen.de/master/C34326484_N34325324_L20_D0_I598.html
Saxony-Anhalt	Text of the decree on habitat banking in Saxony-Anhalt	1.http://www.sachsen-anhalt.de/LPSA/fileadmin/Files/oekokontoverordnung_01.pdf
Thuringia	1. Guidance document on habitat banking under the urban development plans. 2. Guidance document on habitat banking under the German Federal Nature Conservation Act.	1.http://www.thueringen.de/imperia/md/content/tmlnu/19.pdf 2.http://www.thueringen.de/imperia/md/content/tmlnu/themen/naturschutz/flaechenpools.doc

Appendix II: Legal and institutional background of Habitat Banking in Germany

Habitat banking is an approach to remediate adverse effects of projects and other interventions on the natural environment. The following section gives an overview on the German impact remediation regulation and the rational that led to the introduction of habitat banking in Germany in 1993.

The German Federal Nature Conservation Act regulates a specific impact remediation regulation (Eingriffsregelung), which has been established with the enactment of the German Federal Nature Conservation Act in 1976. In the German Federal Nature Conservation Act an impact is defined as an intervention that negatively modifies the productivity and the performance capacity of the natural environment as well as the diversity, characteristics and beauty of the landscape. While the procedure of the Environmental Impact Assessment (EIA) regarding the impact of certain projects is listed in the Annexes of the European EIA Directive, the German impact remediation regulation becomes effective in each situation where damage to the natural environment is predicted and where the shape and/or the utilisation of the land surface will be changed. As a result the damage of the intervention is the focal point of the procedure. The difference between the impact remediation regulation and the EIA procedure is mainly in their different definitions of the protection subject. These definitions are for the impact remediation regulation to be found in Section Three, Art. 18 of the German Federal Nature Conservation Act[7] and for the EIA Directive in Art. 3[8] of the directive.

The responsible party, liable for the damage, has to prevent adverse effects of the intervention or has to take compensating[9] and/or complementary measures. The authorisation of an intervention is bound to the principle of prevention of damage. The authorisation follows a so-called decision cascade: the dictum of the first assessment is to find solutions that prevent any damage to the natural environment. If this is not possible, the adverse

[7] Section Three: General Protection of Nature and Landscapes, Article 18: Interventions in Nature and Landscape "*(1) Interventions in nature and landscape within the meaning of this Act are: changes to the shape and appearance or utilization of land (Grundfläche = land/primises, translator's note) or changes to the groundwater table with its close correlations to inhabited soil compartments, that may significantly impair the ecosystem, or the natural scenery.",* TRANSLATION Federal Nature Conservation Act of 25 March 2002, english version url-source:

http://www.bmu.de/files/pdfs/allgemein/application/pdf/bundnatschugesetz_neu060204.pdf

[8] Art. 3, Directive 85/337/EEC: "*The environmental impact assessment will identify, describe and assess in an appropriate manner, in the light of each individual case and in accordance with the Articles 4 to 11, the direct and indirect effects of a project on the following factors:*

- *human beings, fauna and flora,*
- *soil, water, air, climate and the landscape,*
- *the inter-action between the factors mentioned in the first and second indents,*
- *material assets and the cultural heritage."*

Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment.

[9] In the context of the German impact remediation regulation, compensating measures are measures taken in situations where it is not possible to achieve the baseline situation. These measures shall be able to mitigate the adverse effects in order to come close to the baseline situation.

effect has to be compensated on-site, in order to minimise the damage. Only in the last step are complementary measures, i.e. measure that are able to substitute ex-ante conditions, to be considered. In case there is no feasible remediation available and the natural environment will be significantly damaged the authorisation of the intervention has to be denied.

The provisions of the 1976 Nature Conservation Act are related to the concrete implementation of a project or other interventions. In the late 1980s the practice of urban development planning however experienced the growing need of considering the impact remediation regulation already at the stage of the legally binding urban development plan at the level of municipalities. As a consequence the Nature Conservation Act was amended in 1993 and the legal regulation of the impact remediation regulation for urban development plans shifted to the German Federal Building Code. Since then the regulation has to be applied at the level of the urban development plan for areas that lie within the urban districts of the municipalities and that dispose of an urban development plan. Given that urban planning follows different requirements than in the unzoned open land, the implementation of remediation measures also had to follow slightly different rules.

In order to meet these requirements many municipalities, who are the Competent Authorities for the implementation of the impact remediation regulation, introduced the concept of habitat banking. In the following years habitat banking has been widely applied in Germany and today even inter-municipal types of habitat banking exist that cover larger geographical areas.

Habitat banking was restricted for a long time to measures taken under the German Federal Building Code. The revision of the German Nature Conservation Act in 2002 empowered the Laender to introduce habitat banking for any other impact under the impact remediation regulation. Since the Nature Conservation Act is a framework law that requires legal implementation with own Laender laws, it took a few more years until habitat banking came into practice for areas outside urban development plans. Reasons for opening up the regulation for habitat banking were manifold. There is evidence from past experiences that many compensation and complementary measures have not sufficiently been implemented, because of the lack of appropriated areas. In other cases the measures ended up insignificant due to fragmentation of the sites. In this situation habitat banking offers the option for a coherent nature conservation planning also in regard to the Natura 2000 network as well as a cost-efficient procurement of the needed remediation areas. In addition habitat banking also offers the possibility to implement measures ex-ante of the impact and the institutionalised agencies of the habitat banks assure long-term ex-post maintenance.

Appendix III: Excursus - Distance Decay Factor

The objective of remediation is to reach a condition that is most similar to the baseline scenario. Remediation projects benefiting natural resources typically are more relevant if they are geographically close to the damaged place.

The concept of habitat banking in most cases implies that the impact is not compensated on site but within a certain distance from it. This distance represents the threat that the remediation will not be able to assure the coherency of the baseline habitat network.

With the amendment of the Federal Nature Conservation Act in 2002 the correlation of the impacted site and the remediation site has been relaxed. There is no strict regulation which identifies the parameters that have to be applied to estimate the correct distance between damage and compensation sites or to decide whether the chosen distance is significant (the expression "landscape space" (Landschaftsraum), which is considered to be the more or less homogeneous landscape unit, referring to this. The complementary remediation measure should be implemented in the region of the same context of geography and the same prerequisites of planning (Anger, 2002).

The current practice of habitat banking in Germany, however, is generally bound to the boundaries of municipalities and concerns about distances between impacts and remediation when using habitat banking might not be relevant given the small radius of action (about 60 km) of municipalities and their pools of areas. Even in the case of banks that are based on intermunicipal co-operation the distances seldom go beyond the landscape unit in question. One valuable approach focussing on coherency of the baseline habitat network has been initiated in the federal state of North Rhine-Westphalia (NRW) by designating specific compensation areas, within which an impact might be remediated and which could go far beyond the borders of municipalities (see Figure 6). Experiences with this option have not yet been assessed. These compensation areas present homogeneous landscape units, which are generally derived from geo-morphological, landscape-genetic and climate characteristics.

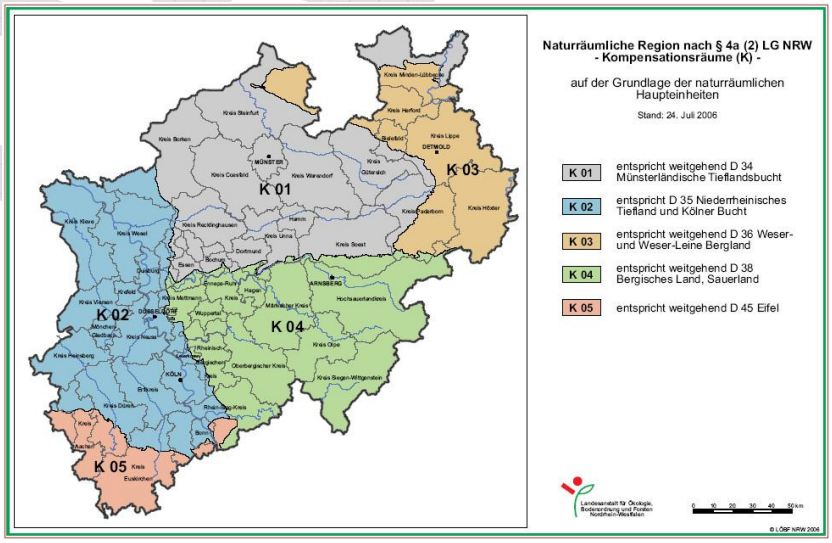

Figure 6: All five compensation areas in the Federal State of North Rhine-Westphalia (total area: 34,085 km^2); Names are geo-morphological, landscape-genetic and climate characteristics[10]

[10] http://www3.lanuv.nrw.de/Willkommen/Infosysteme/Kompensationraeme/index.html

Compensation areas, determined at Federal State level could be further subdivided at municipal level, where the habitat banking (pool) takes place in order to meet specific regional conditions and to ensure coherency of the baseline habitat network. This approach may also contribute to prevent regional drift of remediation measures as well as accumulation of remediation measures at one location.

It has been found out by conducting interviews with responsible bodies from Federal Ministry for Environment[11] as well as the Federal Agency for Nature Conservation[12] and literature research at national level that the issue "Distance Decay Factor" within remediation processes is not recognised and reflected in Germany up to this moment. There is neither an official statement nor a scientific discussion on this issue.

Therefore, there is a strong need for further research in order to investigate the following questions:

- Have there been cases of large distances (e.g. > 60 km) between site of impact and remediation within habitat banking procedures and if yes, what are the effects on coherency of the baseline habitat network?
- Would it be better to protect, say, five great bustards *(Otis tarda)* in the Federal State of Brandenburg or, say, 200 individuals somewhere else at the same costs? (This question could be investigated by conducting a cost-benefit analysis.)

[11] Federal Ministry for Environment, Nature Conservation and Reactor Safety, Department Referat N II 2 Sustainable Urban Planning, Landscape Planning, impacts to Nature and Landscape

[12] Federal Agency for Nature Conservation, Department II 3.2 Impact Remediation Regulation, Infrastructure Planning