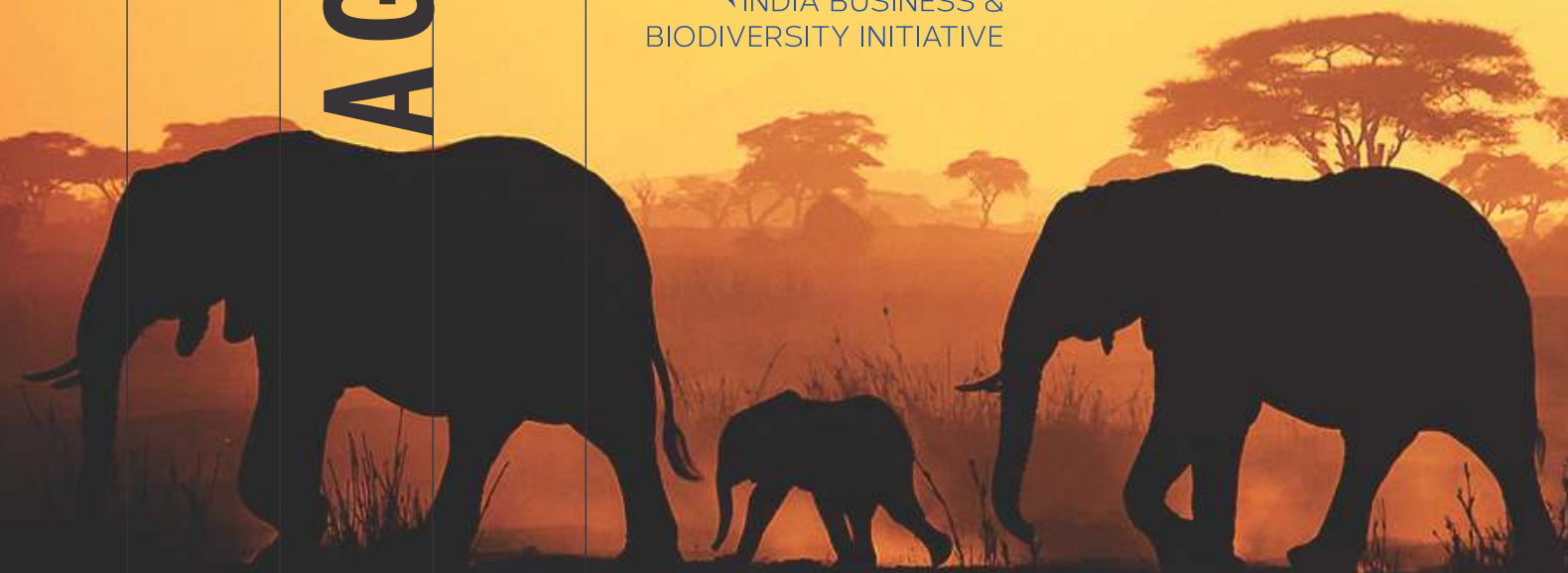


# A GUIDEBOOK FOR

## BIODIVERSITY MANAGEMENT:

### SECTOR OUTLOOK AND ROADMAP FOR IMPLEMENTATION



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सत्यमेव जयते


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## Foreword

India encompasses a wide range of ecosystems: desert, high mountains, highlands, tropical and temperate forests, swamplands, plains, grasslands, wetlands, mangroves, coral reefs, as well as island archipelago. Four biodiversity hotspots are represented in the country: the Western Ghats, the Himalayas, Indo-Burma region and Nicobar Islands. India harbors 7-8% of globally recorded species in 2.4% of the land area; many of the species are endemic. Biodiversity underpins all ecosystem goods and services that are responsible for providing food and water, buffering the impacts of climate change, controlling the outbreak of diseases and supporting nutrient cycling. Biodiversity also serves as the foundation of many spiritual, recreational and cultural benefits. It is, therefore in our interest to conserve the rich biodiversity of the country. In pursuance to the Convention on Biological Diversity (CBD), to which India is a Party, India enacted the Biological Diversity Act 2002, and notified the Rules in 2004. Though broadly aligned with the Strategic Plan for Biodiversity 2011-2020, India updated the NBAP in 2014 by including 12 National Biodiversity Targets developed in line with the global Aichi biodiversity targets in consultation with stakeholders. The National Biodiversity Targets (NBTs), by mainstreaming biodiversity across all sectors, provide an opportunity for contributing to sustainable development.

Industry is an important stakeholder in biodiversity. Towards this, the India Business and Biodiversity Initiative (IBBI) serves as a platform for dialogue, sharing and learning, ultimately mainstreaming biodiversity management into business. I express my appreciation to industry leaders who have shown public commitment towards conservation and sustainable use of biodiversity, by being part of this initiative, and encourage more companies to join IBBI and adopt practices and strategies for management of biodiversity in their operations and value chain.

I would like to congratulate CII for this initiative in bringing out this publication titled "A guidebook for biodiversity management: sectoral outlook and roadmap for implementation" which provides well-informed insights on biodiversity and its links with businesses. Apart from being a guidebook that will help industries align their work and future strategies keeping in mind biodiversity and the associated benefits, the guidebook is a knowledge resource of good business practices nationally and internationally.

  
5.7.16  
(Amita Prasad)



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## FOREWORD

We are familiar with species that share common spaces with us. We have been talking a lot of saving iconic species in many parts of world and internet, such as tiger, panda and whales. Yet most of us are hardly familiar with the magnitude of the diversity of plants and animals that live on this planet, or habitats that support them. We seldom appreciate that biodiversity provides us with ecosystem services that are our foundations for life, from farmers depending on crops, fishermen on rivers and seas to industries which depend on almost everything that nature produces.

Businesses rely on natural resources for their production processes and depend on healthy ecosystems to remove waste, and maintain soil, water and air quality. At the same time, businesses can have major negative impacts on biodiversity. While business is part of the problem, it is also part of the solution—it can offer innovative solutions to conservation. By addressing their environmental footprint, companies can open up new opportunities, respond to consumer demand for responsible products, pre-empt new regulations, and save both costs and natural resources. For organizations to remain competitive they have to identify their current and future impacts and dependencies on the biodiversity. In so doing, businesses can also identify and capitalize on key opportunities by integrating the effective and proactive management of biodiversity into their strategies and plans

India Business and Biodiversity Initiative (IBBI) was set up in 2014 with an aim to transform the way business values, manages and invests in nature, highlighting the opportunities and benefits of a more sustainable approach. India Business & Biodiversity Initiative (IBBI) was launched on 22nd May 2014 by CII-ITC Centre of Excellence for Sustainable Development (CESD) on invitation by Ministry of Environment, Forests and Climate Change (MoEFCC) and with support of German Development Cooperation through GIZ. IBBI serves as a platform for business, to promote sharing and learning, and will ultimately lead to mainstreaming sustainable management of biological diversity by business. IBBI provides knowledge products and tools to help businesses adopt practices that conserve nature and lead to sustainable use of natural resources.

It gives me enormous pleasure as a chairman to IBBI to present the publication titled “A guidebook for biodiversity management: sectoral outlook and roadmap for implementation” which provides well-informed insights on biodiversity and its links with businesses, maps seven major sectors for its impacts and dependencies on biodiversity and benchmarks best practices on biodiversity management globally in those sectors, at the end it provides a detailed and informative roadmap for implementing biodiversity management in every company. The publication promotes biodiversity, not as a problem, but as an opportunity to help decision-making processes and achieve broad social and economic goals. I am hopeful that the publication will help business identify its impacts and dependencies on biodiversity, understand ways of biodiversity management which can transform risk to opportunities and step wise approach to integrate biodiversity in business.

**R Mukundan**  
Chair of IBBI  
Managing Director, Tata Chemicals

## FOREWORD

The dedicated efforts of CII-ITC Centre of Excellence for Sustainable Development and Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, over the past two years, have supported Indian businesses to become champions of biodiversity. India Business and Biodiversity Initiative (IBBI) with its twenty six forerunner members speak for the leadership of Indian industry and have set up an encouraging example for other countries to follow. I like to congratulate IBBI for releasing this innovative guidebook for biodiversity management which would enable companies to understand the concept of 'Biodiversity and Ecosystem Services' and understand their impacts and dependencies on it.

As more companies join IBBI and honour their commitments to the ten point leadership declaration, I believe the Indian industry has already begun a proactive movement towards conservation and sustainable use of biodiversity. I would express sincere thanks to the Ministry of Environment, Forests and Climate Change and CII-ITC Centre of Excellence for Sustainable Development for hosting and supporting IBBI.

IBBI is supported by the Indo-German Biodiversity Programme under its project, 'Incentives for Sustainable Management of Biodiversity and Ecosystem Services (ISBM)', which is commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ). The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) - is a federal enterprise and supports the federal government and other clients in achieving their goals concerning international cooperation for sustainable development.



**Edgar Endrukaitis**

Director

Indo-German Biodiversity Programme





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# WHAT IS BIODIVERSITY?

Our planet is crawling, not to mention swimming and flying, with life. In a single scoop of soil from your backyard, you might just witness an impressive collection of biodiversity right from microorganisms, seeds, and spores to insects, mites, and worms. There could be thousands of species right there in your palm, and chances are that many of these still might be unknown to science, or unseen to the naked eye.

Humans share the planet with millions of other living things. All living things, including humans, are interconnected. This variety of living things on Earth is called biodiversity. Biodiversity is all of the Earth's plants, animals, ecosystems and genes. It includes the tallest tree, the smallest insect, and the most delicate coral reef ecosystem. There are three very important concepts related to biodiversity: species diversity, genetic diversity and ecosystem diversity.

The Earth is so rich with life that scientists don't even know for sure how many different kinds of organisms may exist. So far 1.3 million species have been identified worldwide (UNEP, 2016).

**1.3 MILLION  
SPECIES**  
HAVE BEEN IDENTIFIED  
WORLDWIDE





# COMPONENTS OF BIODIVERSITY

Species diversity includes all living things from the tiniest bacterium to the Royal Bengal Tiger and White Oak tree. It has been estimated that the number of species on earth is somewhere between 10 million and 300 million.

Biodiversity also includes ecosystem diversity, the habitats that house all life forms and the interconnections that bind living things together. Ecosystem diversity includes the prairies, marshes, swamps, deciduous forests and all other habitats where species live. Ecosystems not only provide habitat for species but also perform functions such as flood control and water purification.

Biodiversity includes the variety within species, which is determined by the genes. Genetic diversity makes every living thing unique. Each species is like a book of genetic information, containing billions of genetic letters that give it a particular code of life. Its traits are the result of coded messages in the genes that are passed from one generation to the next. When a species becomes extinct, all the information is lost. Genetic diversity is a safeguard against future problems, such as disease or natural disasters.

All three — genetic, species, and ecosystem diversity — are critical to understanding the interconnections that support all life on the planet.

There are many perspectives on why biodiversity is important. However, there is one message which is loud and clear, “The quality of our lives depends on it”. Biodiversity does more than provide a variety of products and resources; it also keeps the planet liveable for us and for all other species. Biodiversity helps maintain the atmosphere, keep the soil fertile, purify water, and generally keep the world running smoothly. In this section, we’ll explore the many ways biodiversity enriches our lives and why we’re so dependent on it. In the process, we’ll focus on some of the complex ecological interactions that make up life on Earth.

**10 MILLION -  
300 MILLION**  
NUMBER OF SPECIES  
ESTIMATED ON EARTH

# FACTS AND FIGURES ON INDIAN BIODIVERSITY

India is one of the mega-diverse nations in the world. It is called so because the country's gamuts of life forms are wonderfully different wherever you might be. From extreme cold to extreme heat, coastal areas to rain forests, tropical jungles to mangrove belts, the extraordinary weather and climatic conditions have created homes and habitats for numerous species of plants and animals.



**96,000+**  
SPECIES OF  
ANIMALS

**11%**  
OF PLANT  
BIODIVERSITY  
IN THE WORLD  
IS FOUND  
IN INDIA



**3092**  
SPECIES  
OF FISHES



**47,000+**  
SPECIES  
OF PLANTS



**371**  
SPECIES OF  
AMPHIBIANS



**423**  
SPECIES OF  
MAMMALS




**1234**  
SPECIES  
OF BIRDS




**530**  
SPECIES OF  
REPTILES

INDIA IS JUST  
**2%**  
OF THE WORLD  
LAND MASS BUT  
**8%**  
OF THE WORLD'S  
BIODIVERSITY  
IS FOUND IN THE  
COUNTRY.



APPROXIMATELY  
**28%**  
OF THE TOTAL  
INDIAN FLORA AND  
**33%**  
OF ANGIOSPERMS  
OCCURRING IN  
INDIA  
ARE ENDEMIC\*\*\*




## WESTERN GHATS AND THE EAST HIMALAYAN REGION

ARE THE TWO OF THE  
MAJOR BIODIVERSITY  
HOTSPOTS PRESENT  
IN INDIA



**16  
TYPES OF  
FORESTS\*\*  
ARE FOUND  
IN INDIA**

INCLUDING THE  
EVERGREEN  
TROPICAL  
RAIN FORESTS,  
DRY ALPINE SCRUB  
FORESTS, SEMI  
EVERGREEN  
RAIN FORESTS,  
DECIDUOUS  
MONSOON FORESTS,  
THORN FORESTS,  
SUBTROPICAL PINE  
FORESTS AND  
MORE.



# WHY IS THERE DIVERSITY?

Certain ecosystems around the world harbor especially large numbers of species. The most familiar of these are tropical rainforests. In Southeast Asia, the tropical rainforests are found in India, Bangladesh, Sri Lanka, Malaysia, Brunei, Indonesia, Burma and Papua New Guinea. The rainforests found in India, Bangladesh and Sri Lanka are in small patches and strips, while on the other hand, Indonesia contains one-tenth of the world's rainforest and 40% of all Asian rainforests. Other incredibly diverse ecosystems include coral reefs, large tropical lakes, and parts of the deep-ocean floor.

**IN SOUTHEAST ASIA,  
THE TROPICAL RAINFORESTS ARE FOUND IN  
INDIA, BANGLADESH, SRI LANKA,  
MALAYSIA, BRUNEI, INDONESIA,  
BURMA AND PAPUA NEW GUINEA.**

Although ecosystems with large numbers of species are important to focus on in the effort to conserve biodiversity, the number of species is just one measure of an ecosystem's importance. Another factor is the uniqueness of an area— from the types of species that live there to the physical landscapes within it. Still another factor is whether the ecosystem performs a key function, such as flood control or water purification.

The recent advances made in functional biodiversity research led to a new synthetic ecological framework, which has even been denoted as a new paradigm of ecology. While biodiversity has historically been seen as a response variable that is affected by climate, nutrient availability and

disturbance, this new emerging paradigm, called 'Biodiversity-Ecosystem Function Paradigm' (Naeem 2002), sees the environment primarily as a function of diversity, underlining the active role of the biota in governing environmental conditions. More specifically, within this framework, a specific ecosystem function is thus seen as a function of following factors.



**Biodiversity  
and the functional  
Traits of the  
Organisms  
Involved**



**The abiotic  
Environment**



**Associated  
Biogeochemical  
Processes**

# WHERE IS THE DIVERSITY?

Some areas of the world are uniquely rich in biodiversity, provide important ecological processes, contain species or landscapes that don't exist anywhere else, or are under threat of being damaged or disappearing altogether. By defining these regions, scientists and conservationists can set priorities for where they most urgently need to work. Biodiversity is not spread evenly across the Earth but follows complex patterns determined by climate, geology and the evolutionary history of the planet. These patterns are called "ecoregions".

WWF defines an ecoregion as a "large unit of land or water containing a geographically distinct assemblage of species, natural communities, and environmental conditions". Ecoregions denote areas of general similarity in ecosystems.

**867+**  
ECOREGIONS  
RECOGNISED  
IN THE WORLD



**200+**  
IDENTIFIED AS RICHEST,  
RAREST, AND MOST  
DISTINCT NATURAL AREAS  
ON THE PLANET





Ecoregion is simply a large, more loosely defined ecosystem that is still distinct from its surroundings. For instance within the Andaman Islands there are many ecosystems, but the whole island chain might be an ecoregion because it defines a unique ecological region that is distinct from other regions.

The boundaries of an ecoregion are not fixed and sharp, but rather encompass an area within which important ecological and evolutionary processes most strongly interact. The Global ecoregions recognize the fact that, while tropical forests and coral reefs harbour the maximum biodiversity and are the traditional targets of conservation organizations, unique manifestations of nature are found in temperate and boreal regions, in deserts and mountain chains, which occur nowhere else on Earth and which are at risk of being lost forever if they are not conserved.

More than 867 ecoregions<sup>1</sup> are recognised in the world. Of those, more than 200 have been identified as being the richest, rarest, and most distinct natural areas on the planet. These outstanding terrestrial, freshwater, and marine

habitats require special attention to ensure their protection and to conserve the broadest array of life around the world.

Today, species are going extinct at the fastest rate, since the mass extinction of the dinosaurs. To stem this crisis, we must protect and conserve biodiversity. But species aren't evenly distributed around the planet. Certain areas have large numbers of endemic species —those found nowhere else. Many of these are heavily threatened by habitat loss, and other human activities. These areas are the biodiversity hotspots, 35 regions<sup>2</sup> where successful conservation of species can have an enormous impact in securing our global biodiversity. They represent just 2.3% of Earth's land surface, but they support more than half of the world's plant species as endemics — i.e; species found no place else — and nearly 43% of bird, mammal, reptile and amphibian species as endemics<sup>2</sup>. The Guinean Forests of West Africa, which cover parts of nine countries, are an example of a hotspot.

<sup>1</sup><http://www.eoearth.org/view/article/151948/>

<sup>2</sup><http://www.conservation.org/How/Pages/Hotspots.aspx>

**35 REGIONS**  
**SUCCESSFULLY CONSERVING**  
**SPECIES CAN IMPACT**  
**THE SECURING OF**  
**GLOBAL BIODIVERSITY**

**43%**  
**OF BIRD, MAMMAL,**  
**REPTILE AND**  
**AMPHIBIAN SPECIES**  
**AS ENDEMIC**

**THE MAP OF  
TERRESTRIAL  
ECOREGIONS OF  
THE WORLD  
RECOGNIZES  
867  
DISTINCT UNITS**

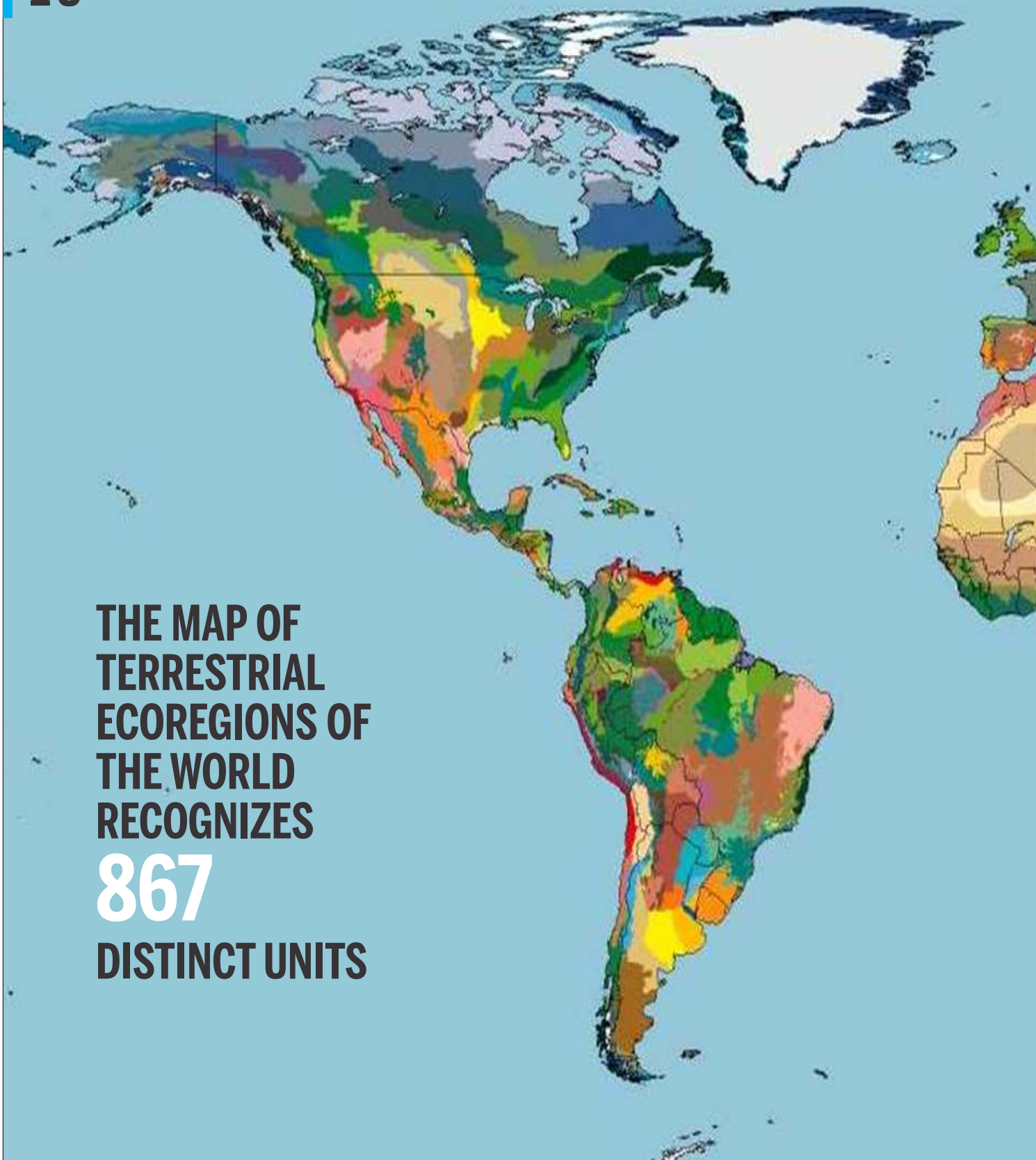
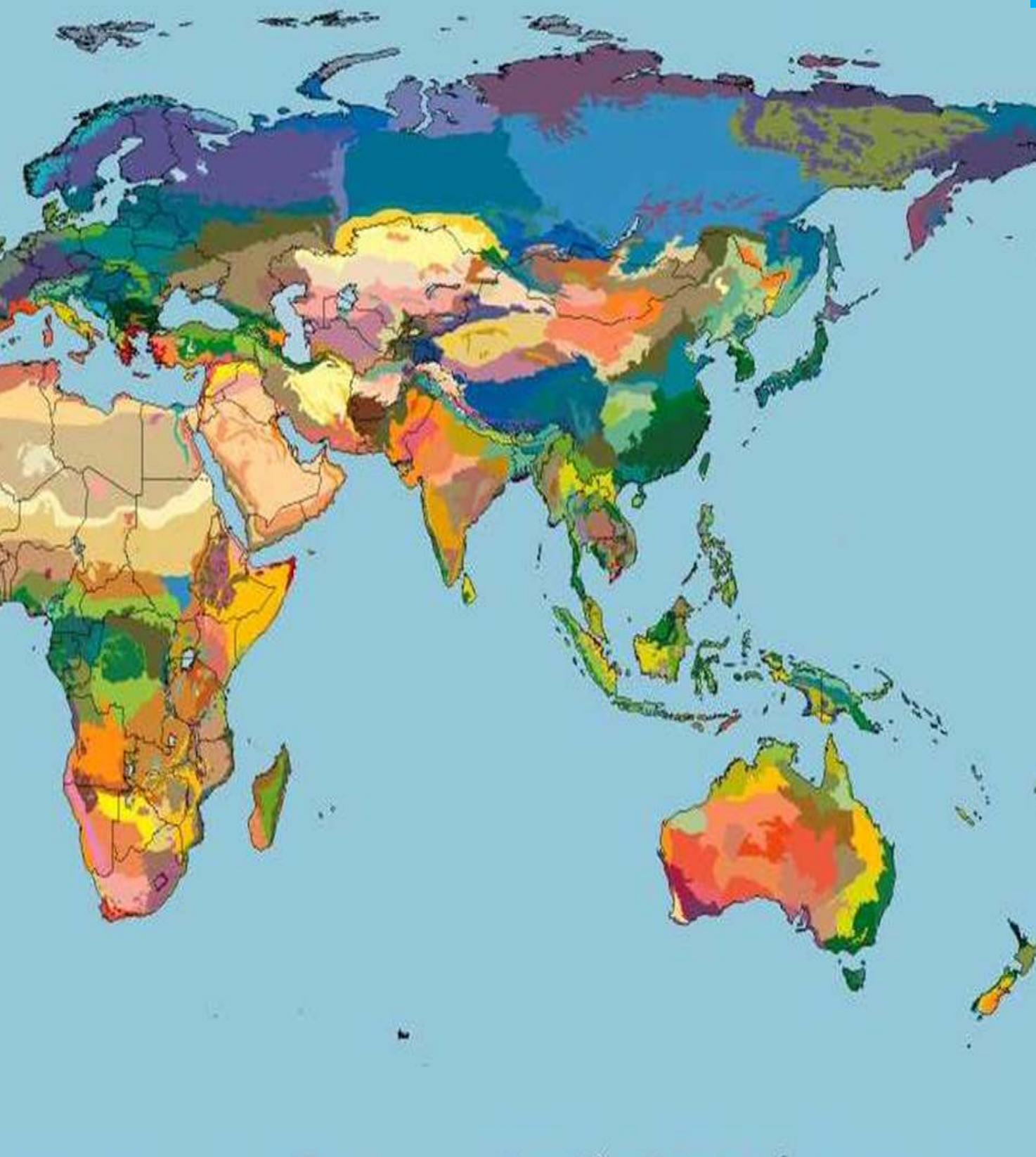


Image 1: The map of terrestrial ecoregions of the world recognizes 867 distinct units



- Tropical and Subtropical Moist Broadleaf Forests
- Tropical and Subtropical Dry Broadleaf Forests
- Tropical and Subtropical Coniferous Forests
- Temperate Broadleaf and Mixed Forests
- Temperate Coniferous Forests

- Boreal Forests/Taiga
- Tropical and Subtropical Grasslands, Savannas, and Shrublands
- Temperate Grasslands, Savannas, and Shrublands
- Flooded Grasslands and Savannas

- Montane Grasslands and Shrublands
- Tundra
- Mediterranean Forest, Woodlands, and Scrub
- Deserts and Xeric Shrublands
- Mangroves



# ECOSYSTEM SERVICES

The significance and value of ecosystem services for human well being is well known. Ecosystems provide four types of service: provisioning (e.g. food), regulating (e.g. water quality regulation and pollination), cultural (e.g. recreation) and supporting (e.g. nutrient cycling) (Millennium Ecosystem Assessment, MA, 2005).

The importance of biodiversity in underpinning the delivery of both ecosystem services and the ecosystem processes that underlie them is well recognised, and our understanding of the nature of relationship between biodiversity and ecosystem services, and the possible effects of biodiversity loss on the delivery of ecosystem services is increasing. Consequently, there is an increasing trend to integrate ecosystem service arguments within the management plans and strategies of protected, as well

as the wider landscape. However, ecosystem service-related argumentation is not undisputed.

Early work on the biodiversity – ecosystem services relationship explored the contribution of habitats to different ecosystem services and of individual species to the functional structure of ecosystems, as well as the impact of interactions, both between species, and between species and the environment, on ecosystem function<sup>3</sup>. The link between ecosystem services and biodiversity has further been examined, not only in terms of species, but also genotypes, populations, species functional groups and traits in an ecosystem<sup>4</sup>. Much recent work has focused on functional relationships between biodiversity and ecosystem services. Functional diversity is one of the most important biodiversity attributes affecting ecosystem services by impacting the underlying ecosystem processes<sup>5</sup>.

Unprecedented changes are taking place in the ecosystems of the world, including species losses through local extinctions, species additions through biological invasions, and wholesale changes in ecosystems that follow transformation of wildlands into managed ecosystems. These changes have a number of important effects on ecosystem processes. Scientific Studies demonstrate that both the magnitude and stability of ecosystem functioning are likely to be significantly altered by declines in local diversity, especially when diversity reaches the low levels typical of managed ecosystems. Although a number of uncertainties remain, the importance of ecosystem services to human welfare requires that we adopt the prudent strategy of preserving biodiversity in order to safeguard ecosystem processes vital to society.

<sup>3</sup>Balvanera, P., Pfisterer, A.B., Buchmann, N., He, J.S., Nakashizuka, T., Raffaelli, D., Schmid, B., 2006.

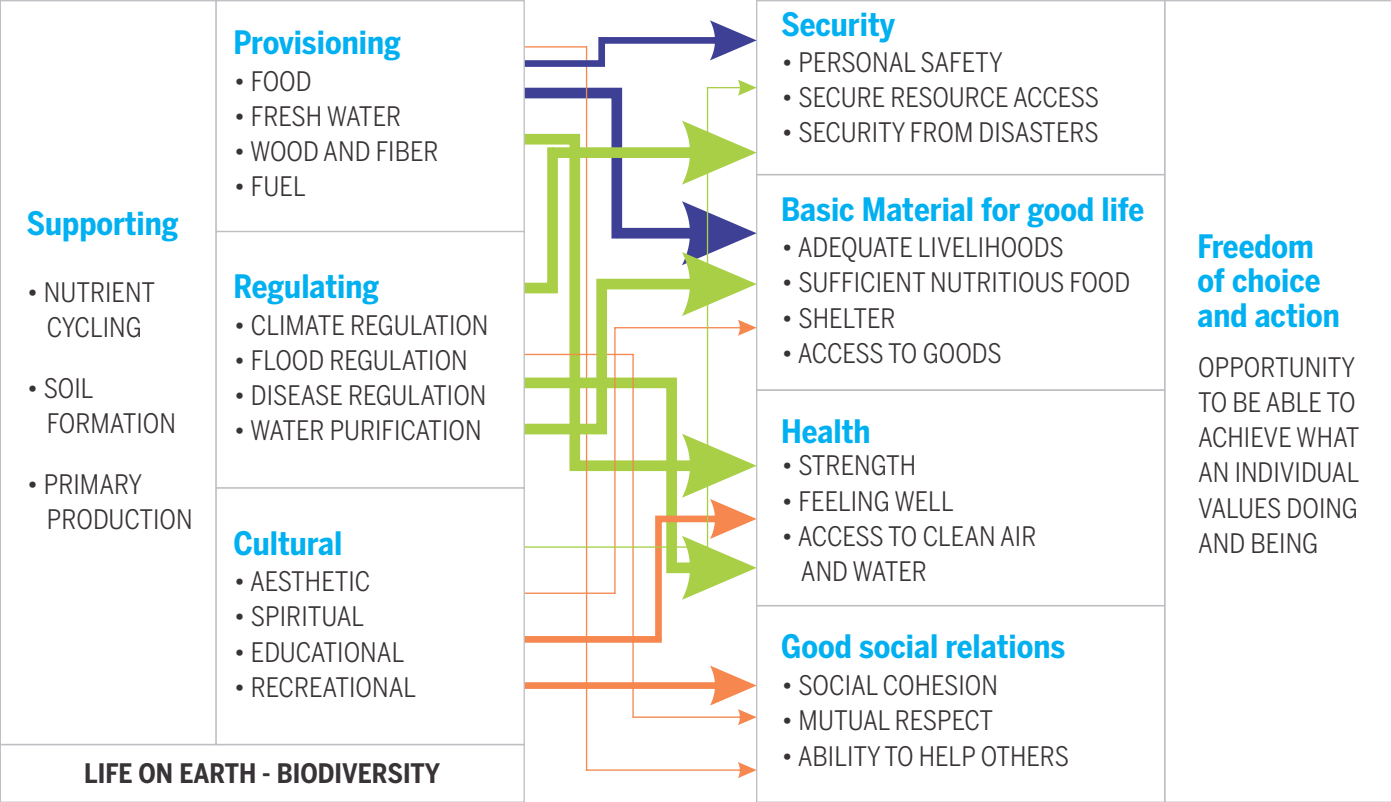
Quantifying the evidence for biodiversity effects on ecosystem functioning and services. *Ecol. Lett.* 9, 1146–1156.

<sup>4</sup>Díaz, S., Lavorel, S., de Bello, F., Quétier, F., Grigulis, K., Robson, T.M., 2007. Incorporating plant functional diversity effects in ecosystem service assessments. *Proc. Natl. Acad. Sci.* 104, 20684–20689

<sup>5</sup>Díaz, S., Cabido, M., 2001. Vive la difference: plant functional diversity matters to ecosystem processes. *Trends Ecol. Evol.* 16, 646–655

ECOSYSTEM SERVICES

CONSTITUENTS OF WELL-BEING



Source: Millennium Ecosystem Assessment

**ARROW'S COLOR**  
Potential for mediation by socioeconomic factors

Low

Medium

High

**ARROW'S WIDTH**  
Intensity of linkages between ecosystem services and human well-being

Weak

Medium

Strong

Ecosystem Services and relation with Human

Image 2: Ecosystem Services and relation with Human

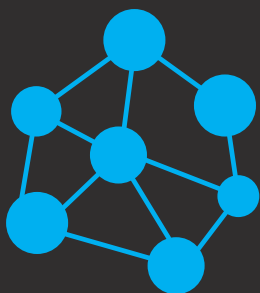
## ECOSYSTEM FUNCTION

(resource capture, biomass production,  
decomposition, nutrient recycling)



## BIOLOGICAL DIVERSITY

(variation in genes, species, functional traits)



**LINK FUNCTIONS  
TO SERVICES**



**EXPAND OUR  
FOCUS**



**IMPROVE  
PREDICTIONS**

Image 3 Source Cardinale et al., 2012. This figure shows the basic shape of the relationship between biodiversity and ecosystem functions, based on over three decades of research.



# DRIVERS OF BIODIVERSITY LOSS



**Habitat loss caused by land use change, e.g. conversion for urban, industrial or agricultural development**



**Climate change, which is affecting the distribution of species globally, as well as the resilience and stability of ecosystems**



**Over-exploitation, such as uncontrolled and excessive freshwater use by agriculture, industry and private households**



**Pollution of air, water and soils**



**Invasive species, which can disturb native ecosystems and functions**

# BUSINESS AND BIODIVERSITY

Businesses are both affected by, and rely upon, these biodiversity and ecosystem services, regardless of organization size, location and sector. This is more obvious for some, less so for others. There are some industries whose profitability depends directly on the health of ecosystems, for example forestry, fishing, agriculture and ecotourism. Other sectors have a direct impact on ecosystems and biodiversity through their operations, such as mining, construction and energy. For companies in these areas, a good track record on sustainability management is crucial for them to be able to obtain operating licenses and to

maintain good relationships with stakeholders (i.e. local communities and NGOs).

Other industries, such as cosmetics and pharmaceuticals, also depend on biological material and genetic resources in the creation and manufacture of their products. Many firms find inspiration in biological systems when they are designing new products, and all companies, in all sectors, rely upon the various ecosystem services provided free of charge by natural systems around the world. Even the financial sector is exposed to risks caused by biodiversity loss. This is due to insurance claims and poor (or negative) returns on

investments caused by natural and man-made disasters, made worse through environmental degradation.

Because of this reliance, disruptions or degradation of biodiversity and ecosystems can have severe impacts upon supply chains, and consequently on your business model, even if it seems to be unrelated to your direct area of concern. Short-term disruptions can be expensive, long-term degradation leading to permanent damage of supply can be catastrophic, resulting in significant long-term economic dislocation, loss of market share and even complete failure of the business model.

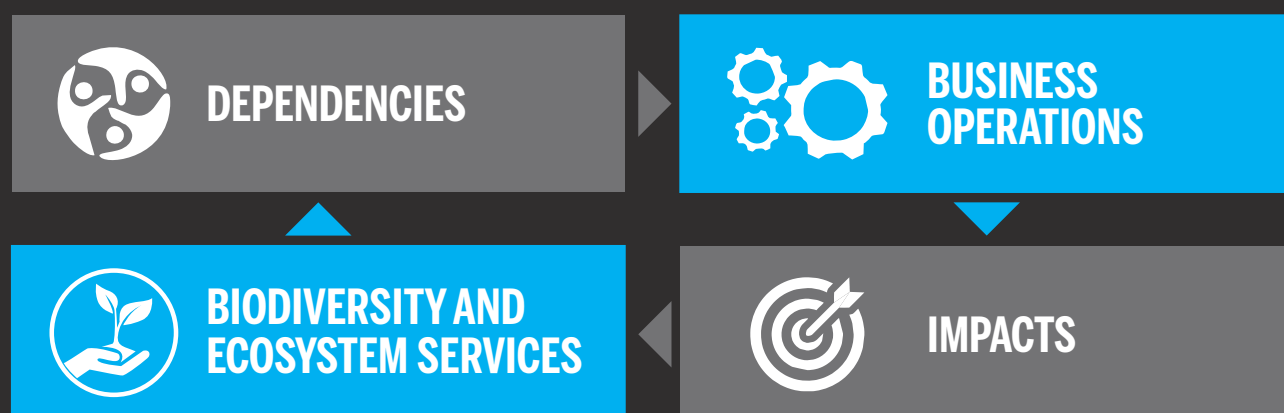


Image 4 Business relation with biodiversity

The Economics of Ecosystems and Biodiversity (TEEB) noted that the “ecosystem services”, resulting from natural environmental processes, represents tens of trillions of dollars per annum worth of benefits that are currently utilized for free. By the same token, the loss of these services due to environmental degradation is on the order of \$5-7 trillion per year, roughly comparable to the GDP of China<sup>6</sup>. Companies or governments must either forgo the services that this represents, or find costly alternatives. When we consider the vast efforts that global corporations and governments put into accessing the newly emerging mega-economies, we have to wonder why we are so willing to simply allow this type of economic value slip through our fingers.

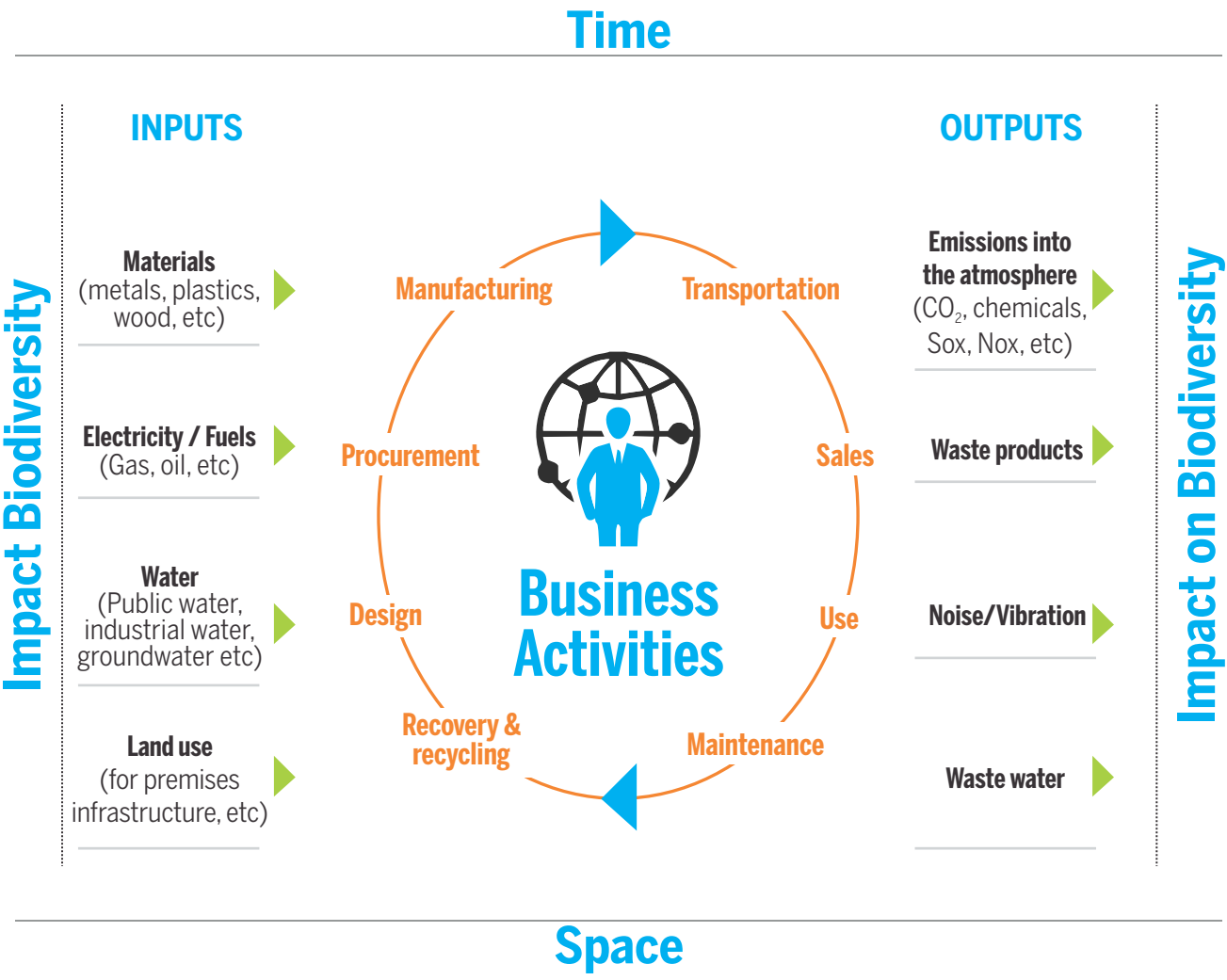


Image 5: Adapted from Mitsubishi Global Environmental Portal

<sup>6</sup><https://www.cbd.int/business/info/bb.shtml>

There is a growing level of awareness of the importance of considering biodiversity in business decision making, and the biodiversity-related risks and opportunities to businesses.

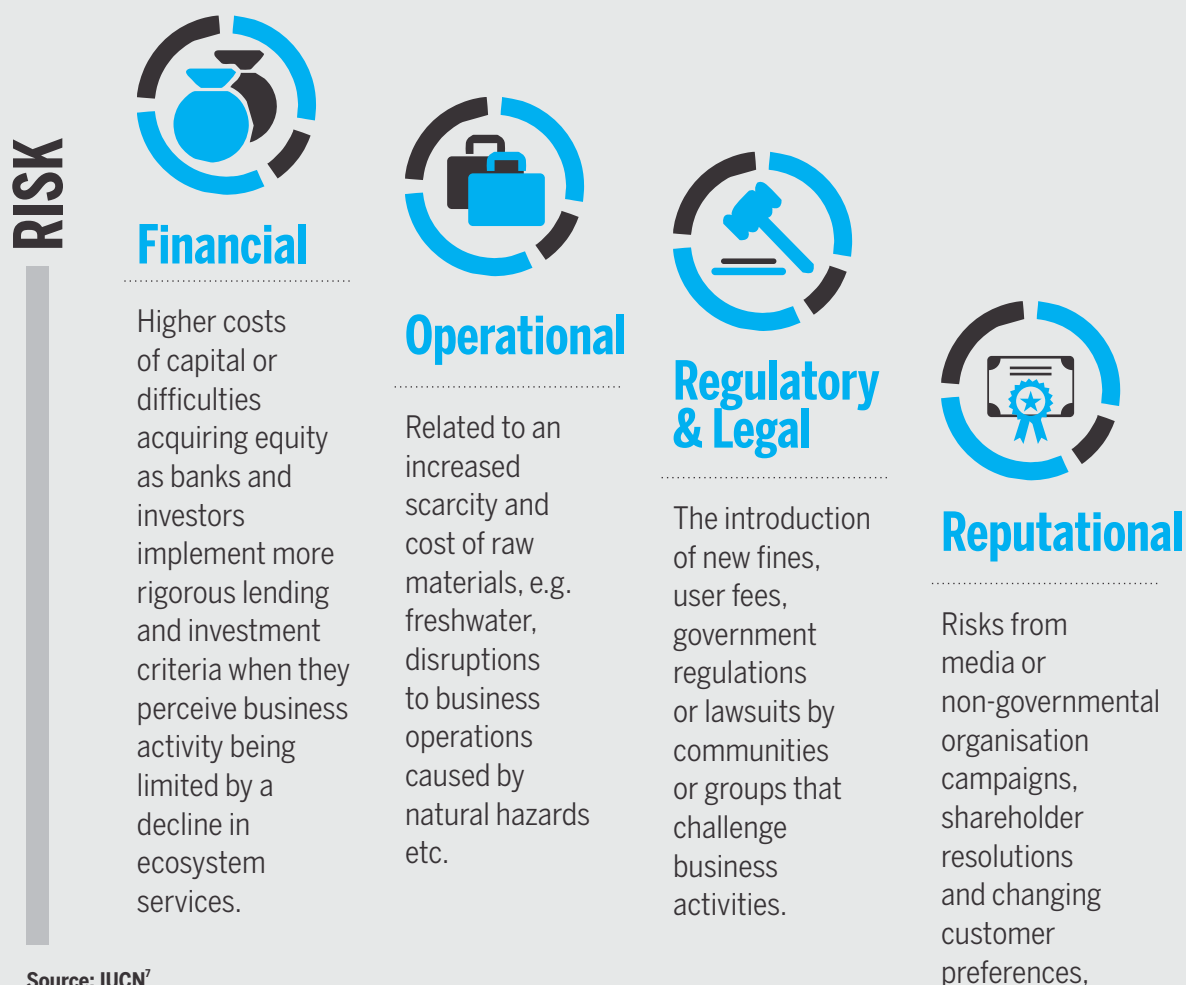


Table 1: Four major risk and opportunities for business from biodiversity and ecosystem services

## OPPORTUNITIES



### Financial

Opportunities for businesses that take up other operational, regulatory and legal, reputational and market and product opportunities to access other lenders and socially responsible investment funds that would not otherwise be available to them.



### Operational

From introducing new more efficient technologies and processes that reduce the dependence and impact on ecosystem services, and may also have significant financial benefits.



### Regulatory & Legal

From the production or provision of new goods or services that meet new regulations or opportunities to expand operations due to meeting license or planning requirements.



### Reputational

From businesses being able to improve or differentiate their brand from competitors.

Given the complexity of the often fundamental risks which biodiversity loss presents, more work is undoubtedly needed to fully understand the risks to business and its impacts on economic value. Nonetheless, much research has already been done and more is under way. Deeper analysis and growing awareness of the implications of biodiversity loss are likely to drive it to the fore of the economic and environmental agenda over the coming years, in much the same way that climate change has moved to centre stage over the past decade.

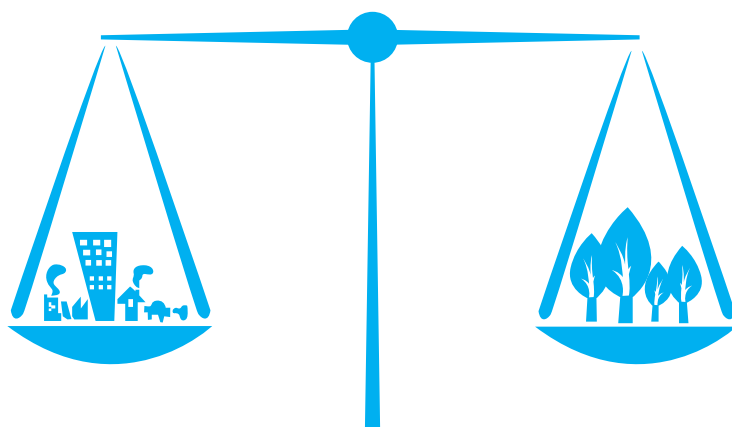
Ecosystem Services and Biological resources resulting from them, can be regenerated and used sustainably only if they are utilized suitably. In order to continue to enjoy these benefits in a sustainable way, we must initiate swift action to create a “society in harmony with nature”, businesses, public entities, local public corporations, as well as the nation and every one of its citizens, must each cooperate and work from their own standpoints to prevent the loss of biological diversity.

<sup>7</sup>[https://www.iucn.org/about/work/programmes/business/bbp\\_aboutus/bbp\\_case/](https://www.iucn.org/about/work/programmes/business/bbp_aboutus/bbp_case/)

# IMPORTANT ACTS AND RULES HAVING RELEVANCE TO BIODIVERSITY CONSERVATION:

Over the year many acts and policies have been introduced by the government for various aspects related to social advancement keeping in mind the conservation of biodiversity. Below is a list of such acts and rules which were made to safeguard the Indian biodiversity. State rules and policies were

not considered as they were similar to the central ones modified in the context of the state. Many other acts not related to environment were also studied, though elements of biodiversity conservation were present but very limited.





- ✓ Fisheries Act, 1897.
- ✓ Destructive Insects and Pests Act, 1914.
- ✓ The Indian Forest Act, 1927.
- ✓ Prevention of Cruelty to Animals Act, 1960.
- ✓ Seeds Act, 1966.
- ✓ Wildlife (Protection) Act, 1972.
- ✓ Water (Prevention and Control of Pollution) Act, 1974.
- ✓ Water (Prevention and Control of Pollution) Cess Act, 1977.
- ✓ Maritime Zones of India (Regulation and Fishing by Foreign Vessels) Act, 1980.
- ✓ Forest (Conservation) Act, 1980.
- ✓ Air (Prevention and Control of Pollution) Act, 1981.
- ✓ Environment (Protection) Act, 1986
- ✓ National Forest Policy, 1988
- ✓ Rules for the manufacture, use / import / export and storage of hazardous microorganisms / genetically engineered organisms or cells, 1989
- ✓ National Conservation Strategy and Policy Statement on Environment and Development, 1992
- ✓ National Policy and Macro level Action Strategy on Biodiversity, 1999 amended to NBSAP
- ✓ National Agriculture Policy, 2000
- ✓ Protection of Plant Varieties and Farmers' Rights (PPVFR) Act, 2001
- ✓ Biological Diversity Act, 2002
- ✓ Biological Diversity Rules, 2004
- ✓ Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006.
- ✓ National Environment Policy, 2006
- ✓ National Water Policy, 2012

# MANAGING THE RISK AND CREATING OPPORTUNITIES

The benefits to business of systematic biodiversity management can be considerable. It can contribute to the preservation of natural resources, allowing maintenance of supply, it can enhance the cost-effectiveness of operations, improve the sustainability of supply chains, and increase revenue through access to new markets. All sizes and types of business can reap these benefits. For some, their principal interaction with biodiversity will be through their supply chain, whereas other businesses, such as those in food production, pharmaceuticals and cosmetics rely directly on natural materials.

As government regulation and societal expectations change, the risks to business from biodiversity issues will likely increase. There are six key factors that drive the argument for proactively managing biodiversity in business activities.

Understanding the ecological and social impacts of proposed development and planning appropriate measures to mitigate those impacts wherever possible is critical. The mitigation hierarchy is a process that when used properly can ensure that development results in No Net Loss (NNL) of, or a Net Positive Impact (NPI) on biodiversity. It involves four key stages beginning with the avoidance of impacts. Where avoidance is not possible, the developer must seek to minimize impacts and restore areas. The last stage, and final resort, is to consider the potential to offset residual impacts. Given the inherent risks and uncertainty involved with offsetting, it should only ever be undertaken as a last resort, when harm to biodiversity cannot be avoided or mitigated. If it is not possible to avoid, minimize or adequately offset harm, the development should not proceed.

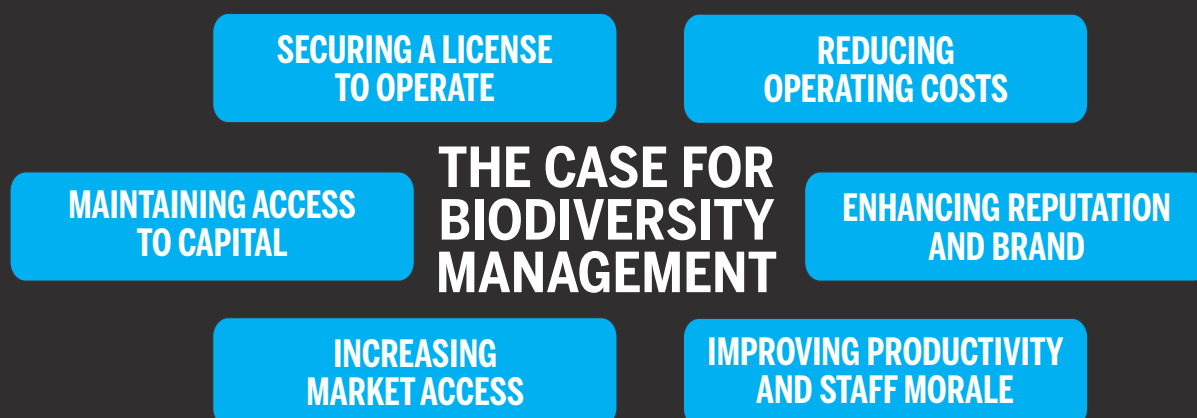


Image 6: 6 key factors to proactively manage biodiversity

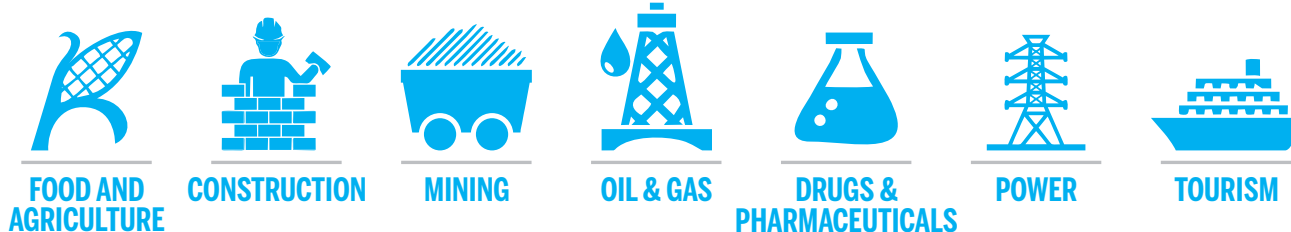
# SECTOR SPECIFIC BIODIVERSITY ISSUES

The relationship between business and biodiversity is more obvious in some sectors than in others. Agribusiness companies rely directly on fertile soils and also on a sustained supply of water; forestry companies depend on healthy trees, and parts of the tourism industry depend on wildlife and pristine destinations. While these sectors have a particularly clear incentive to maintain biodiversity, other sectors, including cement, retail, utilities, oil and gas, or mining, can be affected through equally strong drivers such as impacts to reputation or access to capital.

Biodiversity significance is also dependent on a company's perspective: "where you are on an issue depends on where you stand. Whether your project is in a protected area or near a sacred water body, industrial zone etc." Clearly it can be all of these

things simultaneously and understanding the perspectives and value attributions of others is an important aspect of biodiversity management. The following chapters provide an overview of the major biodiversity issues relating to a selection of key industry sectors. While not intended to provide a comprehensive analysis by sector, they outline impacts and dependencies for each sector, including the major business drivers, and highlight key sector initiatives, benchmark practices by global 10 companies in each sector.

Seven sectors which were studied and analyzed represent all major industries in the country, only Finance, IT and other allied service industries were not documented in this study, given their limited direct interface with biodiversity, the sectors considered in this study are:



Top ten performing companies in each sector were selected based on their Market value for benchmarking pro biodiversity related work conducted by the companies in each sector. Their market value were referred based on their market capitalization as provided in Statista<sup>8</sup> and cross checked with MSCI<sup>9</sup> data (companies not showing any work on biodiversity were not considered to enable completion of analysis).

<sup>8</sup><http://www.statista.com/>

<sup>9</sup><https://www.msci.com/indexes>



# **ROADMAP TO**

## **IMPLEMENTATION OF BIODIVERSITY CONSERVATION AND SUSTAINABLE USE**

**LOGICAL ANGLES TO CONSIDER  
WHILE TAKING ACTIONS TOWARDS  
CONSERVATION OF BIODIVERSITY**

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**28**

**STEP WISE PROCESS TO IMPLEMENT  
BIODIVERSITY CONSERVATION  
MEASURES**

---

**32**

**CONSIDERATION OF BIODIVERSITY  
IN BUSINESS ACTIVITIES, MAINLY  
THOSE BY THE BUSINESS ENTITY ITSELF**

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**36**

Business entities have a wide variety of interrelationships with biodiversity-through the vast variety of contexts in which they operate.

It is desirable that business entities undertake the following actions in order to ensure the conservation and sustainable use of biodiversity.

## **1 Work to assess the interrelationships between business activities and biodiversity (both the benefits (services) received from biodiversity as well as impacts on biodiversity).**

When undertaking actions for the conservation and sustainable use of biodiversity, business entities should assess the interrelationships of their business activities with biodiversity. By understanding these interrelationships, business entities can gain an appreciation of their dependence on the benefits of biodiversity and understand how their activities impact biodiversity, thus leading to a better awareness of the need for actions; such information should be linked to considerations of which actions should be given a high priority.

## **2 Work to reduce impacts on biodiversity and work for its sustainable use through business activities that give due consideration to biodiversity.**

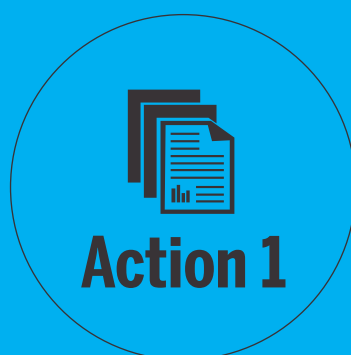
In keeping with the above-mentioned understanding, business entities are expected to reduce their overall impacts on biodiversity, by giving due consideration to the relationships to biodiversity that exist through the various contexts of the business entity's activities, and to engage in sustainable use so that there will be no decrease in the benefits deriving from biodiversity into the future.

In doing so, business entities are expected to pursue actions in order of their perceived priority, in keeping with the size and characteristics of the business entity.

**Those business entities that are not currently taking actions can begin their actions with the activities below.**

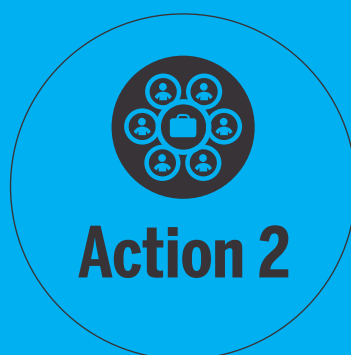
- a) First, indicate a policy to take action for the conservation of biodiversity and its sustainable use.
- b) Identify actions that are of highest importance based on an understanding of the business entity's interrelationships with biodiversity, then determine relative priorities among these actions, and take action with respect to those activities having a high priority. In order to achieve steady results, actions should be pursued through a step-by-step approach, taking into account their feasibility.





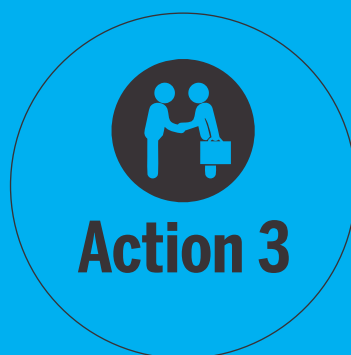
## Action 1

**Clarify a policy to take action on biodiversity. Implement actions based on their priority, while also considering their feasibility.**



## Action 2

**In addition to the activities in Action 1, incorporate biodiversity considerations into environmental management systems.**



## Action 3

**In addition to the activities in Action 1 & 2, take actions in cooperation with suppliers and other business entities (such as for biodiversity-friendly procurement of material inputs).**

.....  
**Actions to ensure conservation and sustainable use of Biodiversity**  
 .....

# 3

## Work to put in place systems that support actions.

As needed, business entities should put in place systems that support biodiversity-related actions, and environmental management systems.

# LOGICAL ANGLES TO CONSIDER WHILE TAKING ACTIONS TOWARDS CONSERVATION OF BIODIVERSITY

When business entities take actions related to the conservation of biodiversity and its sustainable use, the following logical angles are expected to be considered.

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**Focussed Locally, Think Globally**

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**Partnership with Diverse Stakeholder**

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**Social Contribution**

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**Biodiversity and Global Warming**

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**Supply Chain Impact**

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**Extent of Impact**

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## Logical Angle 1

# Focussed Locally think globally

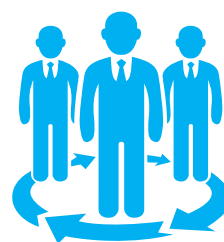


The components of biodiversity may be unique to certain localities or have strong linkages to specific places. If the ecosystems, species and their genes unique to a region, are lost from their native place, they are lost from the Earth as a whole. Conservation of these biodiversity components is made possible through actions in unique natural areas, making a place-based perspective important. Besides, in considering arrangements for conservation activities, it is also significant to see the circumstances of the locations where activities will really take home.

Additionally, in light of the fact that biodiversity is deeply linked with the society and culture of a region, it is important to also give consideration to social and cultural factors, such as traditional lifestyles, knowledge, ideas and practices.

On the other hand, components of biodiversity have wide-ranging connections through material flows such as of water and sediments, and through the movements of animals, etc., and biodiversity itself depends on the unique interconnections among organisms that exist in various places. Additionally, through socio-economic activities, and due to the expansion of business activities, business entities in India have close interrelationships with countries throughout the world (especially centered on the Asia region), linked through the movements of raw materials and products, as well as by financial flows such as investments and loans.

Therefore, it is important for businesses to undertake domestic and international actions with a wide-ranging and global perspective, keeping an awareness of the connections linking biodiversity at the watershed and global scales, as well as linkages involving ecosystem services. In particular, given that Japan is heavily dependent on foreign resources, it is also important to have a perspective that considers impacts on ecosystems through the importation and exportation of organisms from overseas, and the supply chain, as will be addressed further below.



## Logical Angle 2

# Partnerships with diverse stakeholder

It is also important to consider the perspectives of stakeholders utilizing biodiversity, including the local communities where operations are conducted and material inputs are sourced. In particular, when the location is in a developing zone, in light of the fact that biodiversity shapes local society and culture, it is important to act with respect for social and cultural matters including traditional lifestyles, knowledge, ideas and practices, and not only in terms of economic concerns.



### Logical Angle 3

## Social contributions

When conducting social contribution activities related to biodiversity, it is also important to bear in mind that actions should be pursued with clear goals and based on a long-term perspective, and to aim to contribute to the conservation of biodiversity and its sustainable use while seeking a deeper understanding of biodiversity.



### Logical Angle 4

## Biodiversity and global warming

As global warming progresses, there is concern that there will be severe impacts on biodiversity, including through the disruption of ecosystems and the extinction of species. This is just one example of how biodiversity is closely related to other issues.

There are thus many cases in which measures taken for other purposes such as global warming countermeasures, including reducing emissions of greenhouse gases and managing greenhouse gas sinks; reducing and properly disposing of waste; reusing recyclable resources; preventing pollution; green procurement; and others will be useful for the conservation of biodiversity. There are also numerous ways in which biodiversity-related actions may be effective in other areas, such as with respect to global warming. Efforts to contribute to local communities can also be related to the conservation of their biodiversity. On the other hand, there are also cases in which some actions may undermine efforts in other environmental areas.

For these reasons, it is important to keep in mind that certain biodiversity-related actions may have beneficial effects on other environmental issues, as well as in terms of contributions to local communities, and actions should therefore be taken that will be effective in a comprehensive fashion across multiple fields.



## Logical Angle 5

# Supply Chain impact

Business entities have connections to the conservation of biodiversity and its sustainable use in areas beyond those it can directly control, such as the procurement of material inputs by others. While there are cases in which it can be extremely difficult for business entities that procure and use raw materials to gain a full understanding regarding production sites and product lifecycles (due to the length and complexity of the supply chain), a full accounting of domestic and foreign production locations and the lifecycle of products and services may reveal significant impacts on biodiversity.



## Logical Angle 4

# Extent of impact

In order to incorporate proper consideration of the conservation of biodiversity when undertaking concrete projects, it is important to keep in mind whether and to what extent a project will have impacts on biodiversity, which can be evaluated by collecting needed information through cooperation, as needed, with local governments, NGOs & NPOs, local residents and communities and other stakeholders. Considerations of impacts should include, for example, confirming whether the location of the project is of high value for the conservation of biodiversity. A proper assessment of biodiversity and the ecosystem services that the business may have impact upon can also help company to arrive at a decision. Various tools are available to help the company in this regards.

# STEP WISE PROCESS TO IMPLEMENT BIODIVERSITY CONSERVATION MEASURES

Step wise approach to implement biodiversity in a new area or for new project. The process shown below is achieved through meticulous assessment with detailed understanding of impacts that can arise in future. The process is reiterative and can be revised as the project progresses. The below schematic diagram is also what IBBI practices with its companies and has been tested to be robust.

# INVESTIGATE

# ANALYSE

# PLAN



## STAGE 1:

Preliminary assessment of the background of the area



## STAGE 2:

establish baseline with a detailed analysis of habitat, species found and ecosystems present in the area



## STAGE 3:

establish the stake holders being impacted due to the project



## STAGE 4:

Determine priority species and habitats, ecosystems, based on baseline assessment & stakeholder consultation



## STAGE 5:

Define biodiversity targets and related actions



## STAGE 6:

Create monitoring programmes to assess



## STAGE 7:

Review, adapt actions, communicate and report



The process is successful if a detailed baseline is established. Monitoring and reviewing of the parameters in future could be then compared for improvement or degradation in the site.

## STAGE 1

Screen your current knowledge and management of biodiversity impacts and dependencies and possible risk and opportunities.



## STAGE 3

Check on the stakeholders who are dependent on the biodiversity and ecosystem of that area, and plan possible partnership with them.



## STAGE 2

Detailed Analysis of benefits that an entity's business activities receive from biodiversity, as well as their impacts on biodiversity. Also, determine the priority items to address, and consider their level of priority, etc.



## STAGE 4, 5 & 6

Establish objectives for actions addressing biodiversity, and define realistic, measurable targets to be monitored and adjusted every two to three years.

Explain the biodiversity targets to suppliers, and develop cooperative relationships with them.

Based on the interrelationships with biodiversity, develop methodologies and plans to achieve the objectives and targets.

Gather scientific knowledge on the subject, and take a precautionary approach.

Incorporate the conservation of biodiversity into the business entity's environmental management system, and formulate biodiversity indicators.

Designate executive and senior management levels who will promote actions.

Appoint a biodiversity champion within the business entity to steer all activities relating to biodiversity, and for reporting to the management board.

## STAGE 7

Implement actions under the institutional structure that has been established.

When implementing actions, it is important to make steady progress by tackling the high-priority items in order of feasibility—in other words, through taking a step-by-step approach.

Check the implementation status and results of actions, and identify achievements and issues. To resolve problems and undertake improved actions, adopt an adaptive approach to the review of methodologies and plans, etc.



Having a biodiversity management for new sites are easy in comparison to retrofitting old projects by incorporating biodiversity at various stages. Below provided pages offer details for what could be the possible impact or dependency at various stages and what can be the possible way to manage it.

# CONSIDERATION OF BIODIVERSITY IN BUSINESS ACTIVITIES, MAINLY THOSE BY THE BUSINESS ENTITY ITSELF

Business activities should be considered along the whole value chain of products and services, using a life cycle approach. Links between business activities and biodiversity can be observed from the very early extraction phase of raw materials – even the exploration phase to find minerals or oil reserves – or the growing of crops and cattle, over the intermediary processing activities to the final production phase. Impacts also occur during the consumption phase and, finally, during the waste recycling or disposal phase. Between all these phases, transport can have impacts on biodiversity, too.

For key situations where businesses are engaged in business activities, the following pages will showcase the possible impacts of each business activities on biodiversity, possible actions for the conservation and sustainable use of biodiversity, and some action thought to be particularly progressive.

## **PROCUREMENT STAGE**

## **SALES & MARKETING STAGE**

## **FINANCE STAGE**

## **RESEARCH AND DEVELOPMENT**

## **LAND USE**

## **MINING**

## **OPERATION STAGE**

## **BIOLOGICAL RESOURCES USE**

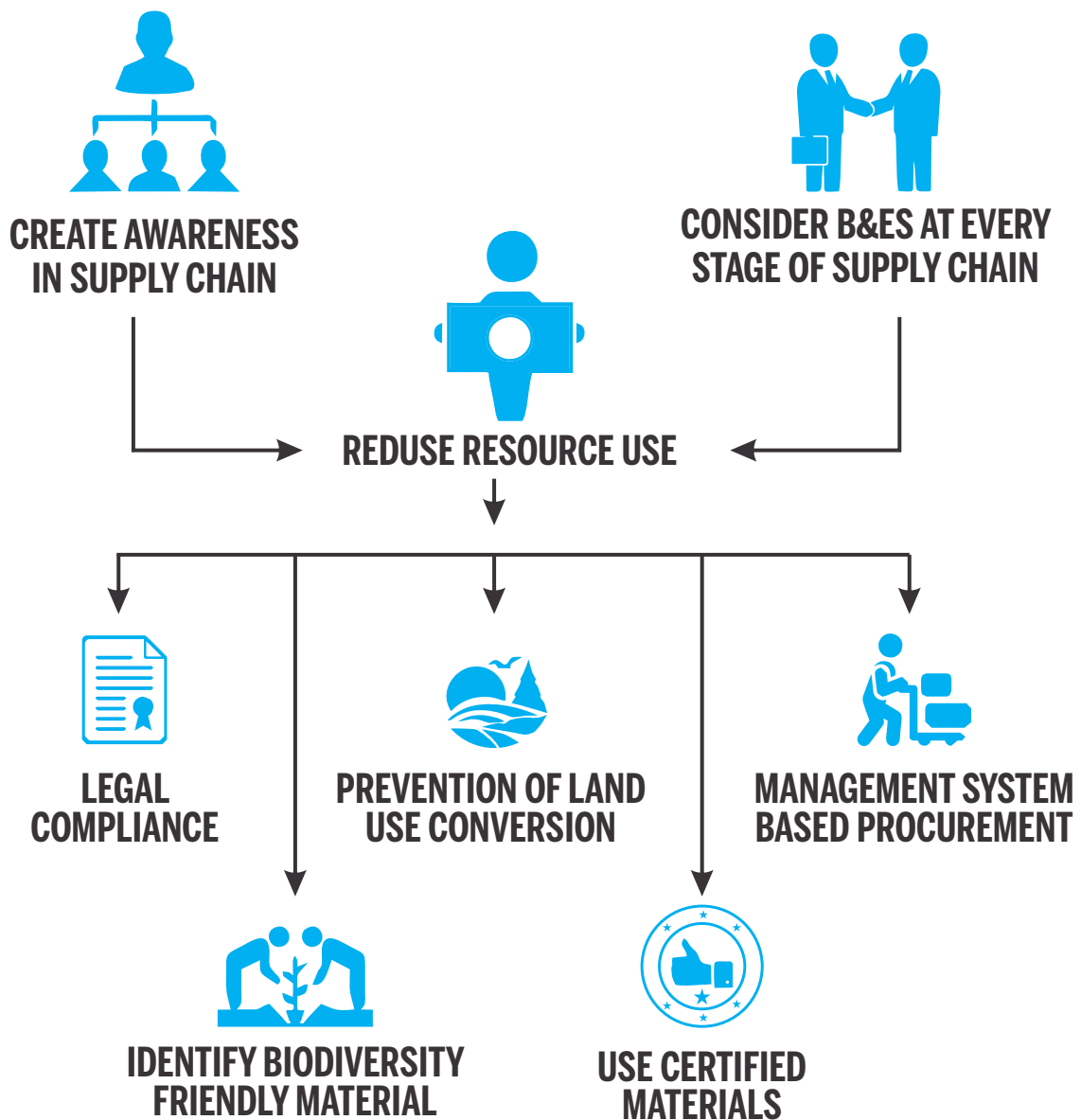
## **TRANSPORTATION STAGE**

# PROCUREMENT STAGE

In addition to what a business entity has direct control over, there are also other interrelationships with biodiversity, such as through the procurement of material inputs, etc. Business entities that procure and use material inputs in some cases have great difficulty in assessing the situation, for example, in the regions that produce

those inputs—due to the length and the complexity of the supply chain. Meanwhile, activities in the producing region (e.g., land use, the use of living resources) can have large impacts on biodiversity, through the procurement of material inputs of living resources, etc. (e.g., timber, fisheries products, agricultural products).

## WHAT CAN BE DONE?



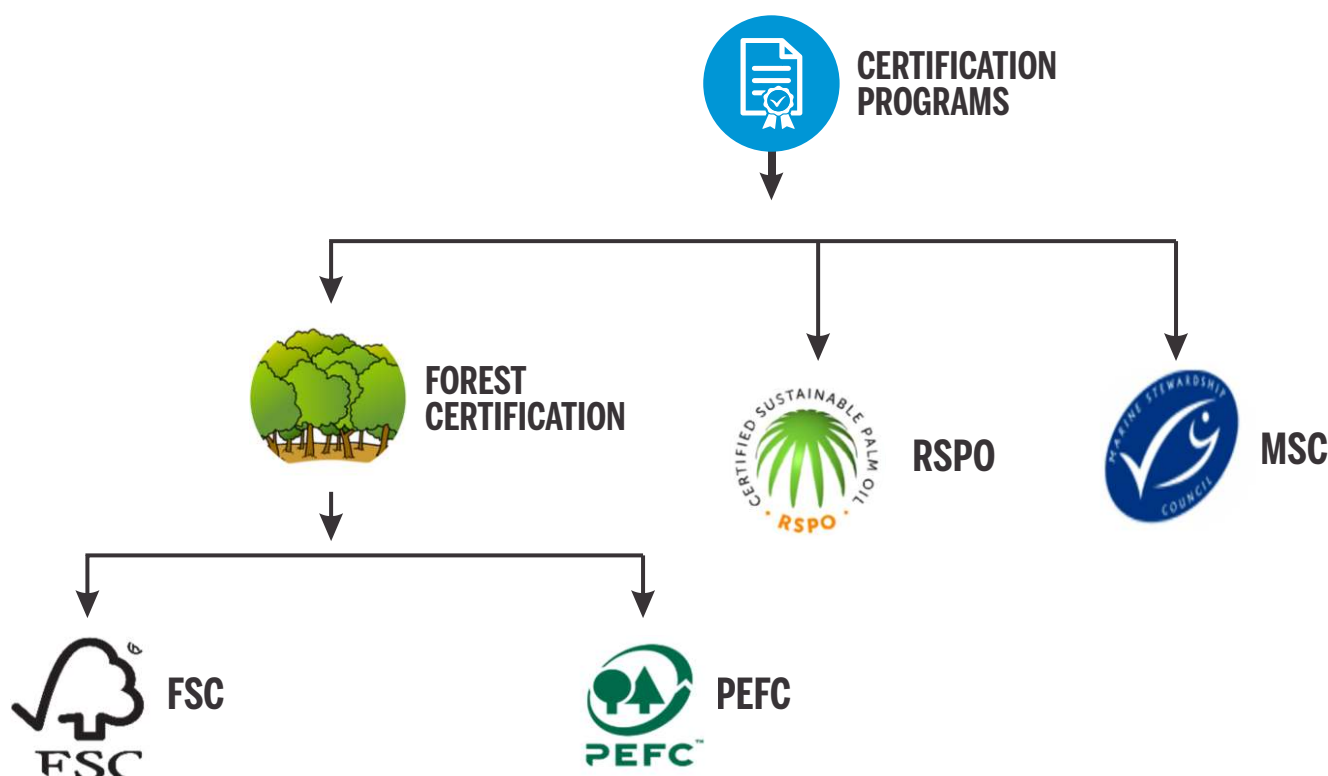
Strive to reduce the amount of resources used.

Encourage business entities at every stages of the supply chain to consider biodiversity when procuring material inputs.

- For living resources and other material inputs procured, consider the observation of laws and regulations (legal compliance); ensure that procurement is not causing the conversion of land use in areas thought to have high conservation value for biodiversity conservation (e.g., development in forested areas or coastal zones); and ensure that procurement works through management systems, etc., based on sustainable use, etc
- Identify, differentiate, and display biodiversity-friendly material inputs separately from other material inputs, in order to promote actions that consider biodiversity in areas that produce living resources, etc., and in order to offer consumers a choice in product selection.
- Use certified items, etc., in the material inputs being procured.

Cooperate and work to raise awareness in the supply chain, within the scope allowed by the company's sphere of influence

## CERTIFICATION PROGRAMS



## Forest Certification

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These are systems in which an independent third party certifies forests that are properly managed and the production and distribution of forest products from such forests—environmentally, economically, and socially.

## Programme for the Endorsement of Forest Certification Schemes (PEFC): PEFC Council

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This is a certification scheme under the Forest Stewardship Council, an open-membership organization of stakeholders involved in forest management. It offers two types of certification: Forest Management (FM) certification applies to forests and forest land, and Chain of Custody (CoC) certification applies to the management of production, processing and distribution processes. Under FM certification, as of December 2008, there were more than 100 million hectares certified in 9 locations in 81 countries worldwide. Biodiversity conservation included within the principles of the FSC. <https://ic.fsc.org/en>

## Forest Stewardship Council (FSC)

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This is the world's largest forest certification program, with the PEFC Council serving as the international managing body that runs the forest certification program, in order to promote mutual recognition between systems, and to review the forest certification schemes developed separately in each country. It provides forest certification, and certification for the chain of custody (CoC – meaning the flow of forest products from forest to market). Currently, 25 systems have mutual recognition, and forests already certified under these systems cover more than 200 million hectares worldwide. <http://www.pefc.org/>



## Marine Certification

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This is a system in which an independent body certifies the sustainability of fisheries and the trade in fisheries products.

## Marine Stewardship Council (MSC)

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The MSC is an international non-profit organization that operates this certification system for fisheries industries that consider sustainability and the environment. There are certification for fisheries and a chain of custody certification for marine product traders and others. The organization conducts certification audits of the status of the resource, impacts on ecosystems, and on management systems, based on the MSC "Environmental Standard for Sustainable Fishing." Reference: <http://www.msc.org>

Other Certification Systems for Natural Resources

## RSPO Certified Sustainable Palm Oil

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This is a certification system of the Roundtable on Sustainable Palm Oil (RSPO), a multi-stakeholder initiative concerning sustainable palm oil. The sustainable production of palm oil and the sustainable supply chain of palm oil are the targets of certification. The former system has eight "RSPO Principles and Criteria for Sustainable Palm Oil Production," of which one is "Environmental responsibility and conservation of natural resources and biodiversity." Reference: <http://www.rspo.org/default.aspx>

# SALES & MARKETING STAGE

Impacts on biodiversity can be caused indirectly from the selling of products and services, etc., that have a large impact on biodiversity. Also, if there is a failure to properly identify and differentiate between products and services that are biodiversity friendly

and those that are not, this can have an impact on the spread of biodiversity-friendly products, etc., and actually hamper actions relating to biodiversity.

Meanwhile, by conveying information at the time of sale to buyers (such as general

consumers) regarding consideration of biodiversity in products and services, it is possible to heighten their awareness of those products, and thereby bring about a change in consumer behavior, to indirectly promote actions for biodiversity.

## WHAT CAN BE DONE?

- Verify the biodiversity impacts of goods and services being handled.
- Properly identify and differentiate items that are biodiversity friendly and those that are not.
- Promote biodiversity-friendly items in the product line.
- Display information about aspects and criteria taken into consideration relating to biodiversity-friendly products and services, etc.
- Promote communication relating to biodiversity, as a part of marketing and promotion activities.

# FINANCE STAGE

Through investment and lending for projects and businesses, it is possible to have an indirect impact on biodiversity as a result

of the activities of projects and business activities of financially related entities.

## WHAT CAN BE DONE?

- Project Financing: Incorporate consideration of biodiversity into review criteria for decisions on project financing.
  - environmental impact assessments that include biodiversity as a part of the overall review;
  - also ensure that in terms of biodiversity the investment does not involve land-use changes that may affect land with high conservation value.

- Project Lending/Investing: When lending, verify that the company is considering biodiversity in its activities. e.g. Biodiversity is present in the company's Environmental Management System.
- Consider the International Finance Corporation's Performance Standards on biodiversity while evaluating project.
- Develop financial products that consider biodiversity (for example, funds that use a biodiversity index).
- Communicate information to investors about your approaches to biodiversity-conscious financing.

## RESEARCH AND DEVELOPMENT

Business activities such as production processes and construction methods, as well as goods and services themselves,

can have impacts on biodiversity, related research and development can cause or reduce impacts on biodiversity.

### WHAT CAN BE DONE?

- In research and development related to production processes, construction methods, etc., consider impacts on biodiversity.
- When conducting research and development for goods and services, consider the impacts on biodiversity over the entire life cycle.
- Investigate services, and sales and marketing methods that consider biodiversity.
- Consider business models that are biodiversity friendly.
- Conduct research and development for production methodologies, to reduce the use of material inputs.
- Conduct research and development for construction methods that can reduce the impacts on biodiversity.
- Conduct research and development of goods that lead to a reduction of the amount of waste emitted.
- Conduct research and development on certification methods to indicate considerations related to biodiversity.

# LAND USE

## (Land-Use Change, Building Construction, Land Management, Vacant Land Use, Redevelopment, etc.)

Land use changes, such as the construction of a factory or business establishment on agricultural or forest land, etc., may cause decreases in size, fragmentation, alterations or other impacts on species' habitats. Even for land that is not altered, there may be impacts on river ecosystems and marine biodiversity through soil runoff, wastewater discharge, and the construction of structures, etc.

Biodiversity impacts sometimes also cause the degradation of local traditional culture that may be strongly rooted in living resources.

Impacts on biodiversity can also occur as a result of the introduction of alien species and other activities associated with management methods for land holdings, the use of vacant land, and redevelopment. Meanwhile, in some cases, the consideration of

biodiversity can increase real estate values.

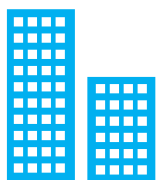
Note that for land use in India, where there is a risk of significant impact on the environment including biodiversity, depending on the characteristics of a project, there may be a requirement to conduct an environmental impact assessment based on the Environmental Impact Assessment Act and other regulations.

## WHAT CAN BE DONE?

- When making a change in land use, give proper consideration to biodiversity.

When managing landholdings,

- Avoid causing negative impacts on local biodiversity (e.g., the introduction of alien species),
- Create positive impacts (e.g., the creation of habitat and the creation of ecological networks).
- Regarding land use (e.g., land alteration; construction of buildings; management of land holdings; use of vacant land; redevelopment; fragmentation of aquatic systems such as rivers and lakes, etc.), relevant parties including property owners, managers, developers and builders are to consider the conservation and sustainable use of biodiversity, in keeping with their respective roles.
- When making a change in land use, consider collaboration with stakeholders.
- When making a change in land use, consider communication and collaboration with a variety of external stakeholders, while disclosing information to the extent possible and necessary—from the business entity's planning stage for the activity, through to the implementation stage.



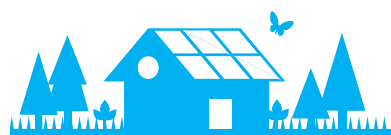
## Changes in Land Use, Construction of Buildings

- Avoid land developments on land that has high conservation value in terms of biodiversity conservation.
- When developing land, a business owner considers biodiversity conservation when selecting the construction contractor, deciding on the development plan, managing the construction, etc.
- When altering land where natural ecosystems remain, the contractor considers reducing the amount of area to be altered, or reducing the impacts on high biodiversity areas to the extent possible, or considers reducing to the extent possible the impacts on areas that are important as part of a network of habitats, and implementing conservation of rare species, etc.
- In the construction of buildings, give proper consideration to biodiversity; when planning, study not only the project site, but also the natural environment in the surrounding area, and consider ecological networks when developing construction plans; when constructing, consider locating temporary structures to not disturb species living there, conduct noise reduction measures, etc.
- For construction activities, consider impacts on biodiversity not only from the construction work itself, but also from the procurement of construction materials, and the handling of construction waste soil and other construction waste.
- When creating areas of greenery, give consideration to the use of endemic species, and be careful about the introduction of alien species. Give consideration to the relationship with ecosystems in the surrounding area, for example, by considering networks of habitats, etc.



## Land Management

- On corporate green spaces such as company-owned land and company-owned forests, establish biotopes with the aims of conservation of local ecosystems, environmental education for employees, etc. Assess the impacts on biodiversity, through timely monitoring, such as in collaboration with local universities, NGOs and NPOs, etc.
- Undertake multifaceted evaluations of management and operations on land holdings, etc., covered by vegetation, based on evaluation systems for green spaces.
- Possible parties for consultation include local universities, NPOs, etc.



## Redevelopment

- Create green spaces and biotopes, while considering networks with surrounding ecosystems, and local natural vegetation, etc.



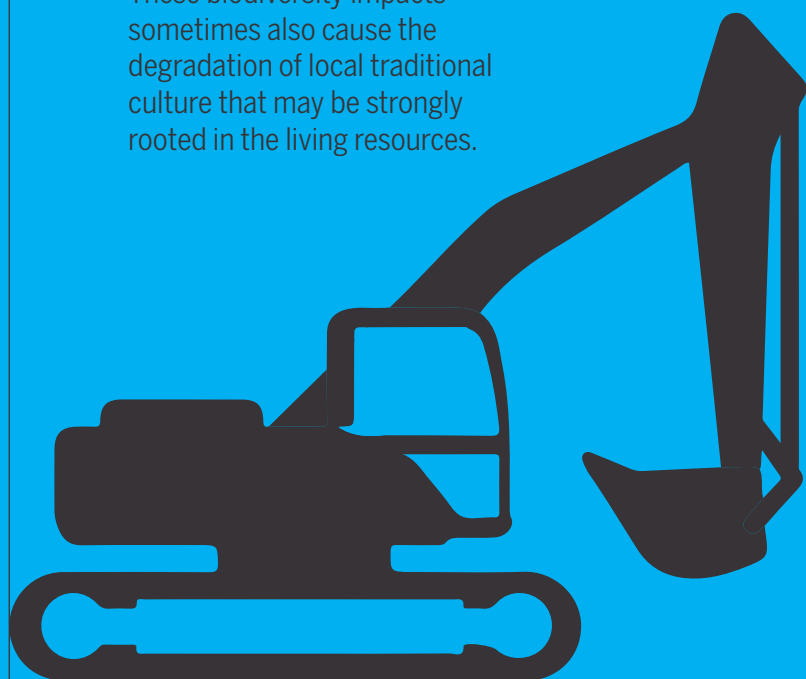
## Vacant Land Use

- While considering networks with surrounding ecosystems, plant vegetation to allow the land to return, as quickly as possible, to the type of vegetation that existed before the land alteration, or to return to the local natural vegetation, etc.

# MINING

With the development of non-living resources (minerals, energy resources), the stripping of the land surface often results in the loss of large areas of existing ecosystems, the dumping of large amounts of mine waste, and also the development of infrastructure such as roads and ports, etc. Furthermore, in mining and primary treatment processes such as ore processing, a number of impacts may affect river and marine ecosystems as a result of water intake, water pollution, and soil contamination. If activities like the extraction of minerals and rocks, etc., and the disposal of tailings are not conducted properly, the results may be the loss or contamination of soil, and the loss of species' habitat, resulting in impacts on biodiversity. Furthermore, the development of non-living resources may also trigger other developments that can affect biodiversity as a result of the construction of access roads.

These biodiversity impacts sometimes also cause the degradation of local traditional culture that may be strongly rooted in the living resources.



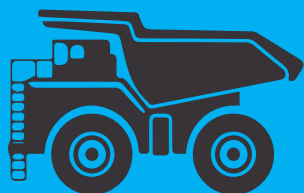
## WHAT CAN BE DONE?

- Investigate biodiversity-friendly extraction methods throughout the planning, construction, operation, closing and completion stages of a mine.



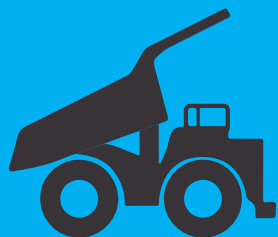
## Planning Stage

- Avoid mining developments on land that has high conservation value in terms of biodiversity conservation. Consider establishing ecological corridors.
- Consider biodiversity-friendly methods for extraction and other activities (e.g., to the extent possible, reduce the area of land to be altered; seek ways to avoid disrupting water flows, and relocate rare species if negative impacts cannot be avoided or reduced).
- Consider biodiversity when selecting the location for tailing dams and road construction, etc.



## Construction Stage

- Strive to carefully manage construction waste soil, wastewater discharges, etc.
- Prevent soil runoff or leaching from excavation sites, road slopes, and construction waste soil areas.
- Develop and implement plans to prevent spills, etc.



## Mine Closing and Completion Stage

- On former extraction sites, return the soil cover and leftover soil, and develop and implement plans such as for the planting of vegetation to restore the site to the vegetative cover prior to the alteration.
- Conduct monitoring of leachate.



## Operations Stage

- Strive to reduce the environmental burdens (water, noise, etc.) of extraction, etc.
- Implement measures to control wastewater, waste materials, chemical substances, and accidents that may occur in the course of extraction, concentration, etc.
- Carefully select disposal sites and implement strict measures to handle mining waste, such as large amounts of waste soil.
- Take measures to prevent oil spills.
- Reduce the consumption of water, energy, etc.





# OPERATION STAGE

Waterpollution due to effluent discharged from factories and other workplaces can potentially affect species' habitat in rivers and marine areas. Furthermore, although much

is still unknown, it has been pointed out that chemical substances may pose risks of impacts on ecosystems. It has also been pointed out that light (nighttime lighting, etc.) has impacts

on living organisms, including insects and plants.

As for operations at workplaces, it is requested to observe effluent standards, develop proper greenbelt etc.

## WHAT CAN BE DONE?

- Wastewater volume, water quality, chemical substances, etc., implement measures to assess their biodiversity impacts, confirm the types and amounts, etc., and implement measures and steps to reduce such impacts.
- Lighting, give adequate consideration, depending on the location and other factors, to prevent light leakage, and to control lights depending on the season of the year and time of day, etc.
- Implement green belt around your premises as per guidelines provided by Central Pollution Control Board for effective air quality control<sup>10</sup>.

<sup>10</sup><http://cpcbenviis.nic.in/scanned%20reports/PROBES-75%20Guidelines%20For%20Developing%20Greenbelts.pdf>

# BIOLOGICAL RESOURCE USE

Examples of the use of living resources include the use of fisheries resources, forest resources, and agricultural resources. The excessive use of fisheries and forest resources can lead to the destruction or deterioration of individual species or entire ecosystems.

Converting land for plantations, afforestation, and the building of aquaculture farms, etc., can lead to changes in natural

ecosystems, and may cause changes to the habitats of living organisms. Meanwhile, tree-planting projects and other activities on degraded land can restore forests, thus creating species' habitat.

With regard to agricultural products, the excessive use of agricultural chemicals and fertilizers or the use of harmful chemicals and fertilizers, as well as activities for improving farmland and

watercourses that put priority on economy and efficiency, can affect biodiversity.

Such biodiversity impacts sometimes also cause problems for the local economy and society, as well as traditional cultures that may be strongly rooted in the living resources. On the other hand, the consideration of biodiversity may lead to opportunities, such as gaining the trust of stakeholders.

## WHAT CAN BE DONE?

Use living resources with an emphasis on conservation and sustainable use of biodiversity.

- Study past experience to determine if land and marine areas subject to the use of living resources are areas having high biodiversity conservation value.
- Avoid land-use conversion on land that has high conservation value in terms of biodiversity conservation. Alternatively, take the approach of using zoning to classify areas that can be used for economic activities and those that should be left untouched.
- Carry out appropriate monitoring of changes in ecosystems, and be flexible in revising management and usage activities depending on the results of the monitoring (adaptive approaches, etc.).
- Conduct timber production activities, etc., based on the “Guidelines for the Conservation and Sustainable Use of Biodiversity in Tropical Timber Production Forests” issued by the International Tropical Timber Organization (ITTO).
- Consider biodiversity by making use of certification systems for sustainable forestry and fisheries.
- Avoid the use of alien species as pollinators or for exterminating pests.

# TRANSPORTATION STAGE

Biodiversity impacts may arise from the introduction of alien species through the transport of goods, etc., including impacts on marine and coastal ecosystems as a result of ship ballast water and organisms attached to ships' hulls.

Businesses are not only profit-seeking economic entities, but are also members of society, and it is hoped that through their activities they will contribute to the conservation and sustainable use of biodiversity.

It is also hoped that business entities will not only contribute to society through their core businesses and manage environmental impacts of their business activities, but will also conduct social contribution efforts on issues relating to biodiversity— issues that cannot be resolved simply by reducing their impacts on biodiversity.

Businesses can follow the above process before undertaking any new projects

or in their existing projects as a way to prevent any impact to biodiversity. Taking mentioned steps will help limit businesses impact on biodiversity and create a sustainable future for all.

Guidebook for biodiversity management combines business success with the conservation of biological diversity. To reach the goal, businesses must organize their biodiversity management system in such a way that it affects both the impact factors and the drivers for a business case for biodiversity. To identify measures, the guidebook shows the connections between the impacts of each sector in the sectoral pages, each department impacts

under the sectors and what can be done to conserve biological diversity. These associations are illustrated with best-practice examples from companies globally and nationally. The guidebook then presents logical angles for industries to work on biodiversity. As a result each company must find its own individual activities to support biodiversity.

For the conservation of our biological diversity it is important to have a broad-based integration of biodiversity management in business decision-making. This roadmap aims to offer companies support in that process.

## WHAT CAN BE DONE?

- Assessment to know whether any alien species is getting transported
- Consider biodiversity when establishing transport routes. Eg. Biodiversity corridor
- Take measures such as using low-emission vehicles, preventing vehicle engine idling, etc.
- Consider and implement countermeasures relating to ballast water.
- Take steps to control insects, seeds, etc., attached to containers, pallets, etc.
- Cooperate with quarantine systems, undertake voluntary fumigation, etc.

# TO DO LIST FOR INDUSTRIES

A quick understanding for every company wanting to improve on biodiversity front.

**Build internal awareness and commitment by involving all relevant departments in developing your BES strategy.**

**Build on existing efforts and information from data and activities that can contribute to your BES strategy.**

**Integrate B&ES to your environmental management system**

**While keeping the global picture in mind, confine assessments to site level, business lines or product lines in order to manage complexity.**

**Use of existing tools which are easily available**

**Assess the present and future risks affecting your company – operational, financial, or reputational – and potential ways to reduce or manage them.**

**Proactively addressing BES issues can help you identify opportunities.**

**Work with your value chain**

**Listen to stakeholders' concerns and use their knowledge as input for prioritizing BES actions.**






**Make your BES efforts visible and communicate about them.**



# **DIFFERENT ACTIVITIES ON BIODIVERSITY MANAGEMENT**

<b>POLICY</b>	<b>55</b>
<b>MAPPING</b>	<b>56</b>
<b>MANAGING</b>	<b>60</b>
<b>PARTNERING</b>	<b>68</b>
<b>MONITORING</b>	<b>75</b>

It is clear that biodiversity and ecosystem services are becoming an important issue for the industries. The question is how companies can deal with it. A large variety of international case studies on good biodiversity management exist. Some are rather generic, while others focus on a particular aspect. This below analysis does not provide a detailed roadmap to develop and implement BES strategies in companies, as this is case specific and needs assessment.

 <b>POLICY</b>	 <b>MAPPING</b>	 <b>MANAGING</b>	 <b>PARTNERING</b>	 <b>MONITORING</b>
<b>Biodiversity Policy</b>	<b>Environment Impact Assessment</b>  <b>Biodiversity Mapping</b>  <b>Climate Change</b>  <b>Sustainable operations in Protected Areas</b>	<b>Biodiversity Hotspot Conservation</b>  <b>Habitat conservation &amp; management</b>  <b>Ecological Restoration</b>  <b>Biodiversity action plan</b>  <b>Biodiversity Management Plan (BMP)</b>  <b>Greenspace development</b>  <b>Sustainable Agriculture</b>  <b>Sustainable livestock production</b>	<b>Biodiversity partnerships</b>  <b>Endangered species program</b>  <b>Community Engagement</b>  <b>Research and Funding</b>  <b>Responsible sourcing</b>  <b>Land Reclamation &amp; Restoration</b>  <b>Sectoral associations</b>	<b>Biodiversity Indexing and monitoring</b>



# POLICY



## BIODIVERSITY POLICY

**Biodiversity policies promote the protection, conservation, and sustainable use of biologically diverse ecosystems and habitats. In doing so, they create significant public benefits and contribute to social well-being.**

**The policy could set out the company's goals, acceptable targets and mechanisms for action, and identify the potential roles of stakeholder groups. This strategy would aim at mainstreaming biodiversity into company activities, recognizing that the biodiversity strategy is a subset of the company's wider social responsibilities or sustainability agenda. It could provide a framework for strengthening existing activities and procedures, rather than initiating the development of new stand-alone programmes. Finally, the strategy should engage key stakeholders, those who can both impact upon the company and who are affected by company activities, thus providing an opportunity for building strategic partnerships with appropriate organizations and initiatives.**

## Biodiversity Policy: Iberdrola

Iberdrola's Biodiversity policy sets out the Company's position and its commitment to taking into account biodiversity in its decision processes, particularly as regards the design and construction of new infrastructure, and integrating it into our environmental management systems, training, collaboration and information systems.

Environmental Impact Studies (through mechanisms for the identification and mitigation of impacts that take into account various alternatives and establish corrective measures to avoid, mitigate or offset possible harm) are prepared and implemented prior to beginning construction.

Promotion of species and habitats by managing positive conservation and research of the sites is also undertaken. Activities are both regulatory as well as voluntary, with the goal of obtaining a positive net balance with respect to the environment.

# MAPPING



## ENVIRONMENT IMPACT ASSESSMENT

Many companies in the corporate sector have developed formal environmental management systems (EMS) or EIA processes which help to identify, prioritize and manage risks, improve performance and reduce impacts. By capturing experiences and good practices they can serve as active learning tools between a company's operations, as well as helping to improve performance year on year.

By integrating company BAPs thoroughly into environmental management systems, a company can ensure that biodiversity issues are considered systematically along with other environmental impacts.

## Environment Impact Assessment: BP

BP takes steps to understand and manage the potential impacts of its operations on protected and sensitive areas. In the early planning stages, projects that are subject to environmental and social practices complete a screening process to identify potential impacts associated with the project. These may include risks to sensitive or internationally protected areas and species also. Following the screening process, they carry out impact assessments, identify mitigation measures and implement these in project design, construction and operations. For example, as a result of screening for a drilling project in Uruguay, BP identified that sensitive corals could be present in the project location and it is determining what steps may be needed to mitigate potential impacts.

Every year, its major operating sites review their environmental performance and set local improvement objectives.

<http://www.bp.com/en/global/corporate/sustainability/environment/managing-our-impact-on-the-environment.html>



## BIODIVERSITY MAPPING

**Biodiversity Mapping is a tool to display and produce maps of a particular region's biodiversity, native vegetation, and flora & fauna data.**

**Maps are useful for spatially explicit prioritization and problem identification, especially in relation to synergies and trade-offs among different ecosystem services, and between ecosystem services and biodiversity. Further, maps can be used as a communication tool to initiate discussions with stakeholders, visualizing the locations where valuable ecosystem services are produced or used and explaining the relevance of ecosystem services to the public in their territory.**

## Biodiversity Mapping: Astellas

Astellas' Nishine Plant is located in the abundant nature of a hillside forest forming a kind of bridge from Mount Iwate to Mount Himegami. Over half the site area (about 345,000 m<sup>2</sup>) comprises unspoiled natural forest in which wild Japanese deer and squirrels have been spotted. In fiscal 2014, an ecosystem survey was carried out by an independent third party to ascertain the value of this forest ecosystem.

Inside the site, trees including chestnuts, Japanese oak and Japanese pines are well looked after, and the existence of wild animals living in the forest has been confirmed. Moreover, some of these plants have been identified as rare species in danger of extinction, in addition to animals that is important to protect, including grey buntings and copper pheasants. It was also estimated that the forest absorbs about 260 tons of CO<sub>2</sub> per year.

<http://www.astellas.com/en/csr/environment/biodiversity.html#a-03>



## CLIMATE CHANGE

The impacts of climate change on biodiversity stem from the fact that species tend to evolve to a specific range of environmental factors, such as temperature or moisture. As these factors alter due to climate change, species need to migrate to stay in their optimum environment. Some species are more adaptive. For others, this threatens their ability to survive and hence increases extinction rates and reduces biodiversity.

Climate change mitigation entails finding ways to reduce the greenhouse gas emissions that cause climate change. Ways of mitigating climate change include reducing demand for emissions-intensive goods and services, increasing efficiency gains, increasing use and development of low-carbon technologies, and reducing non-fossil fuel emissions.

## Climate Change: Bayer Crop Science

Bayer's breeding programs include crops that have higher yields and are able to withstand heat, drought, salinity or cold weather conditions. This technology, therefore, helps to sustain productivity under suboptimal climatic conditions, relieving the pressure to bring more land under cultivation.

<http://www.cropscience.bayer.com/en/Commitment/Climate-Change.aspx>



## SUSTAINABLE OPERATIONS IN PROTECTED AREAS

**This element focusses on identifying and understanding certain risks associated with operations in and around biodiversity. It emphasizes managing and monitoring activities to reduce the risk of impacts and to manage the impacts on biodiversity, or avoid mismanagement.**

**It includes reporting potential impacts on land that lies within, contains or is adjacent to legally protected areas as well as areas of high biodiversity value outside of protected areas. Information pertaining to: geographic location; subsurface or underground land that may be owned, leased or managed by the organization; position relative to protected areas and high biodiversity value area outside protected area; type of operation; size (km<sup>2</sup>) of operation; biodiversity value, including attributes of the ecosystem and the listing of protected species needs to be considered.**

## Sustainable operations in Protected Areas: CNPC China

The Western Kenyan oil pipeline crosses Nairobi and Nakuru sanctuaries which are known as a haven for wild animals. As the EPC contractor, China Petroleum Pipeline Bureau, a subsidiary of CNPC, evaluated environmental risks and put forward the construction principle of "giving way to animals". It developed Rules on Protecting Wild Animals during Construction in National Parks of Nairobi and Nakuru to ensure no wild animal presence in the operating area and equipment moves at a slow pace to minimize noise and construction time. After construction, no garbage was left and the landscape was restored. Biological diversification during the entire construction process was protected and no pollution occurred. The project thus received applause from NTV and YouTube.

<http://www.cnpc.com.cn/en/environmentcase/201405/3ac443fefe0741fb9f5525854ed1c315.shtml>

# MANAGING



## BIODIVERSITY HOTSPOT CONSERVATION

**A biodiversity hotspot is a biogeographic region with significant levels of biodiversity that is under threat from humans. To qualify as a biodiversity hotspot a region must meet two strict criteria: it must contain at least 0.5% or 1,500 species of vascular plants as endemics, and it has to have lost at least 70% of its primary vegetation.**

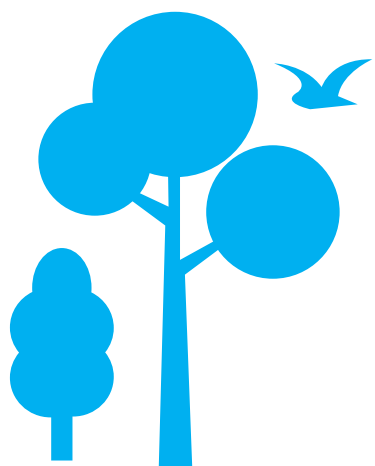
**Industrial activities in such areas need to be assessed and proper plan need to be devised if any impacts are analyzed.**

## Biodiversity Hotspot Conservation: BHP Billiton

BHP Billiton in alliance with Conservation International and The Nature Conservancy has announced an agreement to ensure the permanent conservation of 50,000 ha of the Valdivian Coastal Reserve in the Los Rios region, Chile.. This project involves the ongoing protection of 50,000 hectares of temperate rainforest. It also supports the largest ever restoration of native forest in the country, through the removal of 3,500 hectares of non-native eucalypts and the planting of more than 2.5 million native trees.

The Reserve is one of the 34 biodiversity hotspots identified by Conservation International. It is home to outstanding examples of endemic species, including two of the world's longest living tree species, one of the world's largest living woodpeckers, a small arboreal marsupial (mountain monkey), abundant populations of ground-dwelling birds and several highly endangered carnivores.

[http://www.bhpbilliton.com/~media/bhp/documents/society/reports/2014/140307\\_bhpbillitonvaldiviancoastalreserveproject.pdf?la=en](http://www.bhpbilliton.com/~media/bhp/documents/society/reports/2014/140307_bhpbillitonvaldiviancoastalreserveproject.pdf?la=en)



## HABITAT CONSERVATION & MANAGEMENT

**The indicator focuses on preventing, managing and remediating the damage to natural habitats that result from an organization's activities. Habitat conservation is a land management practice that seeks to conserve, protect and restore habitat areas for wild plants and animals, especially conservation reliant species, and prevent their extinction, fragmentation or reduction in range.**

**There is also economic value in conserving natural habitats. Financial profit can be made from tourist revenue, particularly in the tropics where species diversity is high. The cost of repairing damaged ecosystems is considered to be much higher than the cost of conserving natural ecosystems.**

### Exelon (Habitat conservation & management)

When it was recognized that osprey were making dangerous nesting attempts in the station's high-voltage yard, station personnel took action to research and build nesting platforms on site at Exelon's Dresden Generating Station. The project expanded as station personnel partnered with the Illinois DNR Endangered Species Manager to find additional areas needing platforms along the Illinois River. Contributing both financial and manpower resources, the station installed 14 platforms for osprey, spanning approximately 220 miles. In 2014 and early 2015, the osprey restoration effort continued in coordination with the Illinois DNR's Illinois Osprey Recovery Project. Efforts included the installation of a hacking tower with Exelon's partners at Anderson Lake to facilitate the introduction of young osprey into the wild and the addition of seven new nesting platforms at five locations.

[http://www.exeloncorp.com/sustainability/Documents/dwnld\\_Exelon\\_CSR%20\(1\).pdf](http://www.exeloncorp.com/sustainability/Documents/dwnld_Exelon_CSR%20(1).pdf)



## ECOLOGICAL RESTORATION

**Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.**

**Ecological restoration is sometimes only one of many elements within a larger public or private sector enterprise, such as development projects and programs for watershed management, ecosystem management and nature conservation. Project managers of these larger undertakings should be aware of the complexities and costs involved in planning and implementing ecological restoration. Cost savings can be realized by careful coordination of restoration activities with other aspects of a large program. For this reason, project managers will benefit by recognizing ecological restoration as an integral component of a program. If this is done, the restorationist can contribute substantively to all aspects of the program that impinge on restoration.**

## Ecosystem Restoration: Fairmont Group of Hotels

Fairmont Chateau Whistler installed bat hotels on their golf course to benefit bats, the community, farmers, gardeners and the ecosystem as a whole through providing a warm, safe location for bats on the course. Previously, on the same course, Chateau Whistler opened up corridors to allow bears to pass through without having forced confrontation with golfers. Additionally, tree clippings are piled up into "rabbitats," that attract predators like coyotes and other animals to enrich the biodiversity of the golf course.

The bat hotels give bats a home and in turn they eat thousands of insects. This also reduces the chance of human to bat contact.

Also, Fairmont Peace Hotel committed as a corporate sponsor to the "Million Tree Project" of Roots & Shoots: planted 2,000 trees in the desert lands of Inner Mongolia named "Fairmont Forest".

<http://www.fairmont.com/corporate-responsibility/environment/biodiversity/hotel-initiatives/>





## BIODIVERSITY ACTION PLAN

**Based on the specific findings of the biodiversity assessment and the direction set out in the biodiversity strategy, the biodiversity action plan (BAP) should clearly indicate how the strategy will be implemented. It could assign responsibilities for each activity, determine where these will take place, who will be involved, how they will be financed, how progress will be measured and set a clear timetable.**

**The plan is likely to cover a wide range of actions across various functions and locations of the company. Ideally, the emphasis would be on developing and implementing programmes which integrate biodiversity into existing management systems. Biodiversity-related priorities and objectives should be set within the local and national context.**

## Biodiversity Action Plan (BAP): Rio Tinto Coal Australia (RTCA)

As part of the BAP process, RTCA focused on gaining an understanding of the flora and fauna communities and species known (or suspected) to be present on and adjacent to its four coal mines in the Bowen Basin region of Central Queensland, Australia. Each species or community was summarized by its legislative status and then assessed on its vulnerability and irreplaceability. By taking a risk assessment approach, the species or communities with the highest biodiversity risk for RTCA have been identified and appropriate actions prioritized. Proposed actions under BAP include site-specific enhancement and restoration activities, academic research to improve understanding of species lifecycle requirements, and activities that seek to enhance regional conservation outcomes.

<http://www.riotinto.com/documents/ReportsPublications/RTBiodiversitystrategyfinal.pdf>



## BIODIVERSITY MANAGEMENT PLAN (BMP)

**An ideal BMP should cover the entire lifecycle of an extractive project, including the development or development phase, the operations phase, and the closure or decommissioning phase. In this respect, specific BMP plans for different phases might be appropriate. Further, the plans should be adaptable to enable responses to evolving circumstances.**

**The Standard is built around the protection and conservation of biodiversity; the Environment Impact Assessment (EIA) must take into account the differing values attached to biodiversity (use and non-use values) by various stakeholders and identify impacts on ecosystem services. The focus is on threats to biodiversity, including habitat destruction and invasive alien species.**

## Biodiversity Management Plan: ACS Group

ACS Group has supervision plans which guarantee the fulfillment of the preventive measures and reduce the impact of projects and processes not subject to environmental impact assessments. Specifically, in the Construction area, annual targets are set for identifying sensitive areas and species and adopting prevention and protection measures. Protection plans are also developed for native species.

Moreover, the possibility of incorporating or replacing polluting chemical products with other biodegradable products is being studied. Activities are carried out in strict and rigorous compliance with environmental law. Activities for replanting and relocating species in similar habitats are undertaken.

[http://www.grupoacs.com/ficheros\\_editor/File/03\\_accionistas\\_inversores/06\\_junta\\_general\\_accionistas/2015/5\\_informe\\_de\\_responsabilidad\\_social\\_corporativa\\_2014\\_en.pdf](http://www.grupoacs.com/ficheros_editor/File/03_accionistas_inversores/06_junta_general_accionistas/2015/5_informe_de_responsabilidad_social_corporativa_2014_en.pdf)



## GREENSPACE DEVELOPMENT

**A green space can include recreational fields, urban agriculture, natural play space for children, community, rooftop and balcony gardens, community compost sites, community orchards, and cycling routes. Urban green spaces are sometimes privately owned. Some examples of such places include higher education campuses, neighborhood/community parks/gardens, and institutional or corporate grounds.**

**General benefits include: economic growth and investment; land and property values; labor productivity; tourism; products from the land; health and wellbeing; recreation and leisure; quality of place; land management and biodiversity; land management and biodiversity; flood alleviation and management; climate change adaptation and mitigation.**

## Greenspace Development: Larsen & Toubro

L&T Construction with the help of an NGO started an in-house “Nursery” in April 2001. Within this 2400 square feet saplings are grown from its seeds, nurtured and distributed free to various government schools, colleges, institutions for planting.

The nursery has transplanted more than 350,000 saplings across Tamil Nadu through the collective efforts of all its Green Brigades. The Green Hands team has also demonstrated and converted 7 tonnes of campus garden dry leaves into usable mulch for horticultural use.

<http://www.larsentoubro.com/media/32502/lt-sustainability-report-2015-dec-15.pdf>



## SUSTAINABLE AGRICULTURE

**Sustainable agriculture is the act of farming based on an understanding of ecosystem services, the study of relationships between organisms and their environment. It has been defined as "an integrated system of plant and animal production practices having a site-specific application that will last over the long term"**

**Companies in the agricultural sector are working on a number of initiatives to demonstrate their dedication to sustainability including reduction in water use, local sourcing, anti-deforestation and direct investment at the community level.**

## Sustainable Agriculture: Agrium

Environmentally Smart Nitrogen (ESN), Agrium's controlled-release, polymer-coated nitrogen granules, have been at the forefront of innovative products for some time.

ESN is a urea granule coated with a flexible polymer coating. The coating protects the nitrogen from loss mechanisms and releases nitrogen based on temperature and soil moisture. Just one application of ESN gives crops the N they need, throughout the growing season, providing improved nitrogen efficiency to the farmer. The product not only keeps input costs down for farmers by reducing the number of fertilizer applications needed, but also protects the environment by reducing leaching, volatilization and denitrification.

**<http://www.smartnitrogen.com/how-esn-works>**



## SUSTAINABLE LIVESTOCK PRODUCTION

**Sustainable livestock production will includes the strategies like feed animals with less human food, raise regionally appropriate animals, keeping animals healthy, adopt smart supplements, tailor practices to local culture. This will help in reducing the environmental impacts and minimise the economic costs of keeping livestock and boosting quantity and quality of the food they produce.**

## Sustainable livestock production: Unilever

Farm animal welfare has been included in Unilever's Sustainable Agriculture Code since 2005, whereby it actively encourages its suppliers to participate in initiatives to improve animal welfare standards in the countries where it sources, processes and markets products from animal origin.

Since 2007, Unilever has been developing animal welfare criteria as part of its sustainable sourcing programme. These criteria address issues such as housing, hygiene, feeding and feed, health management and the management of antibiotics, water supply, mutilations, transport, slaughtering practices and traceability.

Unilever has made a policy commitment to source only cage-free eggs for all of its mayonnaises and dressings in Europe, including its market leading brands, Hellmann's, Amora and Calvé. Unilever has also committed to putting the welfare of dairy cows at the centre of its sourcing strategy through its Ben & Jerry's Caring Dairy programme.

Through its sustainable sourcing and animal welfare initiatives, Unilever has received a positive response from consumers who recognize its core brand values.

[http://www.compassioninfoodbusiness.com/media/5818194/unilever-case-study\\_final\\_pdf](http://www.compassioninfoodbusiness.com/media/5818194/unilever-case-study_final_pdf)

# PARTNERING



## BIODIVERSITY PARTNERSHIPS

Partnerships are a prominent mechanism for implementing national biodiversity strategies. The virtues of direct stakeholder engagement – instituting dialogue, building trust, realizing mutual objectives and acquiring mutually assured information accuracy – find their institutional expression through this arrangement.

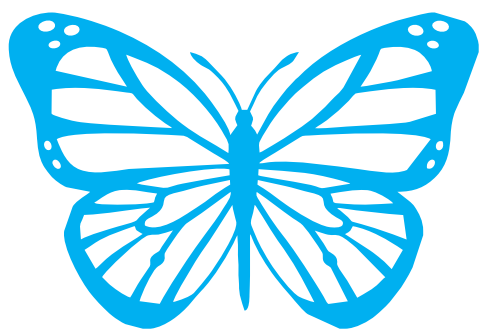
These partnerships can assist companies by providing them with access to biodiversity expertise, and information; strengthening and legitimizing biodiversity activities; allowing companies to efficiently outsource unfamiliar biodiversity activities; building company capacities which may be valuable in other areas of the business; and enabling cultural change.

## Biodiversity partnerships: Monsanto

Conservation International (CI) and Monsanto established this partnership because both organizations believe by working together, they will encourage positive changes for biodiversity and natural habitats.

As part of the partnership, CI will advise and recommend ways Monsanto can improve its environmental practices in relation to protecting the region. In turn, Monsanto will adopt the conservation of biodiversity in the Cerrado and the Atlantic Forest as one of the key elements of its business strategies in the region. The partnership states that both institutions will carry out activities that will produce concrete and measurable results to guarantee the conservation of biodiversity in areas selected as critical to both partners.

<http://www.monsanto.com/improvingagriculture/pages/conserving-biodiversity-with-conservation-international.aspx>



## ENDANGERED SPECIES PROGRAM

**In cooperation with public and private partners, many companies have devised Endangered Species Programs that aim at conserving endangered and threatened species and the ecosystems upon which they depend, through measures like Habitat Conservation Plans. The goal is the recovery of identified endangered species to levels where the species no longer remains endangered. Towards that goal, recovery plans are developed and implemented that provide detailed site-specific management actions in conserving listed species and their ecosystems.**

## Endangered species program: Nextera Energy

In the late 1970s, the American crocodile was on the brink of extinction. In the 1980s, Nextera initiated a crocodile management program at its Turkey Point Nuclear Power Plant south of Miami to benefit these ancient reptiles. Given the 5,900-acre, man-made cooling canal system at the plant offers ideal nesting conditions, the management program includes protecting these nesting areas, completing population surveys, relocating hatchlings within the canal system for better survival, and regulating plant activity at night and during nesting season. Over the past 37 years, 7,007 hatchlings have been tagged from 446 nests at Turkey Point.

Nextera recently added two new monitoring components for crocodiles to assist in crocodile research. In recent years, the crocodile population has rebounded, and in 2007, the U.S. government down-listed the American crocodile from an endangered species to a threatened species - a notable accomplishment.

<http://www.nexteraenergy.com/crr/our-environment/wildlife-habitat-preservation.shtml>



## COMMUNITY ENGAGEMENT

**Many Companies work with local communities on common issues of social and environmental importance like biodiversity conservation, for the enduring benefit of those communities, the resources, and towards a sustainable future for our planet.**

**Measures for community engagement include spreading awareness on importance of biodiversity among local people, engaging them on conservation projects, and promoting concept of participatory monitoring among people.**

## Community participation & engagement: Sands Expo

In September 2013, Sands Expo with support from Green Our Planet and Garden Farms of Nevada established Plant It for the Planet, an urban gardening program at Monaco Middle School. By late November, 20 kinds of vegetables and herbs had been grown and studied by the students and faculty.

Throughout the event, students discussed nutrition; greening their community; how to use insects as organic pesticides; and other lessons for urban gardening. Sands Expo's goal is to expand this initiative to other schools, showing faculty, students and their families the numerous benefits of urban gardening.

<http://www.sands.com/sands-eco-360/our-news/rss-5-sands-expos-urban-gardening-program-teams-up-with-local-school.html>





## RESEARCH AND FUNDING

**This aspect mainly covers mobilizing private sector investments in biological diversity and its associated ecosystem services.**

**Some companies also facilitate research in biodiversity conservation to encourage innovation in sustainable development. This could also include collaboration with national and international research institutions and involvement of community intervention.**

## Research & Funding: Sanofi

In January 2011, Sanofi U.S. R&D chose Beagle Rescue League, Lab and Leash Division as its third-party non-profit vendor for canine adoption. Beagle Rescue League is a nonprofit corporation formed for the purpose of rescuing, rehabilitating and re-homing unwanted beagles. Beagle Rescue League also implemented a Lab and Leash division which is designed to help dogs retiring from research facilities.

Sanofi developed its own dog adoption policy that covers any dog used for research. An internal dog adoption committee reviews and approves adoptions to the rescue organization.

<http://www.sanofi.us/l/us/en/layout.jsp?scat=2167CBCF-E060-4AAF-8A6E-A7306A69577E>



## RESPONSIBLE SOURCING

**Sourcing of natural raw materials can have significant effects on the environment and on local communities. Responsible sourcing implies responsible business conduct which includes ensuring the natural raw materials used in a company's products are produced in a manner that meets applicable laws and regulations, respects human rights, safeguards health & safety, protects the environment, does not cause deforestation and generally supports the contribution of business to achieving sustainable development.**

**Responsible sourcing, also referred to as supply chain responsibility, is a voluntary commitment by companies to take into account social and environmental considerations (biodiversity in this case) when managing their relationships with suppliers.**

## Responsible sourcing: Takeda

A big part of sourcing responsibly involves sourcing locally. For over 80 years, Takeda Garden for Medicinal Plant Conservation (Kyoto) has collected, grown and used herbal and other plants with medicinal value from around the world. Currently, the garden grows about 2,800 species of plant, of which 2,214 have medicinal value. The garden currently has 127 endangered plant species including near threatened ones. Takeda started early with in-house cultivation of medicinal plants, which is connected to conserving biodiversity. As part of its efforts to ensure stable supplies of medicinal plants and to conserve the environment, Takeda has been conducting research into in-house cultivation of the licorice since 1996.

The garden consists of many sections like the Central garden, Kampo garden, a conservatory, an arboretum, exhibition hall, Camellia garden, Spice garden and a Folk medicine garden.

[https://www.takeda.com/csr/reports/pdf/index/ar2012\\_d25\\_en.pdf](https://www.takeda.com/csr/reports/pdf/index/ar2012_d25_en.pdf)



## LAND RECLAMATION & RESTORATION

**Land degradation represents a risk to business, not only for the companies from the agriculture sector, but also to the ones that have indirect links to land, e.g. insurance, retail, mining, oil & gas etc. Restoring land can also represent an opportunity for those companies that have understood the materiality of land to their business and that are taking action.**

**Companies should first prevent further land degradation, by implementing or making sure their suppliers or clients apply the mitigation hierarchy and implement sustainable land management practices. Degraded land can be restored to a natural state, reintroducing and enhancing local ecosystem services and biodiversity. Large-scale land restoration is indeed possible and can bring a wide range of benefits to business and society as a whole.**

**Companies can directly engage in large scale restoration activities in the properties their own, or can choose to partner with local authorities to support restoration of publicly-owned land.**

## Land reclamation and restoration: Pfizer

The North Haven Connecticut site, a former contaminated 78-acre manufacturing site on the banks of the Quinnipiac River came under Pfizer ownership in 2003. Since then, Pfizer has assessed the contamination, developed a remediation plan and secured regulatory and public approval. Remedial design and engineering is under way now.

When the cleanup is complete, approximately 17 acres will be available for commercial or light industrial use. The rest of the site, developed with extensive community input, will be restored to tidal marshes, inland wetlands and upland meadows as an ecological preserve. The redevelopment also includes plans to: Integrate site cleanup with redevelopment, conduct ecological restoration and encourage low impact uses such as green roofs, rain gardens and parking lot biocells.

[http://www.pfizer.com/files/responsibility/protecting\\_environment/A-Birds-Eye-View-of-Stewardship.pdf](http://www.pfizer.com/files/responsibility/protecting_environment/A-Birds-Eye-View-of-Stewardship.pdf)



## SECTORAL ASSOCIATIONS

**A trade association or sector association is an organization founded and funded by businesses that operate in a specific industry. Its main focus is collaboration between companies working in the same field and fostering partnerships amongst them to provide a common platform for dialogue sharing and policy making.**

**Working with other companies in the same sector and beyond enables companies to pool expertise and resources, by developing joint solutions to common biodiversity issues.**

## Sectoral associations: International Council on Mining and Metals (ICMM)

The International Council on Mining and Metals (ICMM) was established in 2001 to act as a catalyst for performance improvement in the mining and metals industry. It brings together 23 mining and metals companies as well as 34 national and regional mining associations and global commodity associations to maximize the contribution of mining, minerals and metals to sustainable development.

Its members are working collaboratively across industries to advance biodiversity management practices, 70 per cent of members have partnerships in place to address biodiversity issues.

More than half the member companies have some form of commitment or aspiration to achieve no net loss or a net gain of biodiversity.

<http://www.icmm.com/document/8330>

# MONITORING



## BIODIVERSITY INDEXING/MONITORING

**A company needs to be able to measure its performance against targets, relevant standards and stakeholder expectations, so that it can evaluate if corrective action needs to be taken and where future targets should be set or revised.**

**There are two aspects to performance: first, the extent to which the planned actions have been carried out according to schedule and the standard to which these have been carried out; second, the effect of these actions against their objectives. Indicators of performance may include the development of a corporate biodiversity strategy in line with company policy, an increase in the number of sites or land-holdings covered by site-specific BAPs, as well as the establishment of a procedure for periodical review of site BAPs.**

## Biodiversity Indexing/monitoring: Chevron

In 2008, Chevron partnered with WCS (Wildlife Conservation Society) to introduce passive acoustic monitoring in the South Atlantic Ocean to assess humpback whale breeding activity. They deployed Marine Acoustic Recording Units on the sea floor to record the marine sounds. This surveying technique resulted in the first complete documentation of the full migratory timing and seasonal presence of humpback whales that spend their winters off the Angolan coast. By knowing the migration routes and seasonality, Chevron workers are better able to schedule their projects and conduct their day-to-day operations as to minimize the impact of their operations on marine life.

During this period, WCS was also able to document the presence of blue whales through recordings of their species-specific vocalizations. These recordings provided the first modern evidence of this endangered species off Angola since the 1970s.

[http://www.chevron.com/documents/pdf/corporateresponsibility/Chevron\\_CR\\_Report\\_2012.pdf](http://www.chevron.com/documents/pdf/corporateresponsibility/Chevron_CR_Report_2012.pdf)



# **FOOD AND AGRICULTURE**

<b>OVERVIEW</b>	<b>78</b>
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# OVERVIEW

The food and agriculture sector constitutes a dominant stake in the Indian economy, contributing to a total of 16 % to country's GDP in 2014-15 (Table 2). While declining share of agriculture in GDP is an expected outcome in a fast growing and structurally changing economy, increasing share of food processing reflects changes in Indian consumer palate.

Agriculture plays a vital role in India's economy. Over 58 per cent of the rural households depend on agriculture as their principal means of livelihood.

## Share in total GDP of food and agriculture

	2011-12	2012-13	2013-14	2014-15
<b>Food and Agriculture Sector GDP Share (%)</b>	18.37	17.72	17.22	16.11
<b>Food and Agriculture sector GDP Share (INR in Billion)</b>	15055.78	15234.7	15792.9	15828.51
<b>Total GDP (INR in Billion)</b>	81955.44	85992.2	91697.9	98270.89
<b>YEAR</b>	<b>2011-12</b>	<b>2012-13</b>	<b>2013-14</b>	<b>2014-15</b>
<b>GDP (At BASIC PRICE)</b>				

Table 2: Share in total GDP of food and agriculture

# 20%

OF PRODUCTION IS WASTED DUE TO LACK OF COLD STORAGE FACILITIES

# 75%

OF THE WORLD'S COMMERCIAL MARINE FISHERIES ARE FULLY EXPLOITED OR OVER EXPLOITED



# Supply chain of F&A sector



Image 7: Supply chain of F&A sector

Agriculture, along with livestock, fisheries and forestry, plays an important role in the country as over 70% of population depends on agricultural activity for livelihoods. World's second largest arable land along with diverse agro-climatic zones have set favourable conditions for India, making it the world's leading producer of many agricultural products. The country ranks first globally in production of milk, pulses, ginger, bananas, guavas, papayas and mangoes. Despite being regarded as a significant player in providing global food security – India stands sixth in the world in exports of agricultural products – it is yet to reach its full export potential.

Grain milling, sugar, edible oils, beverages, fruits and vegetables processing and dairy products constitute the major industries in this segment. With food processing accounting for one third of food market, a number of domestic and international players, including Britannia, Dabur, Godrej, HUL, ITC, Nestle and PepsiCo, have well established their market presence. Food, being the biggest expense for urban and rural Indian households, constitutes a share of 40-

50% in total consumption, changes in consumer preferences have a strong potential to influence the course of the industry in terms of sourcing and manufacturing practices.

Poor infrastructure is a key challenge faced by food and agriculture sector. Lack of cold storage facilities causes wastage of up to 20% of fruit and vegetable production. Multiple intermediaries between farm and fork are yet another shortcoming, leading to increased prices and waste. Permission of up to 51% FDI in multi-brand retail is expected to boost foreign investments and facilitate modernisation in food and agriculture. Government's efforts to advance the sector include National Food Security Mission and National Mission on Food Processing among others.

Agriculture sector includes statistics, facts and market data on the primary sectors Farming, Forestry, and Fishery & Aquaculture. Secondary sectors involved in processing of the primary products and also companies dealing in chemical fertilizers & pesticides, help in improving yield of the sector.

World's forest area declined from

**31.6% to  
30.6%**

**100**

times faster soil is eroded  
due to human activity.

# DEPENDENCIES

Food and agriculture depend on various ecosystem services across its value chain (see Figure 2), covering inputs, agriculture, procurement and storage, food processing and retailing. Sourcing of agricultural inputs extends to a wide variety of product segments, which set the genetic potential of crops and animals: providing them with nutrition and protecting them against diseases, pests and weeds. Dependencies within agriculture can be further distinguished by agricultural products, livestock and fisheries, and forestry and logging.

Agriculture is the largest consumer of water with irrigation accounting for over 80% of total freshwater used in the country<sup>1</sup>. With about 60% of India's agriculture land being rain-dependent, water plays a crucial role for agricultural products and livestock.

Genetic resources play an essential role for food and agriculture, improving productivity and quality of crops, livestock, forestry and fisheries. Food, in turn, is the major dependency for food processing industry. Food security is a major challenge given global food production is set to double by 2020. Overexploitation of fisheries would limit future seafood catches, as 75% of the world's commercial marine fisheries are either fully exploited (50%) or overexploited (25%)<sup>2</sup>.

Pollination by insects and other animals affects 35% of the world's crop production. Predators such as bats, toads, snakes, parasitic wasps and micro-organisms consume crop pests and play a key role in controlling agricultural pests and diseases. The total economic value of pollination service by insect pollinators was estimated at 153 billion euros in 2005<sup>3</sup>.

<sup>1</sup>Central Water Commission <http://www.cwc.nic.in>.

<sup>2</sup>Millennium Ecosystem Assessment (2005). Ecosystems and Human Well-being: Biodiversity Synthesis, World Resources Institute.

<sup>3</sup>Gallia, N. et al (2008). Economic Valuation of the Vulnerability of World Agriculture Confronted with Pollinator Decline. Ecological Economics.





# IMPACTS

Food and agriculture can have versatile negative impacts on ecosystem services (see table 3). To a large extent these result from the loss of forest cover, whereby forest area is cleared either for agricultural use or due to forestry and logging. Agricultural expansion is considered to be a major driver of tropical deforestation. Albeit the slowing rate of deforestation over the past 25 years, the world's forest area has declined from 31.6% to 30.6% of the Earth's land surface – an area almost equivalent to the size of South Africa<sup>4</sup>. Further, tropical forest about the size of India is forecast to be lost between 2015 and 2050 due to land being cleared for industrial agriculture<sup>5</sup>.

Excessive use of chemical fertilizers and pesticides pose adverse toxic effects on the production potential of the land. Agricultural use of fertilizers has badly impacted marine and riverine ecosystems, producing over 400 aquatic “dead zones” worldwide that covers

an area of 245,000 sq.km through eutrophication<sup>6</sup>. Conversely, wise application of crop nutrition and pest control can have positive impact as increased yields reduce the need for conversion of wild lands.

Several regulating services can be affected due to agriculture, including erosion control, maintenance of soil quality, water purification and waste control among others. For example, cutting down or burning native forests and intensive agriculture lead to soil erosion. It is found that human activity erodes soil 100 times faster as compared to natural rate of erosion<sup>7</sup>. Climate regulation is yet another significantly affected service with food systems accounting for about 25% of the total global GHG emissions. Agriculture accounts for 44% of anthropogenic methane emissions and about 70% of nitrous oxide gases, mainly from conversion of new land to agriculture and use of nitrogen fertilizer<sup>8</sup>.

<sup>4</sup>UN Food and Agriculture Organization (2015). Global Forests Resources Assessment.

<sup>5</sup>Busch, J. & Engelmann, J. (2015). The Future of Forests: Emissions from Tropical Deforestation with and without a Carbon Price, 2016-2015. Genter for Global Development.

<sup>6</sup>Greenpeace (2012). Phosphorus in Agriculture: Problems and Solutions.

<sup>7</sup>Reusser, L. et al (2015). Quantifying human impacts on rates of erosion and sediment transport at a landscape scale. *Geology* <http://dx.doi.org/10.1130/G36272.1>.

<sup>8</sup>FAO (2013). Food Wastage Footprint: Impacts on Natural Resources.

# Dependencies and impacts in the value chain of food and agriculture



	Impact	Dep	Impact	Dep	Impact	Dep	Impact	Dep
<b>PROVISIONING SERVICES</b>								
Food								
Fodder								
Timber								
Biological raw materials								
Biomass fuel								
Freshwater								
Genetic resources								
Biochemicals, natural medicines and pharmaceuticals								
<b>REGULATING SERVICES</b>								
Air quality maintenance								
Climate regulation								
Disease mitigation								
Regulation of water timing and flows								
Maintenance of soil quality								
Pollination								
Flood regulation								
<b>CULTURAL SERVICES</b>								
Educational and inspirational values								
<b>SUPPORTING SERVICES</b>								
Habitat								
Nutrient cycling								
Primary production								
Water cycling								

Table 3: Dependencies and impacts in the value chain of food and agriculture

# SECTOR INITIATIVES



## Global Initiatives

### Bonsucro

Bonsucro is a global non-profit, multi-stakeholder organisation fostering the sustainability of the sugarcane sector through its leading metric-based certification scheme and its support for continuous improvement for members.

### Forest Stewardship Council

Forest Stewardship Council (FSC) is a global multi-stakeholder standard setter for sustainable forest management certification, promoting “environmentally appropriate, socially beneficial, and economically viable management of the world's forests.”

## Marine Stewardship Council

First established by Unilever, the world's largest buyer of seafood, and WWF, the Marine Stewardship Council (MSC) uses a product labelling system to promote sustainable and well-managed fisheries.

## Rainforest Alliance

Rainforest Alliance certifies bananas, cocoa, coffee, cut flowers and oranges in sustainable farm management that cover worker welfare, the use of agrochemicals and biodiversity.

## Roundtable on Sustainable Palm Oil

Roundtable on Sustainable Palm Oil (RSPO) includes the entire supply chain for palm oil production, from growers to retailers, as well as investors and conservation groups to develop and implement global standards for sustainable palm oil.

## Sustainable Agriculture Initiative

Sustainable Agriculture Initiative (SAI) Platform was founded by food companies Danone, Nestlé and Unilever to support the development and promotion of sustainable agricultural practices throughout the food value chain.

# CASE STUDY

## Unilever: Sustainable Sourcing of Palm Oil

Unilever, a British-Dutch multinational consumer goods company, is one of the world's largest buyers of palm oil for use in products such as margarine, ice cream, soap and shampoo, accounting for about 3% of the world's total production. Palm oil production is associated with deforestation, carbon emissions and biodiversity losses, posing reputational risk for companies dependent on this commodity.

In 2013 Unilever committed to procure 100% of its palm oil from traceable and certified sources by 2020. The company has Sustainable Palm Oil

Policy, which includes three principles: halt deforestation, protect peat land and drive positive economic and social impact for people and communities.

By 2015 Unilever had achieved its target to source 100% of palm oil from sustainable sources through the purchase of GreenPalm certificates – the first step in reaching the 2020 goal. GreenPalm is a trading programme that allows manufacturers and retailers to purchase one GreenPalm certificate from a grower certified by the (Roundtable on Sustainable Palm Oil) RSPO for each tonne of palm oil used.

COMMITTED TO  
**PROCURE 100% OF ITS PALM OIL**  
FROM CERTIFIED SOURCES BY 2020.



# ITC:

## Biodiversity Risk and Opportunity Assessment

Indian conglomerate with diversified business, ITC is one of the largest exporters for agricultural products. Loss of biodiversity and ecosystem services is acknowledged by ITC to affect the availability of crop, posing a business risk for its agriculture division.

In 2013 ITC implemented the Biodiversity Risk and Opportunity Assessment Tool (BROA) in its crop development regions in Karnataka and Andhra Pradesh. The tool provides a method to identify biodiversity impacts and dependencies of business operations in a given agricultural landscape, followed by an assessment of business risks and opportunities.

The following risks were identified and corrective actions taken by ITC in Mysore:

- (1) **Decline in water flow / quantity / water table:** Water storage tanks were constructed at the bottom of sloppy areas, and 1.1 million cubic metres of silt was removed to revive and increase water table and improve water flow.
- (2) **Soil erosion:** Farmers were encouraged to carry out trenching, and bonding on their fields to prevent erosion. All topsoil that was eroded and settled in the tanks was taken out and deposited back on the farmer's field.
- (3) **Loss or lack of natural vegetation:** Establishment of biodiversity parks to encourage natural vegetation and prevent habitat loss.
- (4) **Pollution:** Sustainable agrochemical management was introduced to prevent soil pollution and disposal of toxic pesticide waste bottles in the fields was discouraged.
- (5) **Fuel:** Farmers were encouraged to deploy energy conservation techniques and energy plantations for fuel self-sufficiency.

VARIOUS RISKS  
**IDENTIFIED AND CORRECTIVE  
 ACTIONS TAKEN**  
 BY ITC IN MYSORE

# TOP 10 AGRICULTURE COMPANIES

Area of work related to Biodiversity	Adecoagro	AgriSA	Agrium	Alicolnc	ADM	BASF	Monsanto	Dupont	Syngenta	Bayer Crop science
Sustainable operations in PA's	■	■	■	■	■	■	✓	■	■	■
Sustainable livestock production	■	✓	■	■	■	■	■	■	■	■
Biodiversity partnerships	■	✓	✓	■	✓	✓	✓	✓	✓	■
Sustainable agriculture	✓	✓	✓	■	✓	✓	✓	✓	✓	✓
Climate change	■	■	✓	■	✓	✓	✓	✓	✓	✓
Habitat conservation	■	■	✓	✓	✓	✓	✓	✓	✓	✓
Land reclamation and restoration	■	■	✓	■	■	✓	■	✓	✓	■
Native plant species	■	■	✓	✓	■	✓	■	■	✓	✓
Community engagement	■	■	■	■	✓	✓	✓	✓	✓	■
Sectoral associations	■	■	■	■	■	■	✓	■	✓	■

Table 4: The table outlines the activities related to biodiversity management top 10 companies in the sector have conducted.

A balance is needed between the conservation of natural resources and the production of agricultural goods. Sustainable land use and management enable both high yields and biodiversity. This reduces the pressure to convert more land to farming, helping to preserve natural habitats and their wildlife. Sustainable Agriculture an important part of biodiversity conservation programs for 9 out of 10 companies. It comprises initiatives to promote practical measures, combining economic success and biodiversity protection on farms. Other important parameters include Habitat Conservation and Climate Change Mitigation.

## AGRIUM

Environmentally Smart Nitrogen (ESN), Agrium's controlled-release, polymer-coated nitrogen granules, have been at the forefront of innovative products for some time. The product not only keeps input costs down for farmers by reducing the number of fertilizer applications needed, but also protects the environment by reducing leaching, volatilization and denitrification.

ESN is a urea granule coated with a flexible polymer coating. The coating protects the nitrogen from loss mechanisms and releases nitrogen based on temperature and soil moisture. Just one application of ESN gives crops the N they need, throughout the growing season, providing improved nitrogen efficiency to the farmer.



**CONSTRUCTION**

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# OVERVIEW

The construction sector has a much broader definition when complete project delivery and servicing the built environment are included. The value chain for construction sector composed of mines, material processors and manufacturers (e.g., rock, gravel, sand, cement, concrete, glass, steel, asphalt concrete, aluminum, plastics, chemical additives), construction equipment manufacturers (e.g., dump truck, backhoe, concrete mixer), building system manufacturers (e.g., electrical, heating, ventilation and air conditioning, elevators), electrical, electronics and software companies (e.g., computer systems for traffic control, software for design and project management), facilities management firms, and others.

In India construction industry forms an integral part of the economy and a substantial part of GDP. Construction is the second largest economic activity in the country next to agriculture. With its various links the Indian Construction industry has generated employment for 45 million people directly and indirectly.



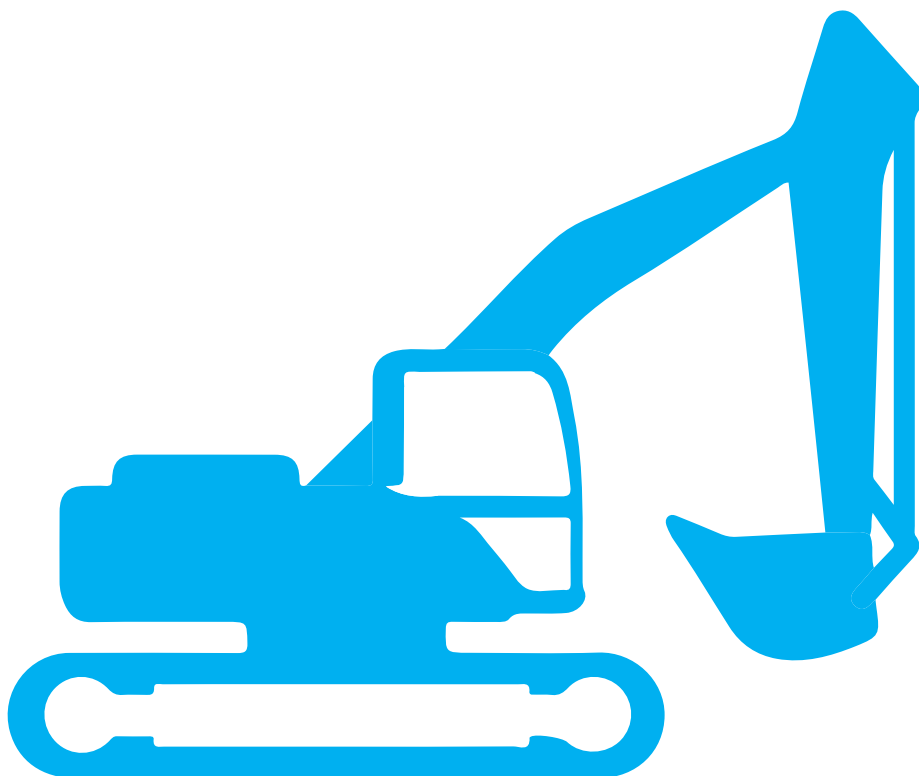
	2011-12	2012-13	2013-14	2014-15
<b>Total GDP (INR in Billion)</b>	<b>81955.44</b>	<b>85992.2</b>	<b>91697.9</b>	<b>98270.89</b>
<b>Mining Sector GDP Share (INR in Billion)</b>	<b>7740.93</b>	<b>7405.19</b>	<b>7588.89</b>	<b>7950.66</b>
<b>Mining Sector GDP Share (%)</b>	<b>9.45</b>	<b>8.61</b>	<b>8.28</b>	<b>8.09</b>
<b>YEAR</b>	<b>2011-12</b>	<b>2012-13</b>	<b>2013-14</b>	<b>2014-15</b>

Table 5: Mining sector Share to total India's GDP

# Supply chain of Construction Sector



Image 8: Supply chain of Construction sector



The construction industry refers to the building of edifices and infrastructure in the following sectors: residential, commercial, environmental and energy, industrial, transportation and defense. All the minor and huge tasks on a construction site need to be carried out by a specialist. As a result, there is often an army of subcontractors involved in a construction project. Each project requires the deployment of a number of construction machines and the use of a variety of building materials. The most important building materials include gypsum and wallboard, cement and concrete, ferrous metals, wood, plastics, as well as stone and

clay. Industries related to raw material producer to energy provider fall in the supply chain category of construction, however few sector analysis is being done separately and not included in this sector for analysis.

The rate of development, coupled with a steady increase in human population, puts significant stress on our biodiversity. Land that may once have been agriculture and forest is being converted into commercial developments, roads, housing estates, infrastructure projects. The development of land and related activities impact both the quantity and quality of biodiversity and ecosystem services.



# DEPENDENCIES ON THE B&ES

Biodiversity provide important raw material to construction sector for providing ecosystem services like timber for construction and furniture, fresh water for drinking, air purification, rivers for sand and other material.

## IMPACTS ON B&ES



### Land use change and habitat destruction

The loss of habitat through the conversion of land from its natural state (forest, agriculture or wetland) to a developed landscape has a greatest impact on biodiversity due to the changes in habitat and altering the habitat value of that area.

Habitat fragmentation due to the construction of roads, rail network, dams, etc. would reduce the connectivity of the migratory animals to remaining habitats, and species may or may not be able to survive as a result. Fragmentation may alter the distribution of populations, the migration rates among populations, or the size of local populations. Animals with large home ranges (i.e. elephants, fishes, fresh water dolphin) will be the most

severely affected. Often habitat fragmentation doesn't present an absolute barrier to movement, but rather subject animals to greater mortality as they try to cross the contrasting habitat.

Sand is a one of the important construction material and mainly source from the rivers, over extraction of sand from river minimise the capacity of river to provide the services like water holding, flood control, ground water recharge, water purification capacity. The sand play important role in providing bridging and feeding habitat to animals (birds, crocodiles, gharial and turtles) and over extraction of sand may results in habitat loss.



## Pollution

---

Construction activity generates noise due to movement of vehicles and machinery which results in disturbance to local fauna resulting in their relocation and thus, reducing the biodiversity of the area.

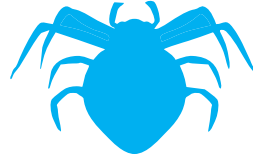
Pollution of watercourses through waste concrete and toxins in runoff from construction sites or fuels, accidentally spilled during storage or delivery, can enter watercourses. These pollutants can impact aquatic habitats, plant life, invertebrate and all life stages of fish.



## Climate Change

---

Forest land diversion for development reduces the carbon sequestration capacity of forest and results in higher concentration of CO<sub>2</sub>, the higher concentration of CO<sub>2</sub> leads to increase in atmospheric temperature. Emissions from vehicles, manufacturing industry also add pollutant to atmosphere which having capacity to contribute in the climate change.



## Invasive alien species

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Landscape modification for development projects caused disturbance to local species and lead to introduction of invasive species into natural habitats, further degrading the quality of biodiversity and ecosystem services.



## Over Exploitation

---

The construction sector is also highly dependent on forests for wood and bamboo as an important construction and furniture material. The rapid growth in demand for bamboo and wood resources over the last two decades has caused excessive exploitation of forest resources. Forest degradation depletes the timber yields and ecosystem services provided by the forests to human beings and also to the business. Forest degradation also threatens the economic viability of forest to provide ecosystem services like nutrient cycling, flood control, soil formation, carbon sequestration, air purification, etc.

# IMPACTS AND DEPENDENCIES OF CONSTRUCTION SECTOR



**Ecosystem  
Services**



**Mining**



**Manufacturing**



**Construction**



**Construction  
Waste**

	Impact	Dep	Impact	Dep	Impact	Dep	Impact	Dep
<b>PROVISIONING SERVICES</b>								
Food								
Fodder								
Timber								
Biological raw materials								
Biomass fuel								
Freshwater								
Genetic resources								
<b>REGULATING SERVICES</b>								
Air quality maintenance								
Climate regulation								
Erosion control								
Water purification and waste control								
Maintenance of soil quality								
Pollination								
Flood regulation								
Natural hazard mitigation								
<b>CULTURAL SERVICES</b>								
Recreation and ecotourism								
Ethical and spiritual values								
<b>REGULATING SERVICES</b>								
Habitat								
Nutrient cycling								
Water cycling								

Table 6: Impacts and dependencies of construction sector

# SECTOR INITIATIVES

## Global Initiatives



### United Nation's Environment Programme's Sustainable Building and Climate Initiative

United Nation's Environment Programme's Sustainable Building and Climate Initiative (UNEP-SBCI) is a partnership of major public and private sector stakeholders in the building sector, working to promote sustainable building policies and practices worldwide.

(<http://www.unep.org/sbc/index.asp>)



### The Cement Sustainability Initiative

The Cement Sustainability Initiative (CSI) is a global effort by 24 major cement producers with operations in more than 100 countries. The CSI has focused on understanding, managing and minimizing the impacts of cement production and use by addressing a range of issues, including: climate change, fuel use, employee health and safety, airborne emissions, concrete recycling and quarry management.

(<http://www.wbcsdcement.org/>)



### International Finance Corporation

IFC - Environmental and Social Management System (ESMS) Implementation Handbook for Construction Sector



### World Steel Association

World Steel Association (<http://www.worldsteel.org/>)

# CASE STUDY

## **Lafarge - Preservation of birds and rich pioneer grasslands, Gaillon Quarry, Normandy, France**

United Nation's Environment Programme's Sustainable Building and Climate Initiative (UNEP-SBCI) is a partnership of major public and private sector stakeholders in the building sector, working to promote sustainable building policies and practices worldwide.

(<http://www.unep.org/sbci/index.asp>)

**(UNEP-SBCI) IS A PARTNERSHIP  
OF STAKEHOLDERS TO PROMOTE  
SUSTAINABLE BUILDING  
POLICIES AND PRACTICES**

## Bouygues Construction: A41 motorway (Villy-le-Pelloux, France)<sup>1</sup>

The A41 North motorway route crosses through some particularly fragile environments, such as the Les Ebeaux wetland and the Ronzier grove, home to lady's-slipper orchids (*Cypripedium calceolus*), and therefore company given special attention during the construction phase of project. The company had a specific structure built for crossing the La Ravoir stream, so as to preserve the whole water body and its riparian vegetation, which is home to a population of white-clawed crayfish (*Austropotamobius pallipes*). In addition, to enable the yellow-bellied toad (*Bombina variegata*) to maintain its breeding area located under the Usses viaduct, a set of pools and ponds was created by company. The regular monitoring of crayfish, yellow-bellied toad populations and other conservation measures have confirmed the merits of the initiative.

<sup>1</sup>[https://www.bouygues-construction.com/sites/default/files/plaquette\\_biodiversity\\_bycn\\_uk.pdf](https://www.bouygues-construction.com/sites/default/files/plaquette_biodiversity_bycn_uk.pdf)

**MONITORING OF CRAYFISH,  
YELLOW-BELLIED TOAD POPULATIONS  
CONFIRMED THE MERITS OF THE INITIATIVE.**

## Royal BAM Group: Wildlife passes and eco duct<sup>2</sup>

The Royal BAM Group was developed BAM A12 road widening project in the Netherlands, crossing through migratory routes of wild species. In order to minimise impact on wildlife they modified the design and developed 26 wildlife passing channels and two eco ducts. Since completion of the two eco ducts the spotted deer are recoded on both sides of the road. It won't take long before they will start crossing the ducts. Modification in design, providing crossing and eco ducts help in connecting natural habitats that are separated by roads and results in preventing road kill, which also contributes to road safety.

<sup>2</sup><http://www.bam.eu/sites/default/files/domain-106/documents/bam-2013-sustainability-report-106-14083652861965143251.pdf>

**26 WILDLIFE PASSING CHANNELS AND  
TWO ECO DUCTS DEVELOPED TO MINIMIZE  
THE IMPACT ON WILDLIFE .**

# 102 TOP 10 COMPANIES IN CONSTRUCTION SECTOR

AREA OF WORK RELATED TO BIODIVERSITY	VINCI	GRUPO ACS	BECHTEL	HOCHTIEF	SKANSKA	BALFOUR BEATTY	BOUYGUES	BAM GROUP	LAING O'ROURKE	LARSEN& TOUBRO
Climate change	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Biodiversity policy	✓	✓	■	■	✓	■	■	■	✓	■
Community awareness	✓	■	■	■	✓	■	■	■	■	✓
Research & Funding	✓	✓	■	■	■	■	■	■	■	■
Biodiversity and land use	✓	■	■	■	✓	■	✓	■	■	■
Biodiversity partnerships	✓	■	■	■	✓	■	✓	✓	■	■
Biodiversity Indexing/monitoring	✓	■	■	✓	✓	✓	✓	■	■	■
Sustainable operations in Pas	■	✓	✓	■	■	■	■	■	■	■
EIA	■	✓	■	■	■	■	■	■	✓	■
Biodiversity action plan	■	✓	■	■	■	■	■	■	■	■
Native species	■	✓	■	✓	✓	✓	■	■	■	■
Land reclamation	■	■	■	✓	■	■	■	■	■	■
Habitat management	■	■	■	✓	✓	✓	■	✓	✓	■
Greenspace development	■	■	■	✓	✓	✓	■	■	■	✓
Responsible sourcing	✓	■	■	✓	✓	✓	✓	✓	✓	■
Sectoral associations	■	■	■	✓	✓	■	■	✓	■	■

Table 7: The table outlines the activities related to biodiversity management top 10 companies in the sector have conducted.



Sustainable development, especially in Protected Areas includes considering biodiversity early on in the design process and incorporating measures, generally at little extra expense, into buildings with an aim to create new structures with a net positive biodiversity impact on the region-which means that the level of onsite biodiversity post-construction is maintained at its pre-existing levels or is enhanced.

Increasing urbanization is contributing to the decline of biodiversity due to the loss and division of natural habitats. Providing opportunities for biodiversity in our built environment is one way that it can be protected and enhanced.

Other factors to be considered include responsible sourcing of materials and conducting an Environmental Impact Assessment for the construction process.

## BECHTEL

### Protecting Alberta's ecosystem

The ATCO Electric Eastern Alberta Transmission Line in Alberta, Canada, is a 500-kilovolt power transmission project that stretches for 301 miles (485 kilometers) and is located within the Prairie Pothole Region, a critical habitat in North America. Using Geographic Information System technology, Bechtel created a series of 3,960 maps and updates to delineate the buffer zones that were then used to plan and schedule the construction work and protect sensitive species habitats, such as the nests of the black tern and ferruginous hawk.



**MINING**

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# OVERVIEW

The Mining sector in India is a major economic activity which contributes significantly to the economy. The GDP contribution of the mining industry varies from 2.39 to 3.21%. India produces as many as 87 minerals, which includes 4 fuel minerals, 10 metallic minerals, 47 non-metallic minerals, 3 atomic minerals and 23 minor minerals (including building and other materials).

## Mining Sector Share in total India's GDP

Mining sector GDP Share (%)	3.21	3.05	3.01	2.88
Mining sector GDP Share (INR in Billion)	2628.14	2622.53	2763.81	2830.62
Total GDP (INR in Billion)	81955.44	85992.2	91697.9	98270.89
YEAR	2011-12	2012-13	2013-14	2014-15
GDP (At BASIC PRICE)				

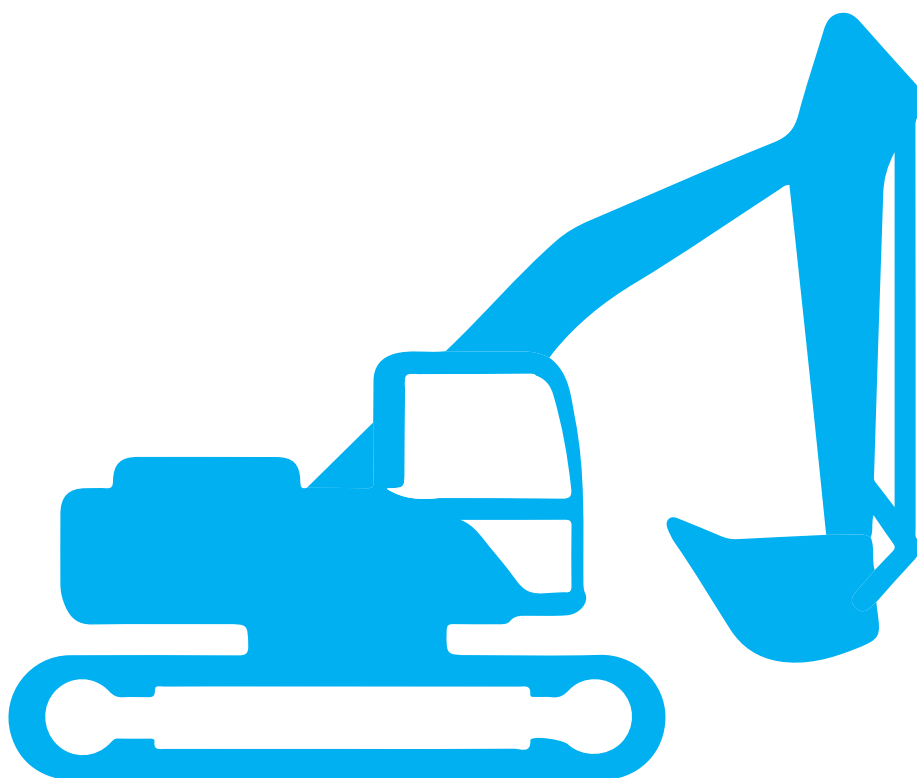
Table 8: Mining Sector Share in total India's GDP

**87 MINERALS**  
ARE PRODUCED IN INDIA

**4 FUEL MINERALS**

The Indian mining industry has a multifaceted structure comprising large and small mines, public and private sector enterprises as well as an informal sector that covers most minor minerals being extracted in the states. The public sector is continuing to play a leading role in mineral production accounting for 67.91% in the total value.<sup>2</sup> India is largely self-reliant in minerals which constitute primary mineral raw materials to industries, such as, thermal power generation, iron & steel, ferro-alloys, aluminum, cement, various types of refractories, china clay-based ceramics, glass, chemicals like caustic soda, soda ash, calcium carbide, titania white pigment, etc.

India has marched in to incrementally meet the growing global demand for minerals and is gaining increasing market share in global minerals trade. Globally India's ranking in 2012 as compared to world production was 2nd in Barytes, and Talc/ Steatite/ Pyrophyllite, 3rd in Chromite, Coal & Lignite and Zinc (slab), 4th Kyanite/ Andalusite/ Sillimanite, 5th in Iron ore, and Steel (Crude), 6th in Bauxite ore, 7th manganese ore and 8th in Aluminum.<sup>2</sup>



**10 METALLIC  
MINERALS**

**47 NON METALLIC  
MINERALS**

# MINING AND BIODIVERSITY

The mining area in India are located in the highly biodiversity rich areas. Mining project operating in these areas has the potential to affect the biodiversity, both directly and indirectly. Direct impacts from the mining and its value chain are land conversion for mining, road development, ore beneficiation and disposal of over burden. The indirect impacts from the mining are loss of water table & soil fertility, flooding, water & soil pollution.

Cumulative impacts occur where mining projects are developed in environments that are influenced by other projects, both mining and non-mining.

Forest cover in India is about 21% of the total geographic area and most of the geological resources are confined to forest area. The presence of large mineral deposits in ecologically sensitive areas threats to vulnerable forests. The total forested land diverted for mining between 1980 and 2005 was 95,003 ha, but it has been estimated to be as high as 1,64,610 ha. These forests are providing natural habitat to the valuable floristic diversity and also to the wildlife. They also provide

range of ecosystem services like flood control, water purification, climate control, soil protection, genetic resources, food, fiber, wood, air purification, carbon sequestration, etc. Mining activity in these areas are having direct impact on the biodiversity, this also leads to degradation of ecosystem services and loss of associated biodiversity.

Despite the significant potential for negative impacts on biodiversity from mining operations, there is a great deal that companies can do to minimize or prevent such impacts in areas identified as being appropriate for mining. There are also many opportunities for companies to enhance biodiversity conservation within their areas of operations. Being proactive in the assessment and management of biodiversity is important not only for new operations but also for those that have been operating for many years, usually under regulatory requirements that were less focused on the protection and enhancement of biodiversity.

## 3 ATOMIC MINERALS

# DEPENDENCIES ON THE B&ES

The mining sector has a high dependency on the land use and water requirement. Depending on the type of mining, development and construction activities often require land clearing for the mine as well as for the process plant, tailings facility, waste and stockpile areas, and infrastructure such as buildings, roads, construction camps, town sites, water management structures, power plant,

transmission lines and access corridors to the mine site.

The dependency is only related to water for the ore beneficiation, dust control, irrigation in the greenbelt area and workforce requirement and mostly sourced from the river, lake, Dams near by the project area.



## 23 MINOR MINERALS

# IMPACTS ON B&ES



## Land use change and habitat degradation

Habitat alteration is one of the most significant potential threats to biodiversity associated with mining. Habitat alteration may occur during any stage of the mine cycle with the greatest potential for temporary or permanent alteration of terrestrial and aquatic habitats occurring during construction and operational activities. Additionally, exploration activities often require the development of access routes, transportation corridors, and temporary camps to house workers which may all result in varying degrees of land-clearing and population in-migration.

The volume of solid waste generated, including tailings from processing, is one of the main pollution concerns in the mining industry. Removal of overburden to access the ore can pose major problems in storage and reclamation. The overburden (waste-to-ore) ratio for surface mining of metal ores generally ranges from 2:1 to 8:1, depending on local conditions. The ratio for solid wastes from underground mining is typically 0.2:1. Where concentration or other processing of the ore is done on site, the tailings generated also have to be managed. The land required to manage this overburden and leads to land use change.





## Pollution

The ore beneficiation process requires large amount of water, mainly sourced from the local river or dam or lake. Continuous extraction of water from natural source minimise the availability of water in downstream areas and directly impact on the aquatic life dependent on them.

The impacts of wet tailings impoundments, waste rock, heap leach, and dump leach facilities on water quality can be severe. These impacts include contamination of groundwater beneath these facilities and surface waters. Toxic substances can leach from these facilities, percolate through the ground, and contaminate groundwater and rivers and lakes. The pollution and high nutrient content of water leads to eutrophication of water body and degradation of aquatic habitat and associated terrestrial habitat.

Air pollution may occur during each stage of the mine cycle, although in particular during exploration, development, construction, and operational activities. The principal sources include fugitive dust from blasting, exposed surfaces such as tailings facilities, stockpiles, waste dumps, haul roads and infrastructure, and to a lesser extent, gases from combustion of fuels in stationary and mobile equipment.

Noise pollution associated with mining may include noise from vehicle engines, loading and unloading of rock into steel dumpers, chutes, power generation, and other sources. Cumulative impacts of shoveling, ripping, drilling, blasting, transport, crushing, grinding, and stock-piling can significantly affect wildlife.



## Climate Change

Most of mining in India are proposed in heavily forested areas that are critical for absorbing atmospheric carbon dioxide (CO<sub>2</sub>) and maintaining a healthy balance between CO<sub>2</sub> emissions and CO<sub>2</sub> sequestration. Some mining projects propose long-term or even permanent destruction of forests which minimise the capacity of CO<sub>2</sub> sequestration and leads to climate change.



## Invasive alien species

Spread of invasive alien species has become a increasing threat to native biodiversity and ecosystem services. Mining activities and construction of access road to mining areas lead to entry of invasive species in pristine area of forest, they also establish themselves on the reclaimed land and degraded land. Invasive species can change ecosystem services and influence the long-term ecological and economic productivity of forest area and farm land.

# Impacts and dependencies of mining sector



**Ecosystem  
Services**



**Mining**



**Ore Beneficiation**



**Transportation**

	Impact	Dep	Impact	Dep	Impact	Dep
<b>PROVISIONING SERVICES</b>						
Food						
Timber						
Biomass fuel						
Freshwater						
Genetic resources						
<b>REGULATING SERVICES</b>						
Air quality maintenance						
Climate regulation						
Dust Control						
Noise attenuation						
Erosion control						
Water purification and waste control						
Soil quality						
Pollination						
Flood regulation						
Natural hazard mitigation						
<b>CULTURAL SERVICES</b>						
Recreation and ecotourism						
Ethical and spiritual values						
Educational and inspirational values						
<b>SUPPORTING SERVICES</b>						
Habitat						
Nutrient cycling						
Primary production						
Water cycling						

Table 9: Impacts and dependencies of mining sector

# SECTOR INITIATIVES

## Global Initiatives

### The International Council on Mining and Metals

The International Council on Mining and Metals (ICMM) (<https://www.icmm.com/>)

Aim: To determine the role that the mining industry could play in sustainable development.

7th principle of ICMM addresses the biodiversity as 'Contribute to conservation of biodiversity and integrated approaches to land use planning'.

### Responsible Jewellery Council

Responsible Jewellery Council (<http://www.responsiblejewellery.com/>)

### Framework for Responsible Mining

Framework for Responsible Mining (<http://www.frameworkforresponsiblemining.org/>)

### World Coal Association

World Coal Association ([www.worldcoal.org](http://www.worldcoal.org))

### FIMI-Sustainable Mining Initiative

FIMI- Sustainable Mining Initiative (SMI) (<http://www.fedmin.com/smi/index.php>)

Address environmental and social issues related to mining industry and to maximize the contribution of the mining sector to the cause of sustainable development in mining regions and the country.

# CASE STUDY

## Hindustan Zinc Ltd., Rajpura Dariba Mining & Smelting Complex, Rajasthan

The Udaipur city generate sewage about 70 million tonnes/ day, which is discharged either in Lake Pichhola or Ahar river, which is a tributary to Udaisagar Lake, resulting in eutrophication of lakes and affecting the aquatic life and water quality.

The HZL developed Sewage Treatment Plant has a capacity of 20 million litres /day to treat sewage of Udaipur city, leading to approx. 30% reduction in sewage inflow to the lakes and the treated water is used in the project for process requirement.

- Improved Water quality of the Ahar River, Pichhola and Uda Sagar lakes due to reduced volume of wastewater discharges
- Decreased dependency on fresh water for project process (from 16,500 m<sup>3</sup>/day to 7,000 m<sup>3</sup>/day)

Reduced consumption of chemical fertilizers, as the production of manure for agriculture is 120 tonnes/year.

## AngloGold Ashanti Brazil

AngloGold Ashanti's operations in the Brazilian state of Minas Gerais include gold mining, processing, smelting and refining. They are located in important Brazilian biomes – Atlantic Forest, Cerrado (scrub forest) and the Campo Cerrado (open savanna), all of which are under intense pressure from urbanization, agriculture, forest exploitation and located in an area of important geological interest.

The Atlantic Forest is highly threatened and has lost 93% of its original coverage. It is among the top five global biodiversity hotspots. The Cerrado is the second largest Brazilian biome, covers 21% of the country's territory, and is also identified in the list of 34 global biodiversity hotspots.

To achieve balance between mining and conservation, the company created two ecological reserves of 147 ha and 726 ha and planning to create an additional 180 ha reserve area to connect these two reserves for creating contiguous protected area network.

These reserves are in priority areas for conservation and help to ensure maintenance of biodiversity and preservation of natural ecosystems. These reserves provide habitat to 510 plants, 158 birds, 24 mammals, 17 amphibians and 7 reptiles, of which 15 species are under threatened category (9 plants, 4 birds and 2 mammals). Through this initiative, the company has contributed to biodiversity protection in operation.

**SEWAGE TREATMENT PLANT  
WITH A CAPACITY OF**

**20 MILLION  
LITRES**

**/DAY DEVELOPED**

**TWO ECOLOGICAL RESERVES OF**

**147 HA AND 726  
HA CREATED**

**/DAY DEVELOPED**

## Iron Ore Company of Canada (IOC)

The IOC owns and operates an iron ore mine at Labrador City, Newfoundland, in an area of valuable native ecosystems – an extensive system of lakes, wetlands and boreal forest. Environmental conditions provide an ideal habitat for a large number of songbirds, mammals, fish and waterfowl.

For 40 years, IOC discharged up to 23 million tonnes of fine-grained waste rock (mine tailing) into Wabush Lake, in compliance with regulatory requirements. The tailings had a significant effect on the physical and biological balance of the lake. Most notably, at times the disposal would result in a red hue over the 20 kilometre length of the lake, which diminished its recreational and ecological value, created the potential for the pollution of interconnected lakes, raised serious community concerns and created a significant legacy risk for IOC.

### Tailings to Biodiversity Initiative (TBI)

The initiative was devised with the local community and regulators to discharge tailing into an impoundment area in Wabush Lake. This presented the opportunity to reduce pollution and rehabilitate

the lake. Restoration was conducted through the federal government's fish habitat compensation plan.

The TBI involves development of land forms and an artificial wetland with the planting of a diverse variety of native vegetation. Low-lying areas will form a mosaic of wetland basins, riparian zones and uplands, which will provide a variety of habitats for native wildlife. IOC anticipates the artificial wetland will not only contribute to biodiversity conservation but also minimise operational costs and maximise the options for post mine land use. Early estimates of the costs of wetlands indicate that the project will be either cost neutral or cheaper than traditional revegetation.

The management of mine tailings by IOC as a chance to control risk to biodiversity; improve community relations and interactions with stakeholders; uphold company standards for environmental stewardship and responsibility; ensure compliance, particularly in the event of regulatory review; and anticipate legacy issues in the event of closure.

**UP TO 23 MILLION TONNES  
OF FINE-GRAINED WASTE ROCK  
DISCHARGED INTO WABUSH LAKE  
FOR 40 YEARS.**

# TOP 10 COMPANIES IN MINING

AREA OF WORK RELATED TO BIODIVERSITY	GLENCORE	BHP BILLITON	RIO TINTO	VALE SP	ANGLO AMERICAN	CHINA SHENHUA ENERGY	FREEMPORT- MCMORAN	BARRICK GOLD	COAL INDIA LIMITED	FORTESCUE
HABITAT CONSERVATION	✓	✓	✓	✓	✓	■	✓	✓	✓	■
ENVIRONMENTAL IMPACT ASSESSMENT	✓	■	■	■	■	■	■	✓	✓	✓
LAND REHABILITATION	✓	✓	✓	✓	✓	✓	✓	✓	✓	■
AGRICULTURAL LAND MANAGEMENT	✓	■	■	■	■	■	■	■	■	■
BIODIVERSITY MANAGEMENT PLAN	■	✓	✓	✓	✓	■	✓	■	■	✓
NATIVE SPECIES PLANTATION	■	✓	■	■	■	■	■	■	✓	✓
BIODIVERSITY HOTSPOTS CONSERVATION	✓	✓	■	■	✓	■	■	✓	■	■
CLIMATE CHANGE MITIGATION	✓	✓	✓	✓	✓	✓	■	✓	✓	■
COMMUNITY INVOLVEMENT	■	■	✓	✓	■	■	✓	■	■	✓
NATIONAL/INTERNATIONAL COOPERATION	■	✓	✓	✓	✓	■	✓	✓	✓	■
SECTORAL ASSOCIATIONS	✓	✓	✓	■	✓	■	✓	✓	■	■

Table 10: The table outlines the activities related to biodiversity management top 10 companies in the sector have conducted.

Land rehabilitation has been the main focus area of sustainability for 9 companies out of 10 in the mining sector. The objective of rehabilitation is to establish native ecosystems that are similar to pre-existing ecosystems in the area. To return the conservation and recreation value of the area after mining, it is necessary to re-establish native biodiversity, and to establish the correct flora as early as possible to ensure the long term viability of the rehabilitated areas.

Other main areas of focus of companies have been Habitat Conservation and Climate Change Mitigation- for 8 out of 10 companies.

## **FREEPORT MCMORAN**

### **Takeda Garden for Medicinal Plant Conservation, Kyoto**

Freeport McMoran has applied innovative approaches in its operations for land reclamation. One such case has been “Reclamation in Climax mine, Colorado”. In 1996, Climax established a pilot demonstration project for the use of biosolids in reclamation. Today, the biosolids and woodchips are mixed and composted on site to produce over 30,000 cubic yards of growth medium for reclamation each year. Climax has now reclaimed much of the land along Highway 91 and has planted numerous spruce, fir, aspen and willow tree saplings. The program promises to establish diverse, permanent vegetation communities capable of sustaining wildlife habitat. It has demonstrated outstanding use of biosolids to help rehabilitate large-scale, high-altitude mine sites. Also, biosolids offered a cost-effective alternative for the organics and nutrients necessary for successful reclamation at the Climax mine



# OIL AND GAS



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<b>DEPENDENCIES</b>	<b>123</b>
<b>IMPACTS</b>	<b>124</b>
<b>SECTOR INITIATIVES</b>	<b>126</b>
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<b>TOP 10 OIL AND GAS COMPANIES 2015</b>	<b>130</b>

# OVERVIEW

India is the sixth largest consumer of oil in the world and the ninth largest crude oil importer. India's oil and gas sector contributes over 15% to the Gross Domestic Product (GDP). According to Ministry of Petroleum and Natural Gas, India has a total reserve of 763.476 MMT of Crude Oil and 1488 billion cubic metres of natural gas as on 01 April 2015. The total number of exploratory and development wells and metreage drilled in onshore and offshore areas during 2014-2015 timeframe was 637 and 1352 thousand metres respectively<sup>1</sup>.

Crude Oil production during 2014-15 is 37.461 MMT which is 0.87% lower than 37.788 MMT produced during 2013-14. The production of petroleum products during 2014-15 was 221.059 MMT registering an increase of 0.17% over last year's production at 220.756 MMT.



## India Oil Production and Import (MMT)

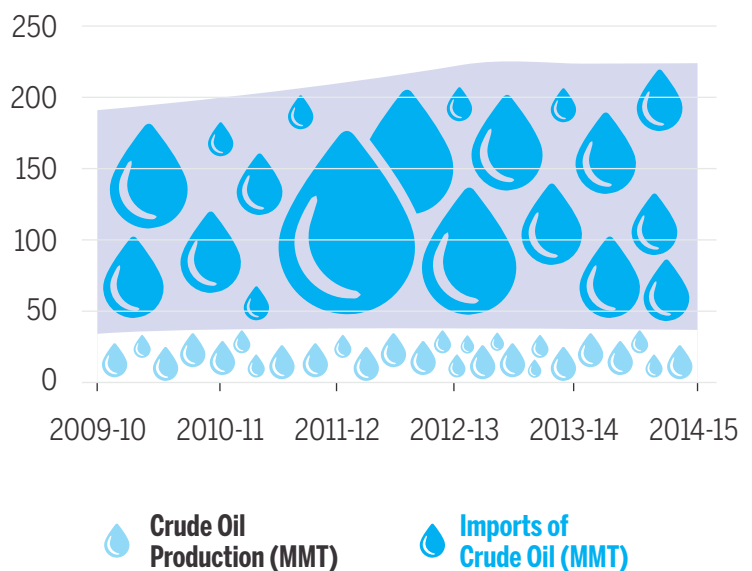


Image 9: Oil Production of India in 5 years

India has a total reserve of  
**763.476 MMT**  
 of Crude Oil

**1488 billion**  
 cubic metres of natural gas

Gross Production of Natural Gas during 2014-15 is 33.656 BCM which is 4.94% lower than the production of 35.407 BCM during 2013-14

Government has taken many initiatives to boost investment in this sector. 100% FDI is allowed for Indian companies in refineries, petroleum products and pipeline sector, natural gas and for infrastructure related to petroleum products marketing.

New Exploration Licensing Policy (NELP) was introduced by the Government of India to enhance exploration activity in the country. A total of 246 blocks were awarded under the eight bidding rounds (from 2001 to November 2010) and 68 oil and gas discoveries have been made so far in the NELP blocks.

## India Gas Production and Import (BCM)

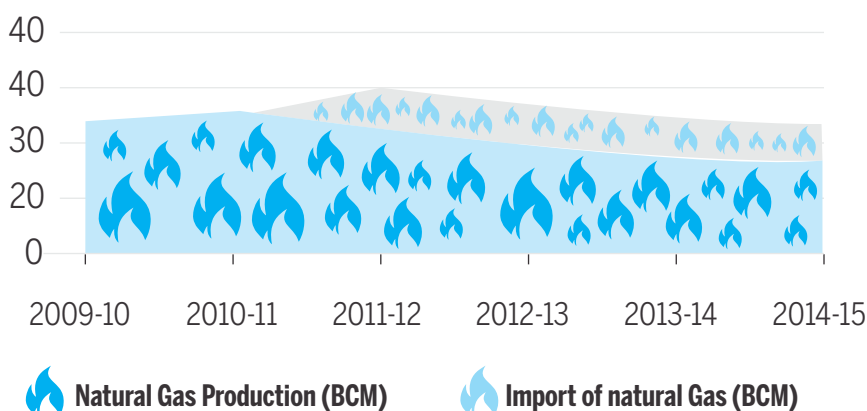


Image 10 : Gas Production of India in 5 years

The oil industry can be divided into three major components: upstream, midstream and downstream. The upstream segment comprises Exploration and Production (E&P) activities. The midstream segment is involved in storage and transportation of crude oil and natural gas. The downstream segment is engaged in refining and production of petroleum products, and processing, storage, marketing and transportation of commodities such as crude oil and natural gas.

In India crude oil is produced Onshore and Offshore. Onshore fields are in Assam/Nagaland, Arunachal Pradesh, Gujarat, and Tamil Nadu/ Andhra Pradesh. Offshore production occurs at Bombay High run by ONGC and Private/Joint Venture companies and for natural gas, onshore fields are at Assam, Tripura, Gujarat, Tamil Nadu, Andhra Pradesh and Rajasthan. Offshore production of natural gas takes place at the Western area of Bombay High

<sup>1</sup><http://petroleum.nic.in/docs/pngstat.pdf>

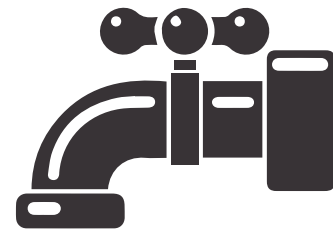
India has  
**20 refineries**  
 out of which —17 are  
 in the public sector  
 and three in the  
 private sector.

The total  
 number of  
 retail outlets of  
 Oil Marketing  
 Companies as  
 on 31.03.2015 has  
 gone up to

**53419.**

The total number  
 of LPG consumers  
 of Public Sector  
 Oil Marketing  
 Companies as on  
 31.03.2015 were

**18,19,02,266.**



## Oil & Gas Exploration and Production Cycle

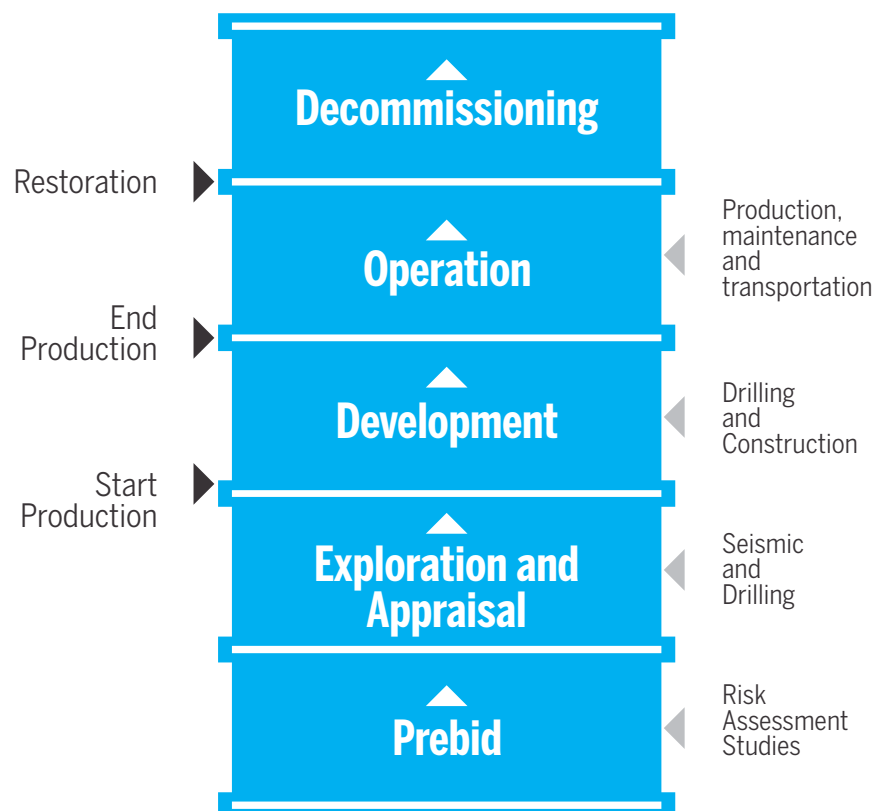
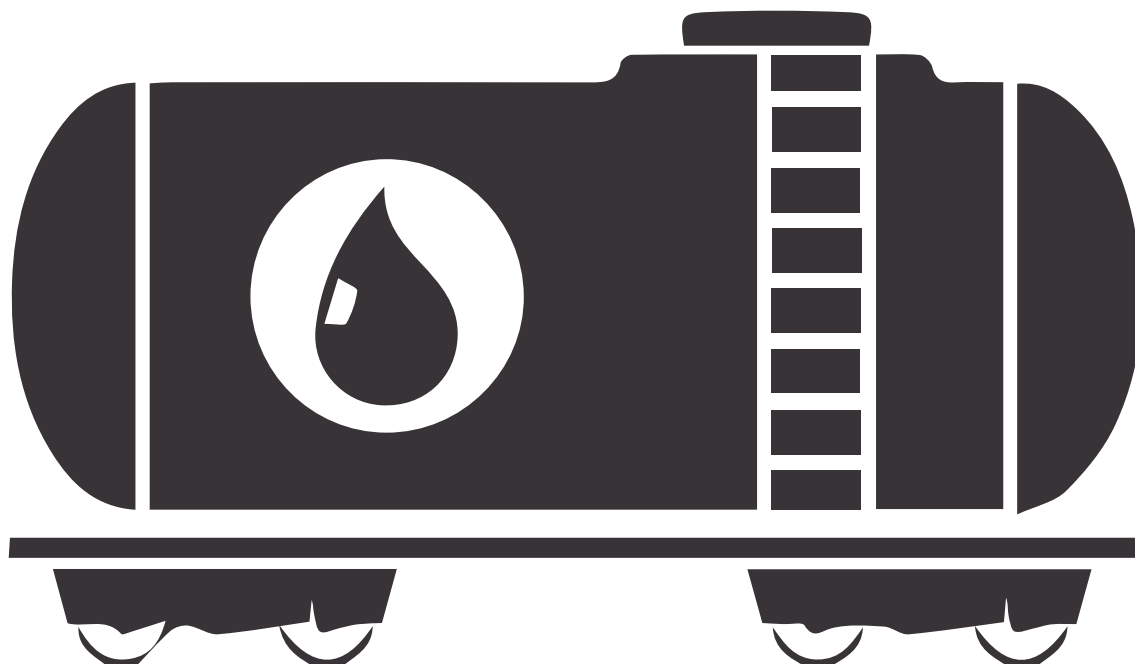


Image 11: Oil & Gas Exploration and Production Cycle

# DEPENDENCIES

Oil and gas provisioning service dependencies include use of water, aggregates and timber for consumption by staff, and for the construction and operation of facilities. Oil and gas regulating service dependencies are typically more indirect, and include a range of physical functions provided by vegetation and habitats such as erosion control, water filtration and flood control. Although not exactly an operational dependency, cultural services can be important for remotely operating workforces that can benefit in terms of enjoyment, health and motivation, from activities such as ecotourism and bird watching, and simply from appreciating the surrounding undisturbed landscapes.

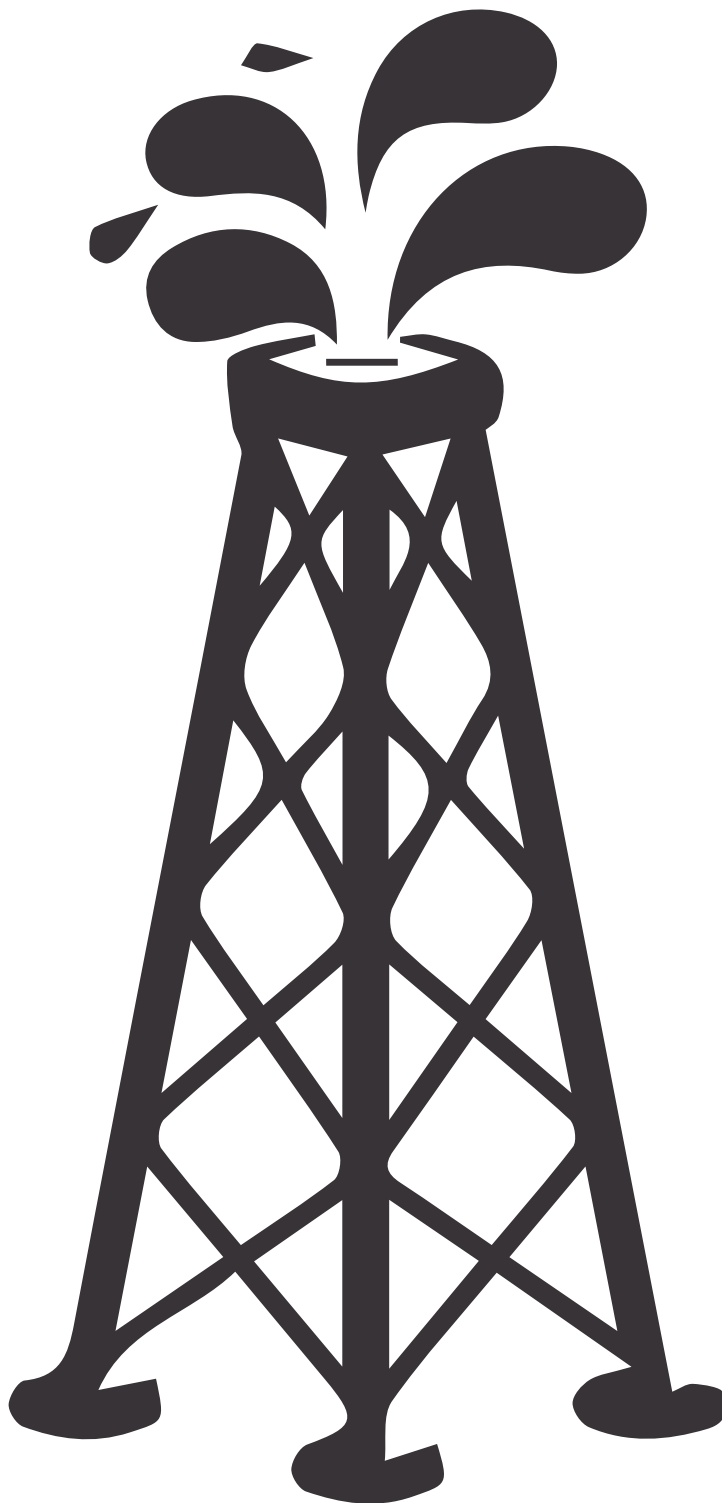


<sup>1</sup>Central Water Commission <http://www.cwc.nic.in>.

<sup>2</sup>Millennium Ecosystem Assessment (2005). Ecosystems and Human Well-being: Biodiversity Synthesis, World Resources Institute.

<sup>3</sup>Gallia, N. et al (2008). Economic Valuation of the Vulnerability of World Agriculture Confronted with Pollinator Decline. Ecological Economics.

# IMPACTS



Secondary impacts associated with oil and gas developments are becoming increasingly significant and scrutinized. The existence of a development project may attract large numbers of jobseekers and their families to move to an area, whether or not they actually obtain jobs at the facility; this may lead to the building of new homes, and to commerce, infrastructure, agriculture and fishing pressures. The effects on ecosystem services of one company's activities may be within bounds that do not threaten the integrity and functioning of the ecosystem.

Oil and gas companies should also manage higher order impacts or follow-on impacts associated with the construction and operation of their developments. Earth-moving activities of an oil and gas development may remove vegetation, resulting in erosion that causes increased sediment load in a river, reducing water quality and affecting invertebrates and fish, and ultimately leading to the decline of local subsistence fisheries downstream. The latter is an impact on human values (i.e. a provisioning service is affected) through a series of cause-effect relationships resulting from the initial construction activities.

In terms of provisioning services, oil and gas impacts include potentially restricting access for gathering wild food. Oil and gas impacts on regulating services include reducing erosion and flood control through loss of vegetation cover. Potential oil and gas impacts on cultural services include disturbance to iconic species, such as whales from seismic activity. On the other hand, a range of positive provisioning, regulating and cultural services can be gained through oil and gas companies helping to restore and protect habitats from a multitude of threats.

# IMPACTS AND DEPENDENCIES OF OIL AND GAS SECTOR



**Ecosystem  
Services**



**Exploration**



**Development**



**Production**



**Decommissioning**

	Impact	Dep	Impact	Dep	Impact	Dep	Impact	Dep
<b>PROVISIONING SERVICES</b>								
Food								
Timber								
Biological raw materials								
Biomass fuel								
Freshwater								
Genetic resources								
<b>REGULATING SERVICES</b>								
Air quality maintenance								
Climate regulation								
Regulation of water timing and flows								
Water purification and waste control								
Maintenance of soil quality								
Pollination								
Flood regulation								
Natural hazard mitigation								
<b>CULTURAL SERVICES</b>								
Recreation and ecotourism								
<b>SUPPORTING SERVICES</b>								
Habitat								

Table 11: Impacts and dependencies of oil and gas sector

# SECTOR INITIATIVES

The  
energy  
and  
biodiversity  
initiative (EBI)

(<http://www.theebi.org/>) -

As leading energy companies came to recognize the value of integrating biodiversity conservation into upstream oil and gas development, several of them joined with leading conservation organizations to develop and promote biodiversity conservation practices for meeting this goal.

International Petroleum Industry Environmental conservation association (IPIECA)(<http://www.ipieca.org/>) - IPIECA is the global oil and gas industry association for environmental and social issues. IPIECA was formed in 1974 following the launch of the United Nations Environment Programme (UNEP). IPIECA is the only global association involving both the upstream and downstream oil and gas industry on environmental and social issues. IPIECA's membership covers over half of the world's oil production. IPIECA is the industry's principal channel of communication with the United Nations.



# CASE STUDY

## SAUDI ARAMCO

Saudi Aramco's operations span the breadth of the Kingdom's environmental zones. Protection and preservation of natural environment for future generations is vital to their success.

From the Rub' al-Khali to the Arabian Gulf and the Red Sea, the Kingdom of Saudi Arabia is home to our resources, our facilities, and the majority of our employees and their families.

### **Company's activities for protecting biodiversity near operational areas:**

- established a wildlife sanctuary in the Rub' al-Khali near our Shaybah facility,
- planted hundreds of thousands of mangroves along targeted shores of the Arabian Gulf
- established artificial reefs, among other actions.

### **Other activities which help improve biodiversity indirectly are:**

- Promotion of reduction of energy intensity across the Kingdom by advocating responsible policies, public education, and energy innovation with initiatives in close cooperation with the government.
- Advances are made in areas such as reducing the energy intensity of operations and producing more cleaner-burning natural gas for domestic industry,
- Reduction of flaring,
- Water conservation,
- Recycling.
- Replacement of half a million incandescent light bulbs with LED bulbs, saving of 30 million kwh of energy in residential communities and commercial offices.

**ESTABLISHED  
A WILDLIFE SANCTUARY  
IN THE RUB' AL-KHALI, AND ARTIFICIAL REEFS.**

## EXXON Mobil

Exxon Mobil recognizes factors such as the rarity of individual species, their roles in different ecosystems and habitats, their vulnerabilities and their cultural significance. As part of their expectations of Protect Tomorrow, they strive to be a leader in safeguarding the ability of the environment to provide these ecosystem services. For their major upstream projects, they identify and evaluate environmental, social and health risks and opportunities through the ESHIA process. Additionally, biodiversity and ecosystem services are taken into account during the Environmental Aspects Assessment (EAA) and Environmental Business Planning (EBP) processes throughout the life of an asset.

ExxonMobil also supports innovative research for improved biodiversity management. In 2014, their contribution on biodiversity protection and land conservation was approximately \$5 million. ExxonMobil Research Qatar is collaborating with Qatar University and Texas A&M University at Galveston to study the dugong population – a marine mammal species that the International

Union for Conservation of Nature (IUCN) has listed as vulnerable to extinction – in Qatar's coastal waters.

Bioko Island, located 20 miles off the Gulf of Guinea coast in West Africa, is considered biologically diverse, with critical habitat for seven species of endangered monkeys and four species of nesting sea turtles. These rare species are frequent targets of poachers and commercial hunters, but with ExxonMobil's support, the Bioko Island Biodiversity Protection Program (BBPP) deploys wildlife patrols to monitor the legally protected areas of the island through a monthly census. The ExxonMobil Foundation also provides funding to open the Moka Wildlife Center, the country's first biological field station. The center hosts training sessions and wildlife research programs. BBPP's efforts have also contributed to passing legislation that promotes conservation and bans the hunting of endangered primates throughout Equatorial Guinea. In 2013, BBPP implemented educational outreach programs for local schoolchildren.

**WILDLIFE PATROLS DEPLOYED**  
**BY BIOKO ISLAND BIODIVERSITY PROTECTION PROGRAM (BBPP)**

## British Petroleum

### Innovative systems, technologies in operations for zero impacts on marine biodiversity.

Technological innovation is helping BP to collate and improve the presentation of data and extract the information they need to make decisions, should an incident occur. As part of an oil spill response training exercise in the North Sea in the UK, BP tested a number of technologies, including the new sensitivity mapping system and a spill assessment tool.

Sensitivity mapping helps them to identify the various types of habitats, resources and communities that could be affected by oil spills and develop appropriate response strategies.

BP has developed a mapping system that brings together geographical, operational, infrastructure, biological, socio-economic and habitat information, to provide a more comprehensive picture of the likely impacts of a spill on the surrounding coastlines.

Oil spill modelling gives us an indication of the potential movement of oil following a spill.

Enhancements in modelling software and the quality of data used are further improving our ability to predict these movements. We use data such as the type of oil spilled and rate of release, as well as environmental data, for example on wind and ocean currents, to model potential impacts.

These technologies have provided useful visual tools for understanding the nature of the incident and developing appropriate response strategies, as well as testing the new technologies, the exercises helped us to understand how to improve their effectiveness. For example, we noted that the increased amount of information generated by the tools means that additional data analysis personnel to process the data and manage the distribution of information to key personnel and teams could be very valuable in a response situation. Lessons learned will be incorporated into future exercises.

TECHNOLOGIES LIKE THE  
**NEW SENSITIVITY MAPPING SYSTEM AND  
A SPILL ASSESSMENT TOOL TESTED**

# TOP 10 OIL AND GAS COMPANIES 2015

AREA OF WORK RELATED TO BIODIVERSITY	Exxon Mobil	Chevron	Shell	CNOOC	Conocophillips	Rosneft	Phillips	CNPC	Saudi Aramco	BP
Environmental impact assessment	✓	✓	✓	■	✓	✓	■	✓	■	✓
Biodiversity Partnerships	✓	✓	✓	✓	✓	✓	✓	■	✓	✓
Funding and Research	✓	■	■	✓	✓	■	■	✓	✓	✓
Community awareness	✓	✓	✓	✓	✓	■	✓	■	✓	✓
Habitat management	✓	✓	✓	✓	✓	■	✓	✓	✓	✓
Invasive plant species/Native species	✓	■	■	✓	✓	■	✓	■	■	■
Sustainable operations in Pas	✓	✓	✓	■	✓	✓	■	✓	■	✓
Climate Change	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Endangered species	■	✓	✓	✓	✓	■	■	✓	✓	✓
Biodiversity Action Plan	■	■	✓	■	✓	■	■	■	✓	✓
Land reclamation	■	✓	✓	■	✓	■	■	✓	■	■
Sectoral Associations	✓	✓	■	■	■	■	■	■	■	■

Table 12: The table outlines the activities related to biodiversity management top 10 companies in the sector have conducted.

Oil and gas exploration and production in ecosystems of high biodiversity value pose both risks and opportunities for energy companies. In terms of risks, operations can have negative primary and secondary impacts on ecosystems and the quality of air, water and soil. Companies operating in areas of high biodiversity value are increasingly expected to go beyond simply mitigating the potential adverse effects of their operations and make some sort of positive contribution to biodiversity conservation. By working closely with government officials and other local stakeholders and carefully evaluating the local economic, environmental and social situation in a project area, companies can develop effective programs and strategies for benefiting biodiversity conservation in the areas and countries in which they work. Therefore, fostering Partnerships with government, NGOs form a major area of focus for companies while working for biodiversity conservation.

## CHEVRON

In 2008, Chevron partnered with WCS (Wildlife Conservation Society) to introduce passive acoustic monitoring in the South Atlantic Ocean to assess humpback whale breeding activity. They deployed Marine Acoustic Recording Units on the seafloor to record the marine sounds. This surveying technique resulted in the first complete documentation of the full migratory timing and seasonal presence of humpback whales that spend their winters off the Angolan coast. By knowing the migration routes and seasonality, Chevron workers are better able to schedule their projects and conduct their day-to-day operations as to minimize the impact of their operations on marine life.

During this period, WCS was also able to document the presence of blue whales through recordings of their species-specific vocalizations. These recordings provided the first modern evidence of this endangered species off Angola since the 1970s.

This case also presents a successful example of biodiversity monitoring and Protection of endangered species.



# **DRUGS AND PHARMACEUTICALS**

<b>OVERVIEW</b>	<b>134</b>
<b>DEPENDENCIES</b>	<b>136</b>
<b>IMPACTS</b>	<b>137</b>
<b>SECTOR INITIATIVES</b>	<b>139</b>
<b>CASE STUDY</b>	<b>140</b>
<b>TOP 10 GLOBAL PHARMACEUTICAL COMPANIES</b>	<b>142</b>

# OVERVIEW

Drugs and pharmaceuticals is one of the fastest growing manufacturing industries having witnessed double-digit growth over the past 10 years (see Graph 1). Given the cost of domestic production of pharmaceuticals is significantly lower than that in the US and almost half of that in the Europe, India has emerged as a leading producer accounting for 10% of global market volume and 2% of world's trade value<sup>1</sup>. It is forecast that India will become amongst top three pharmaceutical markets by incremental growth and sixth largest market globally in absolute size.

The pharmaceutical sector is highly fragmented and comprises of more than 10,000 players with majority of them in unorganised sector. Out of these, 300-400 entities are categorised as belonging to medium to large organised sector with the top 45 manufacturers accounting for up to 70% of the market. Some of the top players in the Indian pharmaceutical sector include Aurbindo, Cadila, Cipla, Dr. Reddy, Glaxo Smith Kline, Jubilant Life, Lupin and Sun Pharma. The foothold of MNCs in India has been on the rise, accounting for 20-25% of market share<sup>2</sup>.

<sup>1</sup><http://www.iosrjournals.org/iosr-jhss/papers/Vol13-issue3/H01335166.pdf?id=3395>

<sup>2</sup><http://www.iosrjournals.org/iosr-jhss/papers/Vol13-issue3/H01335166.pdf?id=3395>

**10%**  
of global market

**2%**  
of world's trade value

more than  
**10,000**  
players



## Revenue of Indian Pharmaceutical Sector (\$)

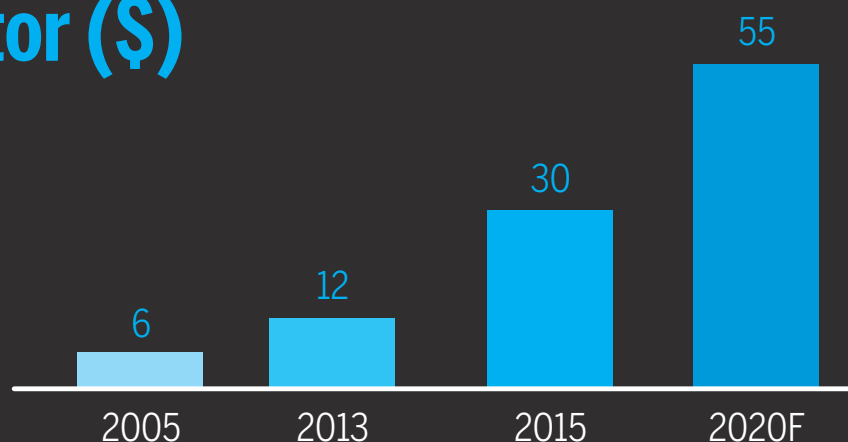
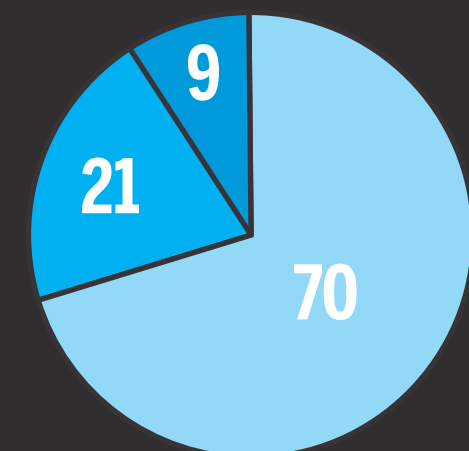


Image 12: Revenue of Indian Pharmaceutical Sector (\$)

<sup>3</sup>Apart from modern medicines, India is characterised by significant presence of traditional ayurvedic drugs. Despite several thousand of small companies that produce ayurvedic medicines, the key suppliers such as Baidyanath, Dabur, Himalaya and Zandu make up to 85% of domestic market<sup>4</sup>.

<sup>5</sup>Some of the challenges faced by the sector include drug and clinical trial quality, patent protection and lack of R&D focus. Together, these shortcomings limit India's export growth potential and adequate response to healthcare needs in India.

## Revenue of Indian Pharmaceutical - Sub Segment (2015)



■ Generic Drugs ■ OTC Medicines ■ Patented Drugs

With an aim to make India a global leader in an end-to-end drug manufacture, the government has unveiled Pharma Vision 2020. Since 2001 up to 100% FDI is permitted in pharmaceutical sector. The approval process of drugs has been simplified and approval time for new facilities has also been reduced to boost investments in the sector. Other steps taken by the government include introduction of Drug Price Control Order and National Pharmaceutical Pricing Authority as to ensure affordability and availability of medicine in the country.

Image 13: Revenue share of Indian Pharmaceuticals - Sub Segment (2015)

<sup>3</sup>Department of Pharmaceuticals

<sup>4</sup><http://www.itmonline.org/arts/ayurind.htm>

<sup>5</sup>Business Monitor International

# DEPENDENCIES

Dependencies in the sector are spread across the phases of drug discovery, drug development, manufacturing and finally sales, distribution and product management (see Table 2). The most evident dependency for drugs and pharmaceuticals relates to sourcing of active ingredients from nature. It is estimated that 25-50% of the pharmaceutical market is derived from active ingredients from nature, be it the case of biologicals, natural products or entities derived from natural products<sup>6</sup>. Genetic resources from plants, animals or micro-organisms is yet another dependency in application of pharmaceutical biotechnology.

Medicinal plants are integral component for ayurvedic drug industry. Out of 3000 medicinal plant species identified in India, over 400 plant species are commonly used for production of traditional medicine.

Non-human primates are indispensable resource for new drug research and tests to assure quality and efficacy of pharmaceutical products. No new drug can be introduced in clinical practise or even clinical research without passing the battery of toxicity tests in animals. India's half a dozen biomedical research institutions tend not to undertake any captive breeding for non-human primates, hence procurement is done from the wild.

Agriculture-based inert ingredients such as sugar, fish oils and vegetable oils are essential for drug manufacturing. Water is another key dependency in manufacturing, being used as direct ingredient for pharmaceutical products and indirectly for rinsing and sanitising.



# IMPACTS

The impacts of drugs and pharmaceuticals in its value chain (see Figure 2) converge primarily in manufacturing phase. Air, water and soil pollution are potential impacts that will occur when treated and untreated effluents are discharged, leading to disruption in provision of regulating services as well as harm wildlife. Contaminated water, for example increased estrogen in water, can lead to feminisation of fish, declines in fertility, developmental effects and impacts on sustainability of wild fish populations.

Overexploitation of natural products can lead to danger of species extinction while sourcing active ingredients, be it in modern or traditional medicine. The Red Data Book of India lists 427 Indian medicinal plant entries on endangered species, of which 28 are considered extinct, 124 endangered, 81 rare and 34 insufficiently known<sup>6</sup>.

End-of-life phase of drugs can have significant negative consequences for wildlife. As much as up to 90% of drugs may be excreted due to medicines being improperly metabolised by animals and humans. For example, the use of diclofenac and ketoprofen to treat inflammation in livestock such as cattle has led to loss of India's vulture population. This happens when vultures eat carcasses of animals treated with drugs, causing death within days due to kidney failure.

<sup>6</sup>KPMG & Natural Value Initiative (2011). Biodiversity and Ecosystem Services: Risk and Opportunity Analysis within the Pharmaceutical Sector.

<sup>7</sup>Omogbadegun, Z. et al (2001). Multimedia-based Medicinal Plants Sustainability Management System. International Journal of Computer Science Issues.

# Dependencies and impacts in the value chain of drugs and pharmaceuticals



**Ecosystem Services**



**Drug Discovery**



**Drug Development**



**Drug Manufacturing**



**Sales, distribution & product management**

	Impact	Dep	Impact	Dep	Impact	Dep	Impact	Dep
<b>PROVISIONING SERVICES</b>								
Food								
Timber								
Biological raw materials								
Biomass fuel								
Freshwater								
Genetic resources								
Biochemicals, natural medicines and pharmaceuticals								
<b>REGULATING SERVICES</b>								
Air quality maintenance								
Climate regulation								
Erosion control								
Water purification and waste control								
Maintenance of soil quality								
Pest mitigation								
Pollination								
<b>CULTURAL SERVICES</b>								
Educational and inspirational values								
<b>SUPPORTING SERVICES</b>								
Habitat								

Table 13: Dependencies and impacts in the value chain of drugs and pharmaceuticals

# SECTOR INITIATIVES



## Global Initiatives

### International Standards for the Sustainable Wild Collection of Medicinal and Aromatic Plants

International Standards for the Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) provides specific guidance on sustainable sourcing practices for medicinal and aromatic plants, and a set of principles and criteria that address conservation, sustainable use, access and benefit sharing and good environmental practice.

### Pharmaceutical Supply Chain Initiative

Pharmaceutical Supply Chain Initiative (PSCI) is a group of pharmaceutical and healthcare companies who share a vision of better, social, environmental and economic outcomes in the communities where we buy.

# CASE STUDY

## AstraZeneca: Preserving Biodiversity in Supply Chain

AstraZeneca is an Anglo-Swedish multi-national pharmaceutical company, formed in 1999 by the merger of Astra AB of Sweden and the British Zeneca Group. The company recognises that what they buy, and from whom they buy, can have significant environmental and business consequences and therefore risk management should extend to its supply chain.

In 2007 AstraZeneca partnered Aston University and Middlemarch Environmental to apply a model for biodiversity risk management in the supply chain for a particular corn-based

solvent it uses in its pills. This involved analysing processes all along the supply chain — from corn monocropping to transportation and storage and manufacturing. The model uses a standard ecological assessment survey to assign a value (positive or negative) to each supplier link in the chain.

By virtue of the partnership, AstraZeneca committed to tailor the methodology to its organic solvent supply chain and later expand to other products, services and materials.

PARTNERED WITH  
**ASTON UNIVERSITY AND  
MIDDLEMARCH ENVIRONMENTAL**  
IN 2007

## Dabur: Supply Security of Medicinal and Aromatic Plants

Dabur is Indian-origin FMCG company, well known for ayurvedic and natural health care products. Highly dependent on natural raw materials, Dabur acknowledges the benefits that nature provides as endangered herbs and plants are core to its business.

In an endeavour to safeguard stable supply of raw materials, wastelands are being adopted to cultivate some of the rare herbs. Moreover, special engagement programmes are being developed involving local farmers to grow some rare Himalayan herbs. In Nepal Dabur has promoted

cultivation of endangered plant species through 50 cooperatives to support farmer livelihoods.

In 2013 Dabur established a 5-year partnership with the International Centre for Integrated Mountain Development (ICIMOD) in the Himalaya region of Nepal to promote herbal medicine and aromatic plants. The partnership entails establishment of an herbal garden at the ICIMOD Knowledge Park in Godavari, aiming to showcase the important role of medicinal and aromatic plants for livelihoods and biodiversity.

**ENDANGERED PLANT SPECIES'**  
**CULTIVATION PROMOTED THROUGH**  
**50 COOPERATIVES**  
**IN NEPAL**

# TOP 10 GLOBAL PHARMACEUTICAL COMPANIES

AREA OF WORK RELATED TO BIODIVERSITY	JOHNSON AND JOHNSON	PFIZER	ROCHE	SANOI	ASTRAZENECA	TAKEDA	LILLY	BRISTOL-MYERS SQUIBB	BAYER	ASTELLAS
BIODIVERSITY MAPPING	✓	■	✓	✓	■	■	■	■	✓	✓
MANAGEMENT FRAMEWORK/BPA	✓	■	✓	✓	✓	✓	■	■	✓	✓
HABITAT RESTORATION	✓	✓	■	■	■	■	✓	✓	✓	■
GREENBELT PLANTATION	✓	■	■	■	■	✓	■	✓	■	✓
INVASIVE PLANT SPECIES	✓	✓	■	■	■	✓	✓	■	■	■
PARTNERSHIPS	✓	✓	■	■	■	■	■	✓	■	■
COMMUNITY INVOLVEMENT /AWARENESS	✓	✓	■	■	■	✓	✓	✓	■	✓
ENDANGERED SPECIES	✓	✓	■	■	■	✓	■	✓	■	✓
CLIMATE CHANGE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ETHICS IN R&D	■	✓	✓	✓	✓	✓	✓	✓	■	■
FUNDING	■	■	■	■	■	■	■	✓	■	■
ECO-SENSITIVE AREAS/PROTECTED AREAS	■	■	■	■	■	■	■	✓	✓	✓
AGROBIODIVERSITY	■	■	■	■	■	■	■	■	✓	■
SUSTAINABLE HARVESTING	■	■	■	■	■	■	■	■	✓	■
SECTORAL ASSOCIATIONS	■	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 14: The table outlines the activities related to biodiversity management top 10 companies in the sector have conducted.



Pharmaceutical companies often use wild varieties of medicinal plant species in their formulations, which could lead to unsustainable harvesting and overexploitation of these critical species. Therefore, there is a need for Responsible Sourcing of these biological resources used as ingredients for products like herbal medicines and sometimes for experimental purposes in R&D activities.

Other important factors to be considered by companies in their operations include Protection of Endangered Species, Native plant species and Compliance of ethics in R&D.

## TAKEDA PHARMACEUTICALS

### Takeda Garden for Medicinal Plant Conservation, Kyoto

For over 80 years, Takeda Garden for Medicinal Plant Conservation (Kyoto) has collected, grown and used herbal and other plants with medicinal value from around the world. Currently, the garden grows about 2,800 species of plant, of which 2,214 have medicinal value. The garden currently has 127 endangered plant species including near threatened ones. Takeda started early with in-house cultivation of medicinal plants, which is connected to conserving biodiversity. As part of its efforts to ensure stable supplies of medicinal plants and to conserve the environment, Takeda has been conducting research into in-house cultivation of the licorice since 1996.

The garden consists of many sections like the Central garden, Kampo garden, a conservatory, an arboretum, exhibition hall, Camellia garden, Spice garden and a Folk medicine garden.



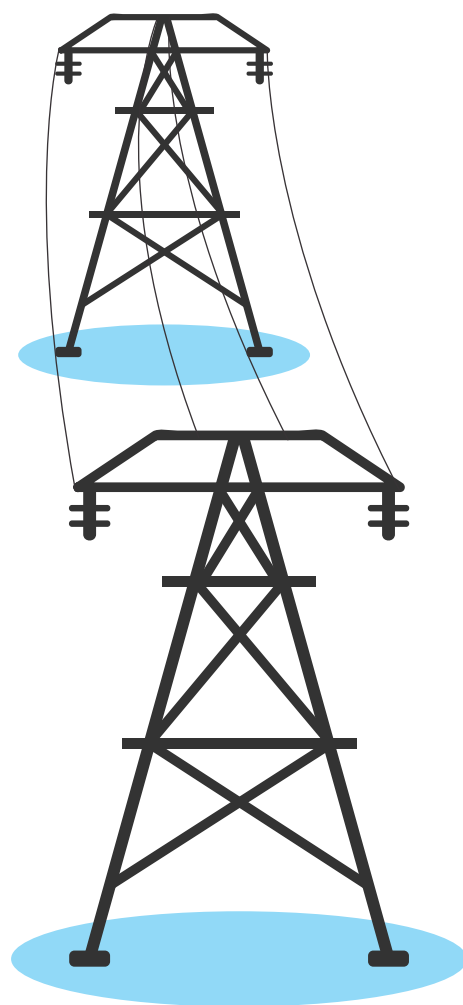
# POWER SECTOR

<b>OVERVIEW</b>	<b>146</b>
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<b>TOP 10 COMPANIES IN POWER SECTOR</b>	<b>155</b>

# OVERVIEW

Power is one of the most critical components of infrastructure crucial for the economic growth and welfare of nations. The existence and development of adequate infrastructure is essential for sustained growth of the Indian economy. Some 600 million Indians do not have access to electricity and about 700 million Indians use biomass as their primary energy resource for cooking<sup>1</sup>. India, being the world's second-fastest growing economy requires effective support from the power sector to support its growth. India is in the process to see a prompt increase in the power demand which is estimated at 3.2% between 2012-2040<sup>2</sup>. The total installed capacities for electricity generation in the country is 280,328 MW as on October 2015<sup>3</sup>. The electricity production expanded at a CAGR of 6.3 per cent from 2010 to 2015 and will witness steeper growth against present rate. India's primary energy use is projected to expand massively to deliver a sustained GDP growth rate of 9% through 2031-32 even after allowing for substantial reduction in energy intensity. In order to fuel this on sustained basis, the growth of around 5.8% per year in primary energy supply including gathered non-commercial such as wood and dung of would be required.

Trends in Installed Generating Capacity of Electricity in Utilities and Non-utilities in India from 2010 to 2014<sup>4</sup> is shown in the Figure. India's energy basket has a mix of all the resources available including renewables. The choice before the country in reference to pursuing for different sources of energy is not choosing among the available ones but to develop them all and to seek what else. The dominance of coal in the energy mix is likely to continue in foreseeable future.



## 700 million

Indians use biomass as their primary energy resource for cooking.

## 6.3 per cent

electricity production expanded at a CAGR from 2010 to 2015





## Trends in Installed Generating Capacity of Electricity in Utilities and Non-utilities in India from 2010 to 2014 in MW

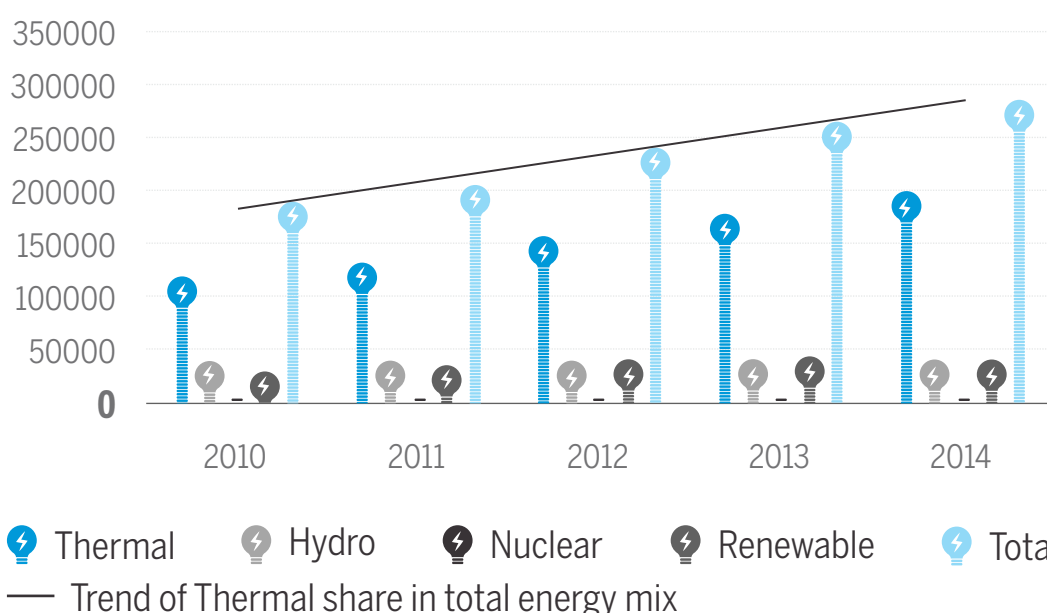


Image 14: Trends in Installed Generating Capacity of Electricity in Utilities and Non-utilities in India from 2010 to 2014 in MW

Putting India's likely energy demand in 2031-32 in a global perspective, one sees that China's current energy consumption is 1100-1200 Mtoe and USA's current consumption is 2400-2500 Mtoe. In comparison, India consumed about 421 Mtoe of commercial energy in 2007-08<sup>5</sup>. India on per capita basis, currently consumes under 6% of what the US consumes and under 41% of what China consumes and will, by 2031-32, consume just under 15% of current US consumption levels and equal China's current per capita consumption. With a projected population of just under 1.47 billion in 2031-32, India's per capita energy consumption will be marginally above China's current per capita consumption or be about one seventh of the current US per capita consumption. This sector is the backbone of all industries and country's development and also employer is huge proportion.

Commercially-produced energy is derived from fossil, nuclear and renewable sources. Nuclear and fossil fuels - such as coal, natural gas and oil - are supplied by the mining industries, while renewable energy is generated in small or large-scale systems with the help of turbines, pumps, collectors or photovoltaic modules. The main electricity sources comprise nuclear fuels, coal and natural gas, as well as solar, wind, biomass and hydropower sources. All companies in following fields were looked up to for analysis.

<sup>1</sup><http://planningcommission.nic.in/sectors/index.php?sectors=energy>

<sup>2</sup>The future of global power sector, Deloitte, 2015

<sup>3</sup>[http://www.cea.nic.in/reports/monthly/installedcapacity/2015/installed\\_capacity-10.pdf](http://www.cea.nic.in/reports/monthly/installedcapacity/2015/installed_capacity-10.pdf)

<sup>4</sup>[http://mospi.nic.in/Mospi\\_New/upload/Energy\\_stats\\_2015\\_26mar15.pdf](http://mospi.nic.in/Mospi_New/upload/Energy_stats_2015_26mar15.pdf)

<sup>5</sup><http://planningcommission.nic.in/sectors/index.php?sectors=energy>

# DEPENDENCIES

The Power sector comprises of Generation of Power, Transmission of the power and finally distributing the power to end customers. Power Generation sector consist of Thermal power (coal, gas, oil etc) plants, Hydro power (large, small, micro and mini) plants, Nuclear power plants and renewable power plants (wind, solar, biomass etc). Dependency in terms of biotic and abiotic can mainly be divided in power generation based on geological resources (under the earth surface) and resources available above the earth surface (River, solar, wind etc). We are not considering geological resources source in the dependencies and will be mainly concentrating on the renewable resources available with us.

High dependency on water exist for all power generating systems. Be it during manufacturing of equipment or at operation stage.

## Water requirement for each generating source

### Source

### Water Required to generate a MWh of Energy



### Nuclear

700 - 1,100 gallons per MWh in closed-loop systems and 25,000 - 60,000 gal per MWh in open-loop



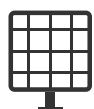
### Coal

500 - 600 gal per MWh in closed-loop systems and 20,000 - 50,000 gal per MWh in open-loop



### Biomass

2.42 billion gal per 50 MW plant and 40,000 - 100,000 gal per MWh for irrigating crops to burn



### Solar

225 - 520 gal per MWh (washing Photovoltaic panels) and 800 gal per MWh (Concentrating Solar Power wet method cooling)



### Wind

45-85 gal per MWh at manufacturer stage

Table 15: Water requirement for each generating source

# IMPACTS

One of the biggest impact of power sector observed is from air pollution, climate change due to release of anthropogenic gases or greenhouse gases such as CO<sub>2</sub>, Habitat Transformation and overexploitation of hydrological resources.

Power plants are necessary for the increasing demand of power/ electricity but operations of these plants have changed air and water quality. Thermal power plants' spatial locations affects biodiversity and migration path of birds, suspended solids in the air and water, which affects respiratory system, leading to premature deaths of both aquatic and terrestrial animals and birds. Thermal pollution causes increase in ambient temperature and reduce dissolved oxygen concentration leading to death of some sensitive species.

Operation of power plants have changed climatic conditions and speeding up the rate of global warming. This is a direct result of the increase in production of greenhouse gases, such as CO<sub>2</sub> (carbon dioxide), CH<sub>4</sub> (methane) and oxides of nitrogen due to the burning of fossil fuels.

The impact on biodiversity by wind power generation is localised and small, the principal direct impact on biodiversity arises from birds and bats colliding with the turbine blades. Also, the location of the wind farms, mostly in remote areas, requires the opening of new roads which in turn attract local populations, adding to the disturbance of ecosystems. About 60% of the world's river flow is regulated. There are more than 40,000 large dams and more than 100 dams with heights more than 150 m.

**40,000**  
large dams

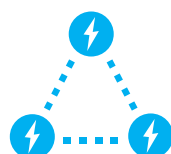
**100 dams**  
with heights  
more than 150 m.



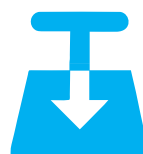
## Dependencies and Impacts in the value chain of Power Sector



**Ecosystem Services**



**Generation  
(Thermal, Hydro,  
Nuclear, Renewable)**



**Transmission**

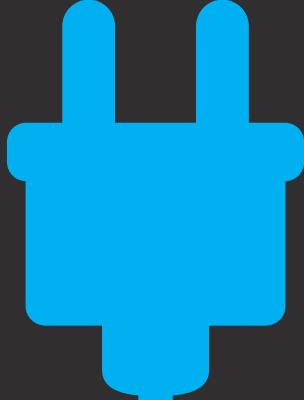


**Distribution**

	Impact	Dep	Impact	Dep	Impact	Dep
<b>PROVISIONING SERVICES</b>						
Food						
Timber						
Biological raw materials						
Biomass fuel						
Freshwater						
Genetic resources						
<b>REGULATING SERVICES</b>						
Air quality maintenance						
Climate regulation						
Erosion control						
Water purification and waste control						
Maintenance of soil quality						
Pollination						
Natural hazard mitigation						
<b>SUPPORTING SERVICES</b>						
Habitat						
Nutrient cycling						
Primary production						

Table 16: Dependencies and impacts in the value chain of Power Sector





# SECTOR INITIATIVES

- **The World Commission on Dams**  
(<http://www.unep.org/dams/WCD/>)
- **IHA Sustainability Guidelines**  
(<http://www.hydropower.org/topics/environmental-and-social/aquatic-species>)
- **Lighting DSM**  
([http://bee-dsm.in/PoliciesRegulations\\_1\\_4.aspx#L1](http://bee-dsm.in/PoliciesRegulations_1_4.aspx#L1))
- **Standards & Labeling Programme**  
([http://bee-dsm.in/PoliciesRegulations\\_1\\_4.aspx#L2](http://bee-dsm.in/PoliciesRegulations_1_4.aspx#L2))
- **Energy Conservation Building Code & Energy Efficiency in Existing Building programme**  
([http://bee-dsm.in/PoliciesRegulations\\_1\\_4.aspx#L3](http://bee-dsm.in/PoliciesRegulations_1_4.aspx#L3))
- **Investment grade audits in buildings**  
([http://bee-dsm.in/PoliciesRegulations\\_1\\_4.aspx#L4](http://bee-dsm.in/PoliciesRegulations_1_4.aspx#L4))
- **Star rating of buildings**  
([http://bee-dsm.in/PoliciesRegulations\\_1\\_4.aspx#L5](http://bee-dsm.in/PoliciesRegulations_1_4.aspx#L5))
- **BEE-ECBC programmes under implementation**  
([http://bee-dsm.in/PoliciesRegulations\\_1\\_4.aspx#L6](http://bee-dsm.in/PoliciesRegulations_1_4.aspx#L6))
- **Municipal DSM**  
([http://bee-dsm.in/PoliciesRegulations\\_1\\_4.aspx#L7](http://bee-dsm.in/PoliciesRegulations_1_4.aspx#L7))
- **Agricultural DSM**  
([http://bee-dsm.in/PoliciesRegulations\\_1\\_4.aspx#L8](http://bee-dsm.in/PoliciesRegulations_1_4.aspx#L8))
- **Powering a Sustainable Future:  
An agenda for concerted action**  
(<http://www.wbcsd.org/work-program/sector-projects/electricity-utilities.aspx>)

# CASE STUDY

## EDF FRANCE

In France, EDF manages almost 40,000 hectares of land and 70,000 hectares of lakes, often lying within or not far from protected areas. This means that all of the Group's activities (operations, maintenance, construction, etc.) run up against major issues in biodiversity. Information, awareness, protection, compensation: EDF is committed to minimising the impact of its business and protecting ecosystems.

**The Group's biodiversity policy revolves around three objectives that encompass the three ARC principles (Avoid, Reduce, Compensate):**

- Learning more about our natural surroundings and the potential impact Group activities may have on these ecosystems
  - Protecting biodiversity by protecting or restoring natural spaces
  - Informing, raising awareness, and training for staff and people living and working on the river, as well as open dialogue, in particular with the scientific community and voluntary sector
- In light of these objectives,

a specific action plan has been developed with the goal of:

- Developing a management plan for all sensitive production sites
- Limiting land artificialisation
- Launching a terrestrial ecology research programme
- Incorporating the concept of environmental continuity as part of the blue corridor
- Developing the experimental operator compensation project

In October 2014, the Group's 2014-2017 action plan received France's SNB (national biodiversity strategy) label from the Ministry of the Environment, Sustainable Development and Energy.

EDF is training its staff in biodiversity issues, in particular by publishing subject guides. These materials are designed to describe the biodiversity issues that affect each operational activity, to recap regulatory changes, explain how the partnerships chosen by the company work, and present reproducible actions.

**40,000 HECTARES**  
OF LAND AND  
**70,000 HECTARES**  
OF LAKES MANAGED

## ENEL GROUP

Biodiversity conservation is one of the Enel Group's strategic objectives, and a Group's Strategic Plan has been defined. In this context, Enel Green Power has promoted a number of projects in Italy and abroad to support the conservation of ecosystems and natural habitats in the areas in which it is present, not only as an industrial operator, but also as a local active member of the social, cultural and environmental life. These projects regard the Company's plants and their areas of influence and consist in preventive and corrective measures, social-environmental studies, monitoring campaigns, research and enhancing projects, compensating measures.

## ENEL GROUP'S PROJECT IN FRANCE

Valée de l'Arce is an area of Community Interest for the Conservation of Birds of the "Barrois": measures aimed at the conservation of the nests and food of the Montague's harrier (*Circus pygargus*). The measures that have been implemented at the wind farm's 20-hectare area include alternating cultivated and covered land in order to favour the reproduction of the preys (micro-mammals, orthopterans and nesting birds). The project involves farmers, who abstain from fighting rodents and using plant protection products, the permanent centre of environmental initiatives (CPIE) and hunters (Aube), who oversee, the bird protection league (LPO) and the Group of Studies for the protection for the Montague's harrier (GEPB) and the Ardenne Region, which monitor birds. The result of the monitoring activities has confirmed that in order to allow reproduction it's necessary to actively protect the nests of the Montague's harrier, especially when hay is harvested.

## Enel Groups's Project in USA

At the Lawrence hydroelectric plant, the new pneumatic system that lowers the crest of the dam allows to monitor fish migration. The lowering of the crest is monitored in different areas, thus removing the effect of attraction due to the current. In order to assess the effectiveness of the system, the number of salmon that are able to go upstream when the eggs are laid is monitored. In the spring of 2011 a total of 402 adults of Atlantic salmon was counted. The captured fish are given to the U.S. Fish and Wildlife Service for the fish restocking programme in the Merrimack basin and in the rest of New England.

GROUP PROJECT IN  
**USA ALLOWS MONITORING  
 FISH MIGRATION**  
 THROUGH THE NEW PNEUMATIC SYSTEM.

## IBERDROLA Spain

IBERDROLA established projects aimed at protecting fauna at new facilities and those already in operation, the restoration and conservation of natural areas, the conservation of endangered animal and plant species, and support for new research projects, etc.

**In this regard, IBERDROLA managed biodiversity on the basis of the following priority lines of action:**

- protection, conservation and sustainable use of the environment;
- the development and implementation of guidelines on biodiversity for new projects;
- the dissemination of information on an internal and external basis;
- and training, awareness and stakeholder relations.

Some of the initiatives carried out by the company in this period around the world and analysed in the report include the Migra scheme, carried out along with the Spanish

Ornithology Society SEO BirdLife, to track the migratory patterns of birds in Spain; the restoration of 8,000 hectares of marshlands in the United Kingdom, via its subsidiary ScottishPower; and the protection provided to ospreys in the United States and to opossums at electrical infrastructure belonging to its Brazilian subsidiary Elektro.

The Group applies advanced criteria for preserving biodiversity in all of its operations with a view to reducing the potential environmental impact of its activities. In 2013 it signed the Pact for Biodiversity, which was launched by the Fundación Biodiversidad as part of the Spanish Enterprise and Biodiversity Initiative. The pact keeps its commitment to an economic development that is compatible with nature conservation. The goal is to promote a strong framework for cooperation between major corporations and public administration and streamline efforts to enhance and ensure environmental protection in Spain.

**8,000 HECTARES OF  
MARSHLANDS RESTORED IN THE UK,  
VIA ITS SUBSIDIARY SCOTTISHPOWER**

# TOP 10 COMPANIES

## IN POWER SECTOR

AREA OF WORK RELATED TO BIODIVERSITY	EDF France	Enel	E.On	Iberdrola	Duke energy	Exelon	Southern company	Nextera energy	Dominion	SSE
Climate change	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Biodiversity policy	✓	✓	■	✓	■	✓	■	✓	■	■
Biodiversity action plan	✓	■	■	✓	■	■	■	■	■	✓
Community engagement	✓	✓	■	■	✓	■	✓	✓	✓	✓
Biodiversity partnerships	✓	✓	■	✓	✓	✓	✓	✓	✓	✓
Sustainable operations in PA's	✓	✓	■	✓	■	■	■	✓	■	✓
Habitat conservation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Native species	■	✓	■	✓	✓	■	✓	■	✓	✓
EIA	■	✓	■	✓	■	■	■	■	■	✓
Land restoration	■	■	■	✓	■	■	✓	✓	✓	✓
Endangered species	■	■	■	✓	■	■	✓	✓	✓	✓
Biodiversity monitoring	■	■	■	✓	■	■	■	✓	■	✓

Table 17: The table outlines the activities related to biodiversity management top 10 companies in the sector have conducted.

Habitat Conservation and Sustainable operations in Protected areas are primary areas of focus for electricity generation companies. Power generating stations traverse thousands of acres of land, which could extensively affect habitats of a wide range of plant and animal species. Thus habitat conservation, especially of endangered species remains a top priority for power sector companies.

Climate change presents a significant risk to biodiversity and power generation companies are expected to reduce carbon emissions in response to this. Rapid climate change affects ecosystems and species ability to adapt, thus increasing chances of biodiversity loss.

All top ten companies were observed to follow Habitat Conservation strategies in their operations.

## Osprey Restoration in Illinois.

When it was recognized that osprey were making dangerous nesting attempts in the station's high-voltage yard, station personnel took action to research and build nesting platforms on site at Exelon's Dresden Generating Station. The project expanded as station personnel partnered with the Illinois DNR Endangered Species Manager to find additional areas needing platforms along the Illinois River. Contributing both financial and manpower resources, the station installed 14 platforms for osprey, spanning approximately 220 miles. In 2014 and early 2015, the osprey restoration effort continued in coordination with the Illinois DNR's Illinois Osprey Recovery Project. Efforts included the installation of a hacking tower with Exelon's partners at Anderson Lake to facilitate the introduction of young osprey into the wild and the addition of seven new nesting platforms at five locations.

## JORDAN WIND PROJECT COMPANY

As part of the ESIA an avifauna assessment for the Tafila Wind Farm was conducted by JWPC in 2011. The avifauna assessment included a baseline study with 34 days of field monitoring. The field monitoring days were spread equally on the year to display the avifauna movements of the whole year.

To support the baseline data with more detailed information, an extensive bird monitoring program was started in late February 2013 and is still on-going. This comprehensive monitoring is conducted with emphasis on the migration periods. During the summer and winter months the monitoring program includes 12 hours per month on each of the three different vantage points spread over the wind farm site. During the migration periods the observation time is enlarged to 12 observation man-days per week.

During the monitoring, the analysis included the assessment of the flight behaviour of each observed species, a collision risk assessment and an impact assessment leading to the establishment of appropriate mitigation measures to secure the best possible safety of the avifauna. The main potential impacts of the Tafila Wind Farm on the avifauna were identified to be electrocution from high voltage transmission lines, and the risk of bird collision with the moving rotors. It was decided to monitor the wind farm site during operation continuously on an ongoing basis for the occurrence of birds and their potential collision with the turbines. In case of a possible collision the wind turbines will be shut down immediately. To minimize the risk of electrocution the wind farm internal power lines will be installed below ground surface.



**TOURISM**



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# OVERVIEW

Travel sector generated US\$7.6 trillion (10% of global GDP) and with respect to India the direct contribution of sector to GDP was INR 2,478.2 billion (2.2% of total GDP) in 2014, and is forecast to rise by 7.2% pa, from 2015-2025, to INR 5,339.2 billion (2.5% of total GDP) in 2025. This sector also provided 277 million jobs globally and in India 23,024,000 jobs (5.5% of total employment) in 2014. This is expected to rise by 2.2% pa to 29,020,000 jobs (5.7% of total employment) in 2025<sup>1</sup>.

Indian Tourism offers a potpourri of different cultures, traditions, festivals, and places of interest. There are a lot of options for the tourists. India is a country with rich cultural and traditional diversity. This aspect is even reflected in its tourism. The different parts of the country offers wide variety of interesting places to visit.



<sup>1</sup><https://www.wttc.org/-/media/files/reports/economic%20impact%20research/countries%202015/india2015.pdf>

**TRAVEL SECTOR GENERATED  
US\$7.6 TRILLION (10% OF GLOBAL GDP)**

**23,024,000**  
**JOBS IN INDIA**

**277 MILLION**  
**JOBS GLOBALLY**

# Supply Chain analysis of Tourism Sector



## TRANSPORTATION



AIRLINE



RAIL



CRUISE &  
SHIPS



VEHICLES



## HOSPITALITY



HOTEL



RESORTS



RESTAURANTS



ECO CAMPS



## ENTERTAINMENT



AMUSEMENT  
PARKS



WILDLIFE &  
BIODIVERSITY  
PARKS



CONSERVATION  
AREAS



GOLF COURSES

Image 15: Supply Chain analysis of Tourism sector

# TOURISM AND BIODIVERSITY

Tourism and biodiversity are closely linked both in terms of impacts and dependency. Tourism like ecotourism, agri-tourism, wellness tourism, adventure tourism, etc. are directly rely on ecosystem services and biodiversity. Tourism also uses recreational and cultural services and other services provided by ecosystems. The sustainable tourism will support in economic

activity and also for the conservation of biodiversity, on the other hand too many tourists can also have a negative impact on local biodiversity results in degradation of biodiversity and ecosystems services. In future the increased tourism forecast to biodiversity hotspot countries will require careful management to avoid negative impacts on biodiversity.

## DEPENDENCIES ON THE B&ES<sup>2</sup>

The sector has direct dependences on the biodiversity and ecosystem services such as fresh water, food, cultural services and biodiversity reach areas like wildlife conservation areas and national parks.

## IMPACTS ON B&ES

Negative impacts from tourism occur when the level of visitor use is greater than the environment's ability to cope with this use within the acceptable limits of change.

Uncontrolled conventional tourism poses potential threats to many natural areas around the world. It can put enormous pressure on an area and lead to impacts such

<sup>2</sup> <http://www.gdrc.org/uem/eco-tour/envi/one.html>

as soil erosion, increased pollution, discharges into the sea, habitat loss, increased pressure on endangered species and intensified vulnerability to forest fires. It often puts a strain on water resources, and it can force local populations to compete for the use of critical resources.



## Land use change and habitat degradation

Increased construction of roads, hotels, etc. for tourism and recreational facilities has increased the pressure on these resources and on scenic landscapes.

Removal of vegetation to make way for accommodations and access roads can lead to flooding, increased erosion, landslides, loss of soil fertility, lowering of the water table and siltation of rivers, lakes and other water bodies. The loss of critical habitats as a result of land clearing can severely impact plant and animal species, some of which may be endemic to the area. In relatively undeveloped areas, opening up access to a development site (with roads or other rights of way) can catalyze further damage by facilitating migration to previously inaccessible areas.

Attractive landscape sites, such as sandy beaches, lakes, riversides, and mountain tops and slopes, are often transitional zones, characterized by species-rich ecosystems. Typical physical impacts include the degradation of such ecosystems.

The ecosystems most threatened with degradation are ecologically fragile areas such as alpine regions, forests, wetlands, mangroves, coral reefs and sea grass beds. The threats to and pressures on these ecosystems are often severe because such places are very attractive to both tourists and developers.



## Pollution

The tourism industry generally overuses water resources for hotels, swimming pools, golf courses and personal use of water by tourists. This can result in water shortages and degradation of water sources, as well as generating a greater volume of waste water which lead to eutrophication of natural water sources and loss of aquatic habitat.

Air pollution due to transport emissions and emissions from energy production are linked to global warming and photochemical pollution and it can contribute to severe local air pollution results in impacting local biodiversity.



## Climate Change

Air pollution from tourist transportation has direct impacts on the climate change globally, especially from the emission of carbon dioxide (CO<sub>2</sub>) for transportation and energy requirement. Higher temperature in the pristine biodiversity area may negatively impacts on the sensitive plant and animal species and lead to losses of habitat.

# IMPACTS AND DEPENDENCIES OF TOURISM SECTOR



**Ecosystem  
Services**



**TRANSPORTATION**



**HOSPITALITY**



**ENTERTAINMENT**

	Impact	Dep	Impact	Dep	Impact	Dep
<b>PROVISIONING SERVICES</b>						
Food						
Fodder						
Timber						
Biological raw materials						
Biomass fuel						
Freshwater						
Genetic resources						
Biochemicals, natural medicines and pharmaceuticals						
<b>REGULATING SERVICES</b>						
Air quality maintenance						
Climate regulation						
Regulation of water timing and flows						
Erosion control						
Maintenance of soil quality						
Pollination						
Flood regulation						
<b>CULTURAL SERVICES</b>						
Recreation and ecotourism						
Ethical and spiritual values						
Educational and inspirational values						
<b>SUPPORTING SERVICES</b>						
Habitat						
Nutrient cycling						
Primary Production						
Water cycling						

Table 18: Impacts and dependencies of tourism sector

# SECTOR INITIATIVES



## Global Initiatives

### The World Travel & Tourism Council

The World Travel & Tourism Council (WTTC) is the forum for the Chairs, Presidents and CEOs of one hundred of the world's foremost Travel & Tourism companies. WTTC advocates to international institutions and governments that their policies and regulatory frameworks are supportive of the sustainable growth of tourism sector.

<http://www.wttc.org>

### International Tourism Partnership

International Tourism Partnership provides a non-competitive platform for hotel industry leaders to share ideas, build relationships and work collaboratively to make this one of the world's most responsible industries.

<http://tourismpartnership.org/>

### The World Tourism Organization

The World Tourism Organization (UNWTO) is the United Nations agency responsible for the promotion of responsible, sustainable and universally accessible tourism.

<http://www2.unwto.org/>

### Indian initiatives

Sustainable Tourism Sector for India - Criteria and Indicators (Applicable to accommodation sector and tour operators)

# CASE STUDY

## North Island, Seychelles: Minimum impact and positive restoration of biodiversity

'An initiative not only to minimise the environmental footprint of a hotel, but also to restore the island's habitat and endemic species, led by an investor and backed up by relevant government standards and checking processes.'

The North Island was purchased by Wilderness Safaris, an international company operating 70 lodges and camps in seven African countries. The company's sustainability strategy is encapsulated in its concept of the '4Cs' – conservation, community, culture and commerce.

Wilderness Safaris focuses on two elements of conservation:

- Environmental management systems (building and operating in the most eco-friendly way possible to ensure the lowest possible carbon footprint); and
- Biodiversity conservation (understanding, managing and protecting the wildlife and ecosystems with which they are involved).

Wilderness Safaris' vision for North Island was to create a sanctuary for the reintroduction of some of the local most endangered animals and plants. This vision would be facilitated by the development of an exclusive hotel on the island. In order to achieve the objective a detailed environmental impact assessment study was undertaken and plan are developed for the eradication of invasive species (plant and animal), plantation of indigenous species, impacts of infrastructure on the turtle population, etc.

Wilderness Safaris has implemented an extensive programme of positive conservation and restoration of the island's biodiversity and about 21 percent of the island's surface has already received some level of vegetation rehabilitation. The endangered species like Seychelles White-eye (*Zosteropsmodestus*), a small passerine bird, black mud turtle and a species of terrapin, was successfully introduced on the island. Systematic management plan implementation resulted in protection and enhancement of biodiversity on the island.

**21 PERCENT OF THE ISLAND  
RECEIVED VEGETATION  
REHABILITATION**

**THROUGH WILDERNESS SAFARIS' IMPLEMENTED EXTENSIVE PROGRAMME**



## Fairmont Mayakoba, Mexico: Minimising impacts from a major development

'An international hotel company adopting a range of measures to avoid and minimise the impact of a sizeable resort and golf course development on coastal ecosystems, including mangroves and water channels.'

The Fairmont Mayakoba has developed a hotel on a 19-hectare site in the Mexican Riviera Maya. The site is located near the sea coast which harbors critical and sensitive habitats like mangroves and large coral reef. The early environmental assessment of the project area provided a guiding framework for Fairmont to design and construct its hotel. Avoiding identified sensitive sites for construction and implementing site specific plans results in the minimising impacts of hotel on the ecosystem. Some of the management plans are discussed below.

- a. Avoid impact on mangrove - More than 90 percent of the rooms at Fairmont Mayakoba, and the majority of the central services, are located behind the mangrove line. Just 34 rooms are situated

near to the beach. This arrangement distributes the weight of the development around the property in such a way that it allows a natural flow of water in the underground river system that feeds the mangroves.

New aquatic habitats were created around the mangroves to serve as shelter, rest and feeding areas for many species of birds, fish, crustaceans and molluscs.

Indigenous drought-tolerant plants are used around the site to minimise stress on the water system. Such plants conserve water, as they are highly adapted to local weather conditions and do not require extensive irrigation.

- b. Relocating species and restoring areas of disturbance or habitat loss: During construction phase more than 1500 tree and 10000 smaller plants having high environmental value was relocated for reforestation in mangrove forest areas.

**1500+ TREE &  
10000+ SMALLER PLANTS**  
RELOCATED FOR REFORESTATION IN MANGROVE FOREST AREAS.

# TOP 10 COMPANIES

## IN TOURISM SECTOR

AREA OF WORK RELATED TO BIODIVERSITY	LAS VEGAS SANDS	AMADEUS	ETIHAD AIRWAYS	WALT DISNEY TRAVELS	SONEVA	TUI GROUP	MERLIN ENTERTAIN-MENTS	FAIRMONT	NIPPON EXPRESS	BAY OF FIRES LODGE
ECOSYSTEM RESTORATION	✓	■	■	✓	✓	✓	✓	✓	✓	■
COMMUNITY INVOLVEMENT	✓	■	■	✓	✓	✓	✓	✓	✓	✓
CLIMATE CHANGE	✓	✓	✓	✓	✓	✓	■	✓	✓	✓
BIODIVERSITY PARTNERSHIPS	■	✓	✓	■	✓	✓	✓	■	■	✓
FUNDING	■	■	■	✓	✓	✓	✓	■	■	✓
SPECIES CONSERVATION	■	■	■	✓	✓	■	✓	✓	■	✓
HABITAT CONSERVATION	■	■	■	✓	✓	■	✓	✓	✓	■
BIODIVERSITY MONITORING	■	■	■	■	✓	■	■	■	■	■
SECTORAL ASSOCIATIONS	■	✓	■	■	■	■	■	■	■	■

Table 19: The table outlines the activities related to biodiversity management top 10 companies in the sector have conducted.

Tourism uses recreational services and supply services provided by ecosystems. Many types of tourism rely directly on ecosystem services and biodiversity. Tourists are looking for cultural and environmental authenticity, contact with local communities and learning about flora, fauna, ecosystems and their conservation. On the other hand, too many tourists can also have a negative, degrading effect on biodiversity and ecosystems. Ecosystem and Habitat Restoration therefore forms an important part of biodiversity policy for tourism sector.

Other important areas of focus are Community engagement in initiatives for biodiversity conservation and Climate change mitigation.

## Fairmont Group of Hotels

Fairmont Chateau Whistler installed bat hotels on their golf course to benefit bats, the community, farmers, gardeners and the ecosystem as a whole through providing a warm, safe location for bats on the course. Previously, on the same course, Chateau Whistler opened up corridors to allow bears to pass through without having forced confrontation with golfers. An artificial marsh is the full-time home of a resident beaver. Additionally, tree clippings are piled up into "rabbitats," that attract predators like coyotes and other animals to enrich the biodiversity of the golf course.

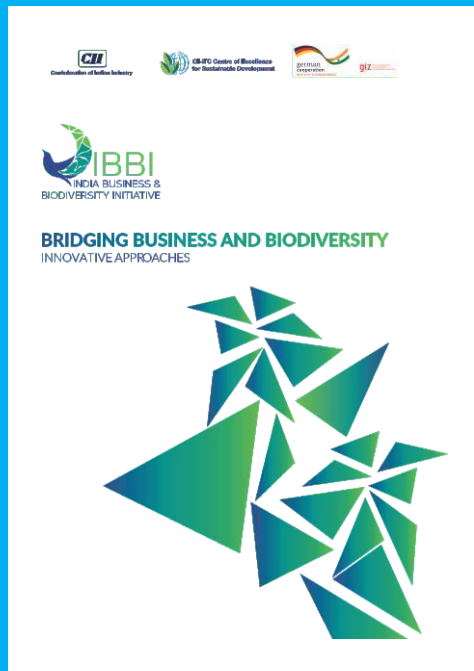
The bat hotels give bats a home and in turn they eat thousands of insects. Bat hotels give bats an alternative to our houses thus reducing the chance of human to bat contact. Bat populations have decreased significantly and bat houses are helping to provide secure habitat.

Also, Fairmont Peace Hotel committed as a corporate sponsor to the "Million Tree Project" of Roots & Shoots: planted 2,000 trees in the desert lands of Inner Mongolia named "Fairmont Forest". Fairmont Peace Hotel also launched a "Greening at Peace" package- for each guest who stayed with the Greening at Peace room package, Fairmont Peace Hotel donated 10 trees on behalf of the guest – including planting and maintenance of the trees for 10 years.



To guide and mentor business organisations in India on conservation and sustainable use, the CII-ITC Centre of Excellence for Sustainable Development launched the India Business & Biodiversity Initiative (IBBI). This business-led initiative serves as a national platform for business, to promote sharing and learning, and will ultimately lead to mainstreaming sustainable management of biological diversity by business. IBBI was initiated by the Ministry of Environment, Forests and Climate Change (MoEFCC), Government of India, and is supported by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

# IBBI PUBLICATIONS





**CII-ITC Centre of Excellence  
for Sustainable Development**

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A pioneering effort by CII, the CII-ITC Centre of Excellence for Sustainable Development creates a conducive, enabling environment for Indian businesses to pursue sustainability goals.

It creates awareness, promotes thought leadership, and builds capacity to achieve sustainability across a broad spectrum of issues.

**[www.sustainabledevelopment.in](http://www.sustainabledevelopment.in)**

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