Risks and opportunities in the biodiversity management and related stakeholder involvement of the RWE Hambach Lignite Mine

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International Union for Conservation of Nature

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While without close interaction with RWE this report would not have been possible, the comments, conclusions and recommendations are entirely the authors' and based on our experience with similar issues in other companies and elsewhere in the world.

Executive Summary

This report is part of a joint undertaking by IUCN and RWE to explore the possibility of integrating biodiversity values into RWE policies and practices. It was felt that a closer examination of the biodiversity management undertaken by RWE at the Hambach mining site during the past 35 years and the methods of the company's stakeholder engagement processes were needed. This examination offers IUCN the best opportunity to understand RWE's past approaches to biodiversity and for RWE to learn about today's needs for the integrated biodiversity management approaches advocated and by IUCN. The scope of this report (**Section 1**) is *not* a review and systematic appraisal of the biodiversity management of the Hambach Mine. Rather, the report aims to provide the basis for development of a company-wide strategic approach to the management of biodiversity and related stakeholder needs.

Moreover, the report is restricted to the issues of biodiversity risks posed by lignite mining and the opportunities of well-planned and implemented rehabilitation strategies. It does not seek to contribute to the fundamental debate about Germany's energy policies or the long-term impacts of lignite mining on the society and the environment in general.

Every business sector impacts and depends on biodiversity and ecosystems, especially those involved in natural resource extraction. The integrated biodiversity management methods developed by IUCN show that biodiversity loss is a risk factor to the company. However, if projected risks are managed properly (e.g. on the basis of the mitigation hierarchy), they can often be turned into opportunities to provide positive outcomes for biodiversity (**Section 2**). In addition, such management methods can improve the company's "social license" to operate, by preventing future delays, thus leading to cost savings and biodiversity benefits.

The Hambach Mine, one of three major RWE mining operations in North Rhine Westphalia, Germany, is a highly complex enterprise (**Section 3**). While, initially, it resulted in many negative impacts on biodiversity (such as the destruction of large parts of the Hambach Forest), it also led to substantial gains for biodiversity through the creation of an entirely new permanent landscape (like the Sophienhöhe hillside) with diverse forests intermixed with other habitat types such as heathlands, wetlands, lakes and ponds. The formation of ecologically interesting temporary habitats (areas for specific animals and plants) in the mining area itself, as well as a variety of targeted measures to secure or enhance the status of important species, are further positive measures that favour biodiversity. While the mining site traverses the landscape, agricultural land is also being re-established and readied for cultivation. This restoration gives state-of-the art attention to the formation of hydrological characteristics and composition of soils that are particularly conducive for cultivation. A special challenge and delicate issue on the social side is the resettlement of several villages.

While the recultivation and biodiversity management of the Hambach Mine is undertaken at a very high professional level, led by dedicated expert scientists and supported by several external scientific bodies and institutions, the achieved outcomes seem mainly the result of numerous and diverse external regulations, with no perceivable overall strategic direction behind it (**Section 4**). As a key recommendation, it is proposed that these remarkable efforts in ecosystem creation and biodiversity management should be put onto a firmer strategic footing linked to clearly defined company-wide biodiversity objectives. These may, in turn, be linked to higher-level regional biodiversity objectives (e.g. on a state level). Parallel to embracing a more strategic approach, the communication of this work to various identified target audiences should be undertaken in a much more pro-active manner. The international business community, where many companies are trying to improve and formalize their biodiversity management and which seems to be largely unaware of RWE's achievements, should be seen as one such important target audience. A comparison of RWE's approach to and achievements in biodiversity management with ten principles of *good biodiversity management* (Table 5) shows RWE above the halfway mark, a respectable level that seems to be better than generally perceived by the public.

A choice of key social issues with direct or indirect links to biodiversity is briefly discussed in **Section 5**. Stakeholder engagements should likewise be pursued more pro-actively and be given stronger participatory elements (instead of information exchange only). In view of numerous links between well-being and health of local stakeholders and biodiversity it is somewhat astonishing that social parameters are not investigated with similar scientific rigour as the many on-going investigations on ecological topics. While a lot is invested in the monitoring of ecosystems and biodiversity, the long-term effects of resettlement and other impacts of the mining operations on local people seem to receive far less attention. RWE should ensure that the social effects of lignite mining are more properly assessed and monitored and that social support schemes are of the highest possible quality. In relation to social issues RWE currently follows the principles of AccountAbility (2011), the implementation of which, however, remains below the potential that could be realized through good and pro-active stakeholder processes (Table 7).

In **Section 6**, the major conclusions and recommendations are summarized. They relate to (1) the urgently required more strategic approach to biodiversity management; (2) the monitoring of biodiversity and the development of possible indices for biodiversity losses and gains; (3) the formalized risk and opportunity assessment of biodiversity; and (4) the more pro-active approach to stakeholder engagements.

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1. BACKGROUND

1.1 Project assignment

In December 2013, IUCN and RWE signed an agreement to explore jointly the possibility of integrating biodiversity values into RWE policies and practices. The agreement[1] aimed at delivering the following results:

1. The restoration plan for the Rhenish (Rhineland) lignite mining area demonstrates best practice in terms of incorporating biodiversity and ecosystem considerations;
2. Based on IUCN recommendations, RWE develops a process for strengthening its biodiversity management policies and practices; and
3. IUCN biodiversity management tools are adapted for the restoration of lignite open cast mines.

As part of this agreement, two experts were appointed with the following remits:

Biodiversity expert (Christoph Imboden): To assess and comment on RWE biodiversity management practices, with special emphasis on the rehabilitation of the Rhenish lignite mining area and to contribute to the testing and adaptation of the biodiversity management tools developed for the cement and aggregate sector to the energy sector.

Social impact expert (Nicola Moczek): To provide expert advice on integration of social standards into the biodiversity management practices of RWE, with special emphasis on the rehabilitation of the Rhenish Mining Area and the stakeholder engagement.

This report represents one of the key deliverables with implications for the first two results identified above.

1.2 Methodology

The following activities were undertaken in preparation for this report:

- Introductory visit to the Hambach mining area and to the RWE office in Cologne (18/19.03.14);
- Study of a first batch of materials provided by RWE, resulting in an interim report submitted on 02.05.14;
- Study of various background documents on social impacts;
- Follow-up visit of both experts to Hambach for detailed discussions and field visits (16/17.07.14);
- Various interviews with experts on social issues and stakeholder engagement;
- Intensive study of further background material on lignite mining, restoration of such mining areas and related social, health and well-being issues connected with lignite mining; and
- Analysis of various project documents and reports.

Some key background documents are listed in the endnotes. They are, however, not to be viewed as a comprehensive bibliography.

1.3 Scope of report

The mining of lignite for the generation of primary energy often results in numerous severe and irreversible impacts on the environment and local communities. Thus, the process is highly sensitive and controversial in Germany. It has become the subject of an ongoing socio-political debate, raising questions regarding the transition towards renewable energy, the diminishing role of fossil fuels, future energy security and efficiency, and liberalization of the energy market, among others. Meanwhile, large and outspoken NGOs are spearheading criticism of the continuing use of brown coal for energy generation and the enormous environmental and associated impacts of open-cast mining. In addition, concern is growing that the long-term effects might also entail unforeseen financial risks.

Therefore, it is important to delineate clearly the scope of this report. It is restricted to the issues of biodiversity and related social aspects – the risks posed by lignite mining and the opportunities offered through well planned and implemented rehabilitation strategies. It does not seek to contribute to or venture an opinion on the fundamental debate about Germany's current or future national energy policies or the direct or indirect long-term impacts of lignite mining on society and the environment in general.

The starting points for discussion in this report are based on a number of established facts:

- Energy derived from lignite mining covered around 12% of Germany's primary energy consumption in 2013, and 26% of its *nationally* produced primary energy was generated through brown coal [2].
- Even in the fastest energy-switch scenarios, lignite mining will continue in Germany for the foreseeable future.
- The impacts of past, ongoing and future lignite mining in Germany will remain and need to be addressed for many years to come.

Within this context, the report seeks to appraise:

1. How biodiversity issues were addressed and managed in the past, and how current Rhenish lignite mining operations are being addressed and managed in the present (with a focus on the Hambach Mine);
2. How this work relates to the best practices and standards of biodiversity management attained in other industry sectors;
3. How, in view of experiences by others, biodiversity management could be improved;
4. How the issue of biodiversity influences, directly or indirectly, local people and stakeholders;

5. How interactions with stakeholders could be improved and enhanced through a special (additional) focus on biodiversity; and
6. How this work could be used as basis for the development of a company-wide policy on biodiversity.

Even within the focal topic of biodiversity some further restrictions have to be declared: the indirect effects on biodiversity of the many severe physical environmental impacts of lignite mining and energy production – such as various forms of air emissions, profound changes to the hydrological conditions of the landscape, chemical changes to water and soil, the shifting of millions of tonnes of soil material – are not being addressed in this discussion paper on any meaningful level.

Finally, it must be clearly stated that, on the whole, this report should be viewed as a basis for possible further collaboration between IUCN and RWE on the topic of biodiversity management, outlining in which general direction an integrated strategic approach to biodiversity should be pursued by RWE. Although this report should not to be considered as a systematic review and evaluation of RWE's biodiversity-related work at the Hambach Mine, 38 concrete recommendations are being put forward by the authors. For ease of reference they are numbered throughout sections 4, 5 and 6. A separate management response to these recommendations has been requested from RWE.

2. INTEGRATED BIODIVERSITY MANAGEMENT

2.1 Worldwide biodiversity concerns and efforts

Every business sector impacts and depends on biodiversity and ecosystems to a greater or lesser extent (see Box 1 for key definitions). Therefore, a widespread recognition has taken hold that businesses have both a responsibility to address their potential impacts on the natural world and an important opportunity to reap benefits by becoming responsible stewards of biodiversity and ecosystems.

Every type of mineral extraction operation – be it for metals, precious stones, cement, aggregates or energy generation – have numerous direct and indirect impacts on biodiversity; some of them are very significant and have profound effects on landscapes, ecosystems (and the services they provide), species and humans. In order to minimize these negative impacts, and even to deliver positive outcomes for biodiversity, companies in these sectors need to measure and address their impacts on biodiversity and ecosystems through proactive and systematic biodiversity management.

Recognizing that biodiversity must be an integral part of risk management processes, many companies have now started to move toward taking a more systematic and systemic approach to biodiversity related issues. Sound socio-economic and environmental management policies can create opportunities for making a positive contribution to local, regional or even global biodiversity conservation. The international finance sector is also increasingly requiring policies and operational processes to meet international standards on biodiversity[3].

IUCN has been acting as a catalyst and champion of such integrated strategic approaches to biodiversity management and assisted many companies to adjust their policies and operational accordingly.

In particular, IUCN seeks to provide practical guidance and recommendations for the integrated, prioritized and systematic management of biodiversity at the company level, with specific focus on:

- Building on existing business decision-making and operational processes;
- Setting a corporate policy and establishing targets for biodiversity management;
- Developing company-wide tools for biodiversity management that link local biodiversity management to global reporting on biodiversity; and
- Providing standardized guidance on the integration of biodiversity into business-related processes, such as scoping, environmental and social impact assessing (ESIA), biodiversity action planning (BAP) and rehabilitation of sites.

One publication[4], which addresses the cement and aggregate sector, contains principles that, by and large, apply to the entire natural resource extraction industry and is therefore relevant for this case.

2.2 Business case for integrated biodiversity management

Within the business sector, there is increasing recognition that impacts and dependency on biodiversity, ecosystems and the services they provide may represent major risks for the business bottom line. Operations can be disrupted or even halted by increased scarcity and cost of raw materials. In addition,

Box 1: Key definitions: Biodiversity, Ecosystems and Ecosystem Services

The Convention on Biological Diversity offers the following definitions for biodiversity and ecosystems:
Biodiversity is *"the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."*

Ecosystems are a component of biodiversity and can be defined as *"a dynamic complex of plant, animal, and microorganism communities and the non-living environment interacting as a functional unit."*

Ecosystem Services: four basic types of services are generally distinguished:
- Provisioning services are the tangible products that biodiversity provides, including food, fresh water, fuel and materials, such as wood for furniture and construction and fibre for clothing, as well as genetic resources for medicines and crop security;
- Regulating services keep major ecological processes in balance, including climate regulation, flood control, disease regulation and water purification;
- Cultural services are the non-material values that humans derive from nature, including aesthetic, spiritual, educational and recreational benefits; and
- Supporting services are necessary for the production of all other ecosystem services, including biomass production, soil formation, nutrient cycling and provision of habitats.

Generally, in this paper, the term biodiversity includes all of the above – species, ecosystems and ecosystem services.

Sources: The Convention on Biological Diversity (1993): http://www.cbd.int
and The Millennium Ecosystem Assessment (2005): http://www.millenniumassessment.org

growing concerns of stakeholders and civil society over environmental impacts, unsustainable use of natural resources and negative effects on people's living space and personal health, can lead to disturbances. Such apprehensions might lead to higher actual costs and negatively affect profits through delays in planning, permitting and operation. Additionally, access to capital may be restricted as the financial community adopts more rigorous investment and lending policies. Moreover, from a regulatory perspective, governments are increasingly implementing new sustainable procurement policies and regulations that include new taxes and moratoria on extractive activities. There are also risks of reputational harm from media and NGO campaigns and shareholder resolutions.

However, with the integration of biodiversity into decision-making and operations, many of these risks can be turned into opportunities. Strong environmental performance can allow a company to differentiate its brand in a competitive marketplace where there is growing demand for sustainably sourced or certified products, as well as enable it to attract and retain high-quality employees. It can also enhance a company's social license to operate by demonstrating a corporate commitment to address civil society's concerns at local and global levels. Pre-empting regulations and public pressure through the implementation of sustainable operational and/or investment practices can prevent future delays and lead to cost savings.

In summary, for a company involved in the exploitation of natural resources *underground*, a demonstrable commitment to, and concern for the biological resources *above ground*, for which it is equally responsible, are indispensable. An *exemplary land stewardship* is essential for sound, long-term economic performance.

2.3 Biodiversity management in major operational phases

Any type of extraction of natural resources consists of the following major operational phases:

1. ***Scoping and feasibility assessment***: usually resulting in a go/no go decision;
2. ***Detailed environmental and social impact assessment (ESIA):*** may lead to design or operational changes and could, in rare cases, result in a no go decision;
3. ***Operational (implementation) phase***: usually based on forward-rolling operational plans derived from commercial considerations, regulatory requirements and, possibly, from evolving socio-political concerns; and
4. ***Post-operational rehabilitation***: derived from general or license-linked specific regulatory requirements and possibly also influenced by changes in public values and perceptions.

While these processes may extend over highly variable stretches of time – from a few years (sand and gravel extraction) to many decades (some hard rock quarries, coal mines), the principles and steps to be taken in biodiversity management and the specific activities to be undertaken remain largely the same. The major objectives and biodiversity management activities of each phase are summarized in Table 1. In cases of long-term projects like lignite mining, these phases, particularly phases 2, 3 and 4, overlap in the steady progress of opening new land for mining at one end and rehabilitating exhausted areas at the other.

The objectives of biodiversity management through the life cycle of a natural resource extraction operation can be best summarized as a process: with an initial focus on the ***risk of biodiversity to operations*** (considered during scoping and feasibility; followed by attention to the choice and implementation of ***appropriate mitigation measures*** (through the environmental impact assessment; and finally concentration on the ***opportunities for creating longer-term biodiversity enhancements and gains*** (during operation and rehabilitation) (Figure 1).

A similar progression is evident in relation to the intensity and level of detail that biodiversity issues are investigated and addressed. During scoping and planning, a quick and more "broad brush" approach is required, concentrating on biodiversity elements that can pose serious risks to operations. More detailed studies are progressively needed as compensatory measures for biodiversity impacts and

Figure 1: Biodiversity management – from risk to opportunity

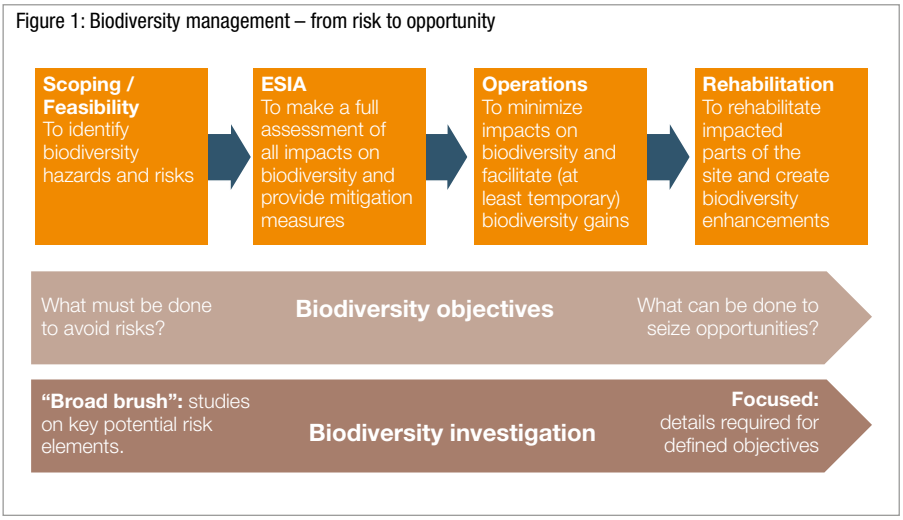


Table 1: Key steps in biodiversity management	
Biodiversity objective of major project phases	**Biodiversity management activities**
Scoping and feasibility To identify at an early stage biodiversity hazards and risks that could have a significant impact on the viability of the project and to provide the biodiversity information needed for the investment decision.	• Compile key biodiversity information[5] • Assess biodiversity importance of a site: identification of key biodiversity features, such as globally or nationally threatened and/or protected species, international or national protected areas, rare ecosystems or habitats, and other unique biodiversity features • Assess risks: – Risk of planned operations causing negative impact on these identified biodiversity elements (risk matrix of likelihood of impact versus potential of mitigation) – Risk of important biodiversity elements causing negative impact on company (reputational risk) or its operational activities (operational risk) • Undertake initial assessment of mitigation potential • Evaluate residual risk
Environmental and social impact assessment (ESIA) To make a full assessment of all impacts on biodiversity and provide mitigation measures that will be accepted by the permitting authority and that will provide the company with effective biodiversity management guidance.	• Collate baseline biodiversity information • Conduct targeted biodiversity inventories where such information is missing • Establish compliance with relevant environmental regulations • Predict impacts on biodiversity over different phases of the project • Develop mitigation measures and biodiversity offsets if required (including social aspects) along the lines of the internationally accepted mitigation hierarchy • Develop key elements of the biodiversity management programme • Identify possible biodiversity indicators and monitoring systems • Assess costs of implementation of the envisaged biodiversity management and monitoring programmes
Operational phase To minimize impacts on biodiversity on an on-going basis and facilitate temporary biodiversity gains through targeted measures.	• Implement the provisions of the biodiversity management programme, especially those aimed at reducing impacts on biodiversity during operation and at utilizing opportunities for biodiversity enhancements that might be offered through the operational processes • Monitor and report on changes in biodiversity • Assess major impacts on biodiversity caused by operational activities
Post-operational rehabilitation To satisfy regulatory, biodiversity conservation and community requirements for rehabilitation of the impacted parts of the site.	• Implement regulatory requirements through a programme of progressive rehabilitation • Establish appropriate and desired post-closure land use and management based on stakeholder consultation • Implement biodiversity or community-led rehabilitation targets • Identify and use opportunities for biodiversity gains • Ensure long-term sustainability of the rehabilitation actions in terms of the desired management outcomes • Monitor and report on rehabilitation progress and development of biodiversity

opportunities for creating biodiversity enhancements are implemented as part of the longer-term operational and rehabilitation activities.

Finally, there is a comparable relation for stakeholder engagement in biodiversity management which should intensify as post-operational formation of the landscape, land-use options and biodiversity enhancements are specified in greater detail.

2.4 Mitigation hierarchy

The mitigation hierarchy (Figure 2) has become an accepted approach in biodiversity management; it plays a key role in defining strategic approaches to minimize impacts on biodiversity on operational sites. The principle of the hierarchy is usually defined as a series of potential remedial actions, each requiring an increasing intensity of management inputs and associated costs. These actions allow the operator to choose the point at which the balance between the biodiversity risk and the costs of remediation – from avoidance, to minimization, restoration and compensation – are judged to be fair and adequate.

The lower part of the hierarchy illustrates, in ascending order, the level of desirability; the upper half shows the "seizing of opportunities" directed towards ultimate biodiversity enhancements through the expansion or improvement of existing habitats, through to the creation of habitats that may no longer exist in the region (e.g. due to earlier land-use changes as part of the intensification, or even industrialization, of the agricultural landscape).

Like the operational phase of any natural resource extraction project, the accompanying biodiversity management has to be seen as a dynamic process where adjustments are required as part of operational changes, especially in the

case of a long-term project such as lignite mining. Flexibility must be integrated into management policy due to anticipated amendments in regulations or probable changing values of society.

2.5 What kind of biodiversity?

The debate about short- and long-term effects on ecosystems and biodiversity of large-scale interventions in a landscape for any kind of development is complicated and frequently misleading. More often than not, proponents of differing views ignore some fundamental questions, which, if unanswered, make an objective and fair debate impossible. Ignoring or not discussing these questions then provides a convenient way of giving weight to one's own arguments, overlooking the fact that the "opponent" might conduct the debate from a very different starting point.

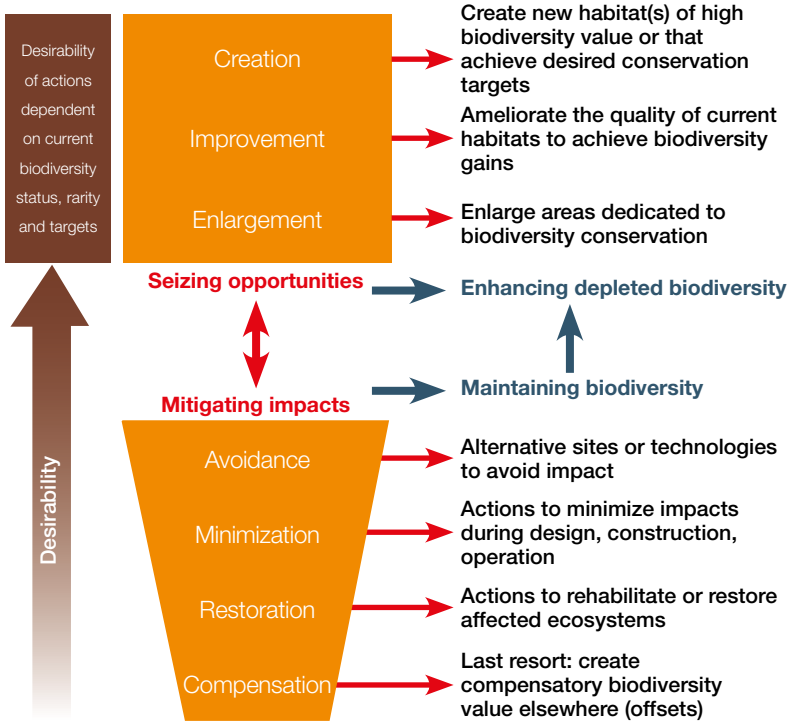
The key questions usually ignored in such discussions are:

1. What "kind" of biodiversity are we seeking to conserve or recreate? Biodiversity in Europe – most parts of the world, actually – has developed over centuries parallel to and greatly influenced by the cultural evolution of societies. What are our reference points when we seek "to maintain biodiversity"?
2. What time spans do we grant the re-establishment of biodiversity? A recultivated forest will indeed not be back to its original level of diversity after ten years; it will require several decades, may be even 100 or 200 years in case of an old growth forest.
3. Over what geographic area do we judge whether biodiversity has remained the same, declined or increased? An action that might have a severe local impact on biodiversity might actually not affect overall diversity in a wider regional context.
4. How do we rate and include in this discussion the creation of new transitional (pioneer) habitats that might result in a (at least temporary) regional biodiversity gain?
5. How do we take into account the creation of new habitats that might have been absent or disappeared from the region in the past?

These questions are of particular importance in relation to mining of natural resources because they often involve very long-term processes with habitat destruction and habitat creation occurring simultaneously over long periods of time. In addition, there is the added complication of societal attitudes and values that might also change during these long time frames, as seems to be happening in the case of lignite mining.

What has to be clearly recognized by anybody commenting on biodiversity within a mining area – when comparing biodiversity between the pre-mining situation and the intended end state of post-mining landscape – is that there will be inevitable differences. Areas prepared for recultivation, usually consisting of soils with a higher portion of loose material and unconsolidated rocks than the original landscape, will, for many years, support a different kind of biodiversity than the original habitat: species of more mature successional stages will be lost, but other species adapted to rapid habitat evolution will be gained. These gains could be even more pronounced if, as part of the recultivation process, new habitats were to be created similar to those that have become rare in the region over time. So, when viewed in a larger regional context, and over a longer time span, the differences in biodiversity may be much less significant and noticeable than when analysed very locally and over short time periods only.

Figure 2: Biodiversity mitigation and enhancement measures



Adapted from: Rio Tinto (2004): Sustaining a Natural Balance: A Practical Guide to Integrating Biodiversity into Rio Tinto's Operational Activities.

These fundamental questions cannot be ignored when planning the restoration and rehabilitation of habitats – nor should they be overlooked when judging the results of such programmes.

2.6 Monitoring

If biodiversity management is to be sound and effective it must be underpinned by a credible programme of Monitoring & Evaluation (M&E), in the same manner it is routine for other aspects of business performance by natural resource extraction companies – be it for extracted resource material, economic performance, health and safety, pollution, etc.

The rationale for biodiversity monitoring originates from a sequence of logical questions arising out of the principles of good land stewardship and professional management as summarized in Box 2.

While key aspects of the initial inventory work (the indispensable basis of a monitoring programme) should be done in the scoping and planning phase, the following steps should be repeated annually as a cyclical process in the same manner that work, production and financial planning are done every year.

Box 2: Rationale for Monitoring and Evaluation

1. **Recording biodiversity**: *do you know the biodiversity of the site?*
   - Inventory of ecosystems, key habitats and species?
   - Which critical species depend on the area during part or the entirety of its life cycle?

2. **Monitoring biodiversity**: *is biodiversity changing during the operation of the site?*

3. **Evaluating biodiversity change**: *why is biodiversity changing?*
   - Due to own operations?
   - Due to activities of others?
   - Due to external environmental changes?
   - Do mitigation measures need to be adapted?
   - Are there opportunities for biodiversity gains?

4. **Reporting on biodiversity performance**: *how successful is the biodiversity management in relation to envisaged targets?*

Source: adapted from IUCN (2014)

3. BIODIVERSITY MANAGEMENT OF THE HAMBACH MINE

3.1 The Hambach Mine

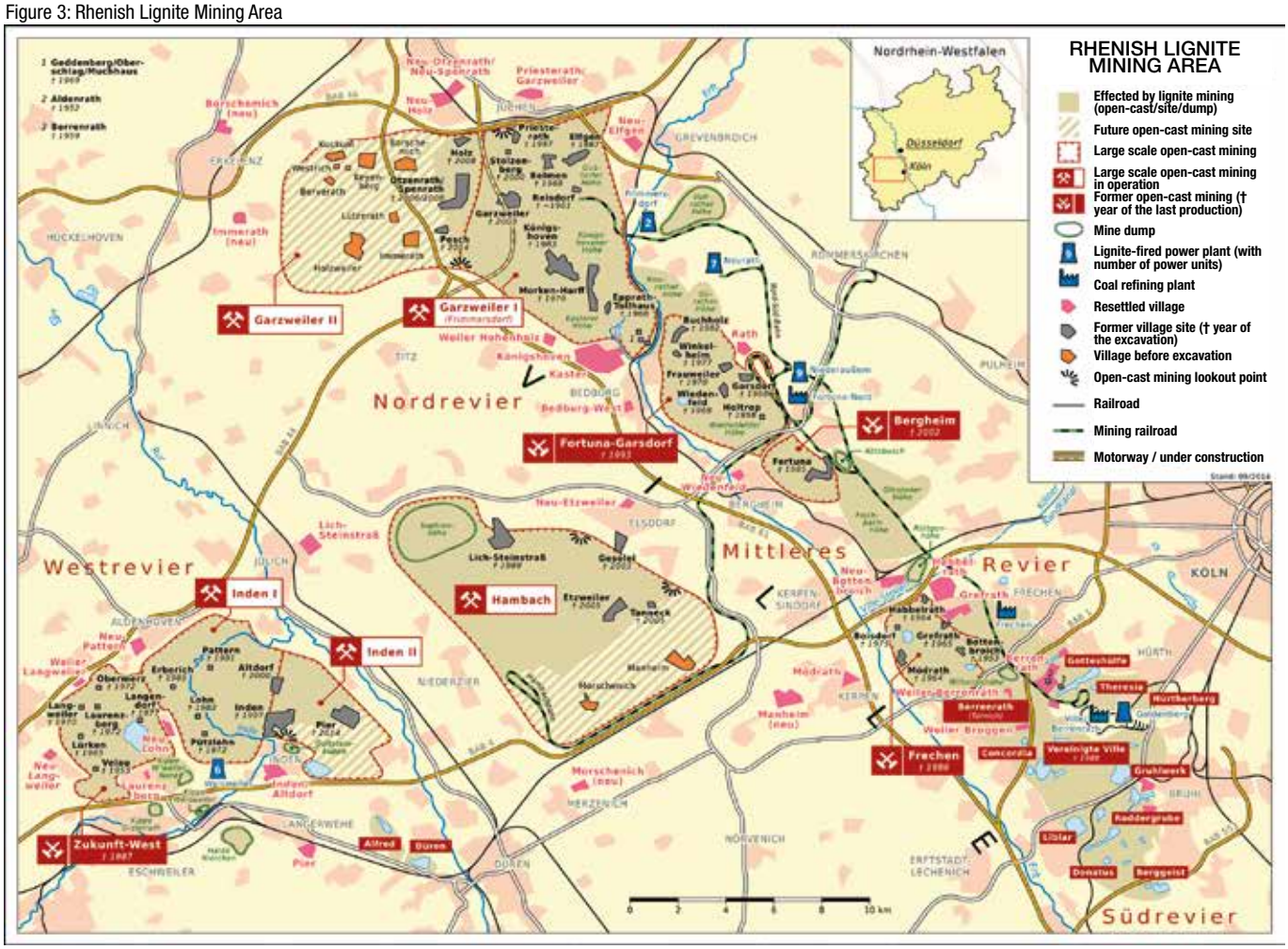
The Hambach opencast mine lies in the lignite mining district of the Lower Rhine Basin in North Rhine Westphalia (NRW). The area harbours the largest continuous lignite deposit in Europe, with an estimated 55 billion tonnes of brown coal. The Hambach Mine was started in 1978 and, according to current plans, mining will be completed by about 2040. It is one of three giant mines currently operated by RWE west of Cologne – the other two being Garzweiler (I/II) and Inden (Figure 3).

The dimensions of these mines are, for European and global standards, rather bewildering. One can understand that - even disregarding all their environmental and social impacts, but just for their size and dominance of the regional landscape - they have been, and continue to be, the focus of an on-going intensive public debate.

The total mining field of the Hambach Mine measures around 85 km^2. It is spread over the administrative districts of Düren and Rhein-Erft Kreis. About half of the approved mining area is currently under operation. With coal content in the Hambach Mine of 2.5 billion tonnes of lignite (up to a depth of up to 465m), current annual extraction is 40-45 million tonnes. On average about six times as much soil material (overburden) lying above the brown coal deposit needs to be shifted every year. The total amount of brown coal extracted from all mines in NRW is around 100 million tonnes per year and is used to generate 12% of Germany's and over 50% of NRW's power needs.

There is a great wealth of scientific (as well as more popular publications) about lignite mining in NRW, in general, and the Hambach Mine, in particular, addressing just about every ecological and environmental topic associated with such a mining operation. These are authored by different groups of people including experts working directly or indirectly for the operating company, external professionals from various scientific institutions involved in specific research programmes (including the monitoring of biodiversity) or from German NGOs. It would be beyond the scope of this report to review and summarize these publications stretching over a period of more than 30 years. A good recent summary of the mine's major impacts on the landscape and ecosystems and the recultivation programme is

Figure 3: Rhenish Lignite Mining Area



provided by Dworschak & Rose (2009)[6].

A series of excursion guides published by the *Forschungsstelle Rekultivierung*[7] provide particularly good overviews of the geology, geography, pedology, forestry and agricultural recultivation, the history of lignite mining and associated restoration activities.

3.2 Regulatory setting

Because of its highly sensitive nature, lignite mining in Germany is greatly regulated by the European Union (EU), the Federal Republic of Germany, state governments and local authorities. These are regulated by the following legal frameworks:

- Federal general planning law ("*Raumordnungsgesetz*)
- Regional planning law ("*Landesplanungsgesetz*")
- Federal mining law ("*Bundesberggesetz*")
- State Development Plans and Programmes
- Regional Development Plans and Programmes
- Special plans and regulations for lignite mining ("*Braunkohlenpläne*")
- Various EU Guidelines (e.g. on habitats for flora and fauna, bird protection)
- Legislation and regulations on Environmental & Social Impact Assessment.

The lignite mining plans, derived from the regional planning laws in combination with the federal EIA legislation, contain specific targets that ensure the mining progress is being monitored by the local authorities. These plans are divided into the following sub-plans:

1. Basic operational plan ("*Rahmenbetriebsplan*"), describing the project in general with information on technical and timeline issues;
2. Main operational plan, containing detailed descriptions of the operational development for a period of two years, and forming the principal legal basis for the lignite mining;
3. Special operational plans, containing regulations and descriptions for specific sub-components of the mining operation (e.g. railway); and
4. Closure plans ("*Abschlussbetriebsplan*"), regulating post-operational activities and the final restoration of the land.

The regulations by the local governments (*Bezirksregierung*) on recultivation and rehabilitation mining areas for forestry or agricultural purposes are as detailed as the report's consultants have come across anywhere. For example, they provide comprehensive guidance and instructions on issues such as the preparation of the layering and composition of soil materials for forestry or agriculture, the attainment of suitable hydrological conditions, and the resettlement of villages and communities.

However, it is rather astonishing that these numerous, often very detailed external and internal regulatory documents on environmental issues, contain practically no references to biodiversity. Only cursory and very general mentions of ecosystems, plants and animal (species) stand in stark contrast, for example, to the detailed treatments of other environmental topics. And they also stand in great divergence to the actual efforts made by RWE in re-creating landscapes, ecosystems and habitats once mining has been completed.

3.3 Pre-mining situation

When looking at the impacts of the lignite mines on regional biodiversity, it must be borne in mind that exploitation of lignite has played an important role in the economic development in this area dating back to the 16th century. Increasingly large opencast mines were moving "through the landscape, devastating the original landscape on the working benches and establishing new landscapes on top of the mine's backfill".[8]

Due to very fertile soils (*loess*), the dominant form of land use in this large base of the Rhine valley has traditionally been arable agriculture. In recent decades, agriculture has progressively intensified and the region has become one of Germany's most productive and prosperous agricultural areas.

The second major form of land use in this area has been forest management with a long and interesting history of traditional forms of forestry developing over several centuries. The most important remnants of this are the *Hambach Forest*, which, in recent times, has become a controversial topic between the interests of lignite exploitation and nature conservation.[9] This ancient forest is the largest oak-hornbeam woodland in the Atlantic biogeographical region of Germany. It once covered 5,500 ha in total, but 3,600 ha of the forest were targeted for mining (Table 2). According to conservation NGOs, the woodland should have been listed as a Natura 2000 site under the European Habitats Directive. However, mining was approved and had started 15 years prior to the introduction of the Habitat Directive. Herein, lies the argument over the remaining old growth oak forest.

As expected, there were a great number of expert investigations and reports before the Hambach Mine was approved and became operational. Unfortunately, it is outside the scope of this report to go through hundreds of pages of these studies. Fortunately, there is an important summary (published in 1998) of major findings and recommendations that describe the profound transformation of the landscape and its ecosystems over the lifetime of the mine[10].

Prior to operation of the Hambach mine, detailed ecological studies were already undertaken in the mid-1970s, long before the introduction of the German legislation for Environmental Impact Assessments (EIA). At that time, a formal framework

Table 2: Land used for the Hambach Mine					
Figures in hectares	**Original land use before mining**	**Land already mined**	**Current situation**	**To be mined in future**	**Envisaged end situation**
Agriculture (mainly arable)	3,985	2,434	14	1,551	~ 1,000
Forestry	3,860	2,799	1,442	1,061	3,500
Freshwater habitats, residual lake	2	2			~ 4,000
Settlements, roads, other infrastructure	653	365		288	0
Operational areas			4,144		
Total (ha)	8,500	5,600	5,600	2,900	8,500

for systematically looking at all risks and evaluating them against the hierarchy of possible mitigation measures had not yet been formalized. However, the Petition Committee of the European Parliament attested in 1999 that these early pre-mining studies nevertheless fulfilled all technical criteria of today's EIA requirements. Moreover, in the 1970s it was not yet customary to involve environmental NGOs in this process. Later, when this became the norm, RWE voluntarily invited these organizations to participate in the regularly recurring development of its actual operational plans.

A general summary of the transformation of the land, its original and intended final state, as well as the land modified to date, is provided in Table 2.

Before mining started, the forested areas comprised approximately the following overall distribution of the main tree species:

10%	hardwood species such as European maples, ash, etc.
8%	softwood species (birch, willow, poplar)
21%	coniferous species (pine, spruce)
1%	red oak
1%	European oak < 80 years
35%	European oak > 80 years
7%	beech < 80 years
15%	beech > 80 years
2%	others (forest glades and meadows etc.)

Overall, around 50% of the forested areas consisted of deciduous forests typical for the region, many of which are older than 80 years. These are potentially the forests with the highest structural diversity and biodiversity composition in the region, and also likely to harbour species of special interest and concern.

In summary, it must be noted that in the great number of detailed external and internal regulatory documents on environmental issues, there is almost no direct attention paid to biodiversity. There are only cursory references to ecosystems, plants and animal species (except for the instructions on replanting forests). These references are in contrast, for example, to the detailed instructions for the physical composition of rehabilitated soils. Of course, the structure and configuration of the soil is an important, albeit indirect, determinant of the richness of biodiversity in which an ecosystem grows, as the soil will eventually support that growth.

3.4 Impacts on biodiversity of on-going mining operations

It is evident that an active opencast mine of such dimensions will have serious impacts on the biodiversity not only of the mining site itself, but also on the nearer and wider surroundings. In order to reach the lignite deposits, habitats and overburden of some 200-300 m in depth are removed. In addition, to avoid flooding of the mine, the groundwater level is lowered significantly, also affecting the hydrology of the areas surrounding the mine.

The Hambach mining programme is one of "progressive advancement", with new ground being prepared and overburden removed at one end (south). Exploitation of the lignite occurs in the centre section, while reconstruction of the landscape (using the overburden of the front end) and recultivation take place at the other end (north). From the onset of the preparatory overburden removal (which itself can last up to seven years), to the actual mining of lignite to the completion of the active recultivation phase, there is a time lapse of 30 or more years.

While the operational areas would generally be expected to be of significantly lower value for biodiversity than the original habitats (sometimes even close to "no value") there are, in certain locations, nevertheless some interesting, albeit temporary, gains for biodiversity: one example is that temporary forests are planted around the hub of the conveyer belts (where overburden from the "active front" is received and re-distributed to the areas of reclamation). Although more could theoretically be done to optimize these forests for biodiversity, they will never reach the biodiversity status of a mature forest. However, they would still have a greater biodiversity value than areas bare of vegetation.

Table 3: Resettlement of villages for the Hambach Mine					
Village	**Number of inhabitants**	**Number of estates**	**Percentage resettlers**	**Year of resettlement**	**Mining of village area**
Lich-Steinstraß	1,473	393	71%	1981	1989
Etzweiler, Gesolei, Tanneck	1,178	313	60%	1994-2001	2003-2005
Kerpen-Manheim	1,631	535	77%	2012	2022
Merzenich-Morschenich	491	176	70%	2013	2024
	4,773	**1,417**	**70%**		

The second noteworthy temporary biodiversity gains are large areas of fallow land created for 6-18 months. Located near the pits, this denuded land would remain idle while waiting for the removal of the next layer of overburden or the commencement of coal extraction. However, Hambach seeds these areas with grass to stop wind erosion of the bare soil, thereby creating a habitat type that is rarely found anymore in areas of intensive agriculture. As ecological investigations have shown, these areas harbour species of plants and animals that are absent or very uncommon in the modern-day agricultural landscape.

The irony is that such transient habitats, and their biodiversity and temporary biodiversity gains for the region, are generally not reported. Some contend that reporting is overlooked in order to avoid the risk of such areas being placed under the provisions of the EU Habitats Directive and thus potentially disrupting mining operations.

3.5 Resettlement of villages

Besides the direct impacts on the natural environment, there are also significant social disruptions for local communities, which increasingly lead to critical public debates in Germany. Around 4,800 inhabitants will have been relocated over the lifetime of the mine (Table 3).

In contrast to the richness of the environmental studies, it appears that there are hardly any studies on the social impacts of the Hambach Mine, including the effects on wellbeing and health of local people, especially those that were resettled. However, there are two excellent reports from 1990 and 1999 evaluating the social impacts of the mine[11],which are the only ones based on studies carried out to date.

3.6 Reclamation and recultivation

After mining has ceased, the efforts to restore the landscape and recultivate the land are as gigantic as the mining operation itself. The story of these efforts, covering not only the Hambach Mine but also its sister operations of Garzweiler I & II and Inden, spans several decades and involves numerous scientists of RWE's own *Forschungsstelle Rekultivierung*[12], universities, institutions, ecological consulting bureaus and cooperating NGOs. Their accounts have been presented in numerous scientific and popular publications. As a representative and particularly important example, reference is made to a book published in 2009[13] that deals comprehensively with all technical, economic, ecological and societal aspects of lignite mining in Germany, including various aspects of reclamation and habitat restoration and examples of the mines in NRW.

According to the lignite mining plan, after completing the mining operations in Hambach in about 30 years from now, the end use of the mined land will consist of at least 1,000 ha of restored agricultural land, 3,500 ha of forest and a remnant lake of ("not more than") 4,000 ha (Table 2).

Sophienhöhe hillside landscape and forests

The showpiece of the recultivation programme of the Hambach Mine is the creation of the Sophienhöhe to the north of the mine, forming the largest artificial hillside landscape made by surface mining in the world. At present it covers a total area of 13 km^2 and reaches a height of over 200 m above the original agricultural flatland of the Jülicher Börde. About 10 km^2 of this hilly landscape is situated outside the actual mining area. Its creation was started at the beginning of mining operations in 1978 at the deposit site for the initial overburden, before the first lignite layers had been reached. From 1990 onwards, the Sophienhöhe started to "grow into" the mining area over sections of land where lignite deposits had already been removed.

Today, on the slopes facing the mine, the Sophienhöhe is still being enlarged with overburden and soil is removed from the active face in the south; the original part outside the mining area is mostly covered in different types of forests. Some are already more than 30 years old and have a "mature" look. They consist of native species or, to a small extent, commercial species commonly used in German forestry. The terrain is attractively landscaped with valleys and a number of small lakes and ponds. It is accessible for recreational purposes through a network of

100 km of trails leading to viewing points at the top of the hills.

Enormous scientific efforts and know-how have gone into the creation of the Sophienhöhe and its diverse ecosystems, starting with the appropriate mixing of the available overburden material. This was done in order to create soil conditions appropriate for the various types of envisaged vegetation covers, taking into account physical and chemical properties of the required soil properties, as well as hydrological requirements[14]. Equal care was taken in the selection of plants for initial soil stabilization, as well as planting of tree species for the purpose of creating a variety of forest types. Forested areas will be used for both recreational purposes and sustainable forestry.

Although the establishment of the Sophienhöhe was an important part of the original plan for the Hambach Mine in the mid-1970s, a more detailed ecological vision for the new landscape was only formulated in 2010, almost 30 years after its creation had begun. The key guiding principles were based on the general vision of:

- Creating self-supporting natural ecosystems that can later be used sustainably, and
- Re-establishing and maintaining regional biodiversity.

Agricultural land

The re-establishment of farmland has been approached with equal commitment and expertise to that given in the creation of new forest areas in the Sophienhöhe. While in the Hambach Mine only a relatively small proportion of the envisaged total area of 1,000 ha has so far been created, large areas of new farmland have already been established at the Inden and Garzweiler Mines. The building up and mixing of the ground layers, as well as the composition of the topsoil (particularly also its hydrological characteristics), are done under guidance of agricultural and soil scientists. Cultivation is undertaken by RWE itself for the first seven years before the farmland is returned to its final owner.

Biodiversity-enhancing features are usually included in the formation of the reconstituted farmland, such as the creation of roadside verges with herbaceous plants, shrubs and trees or pieces of fallow land in between the cultivated fields.

Biodiversity

Restoration – whether it concerns the establishment of forests, farmland or the creation of a new river bed – is guided and greatly influenced by biodiversity considerations. The general, though not formally stated, aim of the restoration activities on the site seems to be the creation of conditions that favour the establishment of a diverse fauna and flora that resembles, as much as possible, the species communities of similar mature habitats in the region. Numerous scientific investigations are under way to monitor the development of species compositions in the re-cultivated areas, the results of which are presented in various publications[15]. Progress is generally encouraging, though species communities of the more diverse original habitats, such as forests, will still require decades of evolutionary time to reach the same degree of maturity. On the other hand, transitional habitats created in the mining areas (mentioned above), and early successional stages of replanted forests, lead to (likewise transitional) biodiversity communities that are not found in the corresponding mature habitats that the new areas seek to replace. On a temporary basis, these may lead to biodiversity gains for the region.

4. COMMENTS ON BIODIVERSITY MANAGEMENT

4.1 Biodiversity outcomes

Post-mining landscapes

The creation of the Sophienhöhe is a remarkable achievement but can be viewed in different ways with regard to biodiversity. Compared with the previously flat land (which, through the intensification of farming practices, has become progressively less conducive for biodiversity), creation of this diverse landscape, mainly forested but with other habitat types interspersed, must be rated as a biodiversity gain for the region. On the other hand, if these artificially created hills are seen as replacement for the Hambach Forest, which partly had to give way to the mine, it might take 100 years for the new forests to equal the rich biodiversity of the ancient woodland, particularly the old growth oak stands.

The recultivation of the forests of the Sophienhöhe is guided by a combination of internal planning documents and external regulations. Some originate from the mid-1970s before the onset of mining operations, but were later amended based on experience gained and the availability of improved technical methods.

In 2010, a specific and belated document was developed summarizing the vision and the guiding ecological principles behind the creation of this large man-made landscape[16].In this document, the long-term, overall ecological aim of the Sophienhöhe is described as: (1) the creation of self-supporting natural ecosystems that can later be used sustainably; and (2) the re-establishment and maintenance of regional biodiversity. The development was guided by a series of accompanying principles that had been used (and/or emerged) over the years, such as:

- Recreational use of the area has to be compatible with natural ecological development of the area.
- A multitude of small, different habitat areas (ponds, wetlands, meadows, pastures, heathlands) are to be interspersed in the recultivated forests.
- Native species are predominantly to be used for recultivation (plus some species generally used in German commercial forestry).
- The colonization of native fauna and flora species is to be fostered through targeted species management.

While the formal and overdue articulation of biodiversity-related objectives and guiding ecological principles is commendable, it is nevertheless surprising that no proper strategic approach, based on a comprehensive ecological vision for the landscape (or the entire region) and clearly identified biodiversity targets, had been pursued from the beginning of this vast investment.

In terms of its recreational function – another form of ecological services provided by ecosystems – the relatively young hills and forests of the Sophienhöhe, may be viewed as a gain, providing people with new recreational opportunities. The assumption that post-mining landscapes can become well-frequented recreation sites is demonstrated by the former mining areas near Brühl, 25 km to the east of Hambach, where a highly attractive and diverse landscape of maturing forests (up to 80 years old) and various lakes has been established.

1. While the forests of the Sophienhöhe are obviously mostly dedicated to forestry purposes, RWE could consider taking the initiative of turning the area into an unmanaged forest reserve, with the specific scientific and conservation aim of demonstrating and monitoring the long-term natural development of such recultivated forests in industrially created landscapes.

It is believed that it might take much less time than often argued by critics for such areas to evolve into forests with a high level of biodiversity.

Forests

A major point of controversy is the destruction of the Hambach Forest, which originally covered around 3,500 ha of the licence area. To date, 2,700 ha have been removed and an additional 750 ha are scheduled to be cleared (Table 2). Thanks to an early amendment of the mining plans, 150 ha of old-growth forests (Lindenburg Wald) were spared and set aside as a forest reserve and declared as a Natura 2000 site.

In view of the fact that public attitudes and concerns for such unique and diminishing habitats have significantly changed since the Hambach Mine was planned, the question arises if the involved players, the State Government and RWE, could not have pursued a more flexible and adaptive approach in relation to this issue, instead of rather rigidly sticking to the binding character of the original lignite mining plan of 1976. The rather acrimonious situation that now appears to have developed could perhaps have been avoided through a more intensive dialogue with concerned parts of the civil society, e.g. represented through the large national conservation NGOs, which strive together with industry to find creative and unusual solutions.

2. Considering the growing public concerns around the Hambach Forest, RWE in partnership with relevant local authorities and civil society should seriously and creatively investigate which additional measures could be taken (1) to reduce the loss of the old-growth Hambach Forest, including the option of a swap with potential mining areas elsewhere (e.g. Garzweiler) and (2) to increase possible compensatory measures to accelerate the long-term regeneration of an ecosystem with a regionally unique biodiversity.

The suggestion made further above on the forests of the Sophienhöhe could be seen as another measure of adaptive management resulting from changing values in society. Not knowing the economic significance of forestry in the Hambach region or to NRW, RWE might want to ask: to what extent restored forest areas could be designated entirely for biodiversity conservation purposes? Although it would take a long time to reach the level of biodiversity of a current Hambach Forest, as experienced in other parts of the world, it is hardly a matter of "several hundred" years as sometime stated.

3. The development of a proactive policy on forests, with the targeted ultimate designation for biodiversity conservation and natural "ecological evolution" could be considered by RWE. This could be done after the forests have reached a certain level of maturity.

A much-debated question in this context is the use of non-native tree species such as Douglas fir and red oak, both of which are accepted in Germany for forestry purposes. Interestingly, some of these non-native tree species can also be defended from a biodiversity point of view as they offer favourable conditions for certain hemerophile species (which particularly thrive in areas developed by humans). Even if these tree species are only used in very small parts of the Sophienhöhe, whether or not this is a sensible practice for a biodiversity conservation can only be properly answered if there is a clearly defined biodiversity goal behind the establishment of the Sophienhöhe. This would have to address the generally neglected key questions of the spatial and temporal scope of the "kind of biodiversity" one seeks to maintain (see **section 2.5**).

4. Depending on the overall biodiversity objective of the Sophienhöhe and if, medium- to long-term, commercial forestry is indeed discounted, a target for the exclusive use of native tree species should also be developed, including the possibility of no longer using "accepted" non-native species such as red oak and Douglas fir.

Agricultural land

RWE has gained considerable expertise in the restoration of land for agricultural purposes. A number of experts and scientists assisted in this process, advising on physical and chemical aspects of the soil, hydrology, method of cultivation, etc. Likewise, many publications document these efforts[17].

Since agricultural land is re-cultivated by RWE itself for seven years before it is handed back to the original owners, the company has taken the opportunity to increase the biodiversity value of the arable land by establishing road side verges with bushes, shrubs and herbaceous plants or setting aside parcels of fallow land interspersed with cultivated fields. However, there is no guarantee that the farmer who eventually takes ownership of the land will maintain these features. There are, in fact, several examples where such biodiversity-enhancing measures have gradually eroded.

5. While it is recognized that modern forms of intensive farming require large areas for mechanical cultivation and that restrictions on the use of land are not compatible with the principles of private ownership, it should nevertheless be explored by RWE (and the local authority) if schemes could be developed to encourage the owners to maintain biodiversity enhancing features on the restored land.

6. During the initial period of direct management, RWE should should promote and showcase the biodiversity-enhancing measures that have been established to relevant experts (including those in agricultural training) and/or interested general public through guided excursions.

Freshwater habitats

Like in all lignite mines, the required lowering of the groundwater level leads to serious and complex ecological impacts on the landscape and surrounding habitats; thus, this also has an indirect negative effect on biodiversity. However, this issue is managed on a highly technical level in accordance with numerous and detailed regulations and through close monitoring by independent supervisory bodies. The objective of such hydrological management is to avoid physical and chemical changes to the water regime of surrounding areas, i.e. to the ecological integrity and functioning of adjoining habitats.

With regard to surface water habitats, the Hambach Mine does not face the same challenges as the Inden mine, where a diversion of the Inden River increased a section from an original length of 4.5 km to 12 km.

However, as part of a programme rendering the Sophienhöhe as biodiversity-friendly as possible, a multitude of freshwater habitats were created: eight lakes, at least 20 smaller habitats with permanent (flowing or standing) water, and at least another 30 temporary freshwater habitats.

An important, greatly debated issue is the nature of the largest and final lake, which may cover up to half the area after the lignite pit has been exhausted, i.e. upward to 40km2. Although detailed plans for the formation of the lake have not yet been developed (which will greatly depend on precisely how long extraction will continue), this lake will add immense biodiversity value to the regional landscape. Thus, its formation should be guided by the express

objective of biodiversity enhancement, regardless of whether or not the high associated costs incurred in its creation can be recouped. The lake's natural capital and ecosystem services are likely to be extremely valuable.

7. RWE should investigate, in collaboration with relevant experts, how the value of the final lake could be optimized for biodiversity and associated ecosystem services through appropriate assessment and valuations as well as eventual landscaping and recultivation of the area. Although detailed recultivation planning will follow at a much later date, general landscaping measures will have to be set on course earlier.

Human settlements

Human settlements can significantly add to local and regional biodiversity, particularly in the case of small villages that might have evolved over a long time within an agricultural landscape. Many plant and animal species are especially associated with such settlements.

A number of villages were moved and a few others still need to be relocated in the Hambach Mine area (Table 3). While their demolition inevitably leads to a local biodiversity loss, in the longer-term this could be compensated for by an integrated approach towards the planning of the replacement settlements. It is not clear if such considerations have been included in the planning of the new villages, by ensuring that the ratio between built-up areas, gardens and public "nature areas" are maintained.

8. In order to seize the opportunity of increasing overall local biodiversity through appropriate measures in the development of new villages, RWE should strengthen its efforts to urge the responsible district government to seek the inclusion of expert know-how to advise and assist in the biodiversity optimization of these settlements.

4.2 Biodiversity management

Strategic approach

RWE invests significant amounts of human and financial resources into the creation of biodiversity outcomes – probably more than the company actually realizes: it seems that the full connection between investing in recultivation and pursuing biodiversity-related objectives or targets, is not made by everyone. Examples of RWE's direct measures for attaining specific biodiversity outcomes include recreation of landscapes, large-scale development of new habitats and targeted actions for conservation of rare or threatened species.

Admittedly, these are first and foremost among measures to remedy severe negative impacts on biodiversity, with the ultimate goal of re-establishing habitats and ecosystems. In some cases, this may take decades. Nevertheless, some of these measures could, even in a relatively short a time, lead to biodiversity gains of a different kind that could be valuable for the overall biodiversity of the region. However, to fully reap the benefit of such a scenario, a much more strategic approach must be followed.

The most astounding finding of this brief examination of the Hambach Mine's biodiversity management is the large gap between the high level of achieved biodiversity outcomes, pursued in an extremely expert manner, and the company's difficulty in explaining the vision behind the work. It appears to have been largely guided by many external regulatory requirements, all of which RWE seeks to fulfil in a good, or even exemplary, manner.

As a first priority, the company would benefit by communicating the vision to all staff, and involving expert staff and their personal ideas and preferences in realizing Hambach's vision and mission regarding biodiversity.

There are, in fact, so many externally imposed obligations and regulations that to comply with them requires high input. Most available resources (time and finance) and professional capacity are limited and already committed. If the pressure exerted by external critics (as can always be found in such an operation) can be mitigated, the agenda could be less dictated by outside forces, and forged within Hambach by informed staff and dedicated leaders, in cooperation with NGOs and government experts.

As an important general recommendation for the biodiversity management of the Hambach Mine (and for all lignite mines) RWE should seek:

9. To underpin its biodiversity work by a clearly and explicitly formulated vision (possibly encapsulated in a company-wide biodiversity policy);

10. To guide its biodiversity work through identified, officially adopted and communicated medium- and long-term targets; and

11. To base biodiversity objectives and targets more formally on the mitigation hierarchy, listing all identified possible biodiversity impacts in a risk matrix, together with the chosen measures of mitigation.

With regard to the first two recommendations above, the following should, however, be noted: Since RWE's business is not the identification of desirable conservation outcomes, it should be guided in the choice of such targets by higher-level strategic biodiversity conservation objectives on regional, state or federal levels. Based on its own biodiversity management expertise and capacity and the physical circumstances

of the land for which it is responsible, RWE could in effect decide where and how it wants to make a contribution to the attainment of biodiversity objectives for the region, state or country.

12. The recently published draft of the NRW biodiversity strategy should be examined by RWE to assess how defining overriding objectives, derived from and linked to this strategy, could enhance its recultivation work. This could be done, for example, through the initiation of a working group involving experts of RWE, the state government and regional NGOs to ensure general support of such a company strategy.

13. RWE and other stakeholders should also check if there are additional higher-level biodiversity strategies that could serve this purpose.

Responsiveness

Besides the suggested adoption of strategic biodiversity objectives and targets, RWE should also embrace a more flexible response to changing public values and priorities as they inevitably arise within the duration of long-term enterprises such as the mining of brown coal. When Hambach was planned in the 1970s, the public's concern for conservation – let alone for biodiversity (a term which came into use only in the 1980s) – was less pronounced than it is today.

Equally, society's attitude towards energy (where it came from, how it was used) was different in the 1970s from today, where now there is widespread serious concern about the effects of climate change, not only on nature but the well-being of societies themselves. All industries, but particularly those involved in the exploitation of non-renewable natural resources, have to be finely attuned to such changes in society – as do governments that, after all, should represent and act for the interests of society.

Failure to have such flexibility towards long-term changes in the values of society could entail a serious reputational risk to the company. Despite the remarkable achievements of RWE in the restoration and recultivation of habitats – which, surely, must be among the best examples worldwide – the company appears to have low recognition or credibility with regard to biodiversity, particularly among organizations that could become prime partners in the implementation of an integrated, forward-looking biodiversity strategy.

Because RWE lacks a coherent strategy on biodiversity and a pro-active communication policy, RWE runs the risk of being judged by single issues, such as the Hambach Forest, or more general problems like brown coal burning and global warming. This perception reflects the general political views of government and society.

Public health is another area of concern where the views of society have changed over time and more responsive policies are required. For example, 50 years ago there was no or little concern about atmospheric particulate matter (PM) and mining. Today, the issue of PM has become a widely recognized health issue for which adaptive management measures are required. Indeed, they have been addressed by RWE as a result of increased public unease and the introduction of much more detailed regulations by the authorities. Since PMs are produced in many stages of the mining process, particularly while digging and transporting soil material and through wind erosion of bare surfaces, RWE has introduced measures to mitigate both environmental and health effects. As mentioned above (Section 3.4), the company has introduced interim seeding of transient areas and quick and efficient stabilization and replanting of reclaimed land. This practise is an effort to reduce human health risks, while at the same time to enhance biodiversity benefits.

14. The biodiversity policy of RWE should cater for an adaptive and flexible approach to biodiversity management (i.e. adaptive issue management), enabling responses to longer-term changes in public attitudes towards environmental issues, even if this might also require an adjustment of some economic targets.

Biodiversity monitoring

There is a great deal of monitoring taking place in Hambach, directly or indirectly linked to biodiversity issues. These activities are pursued by various agencies: RWE's own "*Forschungsstelle Rekultivierung*", external consulting or scientific institutions and semi-government agencies. The programmes, carried out at regular or less regular intervals, cover a wide range of physical and chemical environmental parameters (water, air, soil quality), as well as various plant and animal indicator species.

It is beyond the scope of this assignment to conduct a critical appraisal of these programmes; the following comments are therefore to be taken as general reflections on the nature of such activities.

Since biodiversity monitoring in such a large and complex site could easily develop into a rather large undertaking, it is important to have a clear rationale for every set of parameters measured: who will use the result, for what and how?

Based on the system in **Box 2**, two major types of monitoring should take place in such a setting:

1. Background monitoring in and around the mine of carefully chosen species and ecosystem-related parameters: these

should build on the results of biological inventories carried out before mining operations had started. Their purpose is to gauge if biodiversity changes observed within the mining area might be the result of mining operations or due to larger-scale events unrelated to mining; and

2. Monitoring of biodiversity management performance and outcomes: indicators related to stated biodiversity management targets, such as progress in the biodiversity development of a restored habitat (e.g. in comparison with a nearby, mature habitat of the same type), emissions remaining within defined limits; area of new habitat to be created, etc.

Cursory checks of the published results of such monitoring programmes show that quite a lot of monitoring data are collected and analysed, but based on experience elsewhere.

15. A periodic and systematic check of the rationale, needs and appropriateness of all the monitoring programmes might still be beneficial.

Communication

Following the aforementioned fundamental discrepancy between what RWE is actually doing for biodiversity conservation and the public perception of the company, it could be concluded that there is a serious communication deficit. Although there is a wealth of publications on the biodiversity work in Hambach, no clear communication strategy seems to be behind these publications, especially relating to those addressed to stakeholders other than the scientific community. Rather, one has the impression of a random approach, "*let's publish what and where we can*", without a definition of objectives, key messages and target audiences.

This problem is exacerbated by the tendency of critics to label information released by the company as "greenwashing", but this could also be partly the result of a lack of, or a misguided communication strategy. For example, the slogan of the 2013 Corporate Responsibility report "Earning trust" reveals that trust is lacking, while the company is, in fact, taking many trustworthy initiatives in relation to biodiversity. Hence, there are many reasons justifying the need for the company to take a more positive and pro-active approach to communication.

This seeming lack of a clear communication strategy on biodiversity and biodiversity management is, of course, directly linked to the lack of a simple and obvious strategy towards biodiversity *per se*.

16. Parallel to the suggested development of a more strategic approach to biodiversity management with defined objectives and targets, a communication strategy should be developed, covering target stakeholder audiences and relevant channels of communication.

In addition, it has become clear from a few conversations with management staff that, except for persons directly involved in biodiversity management, biodiversity is not generally recognised as an issue relevant for the company, let alone the interaction these issues can have with public perception and corporate reputation.

17.Together with the recommended company-wide biodiversity policy, an internal communication plan should be initiated starting at top management levels.

Table 4: Strengths and weaknesses of RWE biodiversity management at the Hambach Mine

Strengths	Weaknesses
• Many excellent and unique biodiversity outcomes in habitat restoration, recultivation and species management – on par with some of the best examples seen anywhere in the natural resource extraction industry • Highly professional staff and external experts • Good partners in academia • Good research underpinning biodiversity management actions • Regular monitoring of a wide range of parameters • Lots of published material	• Lack of discernible strategic approach • No formulated overall guiding biodiversity vision for the company, nor the Hambach Mine • No stated biodiversity management objectives and easy-to-understand targets • No communication strategy • No visible identification of main target audiences and messages to be conveyed • Negative public perception with regard to "destroying nature" and "greenwashing" • No flexibility towards evolving public opinions and values

4.3 Summarizing assessment

As a summary, the major points of strengths and weaknesses of RWE's biodiversity management in general and the biodiversity activities at the Hambach Mine are listed in Table 4.

A second method of assessing RWE's biodiversity-related work in Hambach is to compare the efforts and results with the key biodiversity policy principles that are emerging today as norms for integrated biodiversity management[18].These principles are listed in Table 5, together with a general assessment (subjective, based on the experience of this report's consultants) of how well they are realized by RWE along the following scale:

0 Not fulfilled
1 Fulfilled to a small degree, a first step in the right direction (< 20%)
2 Fulfilled up to about half (20 % to 50%)
3 Fulfilled by clearly more than half (50% to 80%)
4 Largely fulfilled (> 80%)

With an average score of 2.4, despite not having a formal biodiversity policy, RWE fulfils the key principles of good biodiversity management just above the "half-way mark".

In some aspects, RWE is more advanced in its approach to biodiversity management than perceived by the outside world; in other aspects there are obvious deficits in relation to a policy- and objective-driven approach to biodiversity. Overall, this is viewed as a good starting point for a company-wide policy on biodiversity – and, ultimately, to an integrated biodiversity management system underpinned by a companywide monitoring and reporting system, including the possibility of a biodiversity key performance indicator (KPI).

Table 5: Biodiversity policy principles and implementation at the Hambach Mine

Principle	Realization by RWE (Hambach Mine)
1. **Stewardship:** Managing all landholdings in a manner consistent with responsible care for the resources and values they contain, including the biodiversity they hold and represent.	2 Lack of strategic approach seen as significant deficit
2. **Integration in decisions**: Integrating the consideration of biodiversity issues, risks and opportunities into all decision-making, planning and operational processes.	1 Lack of formal biodiversity management system is major deficit
3. **Impact on biodiversity**: Seeking opportunities to protect, restore and enhance biodiversity on and around company sites, and creating conservation outcomes that mitigate the adverse biodiversity impacts of company activities.	3 A more systematic approach to identifying opportunities is required
4. **Biodiversity action**: Promoting and supporting the conservation of species, habitats and ecosystems on company land, guided by Biodiversity Action Plans linked to other relevant programmes that might be in place at local, national and global levels.	3 Lack of linkages to higher-level biodiversity objectives and targets seen as deficit
5. **Transparency**: Reporting on biodiversity issues in an open and transparent manner and using targets to track company progress in biodiversity management.	1 Despite good reporting on scientific level, no strategic approach to communication on biodiversity
6. **Equity**: Balancing the differing perspectives and interests of stakeholders as they relate to biodiversity.	1 Interactions on biodiversity only with scientific public
7. **Landscape-scale perspective**: Assessing biodiversity risks and opportunities within the landscape in which each landholding is situated and seeking to engage with other stakeholders to achieve successful conservation outcomes on a broad scale.	3 High-level of landscape perspective
8. **Knowledge**: Basing biodiversity decisions and plans on adequate up-to-date scientific information, and making this information available to others working in the field of conservation.	3 High level of good interactions with scientific community
9. **Resourcing**: Developing, contracting and applying resources and expertise to the management of biodiversity objectives at a level commensurate with the scale of risks and opportunities they represent, and guaranteeing technical, financial and management sustainability.	4 Considerable resources invested in biodiversity management
10.**Excellence**: Striving for continuous improvements in the management of biodiversity on all company landholdings, with the goal of being ahead of compliance.	3 Although excellent on implementation level, deficits on strategic level

5. COMMENTS ON SOCIAL ISSUES LINKED TO BIODIVERSITY

One of the bases for the following comments is the publication on "Ecosystems and Human Well-being" (MEA, 2005)[19],which deals details with the interrelation between ecosystems and human well being. The diversity of ecosystems – biotic communities, habitats, landscapes – are, by definition, included in the term "biodiversity", together with the diversity of species and the genetic variability within species[20] (see also Box 1, section 2.1). It is important to note that in this MEA publication, the English expression of "well-being" includes physical and mental health, as well as security and social relationships. This term includes more than what is normally understood under the German expression "Wohlergehen". The MEA definition follows the wider understanding promoted by the World Health Organization (WHO) which defines "health" not only as the absence of illness but also as a more holistic view integrating physical, mental, emotional, spiritual and social aspects of well-being[21]. Figure 4 depicts a schematic overview.

When addressing biodiversity issues, it is also important to consider social issues as they relate to biodiversity and ecosystem values, which can differ among stakeholders. For this report, a general overview has been compiled without a claim of completeness. In this way, stakeholder engagement is a key activity in understanding sustainability risks and opportunities facing a company, including biodiversity, and is treated first. Afterwards, social issues related to biodiversity which are particularly relevant for lignite mining, in general, and the Hambach Mine, in particular, are briefly looked at, including resettlements and health. It does not consider all social issues, and as such does not purport to be a complete social impact assessment.

Figure 4: Interactions between biodiversity, ecosystem services, human well-being, and drivers of change

5.1 Stakeholder engagement

The topic of stakeholder involvement is wide-ranging; it takes place on a variety of levels and with many different actors. The main stakeholder groups for RWE are considered here, excluding, however, important additional groups of employees, RWE shareholders and customers.

Corporate level

On its website RWE states that stakeholder dialogue essentially takes place on two levels[22]:

1. Key contacts: national and international academics, union representatives, journalists, politicians, lawmakers, analysts and investors as well as NGOs; and
2. Regional stakeholders: local communities, residents around RWE sites, customers and staff members.

The aim of these engagements is: "… to identify issues relevant to corporate responsibility at an early stage through intensive communication with all our stakeholders and take appropriate action. We incorporate all the stakeholders affected by our projects at a regional level so that their interests and concerns can be taken into account right from the outset. We are also in regular dialogue with universities and other research institutes, with the aim of tracking all new cutting-edge developments and trends impacting on sustainable corporate governance. The ultimate aim is to play a leading role in structuring these trends".

Engagement with stakeholders has become a central pillar of general corporate culture, often under the aegis of some kind of corporate social responsibility (CSR) programme. Companies involved in natural

resource use and energy production are particularly challenged in this respect, since their activities often have manifold direct impacts on people's lives. To aid this process, several global standards and principles have been developed, allowing companies to orientate this work on "validated" guidelines of independent external expert organizations, such as:

- United Nations Global Compact (2012): Blueprint for Corporate Sustainability Leadership[23];
- AccountAbility (2011): AA1000 Stakeholder Engagement Standard 2011. Final Exposure Draft[24]; and
- International Council on Mining & Metals (2003): 10 principles of sustainable development[25].

There are similar guidelines from several other eminent organizations, including the Organisation for Economic Co-operation and Development, the World Bank, International Labour Organization and others.

At present, RWE orientates its stakeholder engagement on the principles laid down in AA1000 Stakeholder Engagement Standard 2011 (Section 5.4).

Government of North Rhine Westphalia

Engagement with the NRW government is mainly in relation to the implementation of regulations and permitting processes. However, it is important to note that the interactions at this level are increasingly criticized by NGOs: firstly, because permitting for operations continues to be based on "ancient" lignite mining plans developed in times when demands for and attitude towards energy were different; and, secondly, as the State government has never demanded more detailed studies integrating all direct and indirect social and environmental impacts of the on-going large-scale operation with the objective of balancing long-term costs and gains. This is despite rapidly growing standards for environmental and social impact assessments in the past two decades, especially also for large mining operations.

As already mentioned under section 4.2, the recently published draft of the biodiversity strategy for NRW might offer an opportunity for RWE, as the most important single land manager in the state, to assume a more prominent role in the current biodiversity debate initiated by the State government. The company could make an important contribution to the attainment of a biodiversity vision at a state level.

18. RWE should consider initiating, possibly together with other important land management players and conservation bodies, the formation of a working group contributing to the implementation of the NRW biodiversity strategy and reporting on progress to relevant stakeholders.

General public

Despite the fact that there is growing public concern over lignite mining and its impacts on the environment and the relocation of villages, RWE's engagement on these aspects could be described as mainly responsive, rather than proactive in nature.

One contributing factor for why biodiversity, at least, is not treated in a proactive strategic way is that biodiversity is not an important issue on the general public's radar screen: in a recent study by the "*Bundesamt für Naturschutz*", the indicator for "Awareness of biological diversity" was only 25% among the general public[26]. However, this also represents an important opportunity for RWE: since the company is so actively involved in biodiversity management - from creating entire new landscapes to the implementation of many different species conservation programmes.

19. RWE should consider adopting a company objective of making a significant contribution to raising the general public's awareness level on biodiversity through targeted information campaigns on its vision and objectives for regional biodiversity and the actions undertaken in pursuit of them.

Special interest groups

The relationship of RWE with special interest groups, especially national conservation NGOs is rather strained – even though, on a local level, some examples of productive cooperation have been developed. There are complex reasons behind these dynamics some of which have been briefly alluded to elsewhere in this report.

In general, while some actions and statements from such organizations might be seen as counter-productive, these NGOs do represent some sentiments of public opinion and societal concerns that cannot be overlooked. Furthermore, these NGOs often employ well-respected scientists and experts who assume the role of an important early warning system, recognizing and raising issues before other sectors of society become aware of them. It is in the interest of large footprint companies, like RWE, to reach out to and collaborate with concerned groups in order to develop a collective understanding around issues of mutual importance.

A constructive and strategic way of engaging with special interest groups is to involve them in dialogues, going beyond a mere information exchange, and seek their input and cooperation. Indeed, institutionalized partnerships have become indispensable in many fields of conservation and biodiversity.

20. It is strongly recommended that RWE find ways to overcome the current reluctance of key stakeholder

NGOs to engage on appropriate (and meaningful) topics with the aim of institutionalizing partnerships.

Mining and power plant sites

The decision on the formation of neighbourhood forums for occasional or regular interchanges with local stakeholders has largely been left to local mining sites or power plants. In the case of the "*Nachbarschaftsforum Niederaußem*", representatives of the communes, unions, local associations and citizens' groups meet on a regular basis (two to three times a year). The meetings are usually organized by outside agencies specializing in communication and facilitation of dialogue processes. Although "influence may sometime be exerted on company decisions (such as noise prevention)", these are largely information sessions where decisions are not made.

The second concrete example in the area is the recently formed citizen forum in Elsdorf, which according to its own ambitions, would like to negotiate face-to-face with RWE on topics that affect them directly, like health and land re-allocation. The forum is making a request of RWE for regular information and policy exchanges.

21. Institutionalized dialogues should not only be extended to all mining and power plant sites, but become binding corporate policy and be pursued as a matter of course with all communes directly affected by RWE operations.

22. RWE should pro-actively bring the topic of biodiversity, and social issues linked to it, to the agenda of these forums and consider this as an opportunity to inform stakeholders about an environmental or health topic that is not getting sufficient attention.

5.2 Resettlements

Resettlement is a significant intervention in the personal life of every affected person and – with varying intensity – may have stressful effects over many years to come, even if the resettlements have been made known long in advance i.e. several decades in some cases. Loss of cultural (and spiritual) services linked to biodiversity and ecosystems may be important contributing factors to stress, especially if these negative effects are not sufficiently identified or fully addressed. People who have been rooted in a region for generations are emotionally and often deeply attached to the local landscapes, its habitats (including gardens and orchards, fishing or hunting grounds), as well as its biodiversity including forests, wetlands and resident flora and fauna. Radical changes to these surrounding factors, compounded by the loss of a home where a person has grown up and spent most of his or her life, can create additional emotional trauma.

RWE recognizes and acknowledges that resettlement of villages and people is without doubt one of the most severe effects of mining in a surrounding where the physical landscape and human societies have been formed through centuries of symbiotic evolution. Detailed information on these processes in relation to the Hambach Mine can be found on a dedicated company web page[27].

The resettlement programme for each village is regulated in detail in the lignite plan and accompanying social impact study. The programmes provide affected people with lead times of up to 20 (or even more) years to initiate their respective resettlement conditions. These are executed in cooperation with coordinating partners, RWE and the district government of Cologne.

Section 3.5 refers to two important studies on the social impacts of the resettlements in connection with lignite mining (containing pertinent conclusions and recommendations). Judging from the small amount of specific external material and academic studies on the Hambach mine resettlement (in contrast to the high volume of studies on biodiversity aspects), it could be surmised that more efforts are invested into careful monitoring and evaluation of the restoration of habitats and supporting affected species, rather than in the resettlement of villagers.

Since 70% of the inhabitants have decided to move into replacement villages (Table 3), the fact that 30% have decided not to and go elsewhere suggests that there may be some as yet unknown important sociological changes in the new resettled communities. If the various social factors that are important for a properly functioning community (e.g. trades people, retailers, farmers and elderly people) are not proportionally represented in the two groups of resettlers and people moving away, former village cohesion might be lost or significantly altered, e.g. turning villages into dormitory agglomerations. Such sociological questions require as much scientific examination as the return of beetle populations in a forest, for example.

23. As already recommended in the section on "settlements", biodiversity planning for relocated villages should be an integral aspect of the resettlement process.

24. Fifteen years after the last comprehensive evaluation study RWE should urgently recommend the government of NRW to initiate another independent appraisal of the social impacts of the lignite resettlement programme, particularly (1) against the background of the considerable changes in society since then towards issues such as energy from non-renewable resources, and (2) in view of the increasingly expressed concern about possible underestimated non-

material effects of the resettlement programmes on the physical and psychological health and well-being of settlers.

25. If negative impacts are confirmed, RWE should consider if resettled villagers could be partly compensated through, for example, the establishment of a social fund which would allow people to seek advice and help to alleviate long-term social and psychological impacts from which they suffer.

5.3 Human health and well-being

Following reference to the Millennium Ecosystem Assessment (2005) at the beginning of Section 5, another key publication may be referred to here: "The Economics of Ecosystems and Biodiversity" (TEEB), initiated by the environment ministers of the G8+5 countries in 2007 and synthesized in a report in 2010[28]. The approach of this landmark report in assessing valuing externalities was specifically applied to the impacts on biodiversity and on human well-being in global mining operations. It outlines not only the entrepreneurial risks involved for the companies involved in open-cast mining, but also the important opportunities linked to a forward-looking approach to biodiversity management. Partly triggered by this TEEB report, detailed guidelines were published in the UK in 2011 for the evaluation of the effects of open cast mining on the health and well-being of people[29]. Among others, the following aspects were discussed: air quality, dust levels, noise levels, visual aspects, light pollution, amenity and physical activity, social capital and social networks, mental health and well being, housing, services, employment and transport. While in Section 5.2 some of these aspects have already been touched upon (e.g. housing, social networks, services and transport), three further aspects are dealt with briefly in the following paragraphs.

26. Aspects of human health that are directly or indirectly linked to biodiversity should be included in the recommended more strategic approach on the management of biodiversity.

Air quality: particulate matter and dust

In April 2013, a meta-study was published by the Health and Environment Alliance (HEAL)[30] on the health risks of power generation through coal. A series of (mostly) known issues were documented. In relation to lignite mining, the issues of air quality, particularly PM 0.1, PM 2.5 and PM 10, were highlighted. The damaging health effects of exposure to air pollution are well documented. It can cause irritation to the eyes, the nose and throat, contribute to or cause respiratory diseases, and is also linked to cardiovascular disease.

Dustfall from the Hambach mine is assessed on an on-going basis through 27 air monitoring stations placed around the mine. LANUV NRW runs one extra station in Hambach-Niederzier which measures PM 10 and PM 2.5. An additional temporary station was placed in Elsdorf. These 29 monitoring stations all show that since 2012 (after two years of higher pollution and the clean Air Plan Hambach came into force) the yearly average values are within the regulations and that there are only few days on which the threshold values for PM 10 (>50 µg/m^3) were elevated above safe levels (25 days in 2013; and15 days in 2014).

According to LANUV NRW[31], the Hambach mine was responsible for about 20% of the local PM pollution at the end of 2012[32]. The implementation of measures defined in the "Hambach Clean Air Plan" resulted in a significant reduction of dust pollution from the opencast mines. More recent estimates of LANUV show the Hamback being responsible for 11% of the total pollution (as at the end of 2013[33]). Measures that were taken to reduce dust that are directly linked to biodiversity include temporary grass cover on transient surfaces at the bottom of the mine and the planting of trees on longer-term transient surface fields.

While the existing network of monitoring stations operated by LANUV and RWE around the Hambach Mine fulfils the federal government's legal requirements for measuring air quality[34], and, since 2013, the measured results were indeed below permitted threshold values and the pollution caused by the mining operation has reduced noticeably since 2012, there still appears to be considerable anxiety among local people and critical NGOs about the issue. This concern, in the view of the report's authors, originates from the past failure of the company and LANUV to communicate with the general public and the NGOs in a reasonable and comprehensible way.

An increasing level of distrust has arisen in part as dust pollution is a complex issue and air quality results being published in an unclear and confusing manner or on internet sites that are difficult to find. Rebuilding confidence in RWE (and LANUV) appears to be challenging, but not impossible. RWE's initiative in October 2014 of organizing a public expert conference[35] on this topic is certainly a good step towards re-establishing a basis of dialogue and mutual trust. However, considerable more efforts, especially a pro-active and transparent communication strategy, are needed on the part of RWE and LANUV, in order to build a trusting and effective cooperation between all involved and affected parties.

27. Communication on the complex topics of air pollution control, prevention and monitoring should be maintained and further strengthened. Besides the public debates at expert meetings, the on-going publication of up-to-date and clearly presented information on easily-accessible

Internet sites should be continued and improved.

Visual impact

Open-cast coal extraction can be visually highly intrusive as can be clearly observed at the Hambach Mine: a large expanse of a landscape which, for generations, has been dominated by agricultural activities, and interspersed with mature woodlands, has in a short timespan been replaced by a huge hole in the ground, constantly enlarged by gigantic machinery, digging deeper and deeper, creating an almost surreal landscape illuminated at night by strong floodlights. Such an overpowering transformation of the landscape can have an equally profound effect on the emotional and physical health of people and communities rooted in this region. Living near such opencast sites can cause stress, depression and anxiety; and there are studies describing the loss of a local landscape as having the potential to be as traumatic and intense as a bereavement.

Somewhat in contrast to this negative emotional effect on local communities is the fascination that such a giant development and the huge machinery may exercise on other people. They visit the area in big numbers, wanting to see first-hand the achievements of modern technology, enabled by RWE through the provision of special viewpoints like *Terra Nova* and guided tours. Attitudes towards such enormous developments oscillate between horror and enthusiasm.

Recreation

In compensation to the negative visual impacts of such a large open cast mine, the creation and recultivation of the *Sophienhöhe* hill landscape resulted in a large continuous zone of diverse natural habitats, as it is rarely found elsewhere in the Rhenish lignite mining area. The positive effects of such nature zones on the physical and psychological well-being of people are well-documented, especially in relation to stress reduction, activity and fitness, and social cohesion of groups and communities[36]. Furthermore, 92% of Germans think that "nature" is part of a good, healthy life (report by the German *Bundesamt für Naturschutz*).

Table 6: Strengths and weaknesses of the social dimensions of RWE's biodiversity work and stakeholder engagement

Strengths	Weaknesses
• Many activities to advance stakeholder dialogues, especially in the context of the CSR programme. • Generally recognized that dialogue is path to acceptance. • Strategies and objectives (sometimes also indicators) are laid down in CSR strategy. • Results regularly reported to company board. • RWE orientates itself closely on regulations, political and legal requirements. • The rate of resettlers increased over the last 25 years, the concept of "joint resettlement" works quite well. • New recultivated landscapes offer attractive areas for leisure and recreation. • A tight network of environmental monitoring stations placed around the Hambach Mine. • Initiation of popular science events for the benefits of local stakeholders.	• RWE is seen as powerful player, which might intimidate local stakeholders in formal settings. • Changing values and social norms of society towards nature and biodiversity are not readily perceived and acted upon. • No real "participatory" elements in dialogue processes. • Biodiversity is not an issue in stakeholder dialogue so far. • Not enough sensitivity towards issues/ concerns of social justice, health and emotions of people. • RWE does not initiate stakeholder forums, but responds mainly to initiatives taken by others.

28. Any newly-created landscape in the wake of lignite mining – especially the Sophienhöhe and the final lake – should be planned in such a way that a multi-purpose use (i.e. biodiversity conservation, human recreation and economic use) is achieved in the best possible manner through zoning plans developed with expert assistance and participatory processes involving local stakeholders.

5.4 Summarizing assessment

As a summary, the major points of strengths and weaknesses of the social dimension of RWE's biodiversity management and the stakeholder engagement are listed in Table 6.

A second method of carrying out a cursory, general assessment of RWE's stakeholder engagement and the social dimensions of biodiversity-related work in Hambach is to check the relevant efforts and results against four key principles of the AA1000 Stakeholder Engagement Standard of AccountAbility[37] (a think tank and advisory services firm focusing on mainstreaming sustainability into organizational thinking and practice) which RWE has adopted to guide its stakeholder engagement.

These principles are listed in Table 7, together with a general assessment (subjective, based on the experience of this report's consultants) of how well they are realized by RWE along the following scale:

0 Not fulfilled
1 Fulfilled to a small degree, a first step in the right direction (< 20%)
2 Fulfilled up to about half (20-50%)
3 Fulfilled by clearly more than half (50-80%)
4 Largely fulfilled (> 80%)

In relation to all four relevant AccountAbility principles, RWE is approximately in a halfway position. In other words, the company remains below the level of possibilities that could be realized through good and pro-active stakeholder processes. While certain issues of some stakeholders are taken into account (e.g. via the regional advisory councils or the contact persons/agencies for the resettlement programmes), there are no institutionalized systems for systematic dialogues and participatory mechanisms that would result in greater involvement of stakeholders.

It is believed that integration of relevant social dimensions into biodiversity management at the Hambach mine could not only lead to improvements for the people who endure considerable negative impacts of lignite mining, but also demonstrate RWE's pro-active thinking on biodiversity and its many connections to the well-being of local stakeholders.

Table 7: AA1000 principles of good stakeholder engagement and their implementation at the Hambach Mine

Principle	Realization by RWE (Hambach Mine)
1. Inclusivity: For an organization that accepts its accountability to those on whom it has an impact and who have an impact on it, inclusivity is the participation of stakeholders in developing and achieving an accountable and strategic response to sustainability.	2 Impacts in relation to resettlers are fully assessed, but not all of the effects on health and social cohesion of people in the region; the strategic participation of some stakeholders (e.g. environmental groups and inhabitants) could be improved.
2. Materiality: is determining the relevance and significance of an issue to an organization and its stakeholders. A material issue is an issue that will influence the decisions, actions and performance of an organization or its stakeholders.	2 Not all material issues are treated equally; clear deficits in relation to factors affecting human health.
3. Responsiveness: An organization's response to stakeholder issues affects its sustainability performance and is realized through decisions, actions and performance, as well as communication with stakeholders.	2 Traceability is often missing; no overall concept showing what is to be achieved; level of communication, especially in relation to directly affected local stakeholders, not as good as it should be.
4. Accountability: acknowledging, assuming responsibility for and being transparent about the impacts of the companies policies, decisions, actions, products and associated performance. It obliges an organization to involve stakeholders in identifying, understanding and responding to sustainability issues and concerns, and to report, explain and be answerable to stakeholders for decisions, actions and performance. It includes the way in which an organization governs, sets strategy and manages performance.	2 Sharing of information on selected basis, not everything is freely available.

6. CONCLUSIONS AND KEY RECOMMENDATIONS

Many specific recommendations are interspersed in the main body of the text as specially marked and numbered paragraphs. This chapter provides a brief summary of the major conclusions and key recommendations.

6.1 Strategic approach

As pointed out in several places of this brief assessment, the most significant deficit in RWE's approach to biodiversity management and related stakeholder engagement at the Hambach Mine is the lack of an obvious strategic approach. While, in relation to the recreation and recultivation of landscapes, there are many excellent achievements, there is no discernible vision guiding this work and no measurable targets against which to gauge success. Engagement with stakeholders seems to be on an even more ad-hoc basis.

Therefore, the following general recommendations, already stated in previous sections of this paper, are viewed as essential steps for RWE to take:

29. Adopt a more strategic approach towards the creation of new landscapes and biodiversity management by formulating a vision, long-term objectives and shorter-term targets for this work with clear references to the above-mentioned temporal and spatial elements of biodiversity conservation;

30. Link the chosen strategic approach to identified, higher-level regional or state biodiversity strategies;

31.Involve directly-affected local stakeholders in a meaningful way in the choice of options for the design of the post-mining environment and living space that is to be created; and

32. Communicate this strategy in a consistent and pro-active manner to all stakeholders and the public.

6.2 Monitoring and reporting system

The importance of a good monitoring system, based on meaningful indicators, has already been pointed out, as well as the need for communicating the results in a consistent and pro-active manner. As also explained, the lack of the latter is seen as an important strategic shortcoming because the breadth and depth of RWE's biodiversity management efforts do not appear to be known, let alone properly appreciated by many important stakeholders.

A monitoring system needs to be tailored towards the vision, objectives and targets of biodiversity management, which in turn needs to contain a clear identification of what kind of biodiversity the company seeks to restore in the post-mining areas. The best approach to this could be the establishment of some kind of biodiversity balance sheet. This would compare what has been lost in the areas, and what has been gained through the creation of new permanent (and temporary!) ecosystems and their natural evolution towards maturity.

IUCN has developed such a *Biodiversity Indicator and Reporting System (BIRS*) for the cement and aggregate sector (measuring the biodiversity suitability of a large number of sites throughout the world). This system could be adapted to lignite mines to a higher level of refinement and sophistication because a great amount of information is available and continuously collected. While BIRS has been designed for implementation by non-expert company staff, in the case of RWE, expert staff are available to provide the data for such a system.

33. RWE should develop, as a matter of priority, a biodiversity monitoring and reporting system linked to the biodiversity vision and objectives for the region with the aim of making its biodiversity interventions known to a wide group of relevant target audiences.

6.3 Risks and opportunities

Biodiversity management has to be approached in the same manner as is standard in relation to other operational aspects – namely as a business factor that entails risks for the company (including for its reputation and its acceptance by the public), as well as opportunities to respond and contribute positively to concerns of the public. Both need to be managed professionally.

Therefore, it is also essential for RWE to:

34. Develop a biodiversity policy that should eventually be applied to all parts of the company's operations;

35. Internalize biodiversity management in all relevant operational processes; and

36. Elevate biodiversity to a level of concern for senior management.

6.4 Engagement and communication with stakeholders

A key finding of this assessment is the discrepancy between the excellent biodiversity management work being done by RWE on the ground and the low level of awareness of this work among experts, similar industry and the conservation community. Criticisms of company policy seem to be the result of a mixed bag of issues hotly debated by society today. These range from the transition to renewable energy to the promotion of energy efficiency, exploitation of lignite and its associated destruction of ecosystems and alterations of landscapes, right to the question of whether or not nuclear power would be a cleaner alternative. An objective

debate about the company's achievements in relation to the restoration of landscapes, recultivation of habitats and management of species is therefore difficult and often masked by the above wider topics. They form a risk to the company.

To respond to this challenge and reduce the risk to its reputation, RWE should not only adopt a more strategic approach to its work on ecosystems, habitat and species but also pursue a more strategic approach to communicating on these controversial issues and interacting with stakeholders. In particular, RWE should seek to:

37. Develop a pro-active (and strategic) approach to communication on its biodiversity-related activities, based clearly formulated visions, objectives and targets; and

38. Increase its engagement with stakeholders by forming meaningful partnerships and introduce a degree of true participation in decision-making processes that determine the future environment of local stakeholders.

END NOTES

[1] See http://www.iucn.org/about/work/programmes/business/bbp_work/by_engagement/rwe/

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[3] For example: Performance Standards of the International Finance Corporation (IFC), with performance standard 1 focusing on identifying and managing environmental and social impacts and risks and performance standard 6 focusing on biodiversity http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/sustainability+framework/sustainability+framework+-+2012/performance+standards+and+guidance+notes+2012/performance+standards+-+2012

[4] IUCN (2014). Biodiversity management in the cement and aggregates sector: Integrated Biodiversity Management System (IBMS). https://portals.iucn.org/library/sites/library/files/documents/2014-008.pdf

[5] The minimum biodiversity information required at each of the operational phases is described in IUCN (2014). Biodiversity management in the cement and aggregates sector: Integrated Biodiversity Management System (IBMS). https://portals.iucn.org/library/sites/library/files/documents/2014-008.pdf

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