IUCN

Biodiversity management in the cement and aggregates sector

Integrated Biodiversity Management System (IBMS)

Cement Sustainability Initiative

Association Européenne du Ciment
The European Cement Association
CEMBUREAU

FICEM
Federación Interamericana del Cemento

UEPG
Union Européenne des Producteurs de Granulats
Europäischer Gesteinsverband
European Aggregates Association

About IUCN

IUCN, International Union for Conservation of Nature, helps the world find pragmatic solutions to our most pressing environment and development challenges.

IUCN's work focuses on valuing and conserving nature, ensuring effective and equitable governance of its use, and deploying nature-based solutions to global challenges in climate, food and development. IUCN supports scientific research, manages field projects all over the world, and brings governments, NGOs, the UN and companies together to develop policy, laws and best practice.

IUCN is the world's oldest and largest global environmental organisation, with more than 1,200 government and NGO Members and almost 11,000 volunteer experts in some 160 countries. IUCN's work is supported by over 1,000 staff in 45 offices and hundreds of partners in public, NGO and private sectors around the world.

www.iucn.org

About the Cement Sustainability Initiative (CSI)

The Cement Sustainability Initiative (CSI) is a global effort by 24 leading cement producers with operations in more than 100 countries. Collectively these companies account for around 30% of the world's cement production and range in size from very large multinationals to smaller local producers. All CSI members have integrated sustainable development into their business strategies and operations as they seek strong financial performance with an equally strong commitment to social and environmental responsibility. The CSI is an initiative of the World Business Council for Sustainable Development (WBCSD).

www.wbcsdcement.org

About CEMBUREAU

CEMBUREAU, the European Cement Association based in Brussels, is the representative organisation of the cement industry in Europe. The Association acts as spokesperson for the cement industry before the European Union institutions and other public authorities, and communicates the industry's views on all issues and policy developments with regard to technical, environmental, energy and promotional issues.

Currently, the 27 Full Members of CEMBUREAU are the national cement industry associations and cement companies of the European Union (with the exception of Cyprus, Malta and Slovakia) plus Norway, Switzerland and Turkey. Croatia and Serbia are Associate Members of CEMBUREAU.

www.cembureau.eu

About FICEM

The Inter-American Cement Federation represents the majority of the cement manufacturing companies, cement institutions and cement associations in Latin America, the Caribbean, Spain and Portugal. FICEM is active in the communication and strengthening of the global cement industry agenda for sustainability among its members including: climate protection, energy efficiency, fossil fuel substitution and good industrial health and safety practices.

Likewise, FICEM promotes the use of cement- and concrete-based construction systems and consolidates good practices related to social responsibility models and environment-friendly technologies that encourage progress and welfare for the communities were its members operate.

www.ficem.org

About UEPG

UEPG, the European Aggregates Association, is striving for sustainability in the Aggregates Industry by lobbying for an enabling policy environment and encouraging best practices amongst their members through more than 150 biodiversity case studies available online, a dedicated Biodiversity Task Force and a tri-annual Sustainable Development Awards Scheme comprising a special category for biodiversity excellence. Emphasis is placed on issues such as sustainable access to local resources, resource efficiency, biodiversity stewardship and health & safety. UEPG has developed biodiversity indicators applicable for its many SMEs.

www.uepg.eu

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Credits

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We are also grateful to Holcim for their generous financial support and for opening themselves up to scrutiny from our experts.

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Foreword

Concrete is one of the most utilised resources in the world, second only to water. Extraction of materials for concrete production can have significant environmental impacts, posing major risks to biodiversity and ecosystems. At the same time, however, there are also important opportunities for cement and aggregates companies to bring about positive change for biodiversity and ecosystems, through responsible resource management in and around their operations.

IUCN, International Union for Conservation of Nature, created the guide for an Integrated Biodiversity Management System (IBMS) as a way to help companies in the cement and aggregates sector reduce risks and enhance opportunities for biodiversity and ecosystems in their operations. The IBMS guide was developed over the last seven years through a partnership with Holcim, a leading supplier of cement and aggregates. IUCN's work with Holcim has enabled a better understanding of how a company in the sector operates and the challenges it encounters, as well as the opportunities that can arise from good biodiversity management. Through site visits, discussions with operational staff and other stakeholders, a global system for biodiversity management that is applicable to the entire sector was developed and piloted.

This publication is part of a series addressing the risks and opportunities for biodiversity and ecosystems that result from quarrying for cement and aggregates. While this particular guide is aimed at businesses and focuses on biodiversity management, the Biodiversity Indicator and Reporting System looks at monitoring and reporting, and a guide on regulatory tools is addressed to policy makers, to support them in creating an enabling policy environment for improved biodiversity management in the cement and aggregates sector. The series emphasises the distinct but complementary roles that governments and businesses have to play in the conservation and sustainable use of nature and natural resources.

Given the current rate of biodiversity loss, business as usual will not suffice. It is necessary to move from businesses merely mitigating impacts to businesses becoming agents of change. This shift will increasingly require that biodiversity and ecosystems be addressed outside a company's direct sphere of influence, namely outside site boundaries, and within and across sectors. The IBMS approach can help support the development of processes and practices that consider other players in the landscape and can be used as leverage for the entire sector. In addition, the IBMS can support collaboration amongst business, government and civil society; it is important that business actions be matched by actions from governments and civil society, as efforts from all three sectors will lead to the type of change needed to halt biodiversity loss.

Finally, although the IBMS was designed with the cement and aggregates sector in mind, IUCN believes that the approach can be effectively trialled and adapted to other extractive industries.

IUCN invites you to join this journey to integrate biodiversity management into the cement and aggregates sector and beyond.

Julia Marton-Lefèvre
IUCN Director General

Dissemination and promotion of the IBMS

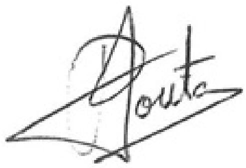
In order to disseminate and promote this guidance as best practice especially for those companies who have not yet embarked on managing biodiversity, IUCN has joined forces with several key players in the cement and aggregates industry, including:

The Cement Sustainability Initiative (CSI): This initiative is a voluntary worldwide platform of cement producers that has developed common methodologies and tools for member and non-member companies to address several critical elements of sustainable development in the biodiversity area which are of importance to the industry: for instance, the CSI has developed a number of tools to address the various operational stages of cement quarrying, including Environmental and Social Impact Assessment (ESIA) Guidelines and Guidelines on Quarry Rehabilitation. The CSI has also developed a Biodiversity Management Plan (BMP) guidance document as a resource for cement companies working on site-specific biodiversity management planning. By offering a good overview of biodiversity throughout the lifecycle of extraction operations, the current IBMS thus complements existing CSI guidance to provide a holistic perspective on biodiversity management in company policy development and decision-making operations. The CSI supports endeavours of business to maximise their work on biodiversity management and welcomes the IBMS as complementary resource to the CSI BMP guidance.

CEMBUREAU, the European Cement Association: CEMBUREAU represents the interest of the cement industry vis-à-vis the European institutions. It also strives for sustainability within the cement industry by promoting an enabling policy environment at EU level and encouraging best practices amongst its members. Emphasis is placed on issues such as climate change, resource efficiency, health and safety, sustainable construction and biodiversity stewardship. The Association also aims to demonstrate that compatibility between extraction activities and biodiversity is achievable through correct resource management. For this purpose, CEMBUREAU has developed an interactive database of biodiversity case studies which support its messages towards a variety of EU stakeholders. CEMBUREAU welcomes the adoption of an IBMS as a way for cement companies in Europe to comply with legislation and for the sector to differentiate itself on biodiversity stewardship.

FICEM, the Cement Association of Latin America, Caribbean, Spain and Portugal: The core objective of FICEM is to promote the agenda of the industry's sustainability and of cement's sustainability as a product, inspired in the guiding principles of the Cement Sustainability Initiative (CSI), a sector-project of the World Business Council for Sustainable Development (WBCSD). FICEM believes that, the integrated management criteria for the restoration of quarries and the protection of biodiversity outlined in the IBMS guide will be a key tool in supporting and strengthening the objectives of environmental policies adopted by cement companies.

UEPG, the European Aggregates Association: This organisation is striving for sustainability in the Aggregates Industry by lobbying for an enabling policy environment and encouraging best practices amongst their members through more than 150 biodiversity case studies available online, a dedicated Biodiversity Task Force and a tri-annual Sustainable Development Awards Scheme comprising a special category for biodiversity excellence. Emphasis is placed on issues such as sustainable access to local resources, resource efficiency, biodiversity stewardship and health & safety. UEPG has developed biodiversity indicators applicable for the many SMEs among the 15,000 companies operating on 26,000 aggregates extraction sites. The European Aggregates Association sees the adoption of an IBMS by aggregates producers in Europe as a way for the sector to differentiate itself on biodiversity management.



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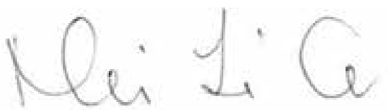

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Executive summary

Biodiversity is a vital part of every aspect of human well-being; most of the goods and services that we depend on, from oxygen, food and fresh water to medicine and shelter, derive from nature. Yet, human activities are causing an unprecedented rate of biodiversity loss that, if it continues, will pose a serious threat to future societies. As a key part of society, business has an important role to play which provides both the opportunity and the responsibility to help halt biodiversity loss.

Due to the nature of their business, cement and aggregate companies can have major impacts on landscapes and biodiversity. These impacts can contribute to habitat degradation, fragmentation and loss and pose a significant risk to business operations. However, when managed adequately, biodiversity can also present an important opportunity, allowing companies to demonstrate to stakeholders that they are responsible stewards of biodiversity thereby improving the ability to secure permits and maintaining a social license to operate among communities surrounding their operations.

By adopting an Integrated Biodiversity Management System (IBMS), cement and aggregates companies can minimise their biodiversity risks and maximise their opportunities to contribute from good biodiversity and ecosystem management practices. An IBMS involves the development of a company-level biodiversity policy with targets, early identification of biodiversity risks and opportunities and a description of differentiated biodiversity management responses that can be implemented at the site level. To increase its chances of success, an IBMS should be integrated within a company's existing processes, from corporate decision making to all stages of field operations.

At the core of an IBMS is the development and adoption of an overarching policy framework for biodiversity management. This framework should be ambitious, but also realistic, and signal the company's intention to safeguard biodiversity within its sphere of influence. The policy framework can begin by recognising the global importance of biodiversity and the company's overall dependence and impact upon natural resources, and include specific commitments to responsibly manage biodiversity on and around a company's operations as well as long-term aspirational biodiversity goals.

A risk-based approach should be used to integrate biodiversity into all stages of operations, from planning for extraction through to site closure, with differentiated biodiversity management options based on the value of and expected impacts to biodiversity at each stage. This approach will ensure that the level of management is commensurate with the level of risk. In the planning stage, companies should prioritise avoidance and minimisation of impacts, to ensure that risks to high-value biodiversity are addressed as early as possible in the lifetime of a project. This early planning allows companies to identify red flag issues related to biodiversity and opt out of an investment if the biodiversity risks appear to outweigh the opportunities. At the operational stage, companies should continue to minimise impacts and also capture opportunities for biodiversity enhancement through targeted biodiversity actions. In preparation for site closure, a company should rehabilitate a site for its final use, in line with biodiversity and other considerations.

By investing in the gathering of up-to-date, robust and accurate biodiversity data and putting in place comprehensive biodiversity monitoring systems, a company can ensure that appropriate biodiversity management measures are taken. The collection of site-level biodiversity information ensures that sites are classified correctly with regards to their biodiversity importance category and that the potential impacts of the operations on biodiversity are accurately assessed. Good data will also further support biodiversity management activities and lead to informed decision making. Data collected as part of monitoring activities will then provide assurance that the chosen activities are having the desired effect on biodiversity, and can also feed back into management processes for optimal outcomes.

The effective implementation of an IBMS requires appropriate institutional arrangements, with the development of any new structures and processes building on the company's existing systems. Investment in internal capacity and external partnerships will also be cornerstones of success for an IBMS.

Checklist for implementing an Integrated Biodiversity Management System

This checklist provides an overview of the key elements that need to be considered when implementing an IBMS and where additional guidance can be found within this guide.

☑ Establish a corporate biodiversity policy, company commitments and targets

→ Recognise the global importance of biodiversity resources and the company's dependence on, and impact upon, these resources

→ Commit to the responsible management of company landholdings to promote the conservation and sustainable use of biodiversity

→ Commit to practice responsible stewardship of company land and to work with partners, customers, relevant constituencies and other stakeholders to support their activities aimed at the same goals

→ Pledge to reflect due consideration of biodiversity risks and opportunities associated with its business, and recognise that such an approach will create long-term added value both for the company's business and for society as a whole

→ Aspire to long-term goals such as no net loss of biodiversity or net positive impact, as well as defined targets for biodiversity management

Chapter 3

☑ Report on biodiversity at the company level

→ Reporting on assets – make summary information about the biodiversity values of landholdings available

→ Reporting on management performance – provide an overview of processes in place to safeguard biodiversity, e.g. number of Biodiversity Action Plans in place

→ Reporting on outcomes – make available summary information related to results of biodiversity monitoring procedures

Chapter 3

☑ Assess biodiversity risks and opportunities of extraction operations

→ Establish the biodiversity importance category of existing and new sites

→ Determine the expected impact of resource extraction on biodiversity based on: (i) the likelihood that a certain activity will have an impact on ecosystems and/or species, and (ii) the degree to which this impact could be mitigated through targeted measures

→ Plot biodiversity importance against impact to determine risk both to biodiversity from the project and to the project from biodiversity

→ Determine mitigation options for the different risks based on the mitigation hierarchy as well as opportunities for biodiversity

Chapter 4

☑ Ensure that the level of management is commensurate with the level of risk

→ For new sites:
- Base the decision to proceed with the project on identified risks
- Reduce risks using the mitigation hierarchy
- Identify opportunities for positive impacts on biodiversity
- Develop biodiversity management measures in line with biodiversity importance and risk, where the higher the biodiversity risk, the higher the level of management required

→ For existing sites:
- Retrofit assessment of biodiversity risks using rapid biodiversity surveys to determine biodiversity importance and impact categories
- Put in place biodiversity management measures in accordance with biodiversity risk assessment, where the higher the biodiversity risk, the higher the level of management required

Chapters 4 to 6

☑ Monitor changes to biodiversity at the operational level

→ Determine objective(s) for monitoring biodiversity:
- Monitor relative changes in biodiversity (status, distribution and composition of species, quality and distribution of habitats and ecosystems)
- Assess the effect of mineral resource extraction on biodiversity
- Evaluate the effectiveness of biodiversity management measures on performance and outcome levels (against chosen indicators or targets)
- Provide information for reporting on biodiversity management performance and outcomes

→ Identify outcomes related to specific targets for conserving biodiversity assets, generally associated with a specific site

Chapter 6

☑ Put in place institutional arrangements for rolling out the biodiversity policy and targets

→ Create fit-for-purpose management structures and processes

→ Develop company-specific operational handbooks (i.e. toolkit for implementation)

→ Build internal skills through awareness-raising and training

→ Secure early buy-in from operational staff

→ Seek external expertise and foster partnerships

→ Allocate financial resources

Chapter 7

1. Managing biodiversity in the cement and aggregates sector

About this document

No matter what their specific trade, every business sector impacts on and depends upon biodiversity and ecosystems to some extent. As such, businesses have both a responsibility to address their potential impacts on the natural world and an important opportunity to reap benefits by becoming good stewards of biodiversity and ecosystems.

Extraction operations for cement and aggregates are no exception; these operations are widespread and can have direct impacts on biodiversity. In order to minimise these impacts, and even to deliver positive outcomes for biodiversity, companies in this sector need to measure and address their impacts on biodiversity and ecosystems through proactive and systematic biodiversity management. Despite this need, guidance for biodiversity management in the sector is still lacking, specifically in terms of developing company-wide strategies with site-level implementation.

This document aims to fill this gap by providing guidance and recommendations for the integrated, prioritised 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 standardised guidance on the integration of biodiversity into business-related processes (scoping, environmental and social impact assessment, biodiversity action plan, rehabilitation).

This guidance has been developed primarily for sustainability and/or environment managers at the company level who are responsible for implementing company-wide systems for biodiversity management. It will also be relevant for site managers implementing such systems, as well as for managers of small and medium enterprises that have extraction operations.

Chapter 1 introduces the concepts of biodiversity and ecosystems, as well as the importance of conservation. **Chapter 2** outlines the structure of an Integrated Biodiversity Management System (IBMS) and some of its key features. **Chapter 3** discusses what a biodiversity policy and targets should contain. **Chapter 4** explains how to carry out risk and opportunity assessments and introduces the biodiversity risk matrix. **Chapter 5** explains how to assess biodiversity risks and opportunities for new investments. **Chapter 6** focuses on biodiversity management during operations. Finally, **Chapter 7** provides guidance for rolling out an IBMS.

Biodiversity, ecosystems and ecosystem services

Biodiversity encompasses much more than just the diversity of animal and plant species, habitats, ecosystems and landscapes by which we define and view our biosphere; it also provides the basis for all ecological processes that sustain life on earth and human livelihoods. The variation within species provides the basis for evolution, through the adaptation of species to new and changing habitats, while species, in turn, are the basic building blocks of ecosystems. Therefore, the status of individual species (especially those typical for a certain habitat type) and the overall diversity of higher species are often used as a first measure for the health of specific ecosystems. See Box 1 for key definitions.

Status and impacts

The most comprehensive analysis of the status of the world's ecosystems to date, the Millennium Ecosystem Assessment, presents clear and ample evidence that, across the globe and in almost all ecosystem types, the status and health of biodiversity and ecosystems are being seriously eroded, threatening the livelihood of more and more people. As biodiversity and ecosystems decline, so does their ability to provide the services that underpin all life and the well-being of human societies.

Box 1 – Biodiversity, ecosystems and ecosystem services: Key definitions

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, as defined in the Millennium Ecosystem Assessment, are "the benefits that humans obtain from ecosystems, and they are produced by interactions within the ecosystem. Ecosystems like forests, grasslands, mangroves, and urban areas provide different services to society. These include provisioning, regulating, and cultural services that directly affect people. They also include supporting services needed to maintain all other services."

Four basic types of ecosystem services have been described:

- **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.

Sources:

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

The current rate of extinction of known species is as much as 1,000 times higher than the normal background extinction rate. Intraspecific variation is also declining, as local populations become extinct or lose viability. Of equal concern, but less well-documented, is the steady decline of many common and widespread species. Abundance, distribution range and distribution patterns of a species are as much an expression of biodiversity (on a genetic level) as the simple total number of individuals in a given locality. A great number of species not yet rare enough to qualify for the IUCN Red List of Threatened Species™ are affected by this process. In Europe, for example, the most recent Birdlife International bird population assessment (2004), showed that while 8 percent of the bird species are considered globally threatened, another 38 percent are undergoing steady decline, mainly due to changing land-use patterns, especially in relation to agriculture.

There are many drivers for the overall loss of biodiversity, including:

- **Habitat conversion:** Through land-use changes, physical modification and water withdrawal from rivers, loss of coral reefs, and damage to sea floors from trawling, about half of the Earth's land surface has already been transformed or degraded by human activity;
- **Overexploitation:** The use of species, nutrients, water and other biological resources faster than they can be replenished by natural cycles of reproduction or replenishment can cause serious declines in species populations and resource availability;
- **Pollution:** Chemicals, fertilisers and pesticides, air pollutants, wastewater and solid wastes can all cause damage to individual species and overall ecosystem functioning;
- **Invasive species:** Non-native species introduced accidentally or deliberately (for example by using exotic species for gardening) into an ecosystem can cause major damage to ecosystem functions and populations of indigenous species, through predation or by out-competing native species for key resources such as food, water or nesting sites; and
- **Climate change:** Human-induced climate change is altering temperatures, rainfall patterns, water availability, drought and similar factors that affect the distribution of plant and animal species throughout the world. According to the Intergovernmental Panel on Climate Change, 20-30 percent of plant and animal species assessed would be at risk of extinction if average global temperatures rise by more than 1.5-2 degrees Celsius.

Mineral extraction can have significant direct and indirect impacts on biodiversity. Direct impacts include conversion and destruction of habitats through land clearance for the development of production and extraction sites, as well as the construction of access roads and other auxiliary infrastructures. Habitats may be altered through extraction, management and rehabilitation of quarries, and wildlife may be disturbed by increased human access and noise from blasting and quarry traffic. Extraction activities can also result in pollution of soil (deposits of cement kiln dust), air (NO_x, SO_2 and dust emissions) and water, as well as sedimentation and altered hydrology (for karst systems).

Indirect impacts of extraction include contributions to climate change (which in turn has a major impact on biodiversity) caused by the emissions of plants and the use of energy in production processes and transportation. In addition, procurement processes within the company's supply chains and the products it purchases (e.g. fuel, additives, construction of new plants) can negatively affect biodiversity and ecosystems. Finally, there may be wider local or regional social and associated environmental changes resulting from extraction operations.

There are also some specific biodiversity considerations that relate exclusively to extraction for aggregates, limestone, clay and other primary resources used for construction purposes. A key biodiversity issue linked to limestone quarries, which provide 70 percent of the raw material for cement production, is the conservation of karst ecosystems, which are characterised by systems of underground streams and caves, enclosed depressions, dry valleys, gorges, prominent rock outcrops and large springs. These ecosystems harbour unique (often endemic) cave fauna and flora and generally are of high conservation priority. In addition, extraction of sand and gravel is often located in alluvial areas of freshwater ecosystems which, in areas of high population density, are generally classified as areas of high biodiversity conservation concern (see Box 5 in Chapter 5).

The business case for action

Within the business sector, there is increasing recognition that impacts on and dependency upon biodiversity and ecosystems may represent major risks for the business bottom line. Operations can be disrupted or even halted by increased scarcity and cost of raw materials, including freshwater required in processes of cement and aggregates production. Natural hazards and higher insurance costs resulting from natural disasters can affect profits. Within the marketplace, there is growing demand for sustainably sourced or certified products, accompanied by a risk of reputational harm from media and NGO campaigns and shareholder resolutions. Access to capital may be restricted as the financial community adopts more rigorous investment and lending policies. And from a regulatory perspective, governments are increasingly implementing new sustainable procurement policies and regulations that include new taxes and moratoria on extractive activities.

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 and 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 social concerns at the local and global levels. Pre-empting regulations and public pressure through the implementation of sustainable purchasing, operational and/or investment practices can lead to cost savings and prevent future delays, while more efficient use of natural resources can lead to cost savings. Responsible environmental performance can also enhance profits, for example through new markets or revenue streams from certified sustainable products, carbon sequestration, biodiversity offsets and payments for ecosystem services for company-owned natural assets such as forests and wetlands.

2 The Integrated Biodiversity Management System

Purpose, goal and structure

By adopting an integrated approach to biodiversity management, companies in the cement and aggregates sector can create a strategy for biodiversity management that includes company-level targets integrated into existing business processes. This approach, the Integrated Biodiversity Management System (IBMS), can also ensure that biodiversity risks and opportunities are assessed and managed at the site level and that biodiversity management efforts are prioritised and reported at the company level.

The general purpose of an IBMS is to make biodiversity conservation considerations an integral part of a company's environmental management strategy, to ensure that the company is following high standards of responsible environmental stewardship.

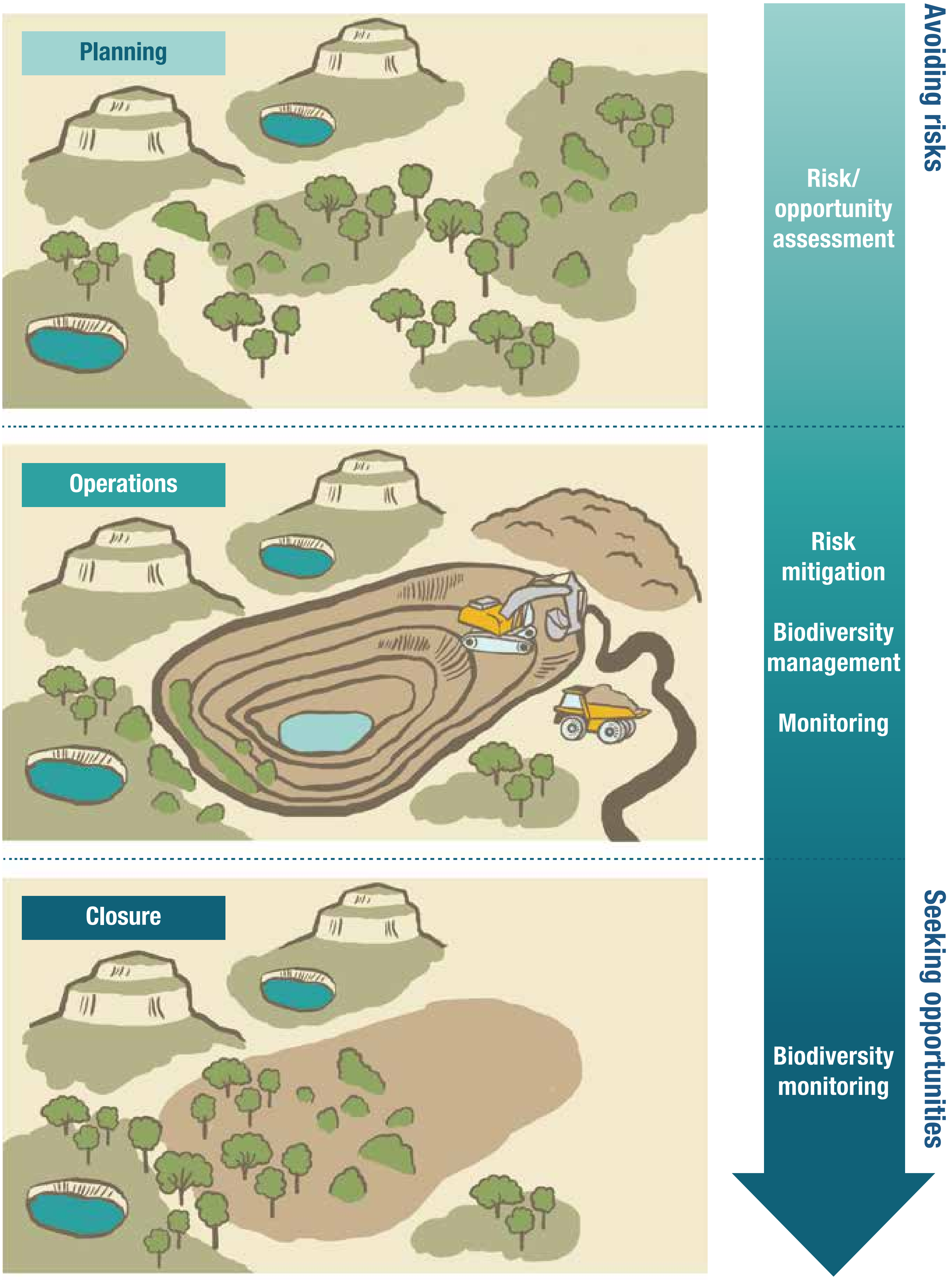
The overall goal of such a system is the integrated, prioritised management of biodiversity at extraction sites and in all activities, aimed at delivering better outcomes for the conservation and sustainable use of biodiversity.

To maximise efficiency and effectiveness, adopting an IBMS involves integrating appropriate biodiversity measures and considerations into existing strategic and operational processes, rather than creating new planning and management steps. This document provides guidance for addressing and managing biodiversity issues in all parts of the business, from strategic policy development and target setting to site-level implementation, and at every stage of the project life cycle, from initial scoping to operation, rehabilitation and site closure (see Figure 1). In terms of policy, an IBMS should define the overall policy principles that govern biodiversity-related activities for the company. At the strategic planning and management level, the system sets out key biodiversity risks and opportunities for each of the principal planning and operational stages, offers general guidance on strategic responses to these risks and opportunities, and provides guidance on how to measure progress, achievement and impact. In order to implement the guidance provided, operational handbooks could be developed internally by a company, ideally in consultation with relevant experts.

Applicability

There are many different kinds of cement and aggregate extraction sites, including properties of different sizes, legal status and management regimes, with a broad range of mineral resources. An IBMS can, in principle, be applied to any such site. Biodiversity management should be carried out at all active extraction sites, regardless of size, that are owned by the company or under the company's control, whether extraction has begun or not. An IBMS should also be applied at any other sites owned or leased by the company, including closed and/or exhausted quarries, sites reserved for future resource use or temporarily dormant quarry sites. Figure 2 gives an overview of site

Figure 1 – Biodiversity considerations in the lifecycle of an extraction site



biodiversity management boundaries. The level of biodiversity management will vary based on the risk posed by the operations to biodiversity (Chapter 4).

Whilst an IBMS can be used at any point in the life cycle of a resource extraction site, the most common challenge for companies will be to apply the approach to sites that have already been running for many years and might still be operating well into the future. This will frequently involve retro-fitting the process of integrated biodiversity management in places where this issue has not been properly dealt with so far. For this reason, the IBMS approach has been designed so that it can easily be introduced at any stage of a mineral extraction operation; it can also be implemented progressively, if full and immediate implementation exceeds a company's capacity and resources. Provisions for emergency response through adaptive management if unforeseen biodiversity-related events occur should be captured in environmental management or other processes used by the site.

Biodiversity information needs

Ultimately, the quality and effectiveness of biodiversity management will only be as good as the quality of the available knowledge and information. Since it is not always simple to collect the required biodiversity data, and biodiversity itself is subject to short- and long-term dynamic processes, data gathering must be an on-going process, not only during the planning process but also later when active biodiversity management is already underway. For this purpose, it is important to obtain the support of local expert organisations such as NGOs and universities.

A biodiversity inventory, documenting site-level biodiversity, is an essential input for every step of an IBMS. In the same way that a thorough knowledge of the mineral resources below ground is required for the planning of resource extraction, information on natural assets is essential for reducing impacts on, and safeguarding, biodiversity.

The key objectives of a biodiversity inventory include:

- assessing the biodiversity importance category of the site;
- evaluating impacts on biodiversity, required mitigation and possible biodiversity enhancement measures (inputs for scoping, environmental and social impact assessment, biodiversity action plan, rehabilitation) to determine overall risk of the site to biodiversity; and
- providing baseline data for monitoring the status of biodiversity and evaluating the effectiveness of biodiversity management.

Biodiversity data collection should have a clear functional purpose. Whilst some basic information on local biodiversity should be collected at all sites a company is responsible for, the question of what should be collected, and at what degree of detail and accuracy, will depend on the precise function the data is meant to serve. This function will inevitably vary from site to site, depending on the biodiversity importance of the site, the precise nature of the commercial activities and the required level of biodiversity management.

Data collection follows a progression, from looking at biodiversity in a quick broad-brush manner (e.g. desk studies) to a more detailed investigation of specific issues by relevant experts through field investigations. Thus, over the planning and operational phases, the level of information will be gradually increased to be more and more precise and complete. The need for such an approach is greatly dictated by the fact that, for reasons of economic competitiveness, the early stages of planning are governed by various degrees of confidentiality. Full stakeholder engagement begins only during more advanced planning and throughout the operational phases. This engagement should include, where relevant, consultation with biodiversity expert organisations.

Data on biodiversity is available from multiple sources. At the national level, the repositories of such information will vary, but may include government agencies, universities and nongovernmental organisations. At the global level, there are a number of web-based tools and datasets where such information can be found.

Table 1 provides an overview of tools, objectives, main outcomes and activities related to biodiversity management during each of the main stages of development. More details about the activities under each objective are given in later chapters.

Figure 2 – Boundaries of site biodiversity management

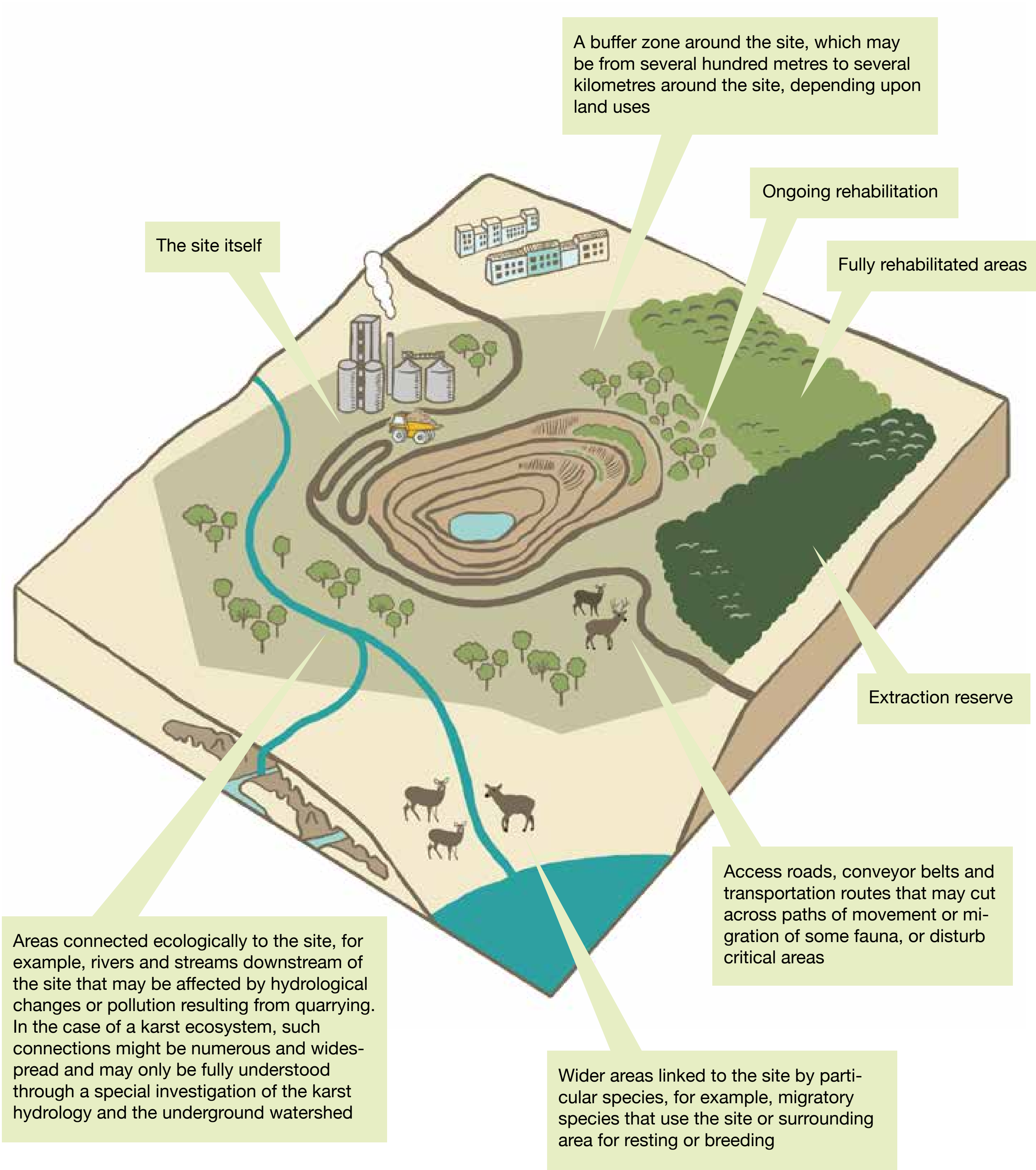


Table 1 – Overview of biodiversity management activities throughout the lifecycle of operations

Tools	Objective	Main outcomes/activities

Initial scoping/investigations	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	• Identify biodiversity importance of the site by:
		  ◦ getting an overview of biodiversity elements that have the highest level of importance (e.g. proximity to protected areas, IUCN Red List of Threatened Species, etc.)
		  ◦ listing the major ecosystems present on the sites and their approximate distribution, as well as major plants and animals native to the ecosystems in question
		  ◦ listing vertebrates and higher plant species on international or national red lists
		• Identify critical/unmanageable biodiversity risks
		• Make a detailed assessment of risks to biodiversity from the project and of risks to the project arising from biodiversity issues
		• Identify and apply strategies for risk reduction, interacting with project concepts and options
		• Identify opportunities for possible biodiversity gains, including offsets
		• Develop ToR and identify required skills for ESIA
		• Identify biodiversity dimension of socio-economic issues
		• Assess costs and benefits of biodiversity management

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 an effective Environmental Management Plan (EMP)	• Collate baseline biodiversity information and conduct targeted biodiversity inventories where such information is missing, including:
		  ◦ maps of ecosystems and habitats of site and immediate surroundings
		  ◦ as complete a list as possible of higher plant and vertebrate species occurring on site
		  ◦ information on seasonal use of site by species that will be impacted by the proposed development and/or are likely to be a target of mitigation measures
		  ◦ information on local community/stakeholder use and importance of biodiversity and natural resources on and around the site
		• 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)
		• Develop biodiversity elements of EMP (with recommendations on a possible BAP)
		• Identify possible biodiversity indicators and monitoring
		• Assess costs of implementation of the EMP and monitoring programme

Tools	Objective	Main outcomes/activities
Rehabilitation Plan	To make the site safe and stable for future use and to return land to a beneficial post-quarrying use, balancing environmental, social and economic factors	• Identify regulatory requirements • Establish appropriate and desired post-closure land use and management based on stakeholder consultation • Set biodiversity- or community-led rehabilitation targets • Include minimum levels of biodiversity input (where a BAP is not applicable) • Identify opportunities for biodiversity gains (linked to BAP where in existence or planned) • Identify and implement progressive rehabilitation • Ensure long-term sustainability of the rehabilitation actions in terms of the desired management outcomes
Biodiversity Action Plan (BAP)	To enable the site management to maintain or enhance the biodiversity values during the operational and closure phases of the project	• Collect detailed qualitative and quantitative information on all ecosystems and/or species to be targeted by biodiversity management • Establish priority for and scope of BAP in relation to biodiversity importance of site • Set biodiversity targets, if possible in relation to national or other level Biodiversity Action Plans • Define actions required to attain each of the targets • Monitor the outcome of these actions • Adapt management measures based on monitoring results • Ensure the long-term sustainability of the biodiversity management through appropriate partnerships and resourcing • Ensure the integration of the BAP with the EMS through review and updating mechanisms
Biodiversity Inventory	To know what biodiversity assets the company controls on its land and is responsible for (stewardship)	For all sites: • Establish Biodiversity Importance Category For most extraction sites: • Carry out standard ecosystem inventory (rapid biodiversity survey of ecosystems/habitats and key plant communities of site and surrounding areas) For sites with full ESIA: • Complete qualitative inventory of higher plants, vertebrates and invertebrates especially characteristic of the local ecosystems, including, if relevant, information on abundance and/or seasonal use
Biodiversity Monitoring	To understand and monitor the impacts of the company's activities on biodiversity and to assess the effectiveness of biodiversity management measures	For all sites with biodiversity management: • Monitor selected, site-specific biodiversity indicators For selected sites: • Carry out qualitative biodiversity monitoring (e.g. species list) at regular intervals • Carry out quantitative biodiversity monitoring (e.g. status of key species and habitats)

IUCN Knowledge Products: Biodiversity information to support business decisions

IUCN knowledge products are combinations of standards, data, processes, tools and products developed and maintained by IUCN and partners to inform the conservation and sustainable use of the world's biodiversity. Four of IUCN's knowledge products that can inform business decisions are described below, as well as a tool to work with them.

The IUCN Red List of Threatened Species provides information and analyses on the status, trends and threats to species to inform and catalyse action for biodiversity conservation. It is a joint initiative between IUCN and Red List Partner organisations to deliver the most comprehensive and credible information source on the global extinction risk of species. The IUCN Red List of Threatened Species is not a prioritisation exercise; it is a standardised and transparent way to evaluate how close a particular species of animal, fungi or plant is to extinction, analyse what are the threats causing this status, and recommend measures to prevent extinction. Species are assessed and placed in one of eight categories of risk (from Least Concern to Extinct), based on scientific criteria linked to population trend, size and structure, and geographic range. Currently, about 70,000 species have been assessed, including all mammals, birds, amphibians, corals, conifers and cactus, among others. Nevertheless, this is not even 4 percent of all known species to date.

Protected Planet offers an overview of protected areas coverage and performance around the world. The underlying data in Protected Planet is the World Database on Protected Areas (WDPA). The WDPA aims to accurately document all of the world's protected areas and their essential intrinsic and descriptive attributes, such as name, location, shape, legal status and IUCN management category. It is the most comprehensive global dataset on marine and terrestrial protected areas available. The WDPA is a joint effort between IUCN and the United Nations Environmental Programme (UNEP), through the World Conservation Monitoring Centre (UNEP-WCMC). UNEP-WCMC and the IUCN World Commission on Protected Areas compile this dataset from multiple local and national sources. The WDPA includes the official set of protected areas submitted by national protected areas authorities (including protected areas classified using the IUCN protected area category system) and the secretariats of international conventions (e.g. Ramsar, World Heritage and Man & Biosphere), which is used to compile the United Nations List of Protected Areas.

Key Biodiversity Areas (KBAs) are sites of global significance for biodiversity. Over the last three decades, various programmes, generally focused on specific groups of species, to identify sites of biodiversity significance have been developed. These have been conceptually grouped as "Key Biodiversity Areas" (KBAs), and include Important Bird Areas, the Alliance for Zero Extinction sites, and others. KBAs are of great use for the private sector for: 1) risk assessment in the screening phase before considering a project, 2) informing Environmental Impact Assessments for identified project sites, 3) site management considerations, and 4) guiding mitigation efforts, including restoration and offsetting. KBAs provide the basis for national and regional gap analysis, to expand and reinforce the existing protected area network. However, not all KBAs are or will become protected areas. The appropriate action for each identified KBA remains a national stakeholder decision.

The IUCN Red List of Ecosystems (RLE) provides transparent, objective and scientifically rigorous assessment of the risk of ecosystem collapse at local, national, regional and global scales, to support decision making in conservation, land use and investment. Following categories and criteria specifically designed for this purpose, it is possible to determine how close an ecosystem is to collapse and to assign categories that range from Least Concern to Critically Endangered and finally to Collapsed. This status is measured by criteria that reflect varying levels of risk and loss of function, and which are easily quantified and monitored, for example losses in area, degradation of abiotic components, disruption of biotic processes, or other major changes such as conversion. The Red List of Ecosystems is consistent with, and complementary to, the IUCN Red List of Threatened Species.

The Integrated Biodiversity Assessment Tool (IBAT) is an online tool for working with these IUCN Knowledge Products. IBAT is designed to facilitate access to critical biodiversity information at the site scale, in order to inform decision-making processes. It includes information on currently identified KBAs, the WDPA and The Red List of Threatened Species, which can be accessed through a simple interface that allows users to visualise dynamic geographically referenced maps and make specific queries. IBAT helps businesses incorporate biodiversity considerations into key project planning and management decisions, including screening potential investments, siting an operation in a given region, developing action plans to manage for biodiversity impacts, assessing risks associated with potential sourcing regions, and reporting on corporate biodiversity performance. IBAT is a partnership between Birdlife International, Conservation International, IUCN and UNEP-WCMC.

Box 2 – Biodiversity-relevant tools developed by the cement and aggregates sector

One of the main purposes of the Cement Sustainability Initiative (CSI) is to identify actions and facilitate steps cement companies can take, individually and as a group, to accelerate progress towards sustainable development. To support this, a range of guidelines, tools and reports have been developed by the CSI to inform and support member companies in achieving their sustainability goals. Resources which include a biodiversity component are:

The CSI Guidelines on Quarry Rehabilitation: The guidelines provide guidance on each stage of rehabilitation planning & implementation and explain external factors relevant to establishing a rehabilitation project. They are relevant to both new and existing quarries and apply to a broad range of environments, climates and geographies. Case studies throughout the document highlight responsible quarry rehabilitation activities drawn from various quarry types and local habitats around the world.

The CSI Environmental and Social Impact Assessment (ESIA) Guidelines were originally developed in 2005 to enable cement companies and local communities to identify and address some of the critical issues during each phase of a cement facility's development, operation and eventual closure. The guidelines are being revised to reflect current best practice and industry innovations. The revised guidelines will set out clearly why and how an ESIA should be done, explaining the benefits to the business of the ESIA process, and the potential consequences of it not being carried out properly.

The CSI Biodiversity Management Plan (BMP) Guidance: The objective of this document is to provide high level practical biodiversity management guidance to all member companies or producers operating in similar activities, by presenting the key issues, explaining the connection between operations and healthy ecosystems and outlining some management approaches. The guidance links to documents, data, tools and guidance so that companies can begin to address and progressively implement biodiversity into site-level management, through the development of an appropriately focused management plan.

For more information about the CSI's work on managing local impacts and land stewardship, visit the CSI website at www.wbcsdcement.org/biodiversity or their publications at www.wbcsdcement.org/publications. You can also send an email to cement@wbcsd.org for any enquiry.

3 Establishing a biodiversity policy and targets

Developing a corporate policy on biodiversity

The development of an IBMS begins with an overall corporate commitment to responsible biodiversity management that integrates biodiversity into the policy landscape of any company holding or land managed for the extraction of mineral resources.

Biodiversity issues could be embedded into an existing environmental or CSR policy or, if no such appropriate policy exists, it might be appropriate to create a new policy focused specifically on biodiversity. Whatever the chosen approach, the general goal should be the adoption of a policy that prescribes an integrated approach to maintaining and safeguarding the components and ecological services of the biosphere in all of the company's operations.

A general policy statement on biodiversity should include the following elements:

- Recognition of the global importance of biodiversity resources and the company's dependence on, and impact upon, these resources.
- A commitment to responsibly manage company landholdings to promote the conservation and sustainable use of biodiversity.
- A commitment to practice responsible stewardship of company land and to work with partners, customers, relevant constituencies and other stakeholders to support their activities aimed at the same goals.
- A statement pledging that the company's decisions and plans will reflect due consideration of biodiversity risks and opportunities associated with its business, and recognising that such an approach will create long-term added value both for the company's business and for society as a whole.
- An aspirational goal for positive change on biodiversity, such as no net loss of biodiversity or net positive impact (see Box 3).
- Defined targets for biodiversity management.

The following general principles should guide the development of a biodiversity policy:

1. **Stewardship**: Managing all landholdings in a manner consistent with responsible care for the resources and values that they contain, including the biodiversity that they hold and represent.
2. **Integration in decisions**: Integrating the consideration of biodiversity issues, risks and opportunities into all decision-making, planning and operational processes.
3. **Impact on biodiversity**: Seeking opportunities to protect, restore and enhance biodiversity on and around company sites, and creating con-

Box 3 – What a commitment to no net loss or net positive impact means

A growing number of companies that have significant landholdings and impact on local biodiversity through the extraction of non-renewable or renewable natural resources are adopting policies of no net loss (NNL) or even net positive impact (NPI) on biodiversity.

NNL/NPI can be achieved at a specific operational site through a series of actions combining impact avoidance, mitigation and ecosystem restoration, followed by biodiversity offsets to address remaining residual impacts and other conservation actions. NNL/NPI is reached when the combined results of actions, after allowing for the negative impact on biodiversity of the extraction process, have an overall positive impact on biodiversity.

Biodiversity offsets are defined by Forest Trend's Business and Biodiversity Offset Programme as "measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people's use and cultural values associated with biodiversity."

For further information on biodiversity offsets, visit: http://bbop.forest-trends.org/index.php

servation outcomes that address the adverse biodiversity impacts of company activities.

4. **Biodiversity action**: Promoting and supporting the conservation of species, habitats and ecosystems on company land, guided by BAPs linked to other relevant programmes that might be in place at local, national and global levels.
5. **Transparency**: Reporting on biodiversity issues in an open and transparent manner and using targets to track company progress in biodiversity management.
6. **Equity**: Balancing the differing perspectives and interests of stakeholders as they relate to biodiversity.
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.
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.
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.
10. **Excellence**: Striving for continuous improvements in the management of biodiversity on all company landholdings, with the goal of being ahead of compliance.

In addition to the general principles above, the following implementation guidelines can help in the development of a biodiversity policy:

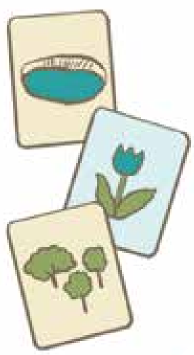
- **Directives and guidelines**: The Biodiversity Policy should be implemented through specific biodiversity-related principles embedded in the guidelines and directives of existing planning and operational processes.
- **Ecological context**: Approaches in restoration and conservation should build on natural environmental conditions and native biodiversity and take into account past patterns of human-induced ecological changes that might have affected a site.
- **Partnerships**: Co-operative relationships should be formed with expert groups and stakeholders that have an interest in the site, to advise and assist in the biodiversity management and help enhance conservation outcomes.

- **Monitoring and evaluation**: A plan should be developed to monitor and evaluate the biodiversity management on an on-going basis and to measure achievements by means of a biodiversity-related Key Performance Indicators.
- **Training and handbook**: Assistance and guidance should be provided to site managers in charge of implementing biodiversity objectives through appropriate training and incentives and the provision of toolboxes and handbooks.

Corporate reporting on biodiversity

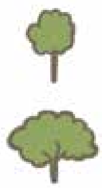
Reporting on a company's performance in relation to biodiversity, whether positive or negative, will enhance the credibility of a biodiversity system. By reporting on corporate commitments and targets, as well as changes to biodiversity on operational sites, companies also demonstrate transparency and accountability.

There are three different types of biodiversity reporting:



Reporting on biodiversity assets: As part of a company's corporate sustainability reporting, summary information about the biodiversity values of its landholdings should be included, as well as information on the efforts invested into biodiversity management. A first step in the process is the presentation of the Biodiversity Importance Category of each site. For sites of high biodiversity importance (biodiversity importance category of 1a, 1b, or 2), this basic data could be supplemented by more detailed information about the species and habitats of special concern.

Reporting on biodiversity management performance: As part of an annual reporting process, giving an overview of internal systems and processes designed to integrate biodiversity considerations into all management procedures, as well as its efforts on the ground to pursue biodiversity-related targets.



Reporting on biodiversity outcomes: Building on the results of more detailed biodiversity monitoring procedures (where biodiversity management targets are actively pursued) and parallel to the reporting on biodiversity assets, outcome reporting should become a standard feature of any corporate Sustainability Report.

Much of the focus of existing reporting on biodiversity is on management performance. For instance, the Global Reporting Initiative (GRI) sets the international standard for sustainability reporting, providing a comprehensive framework that includes performance indicators covering the three pillars of sustainability: economic, environmental and social. Given individual sector needs, GRI also develops sector-specific guidelines and indicators to complement the general guidelines. An important step when embarking on the development of an IBMS is to adhere to and report according to such globally relevant standards.

To further express a corporate commitment to responsible biodiversity management, a company can also adopt one or more Key Performance Indicators (KPI), which would be fully disclosed as part of the company's annual report, alongside other performance figures a company usually reports on. For instance, members of the Cement Sustainability Initiative commit to reporting on two biodiversity KPIs: (1) Number of active quarries within, containing or adjacent to areas designated for their high biodiversity value (number and coverage), with biodiversity value as defined by GRI EN11; (2) Percentage of quarries with high biodiversity value (according to KPI 1) where biodiversity management plans are actively implemented.

Chapter 6 discusses monitoring and evaluation (M&E) as an important way to measure progress towards established targets as well as to assess the need for adjustment to management practices. The data collected in M&E activities can also be adapted for reporting. By having a standard monitoring system for collecting biodiversity data throughout a company's operations, reporting on biodiversity outcomes can be made less onerous. Box 8 describes the Biodiversity Indicator and Reporting System, a system for assessing changes to biodiversity throughout a company's operations.

4 Biodiversity risk and opportunity assessments

From risk to opportunity

There are two types of risk associated to biodiversity for extraction companies – the risk of operations causing negative impacts on biodiversity and the risks to the company associated with damage caused to biodiversity. As such, the biodiversity values of a site need to be established and the possible impacts of resource extraction evaluated. An early step in an IBMS should be a risk assessment that leads to risks being reduced to an acceptable level through a range of potential corrective measures (using the mitigation hierarchy).

Whilst in the early steps of the life cycle of a mining site, the focus is on the risk side of biodiversity, during the detailed planning (ESIA studies) and the subsequent implementation of the operational phase, the focus shifts to the opportunities that present themselves to a company for ultimately enhancing the biodiversity of a site – or even providing for a regional biodiversity gain – through a series of positive management measures, ranging from rehabilitation driven by biodiversity targets, to the creation of new habitat types or the establishment and ecological improvement of adjoining offset areas.

Biodiversity risk matrix

The Biodiversity Risk Matrix (see Box 4) is the principal screening tool for use in developing an IBMS. The matrix plots biodiversity importance (Biodiversity Importance Category; y-axis) against impact (severity and likelihood of expected impacts; x-axis). Whilst the importance is intrinsic and will stay the same irrespective of any development that might take place, the impact measurement is based on a mixture of likelihood of impact and the possibility of mitigation. The matrix allows priorities to be set for detailed evaluation and action, as well as the go/no-go decision.

Biodiversity importance categories

A fundamental first step of the risk assessment is to know the biodiversity importance of a site. Whilst there are numerous scientific ways in which this can be assessed by means of more or less involved methods, an IBMS should initially seek to establish the Biodiversity Importance Category of a site, as quickly and as early as possible, through a desk study, drawing on information available on the internet, especially IBAT. Whilst IBAT and other such tools are important starting points for identifying the biodiversity importance of a site, they will need to be verified through the study of additional published information and/or consultation with experts.

Box 4 includes an overview of the biodiversity importance categories, focusing on the possible presence of globally or nationally threatened species and outstanding or threatened habitats, as well as the overlap of the site with internationally or nationally recognised protected areas.

Biodiversity impact level

The second variable for assessing biodiversity risk is the determination of the expected impact of the resource extraction on biodiversity, which is based on two factors: (1) the likelihood that a certain activity will have an impact on ecosystems and/or species and (2) the degree to which this impact could be mitigated through targeted measures.

If either the biodiversity importance or the biodiversity impact cannot be assessed, closing this information gap should be a high priority, and it is very important to ensure that the absence of information does not lead to the conclusion that no serious issues are present. On the contrary, a lack of information should be seen as a signal for prioritising further investigations to spot any possible risks, before more significant project expenditures are incurred through an impact assessment. This is especially the case if there are indications that the target area falls within Biodiversity Importance Category 1 or 2.

If this review leads to the classification “unknown,” a rapid biodiversity survey should be undertaken. The aim of a rapid biodiversity survey is to provide initial information on the biodiversity found in and around extraction operations. This type of survey should be used in the absence of more detailed biodiversity surveys carried out in the impact assessment stage of an operation (Chapter 5). Such surveys are especially needed for the assessment of the Biodiversity Importance Category of a site. These surveys will also help guide rehabilitation plans, including identification of important habitats, plant species and associated fauna. Information gathered through these surveys will, in addition, help develop biodiversity monitoring protocols to be carried out at sites of Biodiversity Importance Categories 1 and 2.

The focus of these rapid biodiversity surveys should be on the habitat, vegetation types and key plant species. However, if it is known that there are faunal groups of particular interest in the area, these should also be included in the surveys, e.g. mammals, birds, reptiles and amphibians, insects, karst fauna etc. In terms of scope, these surveys should include the landscape and key habitats in and around the quarry site to a distance of at least 500m from the site boundary.

BOX 4 – Risk and opportunity assessment

Biodiversity impact level

		Potential for mitigation			
		Irreversible	Difficult to mitigate	Can be mitigated by intervention	Easily reversed naturally
Likelihood of impact	Almost certain	A	A	B	C
	Likely	A	B	C	D
	Moderately likely	A	B	C	D
	Unlikely	B	C	D	D

A Very significant **B** Significant **C** Moderately significant **D** Low significance

Biodiversity risk matrix

		Expected impact levels on biodiversity Risk to biodiversity value of site (and/or surrounding area)			
		A	B	C	D
Biodiversity Importance Category	1A	Critical	Significant	Medium	Low
	1B	Critical	Significant	Medium	Low
	2	Critical	Significant	Medium	Low
	3	Significant	Medium	Low	Low
	4	Low	Low	Low	Low

Biodiversity importance categories (BIC)

1a Occurrence on site of:
- globally threatened species (IUCN Red List)
- overlap with or adjacent to internationally recognised protected area
- globally outstanding and/or threatened ecosystem/habitat

1b Occurrence of the above within 500m of site or with relevant ecological connections to the above

2 Occurrence on site or within 500m or with relevant ecological connection of:
- nationally threatened, rare species
- nationally protected (recognised) area, reserve, etc.
- nationally important and/or threatened ecosystem/habitat

3 Site:
- in landscape with diverse, natural ecosystems
- in modified landscape with potential for biodiversity enhancement (biodiversity island)
- with significant local value of the natural environment

4 Site in heavily modified, intensely managed landscape (including monoculture)

Table 3 – Description of possible biodiversity risks

Risk category	Critical	Significant	Medium	Low
Protected Areas	Overlap with a significant portion of a globally recognised PA Major overlap with a nationally protected area or KBA	Any overlap with a globally recognised PA Moderate overlap with a nationally protected area or KBA Significant adverse impact on a PA	Minor overlap or proximity to a nationally protected area or KBA Significant adverse impact on a buffer zone (5km) of a PA	No significant impact on protected areas or KBAs
Habitats	Total loss on site of all of any Critical Natural Habitat (IFC) or nationally important priority habitat (NBSAP) present on site, especially karst if this represents >50% in the surrounding eco-area	> 50% loss on site of any Critical Natural Habitat (IFC) or nationally important priority habitat present on site, especially karst if this represents >50% in the surrounding eco-area	25-50% loss on site of any Critical Natural Habitat (IFC) or nationally important priority habitat (NBSAP) present on site, especially karst if this represents >50% in the surrounding eco-area	< 25% loss on site of any Critical Natural Habitat (IFC) or nationally important priority habitat (NBSAP) present on site, especially karst if this represents >50% in the surrounding eco-area
Species	Global or national extinction of a species Disappearance from the eco-region of a globally important (Red List or micro-endemic) species Change in global status of a species to Endangered or Critically Endangered Presence of invasive species severely affecting native plants	Loss of a Red List Species from the site Change in national status of a species to Endangered or Critically Endangered Reduction of local (site and surrounding areas) population of a global Red List species by 50% Presence of invasive species with limited effect on native plants	Reduction of local population of a globally important (Red List) species by 25% Loss of local population of a nationally important species Presence of invasive species with no effect on native plants	Reduction of local population of a nationally important species by up to 50% No invasive species
Hydrological services	Severe adverse impact on water availability, water quality (including turbidity and sediment), erosion, flood protection for local habitats and ecosystems	Significant negative impact on water availability, water quality (including turbidity and sediment), erosion, flood protection for local habitats and ecosystems	Moderate negative impact on water availability, water quality (including turbidity and sediment), erosion, flood protection for local habitats and ecosystems	Insignificant impact on water availability, water quality (including turbidity and sediment), erosion, flood protection for local habitats and ecosystems
Community Use	Loss of access to areas/resources essential for livelihoods Loss of an environmental feature considered sacred or having high existence value	Reduced access to areas/resources essential for livelihoods Harm to an environmental feature considered sacred or having high existence value	Moderate impact on resources essential for livelihoods and sacred sites	No significant impact on livelihoods or sacred sites

5 Assessing biodiversity risks and opportunities for new investments in the planning phase

Overview of Chapter 5

In this chapter	Key elements covered

Initial scoping/ investigations
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
	• Identify biodiversity importance of the site by:
	  ○ getting an overview of biodiversity elements that have the highest level of importance (e.g. proximity to protected areas, IUCN Red List of Threatened Species, etc.)
	  ○ listing the major ecosystems present on the sites and their approximate distribution as well as major plants and animals native to the ecosystems in question
	  ○ listing vertebrates and higher plant species on international or national red lists
	• Identify critical/unmanageable biodiversity risks
	• Make a detailed assessment of risks to biodiversity from the project and of risks to the project arising from biodiversity issues
	• Identify and apply strategies for risk reduction, interacting with project concepts and options
	• Identify opportunities for possible biodiversity gains, including offsets
	• Develop ToR and identify required skills for ESIA
	• Identify biodiversity dimension of socio-economic issues
	• Assess costs and benefits of biodiversity management

ESIA
To make a full assessment of all impacts on biodiver-sity and provide mitigation measures that will be accepted by the permitting authority and that will provide the company with an effective Environmental Management Plan
	• Collate baseline biodiversity information and conduct targeted biodiversity inventories where such information is missing, including:
	  ○ maps of ecosystems and habitats of site and immediate surroundings
	  ○ as complete a list as possible of higher plant and vertebrate species occurring on site
	  ○ information on seasonal use of site by species that will be impacted by the proposed development and/or are likely to be a target of mitigation measures
	  ○ information on local community/stakeholder use and importance of biodiversity and natural resources on and around the site
	• 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)
	• Develop biodiversity elements of EMP (with recommendations on a possible BAP)
	• Identify possible biodiversity indicators and monitoring
	• Assess costs of implementation of the EMP and monitoring programme

Integrating biodiversity into the initial scoping/ investigations

The objective of initial scoping is to identify biodiversity risks that could have a significant impact on the viability of the project; this includes both risks to biodiversity from the project and risks to the project arising from biodiversity-related issues. The initial investigations will also provide all the biodiversity information needed for the investment decision.

During the initial scoping, the most important biodiversity issue to be examined is the likelihood for the project to have adverse, and possibly unavoidable, impacts on high-value biodiversity elements (protected species, habitats, ecosystem services, biodiversity-dependent livelihoods).

During the scoping phase, a company may have an important opportunity to decide on the size and boundaries of the required landholding for the operation, as well as locations of key project elements – decisions which, in turn, could facilitate future mitigation, rehabilitation and biodiversity management through the inclusion or exclusion of certain parts of the landscape (although the identification of such opportunities might be limited by the difficulty in bringing in external biodiversity expertise, due to the commercial imperatives of confidentiality).

Later, the focus will shift to opportunities for mitigating adverse impacts through changes in elements of the project design (location, configuration, process, etc.), or even biodiversity enhancement. Generally, it is important for alternatives to be retained as long as possible in the scoping process, as an alternative location, process or configuration may be the only way to avoid a significant biodiversity risk or minimise it to an acceptable level.

In addition to evaluating risks to biodiversity from the project, the biodiversity investigations should also focus on the identification, evaluation and management of risks to the proposed project arising from biodiversity issues. During the planning phase, it is important to identify threats to the project, particularly those of sufficient magnitude and/ or likelihood to influence the decision on whether to proceed with investment. Lower levels of threat, as well as opportunities to add value to the project by actions on biodiversity issues, are more easily and appropriately dealt with in the impact assessment and operational phase of projects.

Given the need for speed and confidentiality, biodiversity investigations during the scoping phase should concentrate on identifying issues of highest significance. If lower-level risks are missed at this stage, it is of lesser concern, as the more detailed baseline studies of the ESIA will highlight these later.

The classification of the proposed project site to a category of biodiversity importance and identification of critical biodiversity risks will be the main outcome of these investigations. Whilst this classification may include risks at lower than critical level, the focus of the investigations is to identify the highest level of risk. Using strategies based on the mitigation hierarchy (see Figure 3), the biodiversity risks should then be reduced in significance and/ or probability until the balance between risk and cost is thought to be right.

At this stage, opportunities for positive impacts on biodiversity should also be identified, at least on a conceptual level, requiring further elaboration and negotiation during and after the impact assessment phase. The lists of biodiversity risks and opportunities compiled during this stage should be important inputs to the terms of reference and the scoping stage of the Environmental and Social Impact Assessment.

During the scoping phase, it is also important to investigate biodiversity dimensions of social issues, such as community dependence on wild food and other biodiversity resources or loss of ecosystem services through interrupted access to the site.

If the proposed investment is rejected in view of conservation-related issues, land acquired should be considered as a biodiversity asset. It may be suitable as an offset for unavoidable impacts at other sites, or it may have a value in conservation banking, when such systems become more widely implemented. Sites that do not meet the requirements for either option for retaining the land, but which do have significant biodiversity importance, could be put under a conservation easement to prevent other developers from benefiting from the company's high standards.

Information needs and approach

The desktop-based biodiversity investigation should focus on the project site and a notional buffer zone around it. It should also include regional analysis, covering large bio-geographical units such as river basins or forest ecosystems as appropriate, as environments away from the direct footprint may be at risk, and land-use trends always require a broader-scale evaluation. The possibility of impacts to the surroundings of the site should also be considered. IBAT can be used for a first scan of the biodiversity importance of an area, but experience shows that some form of site-based verification (for instance to determine whether a threatened species is really present) will eventually be required for the definite allocation of the Biodiversity Importance Category (required for the Biodiversity Risk Matrix, see Box 4).

Investigations for new extraction sites will contain strong geological components, and the responsible experts should specifically be asked to investigate and comment on the presence of karst features in the project area or the wider landscape, as these features generally have a special value for biodiversity (see Box 5).

Since the focus of the initial scoping/investigations is on the highest level of biodiversity risks, it will require the investigation of those biodiversity elements that have the highest levels of importance and/or protection, including:

- Protected areas:
  - World Heritage sites
  - Ramsar sites
  - Biosphere Reserves
  - IUCN protected area management categories I-IV
  - Other significant national protected areas;
- Key Biodiversity Areas (KBA);
- Critical and Natural Habitats. In particular, limestone resource areas should be investigated for the presence of karst landscapes and features, especially caves;
- Ecosystems (terrestrial and aquatic) and the services they provide;
- IUCN Red List species; and
- National priority species and national priority habitats (defined in legislation and/or a National Biodiversity Strategy and Action Plan).

Ideally, research should focus not only on the species and habitats themselves but also on their distribution ranges and boundaries, in order to judge the relative importance of the site for the species. If possible, aspects of seasonal importance for species, such as breeding areas, migration routes, and summer or winter feeding grounds, should also be included.

The initial investigations may typically be completed in one-to-three months, and collection of biodiversity data may therefore be limited, not allowing, for example, a full evaluation of seasonal variations such as breeding and migration. These factors will form part of the baseline data collection in the impact assessment phase.

Given these limitations, the most suitable form of field work may be an expert-led rapid biodiversity survey that lasts only a few days. This form of survey aims to use the extensive experience of experts to identify significant spatial features of importance to biodiversity, and to understand the connections between the species lists and habitat maps of the site.

In most cases, for reasons of confidentiality, a company may initially only want to work with publicly available information, rather than conducting additional field surveys. This decision would require some form of internal expertise, so that the information could be evaluated without the use of external third party experts. Field biodiversity surveys should form part of the later stages of the scoping phase.

For some areas and countries where scientific capacity is limited and access to information difficult, there might be serious issues regarding how recently the information was collected, as well as the quality and completeness of records. Inaccurate information can lead both to false positives (records indicating the presence of a priority species that is in fact absent) and false negatives (incomplete surveys that may lead to an incorrect conclusion that there are no global priority species present). When this is the case, it is important to work with local experts to collect or source more detailed information. At this stage, when field assessments may be limited, IBAT can also be used for screening for high biodiversity values. It is important however, to ensure that more detailed bio-

diversity surveys are carried out during the ESIA stage to make up for the lack of data and make corrections to the risk assessments.

There are other aspects of biodiversity that may not be covered in public databases, but which are nevertheless important elements of the biodiversity context. With the constraints of time and disclosure in the scoping phase, it may not be possible to collect much information on these aspects, but they should, as far as possible, be a part of these early investigations. These factors include:

- Ecological connections through watersheds, corridors and other physical features that may have an influence on the significance of the presence of species or habitats in a project area should be considered when establishing boundaries for the biodiversity investigations. Whilst a population of an endangered species may live many miles away, it may be connected to the site by a river, for example, and thus potentially affected by the proposed project. Special attention is required in areas with karst formations, where ecological and hydrological connections may be particularly complex and thus require the assistance of an appropriate expert.
- Surrounding land and water uses should also be considered as part of the investigation – a forest on limestone surrounded by farmland may be more important than if the proposed quarry site was a small part of a larger forest of similar type. This analysis also needs to consider how patterns of land use have changed and are likely to continue to change. For example, the intensification of agriculture may only just have started in an area, but its likely continuation would increase the future importance of an area not suited to farming, such as a range of limestone hills. The possibility for impact on underground water flows and springs in the area should also be included.
- Critical social sensitivities or dependencies on biodiversity resources may be a significant potential risk associated with biodiversity, and some information on these issues should be collected. This may involve identifying where access by local communities to the project area for ecosystem services – food, medicinal plants, spiritual activities, materials, etc. – is an important part of their economy and culture. This is especially relevant where Indigenous Peoples and those living traditional lifestyles are involved, even where their rights are not recognised by the state. This aspect of the investigations could be carried out by a company's Corporate Social Responsibility (CSR) department as part of the initial scoping/investigations.

A review of the legal framework for biodiversity conservation and land use should be included, as this may modify the seriousness of risks arising from the biodiversity investigations. In particular, if biodiversity offsets are being considered as compensation for unavoidable impacts (where avoidance and reduction are not cost-effective or technically possible), the legal framework for the design and implementation of offsets must be researched.

At the end of the scoping phase, the minimum information that should have been collected includes:

- a habitat/ecosystem map of the area for which the company will have management control, as well as for the immediate surroundings;
- a list of the predominant and/or important higher plants and vertebrates occurring on the site, especially species native and endemic to the local habitats; and
- confirmation of the presence of globally and nationally threatened species (which, for example, may have shown up on the analysis of IBAT data) for which the site fulfils a life-supporting function.

Furthermore, as part of the identification of biodiversity risks, the initial investigations should identify rehabilitation and conservation options requiring spatial planning of land uses at the site. These may include:

- excluding significant karst cave systems from the extraction plan footprint;
- designing water management to avoid impacts on downstream wetlands and estuaries, as well as underground water;
- managing hydrological issues in order to avoid negative impacts on subterranean streams in karst ecosystems (such as overfilling of karst cracks by sediments or reducing water quality);
- preserving intact high-value elements such as forest remnants, riverine forests and floodplain grasslands as refuges and seed sources; and
- avoiding disruption of connected habitat corridors used by a variety of species for survival and dispersal.

Box 5 – Extraction and biodiversity in limestone areas

Limestone's particular chemistry, hydrology and geology as well as associated microclimates can result in the formation of karst and cave sytems which often harbour unique and rich biodiversity. This biodiversity is particularly vulnerable to impacts from extraction due to the following factors:

Habitats difficult/impossible to restore – key limestone habitats (e.g. caves) can be intricate and complex, having taken millions of years to form by natural processes, such that, unlike some other natural habitats (e.g. grasslands) they are very difficult, or even impossible, to restore once damaged.

Species confined to a small area – the history and geography of limestone areas often means that a particular species may be restricted to a very small area (e.g. an individual cave or hill) such that even a single extractive operation or quarry can lead to a global extinction, as has already been documented.

Challenging to detect and survey – limestone habitats are often hidden and hard to access, and limestone-restricted species may be unusual and unfamiliar, such that biodiversity in limestone areas is often harder to detect and study than in some other areas, and is thus often overlooked, including in regional/national surveys and legal designations, and site-level surveys and impact assessments.

In order to ensure that extraction in limestone areas safeguards these important landscapes and the biodiversity they support, good biodiversity management practices are essential. Specific biodiversity management recommendations for these areas include:

- New limestone extraction sites, and extensions of existing sites, should – where possible – avoid impacting limestone caves, isolated limestone hills, limestone bodies with many small voids and limestone areas with underground water and/or springs, due to the particular biodiversity importance and sensitivity of these features, and because they often cannot be restored. This can be achieved by making use of surveys, and external maps (e.g. of caves), in strategic decisions.
- Limestone extraction sites should be restricted, consolidated and/or grouped into one part of a large continuous limestone area, rather than being extended across the whole area or impacting many small areas, so as to reduce the likelihood of causing species extinctions, given that site-endemic species are unlikely to be restricted to just one part of a larger continuous limestone area.
- Where significant new risks to limestone-restricted biodiversity are detected at existing sites, which were not identified when the site was planned – due to weaker regulations and/or lower awareness at the time – operators should be encouraged by regulators to alter their existing extraction plans, including – where appropriate – by being offered alternative, less damaging, sites for their activities.
- Operators of existing, or newly-proposed, extraction sites should support wider efforts to increase knowledge about limestone-restricted biodiversity, particularly regarding taxonomic groups that may be impacted by their activities. This should include: supporting IUCN or National Red List assessments of species not yet adequately assessed; supporting regional surveys (e.g. atlases) of species and habitats, and; sharing the results of their own surveys/assessments in limestone areas.
- Regulators should ensure that regional/national legal designations adequately include limestone restricted species and habitats, and that operators are made to take responsibility for subterranean habitats – as well as surface habitats – on their sites, including mitigating any impacts upon them.
- Industry associations and regulators should support the creation of regional maps of critical areas for preserving limestone-restricted biodiversity, to better inform the strategic planning of individual companies, as well as to better coordinate the location/management of sites operated by different companies, focusing initially on those areas where quarrying is ongoing, or likely to occur in future.

Source: Birdlife, FFI, IUCN, WWF. 2014. Extraction and Biodiversity in Limestone Areas. Joint Briefing Paper.

Integrating biodiversity into Environmental and Social Impact Assessments (ESIAs)

Recognising that there are existing requirements for environmental and social impact assessments in most jurisdictions, the ESIA process can be used as a framework for future environmental management that will be compliant. This process can also be used to collect necessary biodiversity information for implementing an IBMS, including data for minimising impacts on biodiversity and taking advantage of opportunities for biodiversity enhancement, as well as providing baseline evidence that may be used as a defensive tool to show that not all subsequent impacts are due to the project.

The aim of biodiversity investigations in the ESIA stage is to make a full assessment of all impacts on biodiversity and provide mitigation measures that will be accepted by the permitting authority. It will also form the basis for biodiversity management activities onsite. As part of this objective, it is important to ensure that the proposal – greenfield development, new quarry, site extension or closure – is approved by the relevant permitting authorities in the most effective and efficient way, and that it complies with the safeguard policies of financing agencies.

Outcomes/Activities

Biodiversity investigations during this stage will result in the following key outcomes:

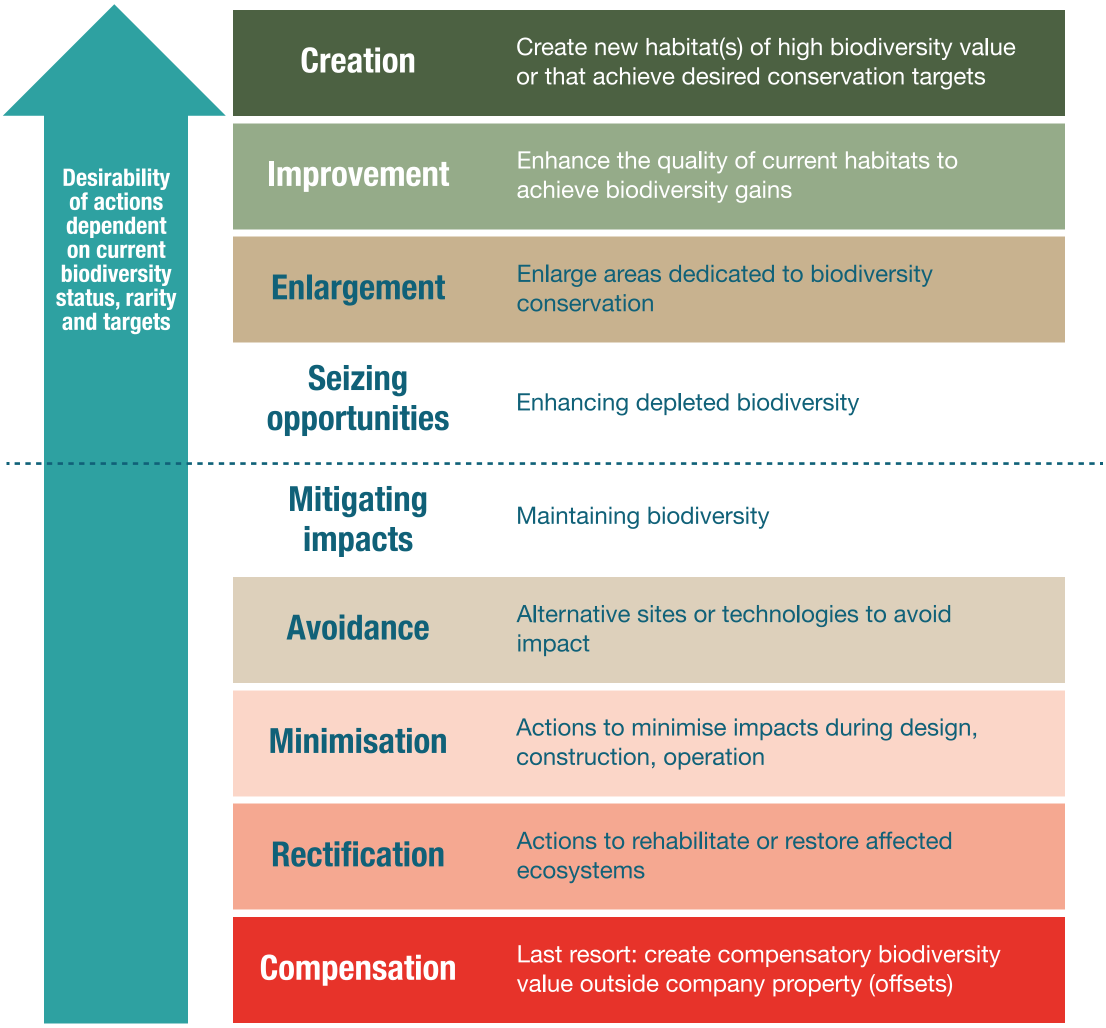
- It will collate the available information on the biodiversity in and around the site, and will supplement this with surveys to provide an adequate and appropriate baseline against which future changes in biodiversity can be monitored.
- It will establish compliance with the environmental and social safeguards or regulations that apply to the particular site.
- Using the baseline information and knowledge of typical impacts from quarrying and cement and aggregates production activities, it will predict the likely effects on biodiversity over different phases of the project, including site preparation and development, operation, rehabilitation and closure. It should also include any access and materials transport infrastructure to and from the site.
- It will provide an opportunity for informing stakeholders, especially local communities that will be the most affected, about the development. The stakeholders should be encouraged to express their concerns and to prioritise issues that the company should consider in implementing the development; this process can then contribute to ideas for future community involvement.
- It will allow a systematic assessment of the level of mitigation measures of all identified impacts; these measures may include creation, improvement, enlargement, avoidance, minimisation, rectification and compensation (see Figure 3).
- It will provide the framework for the biodiversity components of the Environmental Management Plan (EMP). This should follow the definitions of the biodiversity importance category of the site and the level of impacts, bearing in mind that the ESIA process may have provided additional information that may lead to their reassessment. Where appropriate, the ESIA should make recommendations for developing a Biodiversity Action Plan (Chapter 6).
- It will allow the identification of possible biodiversity indicators and propose additional surveys to establish a scientific baseline with regular monitoring to follow the course of impacts and effectiveness of mitigation and enhancement measures.
- It will provide an indication of the residual impacts after mitigation, correlating with the remaining biodiversity-associated risk that the plant or quarry will have to manage as part of the EMP required by many local authorities as part of the operating licence.
- It will provide an initial assessment of the costs of implementing environmental management and monitoring programmes, which can then be incorporated into overall operational costs of the site.

Approach

There are several important factors to be observed in the preparation of an ESIA:

- The impacts of all stages of development and operation should be assessed – site development and construction, operation, rehabilitation and closure.

Figure 3 – Biodiversity mitigation and enhancement measures



- The expected impacts on biodiversity should be compared with current environmental changes and trends in biodiversity that would be likely to happen without the proposed development.
- Both positive and negative impacts should be covered, with appropriate mitigation measures to address the negative impacts, as well as possible measures to enhance the positive ones.
- Whilst the focus of an ESIA is on the proposed development, there should also be a comparison of alternatives – alternative sites, routes for access roads, methods of extraction or processing. In many cases alternative sites would have already been considered in an earlier stage of the planning process, but the key findings should be included for comparison in the ESIA, in order to demonstrate that the proposal has been developed in awareness of environmental and biodiversity issues, i.e. avoiding high biodiversity risks.

The company project timeline for decision making may be less than one year. However, a proper evaluation of biodiversity issues may often require a longer timeframe, to ensure that the ESIA baseline studies cover the full annual cycle of different seasons (wet and dry, summer and winter). Ecological processes and species life cycles (e.g. migration of birds), and thus impacts on biodiversity stemming from industrial activities, may vary significantly throughout the year. This variation, in turn, can be crucial for the proper design of mitigation measures. In many cases, biodiversity baseline studies that do not cover an entire year have to be considered incomplete.

Therefore, if the results of the initial scoping/investigations indicate biodiversity issues that might be influenced by seasonality, then the time span for the ESIA should be extended to cover 12-15 months. If the formal ESIA period is shorter, the collection of biodiversity information should begin earlier.

Steps of the ESIA

Scoping

During this phase, key biodiversity aspects that should be considered are defined. Much of this information may already have been collected during the initial scoping/investigation stage. Scoping during the ESIA stage provides the opportunity to review the information sources, identify gaps in information and develop a plan for filling these gaps through field surveys or other appropriate investigations.

In line with the approaches taken in the earlier planning stages, biodiversity impacts can be categorised into five important aspects:

- **protected areas:** the impacts upon recognised areas of high conservation value that are either in or nearby the plant or quarry;
- **habitats:** characteristic and high-value habitats found in the area upon which the species are dependent;
- **species:** rare or endangered species that are present in or near the quarry or plant site, native and endemic species in the area, and invasive alien species that might be a threat to biodiversity in the area;
- **hydrological services:** an important part of ecosystem services upon which much of the biodiversity depends, including ground and surface water balances and flows; and
- **community use:** the key uses for biodiversity by local stakeholders, including livelihood and recreational uses of biodiversity as well as spiritual values associated with biodiversity in and around the quarry and plant sites.

This categorisation can be applied to both direct and indirect impacts on biodiversity and is a useful method of organising and understanding potential effects more clearly.

Baseline Assessment

During this stage of the ESIA, secondary information should be supplemented with a more detailed study of ecosystem types, plant communities, major groups of species, etc. This may require surveys at different times of year, with several specialists (plants, invertebrates, mammals, birds, fish and amphibians). The idea is to make an assessment of what biodiversity is present in the different impact zones, its status and approximate abundance. The focus should be on the local terrestrial, freshwater and marine habitats, with special attention to individual critical species and habitats. The important ecosystem functions should also be described, especially hydrological functions, breeding and nursery areas, pollination, etc.

The baseline assessment should describe the status and distribution of rare and threatened species (nationally and internationally), important migratory species that visit the site and surrounding areas, and the presence and abundance of invasive species. Particular attention should also be paid to biodiversity corridors, areas of land that link habitats and protected areas and allow the wider movement of animals and dispersal of plants. As more detailed baseline information is collected on species and habitats, it may be necessary to revise the biodiversity importance category of the site.

Information on the biodiversity can be gathered from stakeholders, especially local users, nature groups, schools, etc. These groups have often had a long and direct involvement with the area, and local knowledge can be invaluable in describing the particular habitats and species.

The baseline should also describe the uses of biodiversity by local communities that contribute to their livelihoods. Any biodiversity associated with agricultural land may also be important, and should be described. In some areas, the diversity of agricultural crop varieties (agro-biodiversity) may be significant.

Box 6 provides an overview of the biodiversity baseline information that needs to be collected during the ESIA.

Impact Assessment

In this analytical stage of the ESIA, changes in the biophysical conditions on and around the site that will result from the plant or quarry should be linked

Box 6 – Key biodiversity baseline information to be collected during the ESIA

- Landscape-level description
- Physical description – topography, geology, soils, climate and hydrology (these are generally part of an ESIA, but will provide the basis for the biodiversity description)
- Specific habitats present, including principal vegetation types and specific details of wetlands and caves, karst areas and exposed rock faces present onsite
- Flora and fauna present, including rare, endangered and nationally protected species – show distribution in different habitats
  - mammals, birds, reptiles, amphibians, fish, invertebrates - molluscs, insects, etc. In addition to species lists, the report should identify species characteristic of the habitats
  - keystone species (species that are important for maintaining ecosystem services)
  - important species with larger populations in the area
  - migratory species, including description of seasonal patterns
  - invasive alien species, especially plants that may be spread by quarrying activities
- Important breeding, feeding, resting grounds etc.
- Important seasonal changes in the use of sites
- Land use in the area – this should include the existing land uses that may have an influence upon biodiversity such as agriculture, forests, nearby industries, etc.
- Uses of biodiversity for local livelihoods and estimate of the importance of such uses

with the possible impacts on biodiversity. Typical biophysical changes stemming from quarrying activities include increased noise and dust, hydrological changes and lowered water quality, disturbance from increased human activity, and general habitat modification and loss. Ground disturbance can increase invasion by alien plants.

References to reports on what has happened in similar situations to biodiversity elsewhere – either based on the company's own experiences at other locations or on case studies presented by third parties – can be extremely useful at this stage. Scientific information on the threshold levels of water quality, noise, etc. upon different types of plants and animals should also be included as part of the assessment, as well as an evaluation of the likely impact on Red List species found at or near the site. Demonstrating that the development is likely, or unlikely, to have an effect on the status or the level of threat of the species, is absolutely critical for a proper ESIA report.

Impact assessment often relies on professional judgment – predictions of what will happen based upon knowledge and experience of what has happened elsewhere and the sensitivity of different species. Some impacts will be direct and obvious, others will be more indirect, e.g. the loss of one species that is the main food source of another, or increased competition for the remaining habitat. The need for such judgments is a compelling reason for using experienced professionals to carry out ESIAs.

The ESIA should recognise that the development may be planned in an area that has already been modified ecologically to a greater or lesser extent in the past. Therefore, the ESIA should seek to single out those changes that are likely to occur as a result of the proposed development and compare these with changes that are likely to happen due to other natural or manmade factors. This is particularly important when the plant or quarry is to be developed where existing industrial plants and/ or quarry operations are already having impacts. A careful evaluation of the additional and cumulative impact caused by the development allows a baseline to be laid out, against which its specific impacts can be measured.

The ESIA should include, where appropriate, estimates of the economic values of biodiversity and its use. The description of the uses of biodiversity by local user groups and communities for their livelihoods, recreation, education and research may be obtained through consultation and surveys with these groups. Estimates of values will help in addressing compensation claims, either as a result of direct loss of the resource or loss of access. It is important to note, however, that it is not always possible to attach a monetary value to biodiversity.

Although the direct social impacts of a cement and aggregates plant or quarry should be a standard part of an ESIA, indirect, biodiversity-linked social impacts should not be neglected. These impacts are usually related to the use of biodiversity by local communities, e.g. as part of their livelihood (wild food, fuel, etc.), but may also include culturally important sites, such as waterfalls and sacred forests, or be related to the recreational, tourism and educational values of the site and its biodiversity. Consultation with stakeholders from neighbouring communities will highlight these concerns and allow the value of and impacts on these resources to be assessed. Biodiversity-related questions should be included in social surveys where appropriate.

Mitigation of biodiversity impacts

Following the assessment of biodiversity impacts, the most important subsequent task is the identification of appropriate measures according to the mitigation hierarchy. Whilst potential mitigation measures should have already been examined as part of the scoping phase, the emphasis in those early stages of the planning phase is on avoidance through go/no go decisions. In the ESIA phase there are opportunities for avoidance of biodiversity impacts through changes to project design; minimisation and rectification of impacts also take place at this stage. In instances when mitigation on site is not possible, compensation measures (biodiversity offsets) might have to be considered.

In addition, at this stage, the opportunities for biodiversity enhancements (see Figure 3) should also be carefully appraised. In many cases, especially in areas where biodiversity has been reduced from its original status as a result of previous land-use changes (e.g. for agricultural development and intensification), there are opportunities to manage and rehabilitate a site in such a way that species present in the past may be encouraged to recolonise. In the extreme, this could lead to the establishment of biodiversity islands in an otherwise significantly altered and homogenised landscape. However, biodiversity enhancement measures, whether through enlargement, improvement or creation, should not be considered if they are at the expense of an important existing natural ecosystem – even if it has a lower intrinsic diversity of species.

There are no firm rules or prescriptions for which mitigation measures should be chosen in which case, except for the need to follow the mitigation hierarchy and, in particular, to ensure that impacts are avoided and minimised. In practice, each case is different, depending on a variety of individual factors, such as the exact nature of the impact, the precise biodiversity elements affected (species, habitats, ecosystems, etc.) and the available management resources. Normally, expert judgment is required for this process, but the examples in Table 4, grouped into five aspects of biodiversity, may help to indicate general directions of possible mitigation strategies.

Since mitigation measures often will not entirely eliminate expected biodiversity impacts, the ESIA should seek to predict residual biodiversity impacts that may still remain, despite proactive biodiversity management. The predicted impacts, the mitigation measures and the expected residual impacts can be presented in the form of a matrix (see Table 5).

A key outcome of the ESIA is a set of recommendations for biodiversity management of the site during the operational phase and after termination of extraction, taking into account all the biodiversity mitigation and/or enhancement measures that may have been identified in the ESIA. These recommendations form the basis for the biodiversity component of site management plans.

Site management plans should also include provisions for emergency response if unforeseen biodiversity-related events occur, such as:

- discovery of rare species taking advantage of the changed habitat conditions and starting to breed on the site. This may require additional protection measures to be developed, e.g. during the breeding season;
- discovery of an important, previously undetected cave system;
- accidental spillage of oil reaches a water course; or

- quarrying activities accidentally disturb underground water balance, causing springs to dry up, and changes in stream flows.

These potential emergency situations require an adaptive management approach, possibly necessitating additional surveys, protection measures and monitoring.

Methods and tools

GIS mapping

The methods and tools used in ESIA biodiversity assessments rely heavily on GIS mapping and analysis, especially of land use, forest cover, water bodies, etc., enabling the delineation of different habitats, clarification of impact zones, and quantification of land areas and boundaries. This may be supplemented, both visually and analytically, by satellite imagery and/or aerial survey. Google Earth provides a very accessible initial way of visualising the landscape and what it contains, although the level of detail varies from location to location.

Sources of information

The quality of an ESIA greatly depends on the quality of the collated information. A balance needs to be found between collecting original data in the field and collating published and unpublished (i.e. secondary) information that may already exist about the site or the general area. These secondary sources may include literature surveys covering detailed studies within the area, in adjacent areas, e.g. of protected areas nearby, and of comparative locations elsewhere; academic research projects; previous ESIAs within the region; and input and information from local environment and conservation authorities and conservation NGOs.

Such secondary information may have limitations, however. In some countries, public access to information and data, even to other ESIA reports, may be significantly restricted. If access is difficult, or the relevant data is not available, extrapolation based on professional judgement and experience may be even more critical. Whilst detailed surveys will provide much relevant information, they need to be targeted and timed appropriately, because both time and funds for such studies will inevitably be limited. It is unlikely that a full survey

with detailed information about plant and animal populations will be possible within the usual time frame and budget of a typical ESIA, unless there is a compelling reason for such a study, such as the presence of a rare or threatened species.

Field investigations

The methods used for field investigations depend upon what is being surveyed. Rapid biodiversity surveys are a good way to identify key habitats and give a quick first idea of the presence or absence of certain species, especially when experts and trained observers are used to look out for specific evidence. More detailed field surveys should be discussed and agreed with the experts contracted to do the work, depending upon the objectives of the study.

Field studies for non-biodiversity components of the ESIA might also be required and useful, for example geological and speleological surveys to verify the presence of significant caves and underground habitats. Hydrological surveys will indicate the presence of the direction of water flows, streams and wetlands on or near the site, and social surveys can provide information on the uses of biodiversity resources on the site and how these are valued.

Prediction of impacts

Although predictive impact assessment methods are often summarised in matrices, they should be supplemented by descriptive sections of the report that explain the reasons for the predictions, including:

- **Importance**: How important is the overall change likely to be, locally, nationally, regionally and globally? This is especially relevant for rare and threatened species.
- **Magnitude:** What is the likely magnitude of the change? e.g. the proportion of the population that could be lost.
- **Permanence**: Is the change likely to be permanent, i.e. when the development or activity stops, will the change persist? An example of this might be the disturbance of bats by blasting, which would probably not be permanent once the resource extraction ceases in that area and the bats would return to their original roosts.
- **Reversibility**: Is the change likely to be reversible? The experience of rehabilitation has shown that many changes can be reversed.
- **Cumulative impacts**: Is the change adding to impacts from other developments, e.g. other quarries nearby? Will the additional changes in the biophysical environment as a result of the new development pass a threshold and tip the balance of survival of a species in the area towards its complete loss?

Stakeholder engagement

Many companies involved in the production of cement and aggregates will already have some experience in various methods for stakeholder engagement, many of which are also suited for addressing biodiversity issues.

National ESIA regulations may require formal consultation meetings to be held with stakeholders at community, district, provincial and national levels. Focus group meetings, surveys or Participatory Rural Appraisal (PRA) methods may also be used to gather additional information about biodiversity, and its use and value. Local knowledge about biodiversity should not be underestimated, and may be the only way of getting information about the presence of rarely observed species that would otherwise require costly surveys to assess. The use of photographs or identification guides, e.g. of birds, plants and fish, may be useful to focus such discussions.

Large and potentially controversial developments may need an associated communication strategy for the ESIA process, ensuring that stakeholders are consulted appropriately, and the general public and media are kept informed.

Implementation tools

A number of practical tools could be developed to help project and environmental managers commission, supervise and appraise the ESIA process and reports, including:

- development of a checklist of typical biodiversity impacts resulting from cement production and quarrying;
- advice on the linkage between the impacts predicted and mitigation proposals in EMPs, including a matrix of alternative biodiversity impact mitigation measures;

- generic ToRs for carrying out biodiversity impact assessment;
- advice on how to source local and international expertise for carrying out baseline surveys and impact assessments;
- advice on how to cost biodiversity components of ESIAs and EMPs;
- advice on how to appraise biodiversity components of an ESIA report; and
- a layman's language guide to biodiversity assessment methods, to help managers understand the terms and methods used in biodiversity surveys and monitoring.

Using these tools and providing training in biodiversity impact assessment would serve to promote the use of the ESIA Guidelines. Case studies of some of the ESIAs undertaken by the company that illustrate good practice in biodiversity impact assessment should be prepared to complement such training.

Due diligence for acquisitions

Since it is common in the cement and aggregates sector that companies seek to grow or move into new markets through acquisitions of national or regional companies or, in some instances, of individual plants or extraction sites, the due diligence investigations normally undertaken in such circumstances must include the issue of biodiversity. Principally, this should be done in the same manner as the risk assessment during the scoping of a new development. The presence of an endangered species, special rehabilitation requirements, an obvious gap between the closure practice currently applied on the site and the company's own standards or a pending civil suit involving biodiversity could all negatively affect the economic viability of a potential new acquisition. How this should be done, and to what extent, will depend on the nature of such a takeover:

- **Unsolicited takeover**: By necessity, the evaluation process would be blind, confidential and not allow for much time. The process would be most like the initial scoping investigations. In relation to biodiversity, IBAT or a similar quick desk study would be all that is possible, maybe supplemented with research on media coverage on the biodiversity performance of the operator.
- **Agreed takeover**: In such a case, there would normally be an official period for due diligence investigations, during which access to documentation and sites is granted. If time permits, a short investigation on the ground (in addition to examining whatever background material might be available), a rapid biodiversity survey such as recommended for the initial scoping or hitherto non-assessed sites would be the most appropriate additional biodiversity investigation.

Each due diligence case is different and will likely require individual approaches to checking biodiversity risks (which, if possible, should also include those that may not be subject to local regulations).

Table 4 – Examples of possible mitigation measures

Biodiversity aspect	Examples of impact	Possible mitigation measure
Protected Areas	Quarry creates area with new habitat for rare species	Creation and endowment of new protected area (enhancement)
	Quarry located in PA	Avoid locating quarry in PA (avoidance)
	Quarry impacts on PA • Disturbance of PA • Landscape impacts • Increased level of PA management required	• Blasting control measures agreed with PA management (minimisation), • Screen planting around quarry (rectification) • Contribution to management costs of PA (compensation)
	Loss of protected habitat	Gift remaining land around quarry as conservation easement and manage as protected area (compensation and enhancement)
Habitats	Loss of part of woodland habitat on part of the site through quarrying	Enhancement and protection of habitat in the unquarried area
	Loss of springs with characteristic fauna	Avoid quarrying around springs and water courses (avoidance)
	Loss of characteristic grassland habitat during quarrying	Remove and store topsoil, rehabilitate and replant grassland (rectification)
	Quarrying on brownfield site with limited biodiversity, adjacent to urban areas	Rehabilitation of quarry for urban use, with appropriate vegetation, and provision of habitat for urban biodiversity (rectification with enhancement)
	Loss of nationally protected grasslands in a river valley	Accept open water habitat, create a diversity of wetland habitats – beaches, wet grasslands (rectification and enhancement)
	Loss of karst landforms with endemic flora and fauna	Offset by protecting similar sites under threat (compensation)
Species	Rare species not found previously in area starts breeding in quarry	Special measures to protect and enhance survival of species in quarry (enhancement)
	Endemic cave fauna would be lost due to quarrying	Avoid quarrying around cave (avoidance)
	Disturbance of nesting of migratory bird species	Manage blasting times and locations to minimise disturbance (minimisation)
	Calcareous grassland flora lost from quarry area	Stockpile topsoil for later use, emulate traditional grazing/mowing regimes (rectification)
	Quarry and conveyor belt interrupts predator and prey ranges	Provide crossing points and leave protective vegetation corridors (rectification)
	Total loss of threatened species from site	Relocation and ex-situ conservation; reintroduction in suitable habitats after extraction (compensation)
Hydrological services	Sediment from quarry reaches and pollutes watercourses	Establish reed bed to intercept sediment (rectification and habitat enhancement)
	Ground water flows affected leading to disruption of water supplies and wetlands	Hydrological studies to show which underground water courses to avoid in quarrying (avoidance)
	Ecology of seasonal streams disrupted by year-round pumped discharge	Find alternative use for the water discharged during the dry season, e.g. irrigation (minimisation)
	Cave systems and springs dry out due to lowering of water table	Create artificial groundwater by re-injection (rectification)
Community Use	Loss of amenity value of land around plant or quarry	Creation of new biodiversity habitats for new recreational uses, e.g. bird watching (enhancement)
	Quarrying might involve loss of feature of community importance, e.g. waterfall, historic cave	Avoid quarrying in this area (avoidance)
	Access to firewood disrupted by quarry	Planting of fuel wood crops for local community use (rectification and compensation)
	Loss of recreational use of woodland – walking, hunting	Factor recreation into progressive rehabilitation plan (rectification)
	Loss of site that has spiritual and cultural value in quarry	Negotiate with local religious leaders to find acceptable alternative with appropriate observances (minimisation)
	Loss of livelihood activities, e.g. farming, fishing, hunting, livestock	Compensate and assist to find other land; develop alternative food sources, fish farming, poultry raising (rectification and compensation)

Table 5 – Residual impact matrix

Biodiversity aspect	Examples of initial predicted impact	Impact rating	Examples of mitigation measure	Residual impact rating
Protected Areas	Noise and dust disturbs adjacent nature reserve	Significant	Additional noise reduction and dust abatement measures in place	Low/Neutral
	Scar of quarry has significant visual impact upon a protected landscape	Critical	Early planting of screening vegetation to reduce visual impacts	Medium
	Quarry access roads allow easy route into protected area, increasing illegal hunting	Significant	Control point established on access road, monitoring traffic for wildlife hunting	Medium
Habitats	Conveyor belt crosses and damages wetland habitat	Critical	Alternative route found for conveyor which avoids wetland habitat	Low/Neutral
	Limestone upland meadows with characteristic flora lost in quarry area	Medium	Top soil removed and stored for later rehabilitation and planting to match surrounding areas	Low/Neutral
	Barren cliffs in quarry with little biodiversity value	Medium	Cosmetic blasting to create niches in benches to facilitate colonisation of rock faces	Moderately positive
Species	Presence of invasive alien plant species in surrounding area with high risk of increase in disturbed ground of quarry	Significant	Active monitoring and eradication programme	Low/Neutral
	Nationally protected species of bird nests in and around quarry area	Critical	BAP implemented which protects nesting birds in unquarried area of site, and rehabilitates nesting habitat after quarrying	Medium
	Opportunity for introductions of cliff-loving species in quarry	Low/Neutral	BAP enhances habitats for such species	Moderately positive
Hydrological services	Risk of sediment from quarrying reaching water courses	Critical	Construction of check dams	Medium
	Risks of accidental spillage of oils from vehicle maintenance area	Medium	Emergency response for oil spillage prepared, equipment in place and staff trained	Medium
	Quarrying potentially disturbs flow of groundwater maintaining the adjacent critical wetland	Critical	Hydrological surveys indicate quarry areas to be avoided to prevent groundwater impact. Monitoring of flows and remedial measures if necessary	Medium
Community Use	Access road to community source of fuel wood cut by quarry	Medium	Alternative road provided for communities to collect fuel wood from area surrounding quarry	Low/Neutral
	No current recreational use of site	Low/Neutral	Creation of paths and walkways for bird watching, viewing cliff-loving species	Positive
	Sheep grazing on upland meadows lost in quarry area	Critical	Protection of quarry edge from wandering livestock, compensation for loss of grazing during quarrying. Limited provision of grazing on fully rehabilitated meadow land	Medium

Negative impacts				Biodiversity opportunity (gain)		
Critical	Significant	Medium	Low/Neutral	Moderately positive	Positive	Very positive

6 Managing biodiversity risks and opportunities in the operational phase

Overview of Chapter 6

In this chapter	Key elements covered
Rehabilitation Plan *To make the site safe and stable for future use and to return land to a beneficial post-quarrying use, balancing environmental, social and economic factors*	• Identify regulatory requirements • Establish appropriate and desired post-closure land use and management based on stakeholder consultation • Set biodiversity- or community-led rehabilitation targets • Include minimum levels of biodiversity input (where a BAP is not applicable) • Identify opportunities for biodiversity gains (linked to BAP where in existence or planned) • Identify and implement progressive rehabilitation • Ensure long-term sustainability of the rehabilitation actions in terms of the desired management outcomes
BAP *To enable the site management to maintain or enhance the biodiversity values during the operational and closure phases of the project*	• Collect detailed qualitative and quantitative information on all ecosystems and/or species to be targeted by biodiversity management • Establish priority for and scope of BAP in relation to biodiversity importance of site • Set biodiversity targets, if possible in relation to national or other level Biodiversity Action Plans • Define actions required to attain each of the targets • Monitor the outcome of these actions • Adapt management measures based on monitoring results • Ensure the long-term sustainability of the biodiversity management through appropriate partnerships and resourcing • Ensure the integration of the BAP with the EMS through review and updating mechanisms
Biodiversity Monitoring *To understand and monitor the impacts of the company's activities on biodiversity and to assess the effectiveness of biodiversity management measures*	For all sites with biodiversity management: • Monitor selected, site-specific biodiversity indicators For selected sites: • Carry out qualitative biodiversity monitoring (e.g. species list) at regular intervals • Carry out quantitative biodiversity monitoring (e.g. status of key species and habitats)

Overview of key biodiversity management tools and links to the operational steps

In the operational phase, the categorisation of sites according to their biodiversity risk is an essential prerequisite to a meaningful application of an IBMS in general, and to the development of Rehabilitation Plans and BAPs in particular. By the time this phase begins, the key biodiversity issues should have been identified and plans for mitigating impacts and seizing opportunities for biodiversity developed. These plans should be timed according to the steps of the operational phase. The integrated nature of these different operational steps favours the formulation of an integrated approach for rehabilitation and biodiversity management applying to the whole site and the whole extraction operation.

Biodiversity management of a site needs to be in line with the intrinsic biodiversity value of the site (see Box 4). In addition to mitigation of negative impacts, there should also be a growing focus in the operational phase (ideally already sketched out in the ESIA) on seizing opportunities for biodiversity enhancement through habitat enlargement, improvement or creation, for example:

- **Capitalising on accidents-of-history**: Some sites might have a history of past exploitation followed by periods of recovery. However, others may have enjoyed periods of informal protection as sites for possible future use, during which time they turned into local biodiversity islands. Such events in the past might provide a base for maximising biodiversity benefits during operation.
- **Re-creation of formerly present habitats**: In localities where biodiversity has been reduced from its original status as a result of previous land-use changes (e.g. for agricultural development and intensification), there could be opportunities to rehabilitate a site to its former, more diverse status (e.g. re-establishment of a riverine floodplain after gravel extraction).
- **Creation of new habitats with high biodiversity value**: During the course of the rehabilitation work, new habitats may be created which were not necessarily present on the original site but that may represent scarce habitats in the broader regional landscape and thus hold a high or specific biodiversity value (e.g. creation of an aquatic habitat instead of a dryland restoration).

Operational phase biodiversity management should also consider the landscape and social context of the area. Biodiversity management and rehabilitation should be carried out in the context of the surrounding landscape in order to consider the changing matrix of surrounding land use and land cover over the lifetime of the quarry and how this may positively or negatively influence the setting and attainment of biodiversity targets, establish connectivity with other important biodiversity areas in the vicinity, or achieve a contextual view in terms of biodiversity offsets and (sub)regional planning. In addition, the expectations and desires of local stakeholders should provide important inputs for rehabilitation and post-closure land-use planning and will often influence the level of biodiversity elements (especially biodiversity enhancement) that can be built into such plans. This will, in turn, have some bearing on the institutional arrangements that might be required to achieve positive biodiversity outcomes.

Levels of biodiversity management

Based on a site's biodiversity risk level, there are three levels of biodiversity management that can occur during the operational phase: high, medium and minimum. Each of these levels requires progressively higher biodiversity-related efforts into the Rehabilitation Plans or, in cases of high biodiversity importance, the development of a standalone BAP (see Box 7).

The level of biodiversity management needed for a particular site will depend on the risk of the operation to biodiversity. As shown in Table 6, this is not just a matter of associating each level of biodiversity risk with a certain biodiversity management level. Rather, the determination should be based on a combination of both the potential risk and the biodiversity importance of the site.

Box 7 – Levels of biodiversity management

High biodiversity input: separate Biodiversity Action Plan (BAP)

- Specific positive biodiversity targets
- Re-vegetation using only native species
- Active control of invasive alien species
- Long-term post-closure management for biodiversity-related land use
- Active monitoring of target attainment
- Ultimate land use for conservation (taking into account land-use patterns in the broader landscape) or for natural resource use/biodiversity (forestry, grazing, etc.)

Medium biodiversity input: Rehabilitation Plan with biodiversity targets

- May include biodiversity targets (together with targets for other forms of land use)
- Re-vegetation using only native species
- Active control of invasive alien species
- No biodiversity monitoring (except presence/absence of invasive alien species)
- Ultimate land use based on a natural resource base/biodiversity (forestry, grazing, etc.) with due cognizance of the land-use patterns in the broader landscape

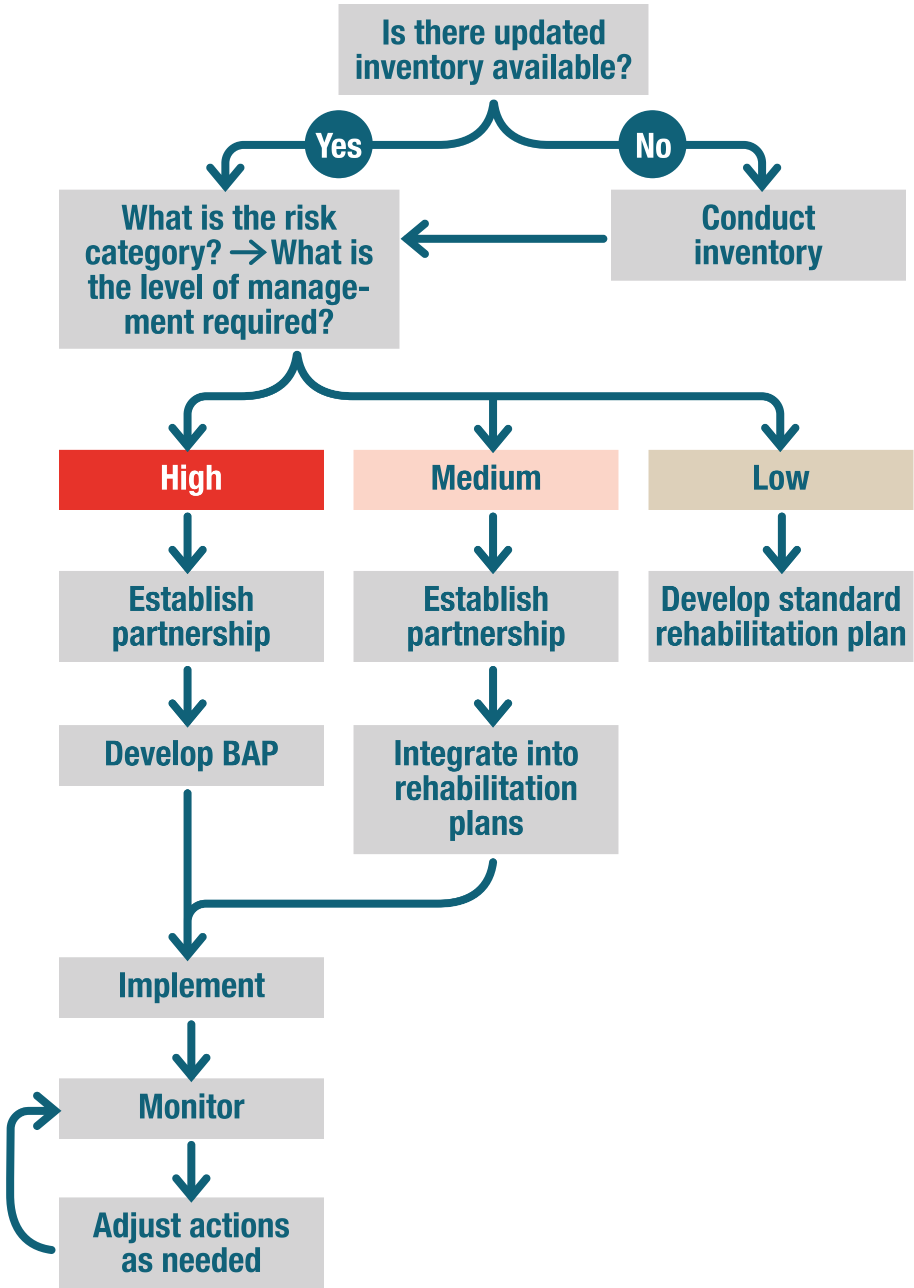
Minimum biodiversity input: standard Rehabilitation Plan

- Re-vegetation using non-invasive alien species or native species
- Active control of invasive alien species
- No biodiversity monitoring
- Ultimate land use not primarily geared at biodiversity or depending on biodiversity (e.g. residential/industrial)

Table 6 – Biodiversity management levels

		Biodiversity Impact Levels (from Box 4)			
		A	B	C	D
Biodiversity Importance Category (from Box 4)	1A	High: BAP	High: BAP	High: BAP	Med./High
	1B	High: BAP	High: BAP	High: BAP	Medium
	2	High: BAP	High: BAP	High: BAP	Medium
	3	Med./High	Med./High	Min./Med.	Min./Med.
	4	Minimum	Minimum	Minimum	Minimum

Figure 4 – Application of IBMS flow diagram



The decision tree in Figure 4 can assist with translating Table 6 into practice and determining when and how to incorporate biodiversity considerations into site management at both greenfield and dormant and closed sites. Greenfield developments offer a unique opportunity to apply the IBMS recommendations systematically right from the early planning phases onwards, while dormant and closed sites offer some of the best opportunities for initiating biodiversity enhancement measures.

Decision making should be based on the highest biodiversity values at the site, even if they are present in only a small portion of the area, and based on the risks that the extraction operations pose to these values. For example, a BAP may be required for a small but important part of the site, whilst the remainder of the site may be rehabilitated with virtually no biodiversity considerations. At existing active sites, it is likely that a formal biodiversity importance categorisation may not yet have been conducted. To operationalise biodiversity management practices, it is important to conduct these assessments so that the appropriate level of required biodiversity input into existing Rehabilitation Plans can be determined.

Biodiversity Action Plans

Purpose

The Biodiversity Action Plan (BAP) represents the highest level of biodiversity management for an active extraction site. Whereas every extraction site must have a Rehabilitation Plan, the development of a complementary BAP is recommended for those sites of high biodiversity importance (category 1 and 2) that may potentially experience medium-to-critical levels of impacts on biodiversity (see Biodiversity Risk Matrix, Box 4). The general purpose of a BAP is to enable the site management to maintain or improve biodiversity values during the operational and post-closure phases of the project.

A BAP normally serves two major purposes:

- mitigating biodiversity loss, with the objective of maintaining the diversity of species, habitats and ecosystems and the integrity of ecological functions; and
- seizing opportunities for enhancing biodiversity as a contribution towards the remediation of significant global, regional and local biodiversity losses caused by expanding human economic activities worldwide.

Whilst the former is increasingly mandatory and regulated by permitting conditions, the latter is still largely voluntary, but encompasses the potential to demonstrate a commitment towards environmental issues. The cement and aggregate industry has already pioneered many success stories around the world, especially in relation to the restoration of highly diverse habitats in alluvial flood plains where, through active management, species diversity has been greatly enhanced.

Setting biodiversity targets

Biodiversity mitigation and enhancement measures of a BAP should be based on defined objectives and measurable targets. The choice of targets for specific biodiversity outcomes is usually more difficult than the determination of commercial or extraction targets for a quarrying site, and probably more complex than targets for the social activities around a site. The effects of management actions may have time delays of many years, and there may be many uncontrollable external factors at play that could greatly influence the outcome of biodiversity management. These targets should therefore be set in collaboration with experts and partners, taking into account the risk classification and the surrounding areas, and including monitoring and adaptive management procedures.

BAPs, required for sites of high biodiversity importance, will in most cases give priority to biodiversity-led targets, with other forms of land use being subsidiary considerations. In contrast, primary objectives in rehabilitation plans may relate to non-biodiversity values.

The following key principles can help ensure the attainment of identified biodiversity objectives and outcomes:

- biodiversity targets (see Box 8) should relate to national or other level BAPs that might cover the area;
- the principal actions required to attain each of the targets should be defined;
- the outcome of these actions should be monitored;
- management actions should be adapted based on the monitoring results;
- the long-term sustainability of the biodiversity management should be ensured through appropriate partnerships and resourcing; and
- the BAP should be aligned with the site's Rehabilitation Plan.

BAPs also result in various direct or indirect social outcomes, including promotion of sustainable socio-economic activities and outcomes related to biodiversity management, promotion of educational and research opportunities, and active involvement of local volunteer groups.

Approach

Compilation of a BAP generally takes six months to a year, depending on the size of the area, type of ecosystem, quality of available information, number and interests of stakeholders, regional setting, regulatory framework, and capacity and level of interest of regulatory authorities. Although a BAP concerns a single site, it should take into account the wider landscape and conservation context, as these determine the biodiversity targets of the plan (thus including buffer zone and potential corridors for connectivity).

Box 8 – Target types for biodiversity action plans

Targets for habitats

- Maintaining extent – no reduction in the area of BAP habitat;
- Achieving condition – maintain and/or improve the condition of the existing BAP habitat;
- Restoration – improve the condition of relict or degraded habitat; and
- Expansion – increase the extent of BAP habitat.

Targets for species

- Range – maintain or increase range compared to range in reference year or at start of monitoring; and
- Population size – maintain or increase population size compared to level in reference year or at start of monitoring.

Targets for processes and flux

- Variation – maintain current variation in, for example, fire return periods (avoid homogenisation through too rigorous management).

Source: Peak District National Park Authority. 2010. A living landscape: Peak District Biodiversity Action Plan Review 2001 - 2010. Available at: http://www.peakdistrict.gov.uk/__data/assets/pdf_file/0003/90867/bapreview2001-10.pdf

BAPs should be developed to complement other, existing management plans and tools. For example, since BAPs are complementary to Rehabilitation Plans, they must be formulated in such a way as to accommodate progressive rehabilitation and legal requirements. A site-specific BAP should be hierarchically linked to higher-order (e.g. regional or national) BAPs, if available, so that it may contribute to the targets of a BAP at a larger spatial level and/or higher-order system level. In addition, BAPs should be integrated with all of the other types of environmental management plans that might already exist for the site.

The BAP should include an appropriate monitoring programme, based on accepted ecological monitoring standards that can be used to assess progress towards the stated biodiversity targets and outcomes. The monitoring programme should also allow for adjustments in biodiversity management activities. Stakeholder engagement, for example liaison with regulatory authorities and regular interactions with local communities (Community Advisory Groups), is also an important part of the development and implementation of a BAP.

Biodiversity in Rehabilitation Plans

All active extraction sites and greenfield sites where extraction plans have been completed should have a Rehabilitation Plan. In most countries, this would already be a regulatory requirement and a condition linked to extraction permits. Depending on the risk classification for the site, the rehabilitation plan will include a higher or lower level of biodiversity management.

Purpose

The general purpose of a Rehabilitation Plan is to satisfy regulatory and community requirements for the rehabilitation of the impacted part of the site. From a biodiversity perspective, such plans need to ensure that biodiversity conservation considerations are included and in line with the biodiversity importance and potential of the site.

Social dimensions often determine the objective and design for the Rehabilitation Plan. For example, direct local employment opportunities in the rehabilitation actions and restoration and improvement of ecosystem services (water, dust control, aesthetic setting etc.) may be priorities in the plan. In addition, the plan may call for a return to a previous form of land use or creation of new land-use opportunities, such as farming, fishing, forestry, hunting, recreation or ecotourism.

Rehabilitation requirements

In general, a Rehabilitation Plan will:

- identify and take into account regulatory requirements;
- establish appropriate and desired post-closure land-use and management options, in consultation with stakeholders;
- set biodiversity- and/or community-led rehabilitation targets;
- include minimum levels of biodiversity input (in those cases where a BAP is not required);
- identify opportunities for biodiversity gains (in those cases where a BAP is in existence or is required);
- define progressive rehabilitation steps and set them out in time and space; and
- ensure long-term sustainability of the rehabilitation actions in terms of the desired outcomes.

Rehabilitation Plans, whilst addressing a variety of potential risks (e.g. in relation to safety and the geological stability of the site), also have a strong focus on opportunities, such as the creation of an area providing some kind of economic or recreational benefit to local communities. In relation to biodiversity, the same dual approach of management of potential risks (e.g. the invasion of alien plant species that could inhibit the restoration of a valuable local habitat) and the seizing of opportunities for biodiversity enhancement should be followed.

Since the rehabilitation of a site might stretch over long periods of time, flexible and adaptive management approaches will allow the company to respond to concerns of stakeholders, legal requirements and external environmental factors that might change over time.

Approach

Whilst the Rehabilitation Plan generally focuses on those parts of a site that have been exploited, it may relate to other parts of the site as well, especially when a biodiversity component is involved. For example, the control of invasive species might have to cover the entire site in order to be successful.

Ideally, rehabilitation is an on-going process throughout the lifecycle of a site, beginning at the time of the initial site preparation (e.g. topsoil and seed bank storage, translocation of rare species, etc.) and progressing steadily throughout the operational cycle of the site. Rehabilitation usually intensifies towards the final rehabilitation at closure and should be maintained after closure through aftercare for as long as might have been mandated by local authorities or agreed to in partnership arrangements.

There are a wide variety of techniques and methods available for rehabilitation, but no matter what approach is taken, the restoration and conservation work should be progressively implemented and should work with nature, rather than against it, by capitalising on natural processes, locally available species and local adaptation. Where legally allowed, rehabilitation should rely as much as possible on natural plant re-establishment and re-vegetation, aiming for aesthetic/functional landforms, particularly in response to stakeholder expectations and concerns.

When a BAP exists, the Rehabilitation Plan should be closely linked with BAP recommendations and to BAP monitoring results; rehabilitation activities should ensure that BAP provisions can also be realised, and BAP monitoring results should feed back into the rehabilitation process in order to eventually modify the techniques used. Finally, there should be follow-up to ensure long-term success of rehabilitation achievements (e.g. mid-to-long-term alien invasive plant control).

Stakeholder engagement is also an important part of the development and implementation of a Rehabilitation Plan, and should include liaison with the regulatory authorities as well as with local stakeholders (particularly in terms of desired post-closure land-use options and BAP targets).

Since rehabilitation is likely to be an on-going concern for many companies in the sector, some management structures and processes may already be in place to deal with biodiversity management. Management considerations include:

- **Quality control**: Whilst rehabilitation management is supervised and directed by local staff, some form of independent quality control should be allowed for – at national, company or headquarters level, if necessary with the support of outside expertise;

- **Monitoring**: To give credibility to biodiversity-related rehabilitation targets (and justify possible special investments), an effective monitoring process is needed;
- **Technical implementation**: For many tasks, specialised service providers can be appointed with great success, as long as company supervision and monitoring is of a high standard;
- **Training**: Company staff, as well as those from external service providers, must be trained and skilled to incorporate biodiversity aspects into classic restoration activities; and
- **Finances**: The operational budget must be sufficient to allow effective rehabilitation and, in particular, to fund the after-care of the already rehabilitated areas.

Information needs

If the Rehabilitation Plan is a result of the normal planning sequence, the background information needed for the development of its biodiversity component should mostly have been collected during the ESIA; in fact, the general objectives and possible specific biodiversity targets should already have been identified as well.

However, there may be situations when a Rehabilitation Plan has to be developed in the absence of results of earlier investigations. In such cases, new data will have to be collected from the site and the surrounding area on local terrestrial, freshwater or marine habitat and species; individual critical species and habitats in relation to set targets and objectives; and local ecological systems (e.g. site moisture regime, seed bank dynamics, pioneer species, invasive potential, etc.). Finally, in order to allow an adaptive management approach to rehabilitation, it is important that past and on-going rehabilitation actions are properly documented and evaluated.

Differentiating between Rehabilitation Plans and Biodiversity Action Plans

Nearly every country has a legal requirement for quarrying operations to develop formal Rehabilitation Plans for the area after resource extraction has ceased. In large and long-term operations, rehabilitation is an on-going management process, with exhausted parts of the quarry being rehabilitated whilst active extraction operations are moved to other parts. Rehabilitation Plans are also promoted as a good management practice, irrespective of regulatory requirements, by industry bodies such as the Cement Sustainability Initiative of the WBCSD and the ICMM (see references to ICMM and CSI guidance in Chapter 8). Rehabilitation Plans usually have the following main objectives:

- to reintegrate the exhausted parts of the quarry into the landscape;
- to make the site safe and stable for future land use;
- to return land to a beneficial post-quarrying use, balancing environmental, social and economic factors; and
- to ensure that after quarry closure, there are no adverse long-term environmental, social and economic impacts.

In contrast to legally required Rehabilitation Plans, a Biodiversity Action Plan is still largely voluntary, although this tool is likewise being advocated as an expression of good land stewardship for sites of generally high biodiversity importance or harbouring species, habitats or ecosystems of high conservation concern. The BAP serves as a supplement to, not a replacement of, the Rehabilitation Plan.

Given its legal and regulatory origin, the Rehabilitation Plan is the first place to begin institutionalising biodiversity management in the operational phase. Depending on the biodiversity importance, local requirements and circumstances, various levels of biodiversity inputs into Rehabilitation Plans should be integrated into an IBMS, from adherence to certain minimum standards everywhere to the completion of a full BAP that stands alongside, but is interconnected with, the Rehabilitation Plan. Table 7 summarises the characteristics of Rehabilitation Plans and Biodiversity Action Plans.

Table 7 – Key characteristics of Rehabilitation Plans and BAPs

	Rehabilitation Plan	Biodiversity Action Plan
Legal requirement	Generally required as part of permit conditions	Mostly voluntary, but more and more becoming a required part of the permitting process
Biodiversity focus	Often secondary focus	By definition primary focus
Targets for end land use	Can be different from original land use, based on practical considerations and/or community demands	Can be different from original land use, primarily based on biodiversity preferences, but may be influenced by community demands and practical considerations
Target(s) for end site condition(s)	Target(s) set locally	Determined by national or regional biodiversity target(s)
Site area concerned	Mostly extraction areas, as well as stockpiling, service and transport areas	Covering whole site (extraction sites and non-disturbed areas alike)
Earthworks and landscaping	Extensive, but limited by legal requirements	Limited, but may need to exceed legal rehabilitation requirements in order to achieve a meaningful biodiversity outcome
Angle of repose	May be preferred from a financial perspective	May not be acceptable as a habitat for indigenous species
Level of intervention	Mostly active. Although a laissez-faire approach may be appropriate for certain restoration purposes, this will be mostly limited by legal and permit conditions	Active or passive. Laissez-faire with protection (relying on the passage of time to achieve a certain outcome) is often an acceptable and cost-effective strategy
Vegetation	Choice of species based on growth potential and functional role (soil binding, erosion control, etc.). Non-invasive alien plant species may be preferred	Choice of species based on local occurrence and their function in habitat creation for other plant species and indigenous fauna. Alien species are to be avoided
Fauna	Mostly of secondary importance	Often of primary importance, depending on biodiversity target(s)
Visual/aesthetic connection to the surrounding landscape	Often highly prized by the local community (in terms of obtaining a visually compatible land form)	Mostly secondary to biodiversity considerations
Biological connectivity to surrounding landscape	Often of limited importance and/or significance	Mostly highly significant in terms of target attainment and/or avoidance of threats
Social aspects	Mostly linked to restoring previous land use and/or aesthetics	Aesthetics, heritage, environmental education
Ecosystem services	Mostly aimed at restoring/replacing previous services to users/ecosystems outside the project area (provisioning, regulating and cultural services, as defined by the Millennium Ecosystem Assessment)	Mostly focused on ecosystem support (internal) (according to the Millennium Ecosystem Assessment terminology)
Recreational demands and opportunities	Open-air activities. Limited by threats to restoration outcomes (stability, erosion, etc.)	Access to nature, environmental education. Limited by disturbance to native fauna and flora
Expertise required	Geo-engineering, restoration ecology	Biodiversity, population ecology, restoration ecology
Implementers	Quarry management, sub-contractors	Service providers, NGOs, volunteers, quarry management
Monitoring	Focused on structural and cover elements of vegetation	Focused on habitat, fauna and flora diversity
Time horizon	Short- to mid-term (with specific end date)	Long-term (in perpetuity)

Whether the biodiversity management during the operational phase is based on a Rehabilitation Plan or a full BAP, it is essential for this work to be guided by clear objectives and measurable targets towards the attainment of these objectives. These targets will form the basis of the monitoring programme.

Usually, objectives and targets will have to balance interests and aspirations of local communities, regulatory requirements and biodiversity considerations. In such situations, it is difficult to fully satisfy all requirements, and a hierarchical grouping of targets will be required, based on the biodiversity importance category of a site (see Box 4). For category 1 and 2 sites, targets defined through biodiversity conservation needs and opportunities (which must also take into account predicted environmental changes due to external factors) should be the primary ones, with other targets (e.g. interest of local communities) to be optimised next. For category 3 and 4 sites, targets defined through local communities or other stakeholders should provide the primary guidance. These targets might be recreational or other forms of land use, but could also be conservation-oriented targets if the local community has such interests. Targets will also be influenced by the intensity of biodiversity management that is required, or can be afforded, and the legal and practical realities of the region.

Monitoring and Evaluation

If biodiversity management is to be integrated into planning and operational processes effectively, it needs to be supported by a credible Monitoring and Evaluation (M&E) programme, such as those that are routinely undertaken for other aspects of business performance, including output of products, economic performance, health and safety or pollution control.

This section provides the rationale for M&E as well as some general considerations to have in developing an M&E programme (see Box 9). It also helps determine the aim of a monitoring programme and outlines some initial steps to putting this in place.

General Considerations

The key challenge for the design and the implementation of an M&E programme is finding a balance between what is practicable by a business and what is meaningful from a biodiversity conservation point of view. For the initial biodiversity inventories, which are mostly done in conjunction with ESIAs or the development of management plans, outside expertise will probably be used as a matter of course. However, for the subsequent monitoring, an operational process that will be repeated at regular intervals, it is important to develop a system that can be executed by company staff. In addition, the programme should provide credible information that allows the company to feel confident about the management of its biodiversity assets and about its transparent reporting on biodiversity performance.

In the end, however, any M&E system will only be as good as the amount of time and resources that are invested into it. The more a company is prepared to spend on M&E, the more weight the results will carry. Experience has shown that, in conservation, a meaningful M&E programme measuring impact (as against performance only) may account for 5-10 percent of the associated project costs (i.e. biodiversity management of a quarry operation).

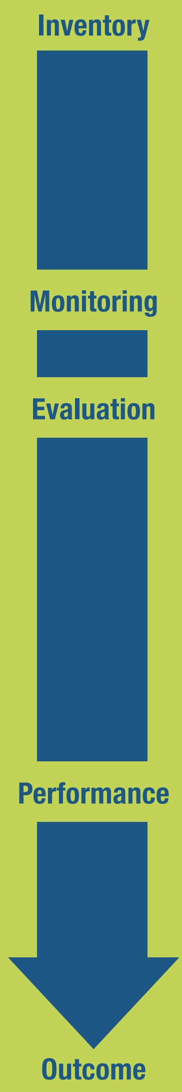
Also, since there are long time lags and a diversity of external contributing factors in biodiversity management, it could be that the M&E system will result more in the demonstration of trends, rather than direct linkages between management measure and changes in biodiversity. Whilst this may mean that the information value of M&E results for individual sites is limited, on a higher (e.g. country) level, the cumulative results might provide a good indicator for the overall outcome of biodiversity management.

Purpose of biodiversity monitoring

Prior to initiating M&E activities, it is essential to determine the company's objectives for monitoring. To be successful, an M&E programme needs to be designed as a function of these objectives. There are generally four basic objectives to a biodiversity monitoring system, each of which is dependent on the results of the previous objective:

- monitor relative changes in biodiversity (status, distribution and composition of species, quality and distribution of habitats and ecosystems);
- assess the effect of mineral resource extraction on biodiversity;

Box 9 – Rationale for monitoring & evaluation



1. **Recording biodiversity:** *Do you know the biodiversity of the site for which you are responsible?*
   - Do you know the biodiversity importance category?
   - Do you have an inventory of key ecosystems, habitats and species?
   - Do you know how the critical species are using the area?
2. **Monitoring biodiversity:** *Do you know if biodiversity is changing while you are operating the site?*
3. **Evaluating biodiversity change:** *Do you know why it is changing?*
   - Is this due to:
     - your own activities;
     - activities of others;
     - general environmental changes of the surrounding area; or
     - a combination of the above?
   - Do you have to adapt mitigation measures?
   - Are there opportunities for doing more and creating biodiversity gains?
4. **Reporting on biodiversity performance:** *How successful is your biodiversity management?*
   - On site?
   - In your country?
   - For the entire company?
5. **Reporting on biodiversity outcomes:** *What impact does your management have on the status of biodiversity?*

- evaluate the effectiveness of biodiversity management measures on performance and outcome levels (against chosen indicators or targets); and
- provide information for reporting on biodiversity management performance and outcomes.

There are also some basic preconditions without which monitoring programmes do not make sense. For monitoring impacts on biodiversity, baseline information on the status of biodiversity before activities began is required. This is one of the important functions of biodiversity inventories (e.g. in conjunction with ESIAs). If this information has not been collected as part of previous investigations, or is likely not to be up-to-date anymore, baseline information must be collected before the onset of activities whose impact one would like to monitor. In addition, for measuring effectiveness of biodiversity management, targets must have been set against which progress can be assessed.

Biodiversity indicators

The choice of indicators is a critically important step in the design of a monitoring programme. Indicators determine the relevance, as well as the practicality of the monitoring scheme. In order to meet the requirements of practicality, indicators should be:

- meaningful, but relatively straightforward to measure;
- measurable by means of a standardised methodology;
- assessable by non-experts (e.g. environment staff), although support from a collaborating NGO or expert would be required;
- designed in such a way that they can be expressed by means of a numerical value or another form of standardised classification (so that progress can be tracked easily from year to year); and
- reported as part of an annual reporting process that might already be in place.

The Biodiversity Indicator and Reporting System (see Box 10), outlines an M&E methodology for cement and aggregates companies, giving them an overview of performance in relation to biodiversity.

Indicators should also be identified for the monitoring of biodiversity management targets as part of the M&E provisions that should be included in every BAP and Rehabilitation Plan. In contrast to those designed with practicality in mind, these will be more specific and more scientifically rigorous, and thus their monitoring will require a higher level of expertise. However, it is assumed that for the implementation of a BAP or of a Rehabilitation Plan with significant biodiversity targets, some form of external support by one or more experts or a partner NGO will normally be available anyway.

Box 10 – The Biodiversity Indicator and Reporting System (BIRS)

BIRS is designed as an easy-to-apply system for annually assessing, by means of an index, the biodiversity suitability of every active or disused extraction site or reserve landholding, taking into account the following factors:

- extent of every habitat type found on a site (including operational and rehabilitation areas);
- ecological condition of these habitats, i.e. their suitability for biodiversity; and
- uniqueness and ecological importance of every habitat found on a site in the regional context.

It is reported as a Site Biodiversity Condition Class on a scale of 1-10.

BIRS reporting can be viewed as a balance sheet of the natural capital of a site, summarising the composite value of the landholdings for supporting biodiversity. Whilst habitat extent provides the quantity of each asset item of the balance sheet, habitat condition represents the quality of each item. Uniqueness and ecological importance place the habitat extent and quality in a wider context by looking at the surrounding area of a site.

An increase in the calculated index value from one assessment to the next would show an overall enhancement of the suitability of a site for biodiversity, while a decrease of the index would signal a lowering of the site's value for biodiversity.

All site indices of a selected region or country can be aggregated into an overall regional/national index that can be aggregated again on a global level – indicating if the overall biodiversity in the landholdings over which a company has management control has generally gone up or down. Therefore, BIRS allows a company to track whether the suitability of its land holdings for biodiversity is increasing or decreasing.

Source: IUCN. 2014. Biodiversity management in the cement and aggregates sector: Biodiversity Indicator and Reporting System (BIRS). Gland, Switzerland: IUCN. Available at: www.iucn.org/cementandaggregates

7 Rolling out the IBMS

Rolling out an IBMS is likely to require a phased approach: Starting with the development and adaptations of policies, guidelines and handbooks, as well as the creation of structures and processes for implementing the system, continuing with the general operationalisation of the system through its introduction as part of normal operational processes with an initial focus on ensuring that site(s) are correctly classified according to the biodiversity risk matrix and finally followed by the retrofitting to existing sites and especially collecting missing data and developing BAPs where required.

The timing of these steps and their activities can be devised in a flexible manner and has to be determined dependent on other business priorities, available resources and capacities. To assist in a phased approach, the following general priorities are suggested:

- **Priority 1:** Sites under planning application, sites approaching closure, any site of biodiversity importance category 1 and 2.
- **Priority 2:** Sites of biodiversity importance category 3, closed sites with ongoing obligations and responsibilities.
- **Priority 3:** Sites of biodiversity importance category 4, dormant sites.

The introduction of an IBMS into a company's operations will have management implications that will vary based on the precise nature of each company, including the size, the legal structure, the location of operations and type of raw materials extracted and processed. The following general requirements will support the successful implementation of such a system:

Commitment from the top: A high-level company-wide target, such as aiming for "no net biodiversity loss" could be one way of bringing biodiversity issues internally into the foreground, though it would need to be accompanied by an internal and external communication strategy;

Inclusion of biodiversity in existing policies and guidelines: Biodiversity concerns should be introduced by amending existing planning instruments rather than through the development of new ones;

Development of company-specific operational handbooks: A toolkit for implementation should be developed with information and guidance for operational staff. The contents will vary and should emulate the company's existing tools;

Creation of fit-for-purpose management structures and processes: This will vary from company to company but should consider the development systems for support and quality control (including acquiring biodiversity expertise);

Establishment of a centrally located biodiversity database: Basic level biodiversity information should be integrated into a global biodiversity database maintained at the company level;

Building internal skills through awareness-raising and training, particularly on:

- biodiversity conservation issues related to extraction operations;
- assessing the quality of biodiversity information, studies and recommendations;
- carrying out and supervising biodiversity management activities on the ground;
- interpreting monitoring results; and
- measuring and reporting on biodiversity KPIs.

Securing early buy-in from operational staff: The success of the IBMS ultimately rests on its effective implementation on the ground. Operational staff are therefore key to successful implementation. This will require capacity-building and awareness-raising in the operations, as well as buy-in from operational staff on the concept of biodiversity management (in a similar fashion as this has occurred for health and safety);

Seeking external expertise and fostering partnerships for specialised tasks such as:

- high-level advice on biodiversity conservation and policy questions;
- biodiversity input into initial scoping/investigations, ESIAs and inventories;
- plans for biodiversity management; and
- biodiversity monitoring and analysis of results;

Allocation of financial resources: Implementation of an IBMS will require appropriate allocation of human and financial resources. It is important to consider set up costs included in this list as well as costs associated with implementation of biodiversity management activities, e.g. biodiversity inventories, BAPs, etc.

Implementing an IBMS will take time and should be approached as a long-term investment. Companies willing to invest will reap the increasing benefits associated to responsible natural resource stewardship. Improved biodiversity management will not only maintain a company's social license to operate but also ensure that companies stay ahead of the curve with regards to new and more stringent regulations.

8 Further reading

This section provides a variety of references for further reading, including guidelines and guidance documents from the industry and beyond as well as industry-specific case studies. It is not meant to be an exhaustive list, but rather presents an overview of available guidance.

Biodiversity Information

Biodiversity for business: A guide to using knowledge products delivered through IUCN: https://portals.iucn.org/library/node/43361

The IUCN Red List of Threatened Species: www.iucnredlist.org

Protected Planet: www.protectedplanet.net

IUCN Red List of Ecosystems: www.iucnredlistofecosystems.org

The Integrated Biodiversity Assessment Tool (IBAT): www.ibatforbusiness.org

Cement and aggregates industry associations

Cement Sustainability Initiative (CSI): www.wbcsdcement.org

CEMBUREAU, the European Cement Association: www.cembureau.eu

UEPG, the European Aggregates Association: www.uepg.eu

Federacion Interamericana del Cemento (FICEM): www.ficem.org

Biodiversity-relevant guidance from extractive industry associations

Cement Sustainability Initiative (CSI)

Guidelines on Quarry Rehabilitation, 2011. http://www.wbcsdcement.org/pdf/CSI%20Guidelines%20on%20Quarry%20Rehabilitation%20(English)_Dec%202011.pdf

Environmental and social impact assessment (ESIA) guidelines, 2005. http://www.wbcsdcement.org/pdf/cement_esia_guidelines.pdf

Communication and Stakeholder Involvement: Guidebook for Cement Facilities, 2002. http://www.wbcsd.org/web/projects/cement/tf6/stakeholder_guide.pdf

International Council on Mining and Metals (ICMM)

Good Practice Guidance for Mining and Biodiversity. International Council on Mining and Metals (ICMM). 2006. http://www.icmm.com/document/13

Planning for integrated mine closure: Toolkit. International Council on Mining and Metals (ICMM). 2008. http://www.icmm.com/document/310

Independent report on biodiversity offsets. International Council on Mining and Metals (ICMM) and the International Union for Conservation of Nature (IUCN). 2013. http://www.icmm.com/document/4934

IPIECA, the global oil and gas industry association for environmental and social issues

A guide to developing biodiversity action plans for the oil and gas sectors. 2005. http://www.ipieca.org/publication/guide-developing-biodiversity-action-plans-oil-and-gas-sector

Euromines

Natura 2000: A Guide to the Guide - Industry Commentary to the European Commission Guidance on Non-energy mineral extraction and Natura 2000. 2011. http://www.euromines.org/sites/default/files/publications/natura-2000-guide-guide.pdf

Europgypsum

Biodiversity Stewardship in Gypsum Quarrying: our Best Practices. 2010. http://www.eurogypsum.org/_Uploads/dbsAttachedFiles/EUROGYPSUMBIODIVERSITYEN.pdf

Other relevant resources and websites

Resources

101 things to do with a hole in the ground. Georgina Pearman. Post-Mining Alliance. 2009.

Biodiversity Indicator and Reporting System (BIRS). IUCN. 2014. www.iucn.org/cementandaggregates

Biodiversity and extraction in limestone areas. Joint Briefing Paper. Birdlife, FFI, IUCN, WWF. 2014.

Interactive database containing a collection of case studies from the European cement industry: http://www.cembureau.eu/topics/biodiversity/case-studies/list/%20/

Websites

International Association for Impact Assessment (IAIA): www.iaia.org

Business and Biodiversity Offsets Programme (BBOP): bbop.forest-trends.org

Global Reporting Initiative: www.globalreporting.org

The Economics of Ecosystems and Biodiversity (TEEB): www.teebweb.org

World Business Council for Sustainable Development (WBCSD): www.wbcsd.org

List of abbreviations

BAC	Biodiversity Advisory Committee
BAP	Biodiversity Action Plan
BBOP	Business and Biodiversity Offsets Programme
BES	Biodiversity and Ecosystem Services
BIC	Biodiversity Importance Category
CBD	United Nations Convention on Biological Diversity
CSD	Corporate Sustainable Development
CSI	Cement Sustainability Initiative of the WBCSD
CSR	Corporate Social Responsibility
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
GIS	Global Information System
GRI	Global Reporting Initiative
IBAT	Integrated Biodiversity Assessment Tool
IBMS	Integrated Biodiversity Management System
IBRD	International Bank for Reconstruction and Development
ICMM	International Council on Mining and Metals
IFC	International Finance Corporation
IPIECA	International Petroleum Industry Environmental Conservation Association
IUCN	International Union for the Conservation of Nature
KBA	Key Biodiversity Areas
KPI	Key Performance Indicator
M&E	Monitoring and Evaluation
NBSAP	National Biodiversity Strategy and Action Plan
NGO	Nongovernmental organisation
NNL	No net loss (of biodiversity)
NPI	Net positive impact (on biodiversity)
PA	Protected Area
PRA	Participatory Rural Appraisal
RLE	Red List of Ecosystems
TEEB	The Economics of Ecosystems & Biodiversity
ToR	Terms of Reference
UNEP	United Nations Environment Programme
WBCSD	World Business Council for Sustainable Development
WCMC	World Conservation Monitoring Centre (UNEP)
WDPA	World Database on Protected Areas

Glossary of terms

Biodiversity action plan: A mechanism by which the objectives and targets for biodiversity conservation can be achieved. BAPs can either be stand-alone or be incorporated into the EMS. Numerous specific elements may be covered in a BAP.

Biodiversity conservation: The management of human interactions with genes, species and ecosystems so as to provide the maximum benefit to the present generation while maintaining their potential to meet the needs and aspirations of future generations; encompasses elements of saving, studying and using biodiversity (Convention on Biological Diversity).

Biodiversity enhancement: Measures undertaken to enhance or improve biodiversity, going beyond mitigation or rehabilitation to explore opportunities to enhance the conservation of biodiversity.

Biodiversity offsets: Measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development, after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss, and preferably a net gain, of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people's use and cultural values associated with biodiversity.

Biodiversity outcome indicators: Indicators used to measure progress towards a targeted goal.

Biodiversity risk matrix: A tool for assessing the risk to biodiversity of a new development or of an ongoing quarrying operation. The matrix has the biodiversity importance category of a site on the y-axis and the level of likely impact on biodiversity by the anticipated activities on the x-axis.

Compensation: Generally, a recompense for some loss or service and something which constitutes an equivalent to make good the lack or variation of something else. Compensation can involve something (such as money) given or received as payment or reparation (as for a service or loss or injury). Specifically, in terms of biodiversity, compensation involves measures to restore, create, enhance or avoid loss or degradation of a community type, in order to compensate for residual impacts on it and/or its associated species.

Critical habitats: Areas with high biodiversity value, including (i) habitats of significant importance to critically endangered and/or endangered species; (ii) habitats of significant importance to endemic and/or restricted-range species; (iii) habitats supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.

Ecosystem: A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

Ecosystem approach: A strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way.

Ecosystem services: Beneficial functions that are performed by natural ecosystems, such as maintenance of hydrological systems, protection of the soil, breakdown of pollutants, recycling of wastes, support for economically important living resources and regulation of climate.

Environmental and social impact assessment (ESIA): The process of identifying, estimating and evaluating the environmental and social consequences of current or proposed actions.

Environmental impact assessment (EIA): A process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse.

Environmental management plan (EMP): A document that defines responsibilities, budgets and any necessary training for environmental monitoring and impact management, and describes how results will be reported and to whom. The EMP can be a separate document, but is considered part of the environmental impact statement. An EMP usually is required in order to obtain permission to implement a project. In a number of countries, an EMP is not a legal requirement.

Environmental management system (EMS): A system that provides a framework for monitoring and reporting on an organization's environmental performance. This typically involves organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy.

Free, prior and informed consent (FPIC): The principle that a community has the right to give or withhold its consent to proposed projects that may affect the lands they customarily own, occupy or otherwise use.

Habitat: The physical and biological environment on which a given species depends for its survival; the place or type of site where an organism or population naturally occurs.

Integrated Biodiversity Management System: A system that includes steps and recommendations for biodiversity management activities at each phase in the life cycle of a development, from planning through operations and eventual closure.

Invasive species: Species that are introduced—intentionally or unintentionally—to an ecosystem in which they do not naturally appear and which threaten habitats, ecosystems or native species. These species become invasive due to their high reproduction rates and by competing with and displacing native species that naturally appear in that ecosystem. Unintentional introduction can be the result of accidents (e.g. when species escape from a zoo) or transport (e.g. in the ballast water of a ship), while intentional introduction can be the result of importing animals or plants or the genetic modification of organisms (Convention on Biological Diversity).

Key biodiversity areas: Nationally identified sites of global significance. The identification of KBAs is an important approach to address biodiversity conservation at the site scale, i.e. at the level of individual protected areas, concessions and land-management units. There is no maximum or minimum size of sites, because appropriate size varies according to socio-economic criteria, such as land use and tenure.

Landscape approach: A mosaic of different types of land use, such as agriculture, forests, pasture and conservation areas. Managed as a whole, a landscape serves a variety of needs for various stakeholders. The Livelihood and Landscape Strategy vision of a landscape is of multiple and complementary land uses based on negotiation rather than centralised planning. Landscapes do not exist in a vacuum, but are influenced by a wide range of external factors, including policies and economic conditions generated far outside it, land use in adjacent landscapes and perhaps remote physical features such as dams. Addressing landscape management issues always requires interventions outside as well as inside the landscape.

Mitigation: Anthropogenic intervention to reduce negative or unsustainable uses of ecosystems or to enhance sustainable practices.

Mitigation hierarchy: A hierarchy of management actions that states that (1) significant impacts should be avoided, (2) impacts that cannot be avoided should be minimised, (3) restoration measures should be taken to address any unavoidable impacts, and (4) any significant residual impacts should be offset.

Monitoring: Activities undertaken after the decision is made to adopt the plan, programme or project that are designed to examine its implementation. For example, a monitoring programme can examine whether the significant environmental effects occur as predicted or establish whether mitigation measures are implemented.

Protected area: A clearly defined geographical space that is recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.

Rapid biodiversity survey: aims to provide initial information on the biodiversity found in and around the extraction operations. This type of survey should be used in the absence of more detailed biodiversity surveys and focus on the habitat, vegetation types and key plant species.

Rehabilitation: The recovery of specific ecosystem services in a degraded ecosystem or habitat (Convention on Biological Diversity).

Restoration: The return of an ecosystem or habitat to its original community structure, natural complement of species and natural functions Convention on Biological Diversity).

Species: A group of inter-breeding organisms that seldom or never interbreed with individuals in other such groups, under natural conditions; most species are made up of subspecies or populations.

Stakeholders: Individual persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively (International Finance Corporation).

Threatened species: Species that face a high (vulnerable species), very high (endangered species), or extremely high (critically endangered species) risk of extinction in the wild.

World heritage site: Includes both cultural heritage sites and natural heritage sites. Cultural heritage sites are works of man or the combined works of nature and man, and areas including archaeological sites that are of outstanding universal value from the historical, aesthetic, ethnological or anthropological point of view. Natural heritage sites are natural sites or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty (UNESCO World Heritage Convention).

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