

# A GUIDEBOOK FOR

# INTEGRATION OF BIODIVERSITY SPICE SECTOR IN THE WESTERN GHATS



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## **Supported by**

Global project Private Business Action for Biodiversity (PBAB) commissioned by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and implemented by GLZ.

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## Executive Summary

A Guidebook for Integration of Biodiversity: Spice Sector in The Western Ghats acts as a guide for the spice sector companies, especially those operating in The Western Ghats of India with respect to biodiversity conservation and sustainable management of natural resources. The Western Ghats are one of the biodiversity hotspots that extend key ecosystem services to the whole of the peninsular India. This region also houses many provisioning services that are of economic value. Most of the spices sourced from this region are endemic and of high value, arising out of the production of spices, medicinal and aromatic plants to name a few due to their unique aroma and flavour. The major component of a spice supply chain is the area under cultivation.

Spice production is highly dependent on healthy functioning of ecosystems that provide various ecosystem services like freshwater, nutrient cycling, pollination, soil fertility etc. In recent times, the Western Ghats is faced with the challenges of changing weather conditions, land degradation, loss of soil fertility and water scarcity, which is adversely affecting the spice production in the region. These challenges indirectly also impact companies sourcing spices and have a bearing on the long-term sustainability of their supply chain. It is now an opportunity time that the companies identify the operational risks through scientific based tools that would help to measure the impacts and dependencies on biodiversity and ecosystem services and develop actions to mitigate and manage.

This guidebook helps in understanding the complexities arising from such situation and integrating biodiversity into business. The important aspects covered are the inter-linkages between business and biodiversity, their impacts and dependencies on biodiversity and ecosystem services and measures for management and monitoring. Through IBBI Assessment Studies, key areas of biodiversity integration for spice companies were identified and a management tool that would assist in the integration of biodiversity into their business plan has been suggested. Good practice case study examples documented in this guidebook highlight the practices followed by certain spice companies that are operating in the Western Ghats to effectively address the concerns of biodiversity conservation and sustainable management of natural resources.

# Acknowledgement

Confederation of Indian Industry (CII), India Business and Biodiversity Initiative (IBBI) is a business led initiative, with an objective to mainstream biodiversity into Indian businesses. CII-ITC Centre of Excellence for Sustainable Development (CESD) hosts this initiative, which is acknowledged by Ministry of Environment Forest and Climate Change (MoEFCC), Government of India (GOI). This initiative provides a national platform for business, to promote sharing and learning, and ultimately mainstreaming biodiversity conservation and sustainable utilisation into their business operations across the value chain. CII-IBBI as an executive member of Convention of Biological Diversity (CBD), Global Platform for Business & Biodiversity (GPBB), represents Indian businesses at the global level. CII-IBBI works with businesses and stakeholders through various projects for capacity building and mainstreaming biodiversity into Indian businesses.

CII-IBBI worked with Spice Sector companies operating in Western Ghats for 'Capacity Development and Sensitisation for Biodiversity Integration' in partnership with Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) This work was part of the global project Private Business Action for Biodiversity (PBAB) commissioned by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and implemented by GIZ. The project is part of the International Climate Initiative (IKI) supported by BMU on the basis of a decision adopted by the German Bundestag. The project pursues identification and analysis of promising mechanisms and instruments for promoting biodiversity-friendly production and commercialisation and to test pilot approaches for biodiversity integration into spice sector companies operating in the Western Ghats of India.

The work focused on sensitizing spice companies through capacity building on importance of Biodiversity and Ecosystem Services (B&ES) and carrying out a pilot biodiversity assessment study through application of tools focusing on B&ES developed in-house by CII-IBBI. The objective of this study was to help businesses in spice sector to identify operational risks arising due to biodiversity loss in the Western Ghats across their value chain. Based on the observations and findings of the study, measures in the form of an action plan are developed to mitigate the risks and achieve long-term business sustainability. Key indicators were identified and documented that will help companies to integrate biodiversity into their existing processes or frameworks and enable easy adaptation to bio-friendly production and commercialisation.

This guidebook is a documentation of all the learnings, findings and observations of Spice Sector companies and their inter-linkage with B&ES. This provides an easy guide for businesses operating in Spice Sector for mainstreaming biodiversity.

## Foreword

The 'Private Business Action for Biodiversity' (PBAB) project aims to identify and analyze promising mechanisms and instruments for promoting biodiversity-friendly production and commercialisation and to test pilot approaches in three partner countries – India, Brazil and Mexico. The project will learn from the pilot implementation to further develop the mechanisms and instruments where required and to systemise the experiences gained in a way that enables both the private and public actors to use them. The focus of the PBAB project lies on supporting micro- small and medium enterprises that are particularly dependent on ecosystem services and biodiversity and often times face challenges when introducing innovations. In India, the project identified and established instruments and mechanisms that promote biodiversity-friendly production and commercialisation in the spice sector in The Western Ghats.

The project is implemented in partnership with the Ministry of Environment, Forest and Climate Change (MoEFCC), the National Biodiversity Authority (NBA) and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. The project will disseminate existing examples of biodiversity-friendly production and commercialisation on management tools that improve the integration of biodiversity aspects. This document is part of the biodiversity assessment package conducted with spice companies in The Western Ghats in collaboration with IBBI in the state of Kerala.

The publication gives a way forward towards mainstreaming biodiversity integration in spice sector and identifying good practices/cases, which have the potential to be developed as biodiversity friendly. I hope that this publication will help to inspire and assist the spice industry in integrating biodiversity and ecosystem services into their production systems.



DR KONRAD UEBELHÖR  
Director  
Indo-German Biodiversity Programme, GIZ

## Foreword

India is the world's largest producer, consumer and exporter of spices and accounts for almost half of the global spice trade. Blessed with diverse agro-climatic zones, India produces about 75 of the 109 spice varieties listed by ISO. Total spices export from India stood at 1.08 billion kgs, valued at US\$ 3.11 billion in the year 2017-18. Over the past decades the spice industry exports have shown tremendous growth and are expected to reach a goal of USD 5 Billion and about 850,000 mt by the year 2020-21. A significant portion of the spice collection of India comes from the Western Ghats. These Ghats are now facing threats from environmental issues like biodiversity loss, degradation of ecosystem services, flash floods and increasing crop pests and diseases which are impacting productivity in this region. Spices being the major agriculture commodity in most of this region, these issues are leading to various operational risks for businesses.

It is important for Spice Sector companies, operating in Western Ghats to be aware of the importance of integration of biodiversity into their operations and supply chain and learn to manage sustainable utilisation of resources. Companies need to map their impacts and dependencies on Biodiversity and Ecosystem Services (B&ES), identify risks associated and adopt measures to mitigate the issues.

Confederation of Indian Industry, India Business and Biodiversity Initiative (CII-IBBI) in partnership with Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) sensitised the spice sector companies through awareness and capacity building on biodiversity integration. As part of this work CII-IBBI carried out a biodiversity assessment study and helped companies to develop a long-term strategy for integration of Biodiversity and Ecosystem Services (B&ES) across value chain. Support was provided to individual companies to identify the critical interventions of the B&ES and develop a specific action plan for mitigation of their risks. Through this work CII-IBBI also provided guidance to companies for integrating sustainable practices, climate change adaptation and incorporate nature-based solutions across their value chain.

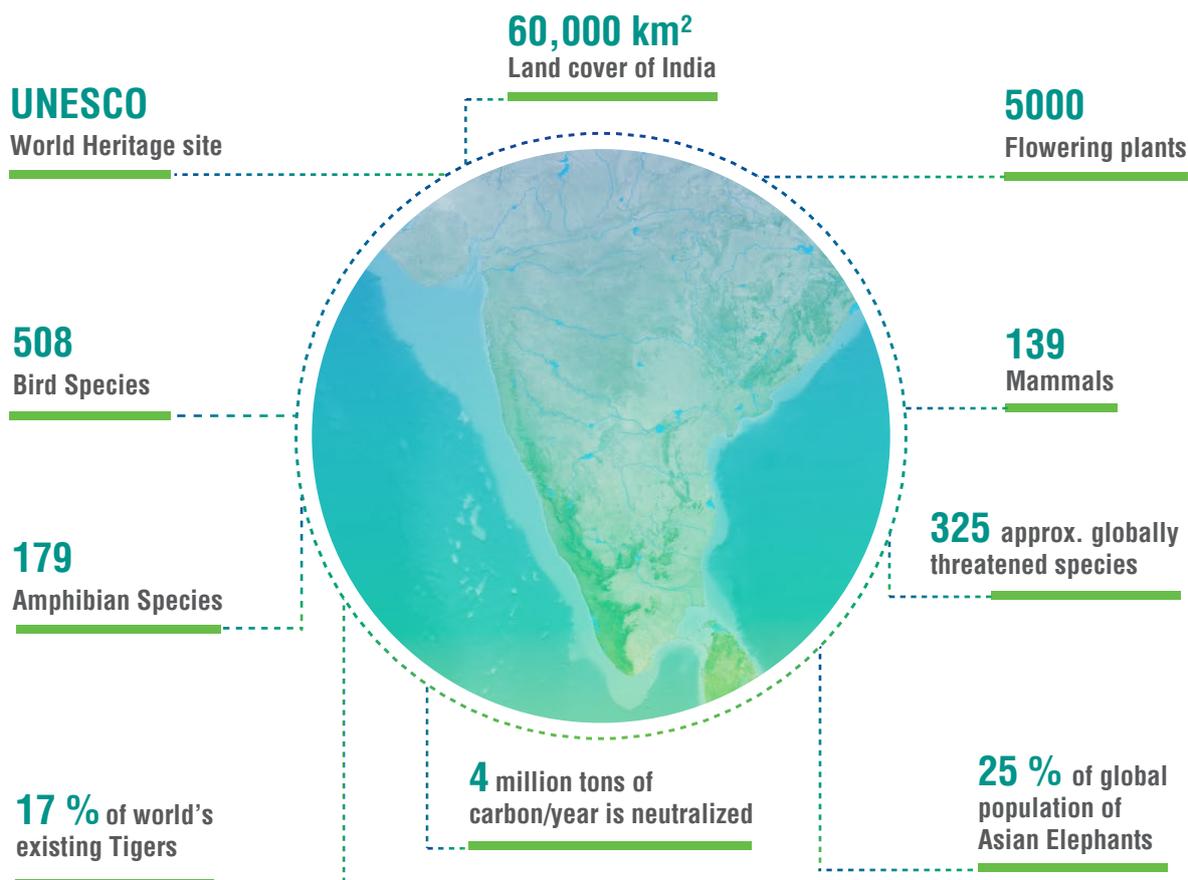
This publication "A Guidebook on Integration of Biodiversity: For Spice Sector in The Western Ghats" shares the learnings and findings of integration of biodiversity into spice companies. This will also provide guidance for businesses to adopt bio-friendly practices and mainstream biodiversity conservation and sustainable utilisation.



MS. SEEMA ARORA  
Deputy Director General  
Confederation of Indian Industry

## Part A: Western Ghats

The Western Ghats (also known as the Sahyadri) located along the west coast of India cover an area of (180,000 Km<sup>2</sup>) 6% of total land in India, running through the states of Gujarat, Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu. The Western Ghats are a treasure trove of biodiversity and the water tower of Peninsular India. The great topographic heterogeneity and strong rainfall gradient together give rise to tremendous diversity of life forms and vegetation types, including evergreen, deciduous and dry forests and grasslands. This topographic heterogeneity forms critical habitats to plants and animals. The Western Ghats are home to about 50 million people and is a biodiversity hotspot<sup>1</sup>.



*\*data from WWF*

The Western Ghats have a agro-forestry system with forest and agriculture landscape co-existing together. It is dominated by intensive agriculture of tea, coffee, rubber, spices and many monoculture crops like oil palm that have been recently introduced. These agriculture practices have displaced most of the natural forests throughout the Western Ghats:

- ▶ Growing agriculture intensification is causing forest loss, fragmentation and degradation of wildlife corridors.
- ▶ Inadvertently increasing use of potent agriculture chemicals, technological practices and unsustainable farming practices is accelerating to loss of biodiversity.

The Western Ghats today are facing rapid degradation due to various changes like land use change, intensive agriculture, urbanisation and industrial operations.

<sup>1</sup>N.H Ravindranath & G. HariPriya, Valuation of forest ecosystem services and biodiversity in the Western Ghats, TEEB Report, pg. no. 18

## Climate Change

- ▶ Changing temperatures
- ▶ Changing rainfall patterns

## Pollution

- ▶ Pesticide & Fertilisers
- ▶ Waste

## Over Exploitation

- ▶ Exploitation of forest resources
- ▶ Continuous water extraction
- ▶ Excessive use of chemical fertilisers and pesticides

# Threats Impacting Biodiversity in The Western Ghats

## Soil Erosion

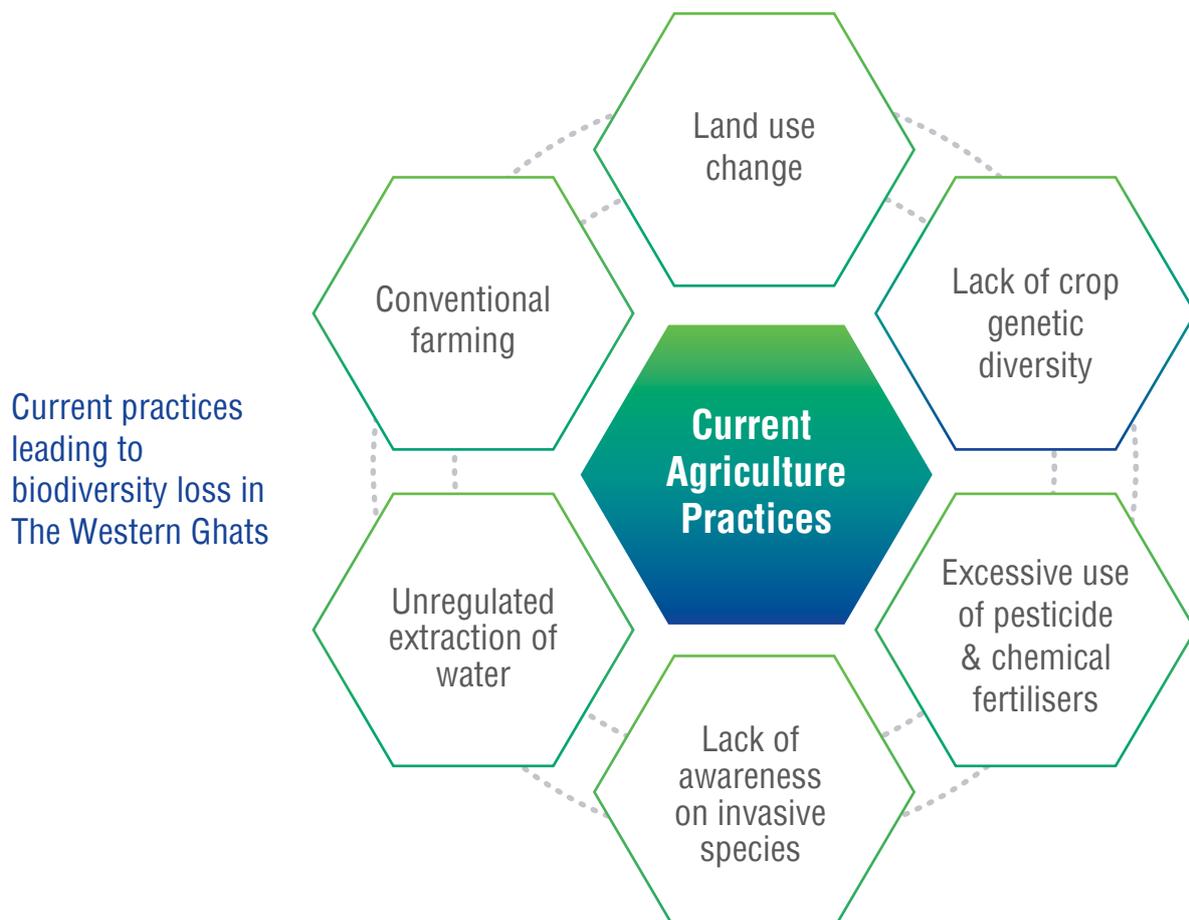
- ▶ Load of pesticide
- ▶ Loss of soil fertility

## Decline in Plant Genetic Variability

- ▶ Loss of native & wild crop varieties
- ▶ Decline in gene pool

## Invasive Species

- ▶ Forest fragmentation or ecosystem alteration and displacement of native flora and fauna
- ▶ Increased disease or pest attack incidents



*\*data as per MoEFCC report on Western Ghats, 2010 & 2013*

## Part B: Spices & Spice Sector

Spices are defined as strongly flavoured or aromatic substances of vegetable origin, obtained from tropical plants, commonly used as a condiment<sup>2</sup>. Spices are an integral component of virtually all recipes in all cultures, because of the flavour, medicinal value and rich aroma. The history and culture of spices is as old as human civilisation and forms an important group of agriculture commodities.



Spice is a dried seed, fruit, root, bark, or vegetative substance primarily used for flavouring, colouring or preserving food. Spice products are essential products derived from the whole spices. They are available in the form of powders, extracts (oil, oleoresin, colours), preserved as freeze dried, dehydrated frozen, in brine, in sugar syrup etc.



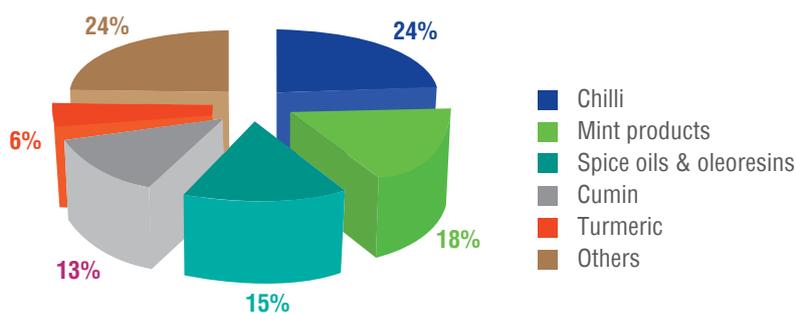
### Spice story of India<sup>3</sup>

India is the world's largest producer and exporter of spices, producing around **3.2** million tonnes of different spices that are valued at around US\$ **4** billion.

Indian exports of spices and spice products reached **843,255** tonnes in 2015-16, valued at Rs. **16,238.23** crore (US\$ **2,482.83** million).

Spice oils and oleoresins of up to **11,635** tonnes exported are valued at Rs. **21.42** billion in 2015-16.

Share of major spices in India's exports by value (2017-18)



Indian spices are exported to over **150** global markets, which include US, Europe, Japan, Oceania, Singapore, China, South Korea and Middle East.

Spices such as turmeric, black pepper, ginger, mint and cardamom have high demand by nutraceutical industry.

Christopher Columbus and Vasco De Gama embarked on their historic expedition in the quest of Indian spices, particularly Pepper and established the 'Spice Route'.

India holds a long history of trading of spices with the ancient civilizations of Rome and China.

<sup>2</sup> Ganga Devi & KS Jadav, Growth Performance in Area, Production, Productivity and Export of Spices in India, Acta Scientific Agriculture (ISSN: 2581-365X), Volume 2 Issue 11 November 2018

<sup>3</sup> Factbook on Tea, Coffee and Spices of India, India Brand Equity Foundation (IBEF): <https://www.teacoffeespiceofindia.com/resource/publication>

India primarily exports pepper, chili, turmeric, ginger, cardamom, coriander, cumin, fennel, fenugreek, nutmeg & mace, garlic, turmeric and vanilla. Processed spices such as spice oils & oleo-resins, mint products, curry powder, spice powder, blends and seasoning are also exported.

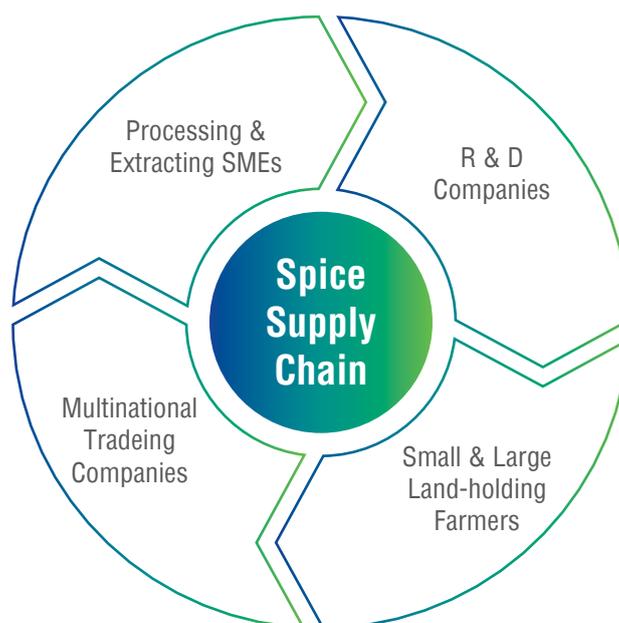
## Spices of the Western Ghats

<p><b>CARDAMOM (SMALL)</b> Kerala, Karnataka Tamil Nadu</p>	<p><b>CHILLI</b> Gujarat, Karnataka Maharashtra, Tamil Nadu,</p>	<p><b>CLOVE</b> Kerala, Karnataka Tamil Nadu</p>
<p><b>CINNAMON/CASSIA</b> Kerala Tamil Nadu</p>	<p><b>GINGER</b> Karnataka, Kerala, Tamil Nadu</p>	<p><b>GARLIC</b> Maharashtra, Gujarat Karnataka</p>
<p><b>NUTMEG &amp; MAC</b> Kerala, Karnataka Tamil Nadu</p>	<p><b>PEPPER</b> Kerala, Karnataka Tamil Nadu</p>	<p><b>POMEGRANATE</b> Maharashtra Tamil Nadu</p>
<p><b>TURMERIC</b> Karnataka, Tamil Nadu Maharashtra, Kerala</p>	<p><b>KOKAM</b> Karnataka</p>	<p><b>VANILLA</b> Kerala, Karnataka Tamil Nadu</p>

Commonly Used Spices		
Spice Name	Uses	Medicinal Value
 <b>Black Pepper</b>	Adds flavour to food	Prevents indigestion it is anti-bacterial, reduces blood pressure and contains iron
 <b>Ginger</b>	Adds aroma and pungency to food	Contains gingerol, possesses quick relieving effects from cold, heartburn, stomach issues and morning sickness. Has anti-inflammatory benefits.
 <b>Turmeric</b>	Adds colour and flavour	Helps prevent Alzheimer's disease, joint inflammation, liver damages and fights cold & cough. It works as antiseptic.
 <b>Clove</b>	Adds sweetness and aroma to foods	Has antiseptic and antibiotic properties. Used in dentistry, oral and pharyngeal treatments.
 <b>Cinnamon</b>	Used widely for desserts and sweets for flavour	It has astringent; stimulant and carminative properties. Helps in diabetics, cardio-vascular health, increase metabolic rate, regulates blood sugar.
 <b>Nutmeg &amp; Mace</b>	Adds spicy aroma and flavour to food	Has anti-bacterial properties, fights tooth decay and Alzheimer's, improves memory and helps release muscle tension.

(quote reference to the above : Indian trade portal: spice industry in India- [www.indiantradeportal.in](http://www.indiantradeportal.in))





It has been observed that there is growing awareness among businesses for implementing sustainable practices and standards for procuring sustainable raw materials and delivering sustainable products. The spices companies focus on key constraints: availability of raw material and its direct access, good quality and quantity as well as continuous supply. To ensure this, more and more spice companies are focusing on sustainable production practices. However, the predominance of smallholders and complex supply chain in the spice sector poses a number of challenges.

Spice Sector Challenges		
Challenges	At Farm Level	Business front
Smallholder Farmers	<ul style="list-style-type: none"> <li>▶ About 98% of the spices in India are produced by small-scale farmers, who typically farm less than two hectares and seasonally follow crop rotation</li> <li>▶ Low income, difficulties in accessing market, poor living standards, and limited collective bargaining power are some of the socio-economic challenges of farmers</li> <li>▶ Proper farm management is not done due to lack of awareness</li> </ul>	<ul style="list-style-type: none"> <li>▶ Industry faces challenge of having long-term commitment with farmers</li> <li>▶ Sourcing of desired quality and quantity of raw material</li> <li>▶ Lack of Awareness on good practices</li> <li>▶ Contract and Buy-back arrangement with farmers</li> <li>▶ In the following crop cycle, farmers shift to alternative crops due to which companies have to look for new suppliers</li> </ul>
Raw material sourcing and Traceability	<ul style="list-style-type: none"> <li>▶ Farmers opt for good yielding, disease resistant crop varieties. There is no awareness of retaining seeding material or developing seed banks of identified good varieties</li> </ul>	<ul style="list-style-type: none"> <li>▶ Spice procuring companies look for desired quantity and quality of the raw material. There is challenge of rejection of material due to pesticide residue and meeting the requirement of buyers</li> </ul>

Sustainability Issues	At Farm Level	Business front
Water Problem	<ul style="list-style-type: none"> <li>▶ Unmonitored water extraction for irrigation</li> <li>▶ Irregular rainfall and scarcity of water for irrigation influence the yield of the crop</li> </ul>	<ul style="list-style-type: none"> <li>▶ Lack of accountability and management of sourced water</li> <li>▶ No restoration and conservation plan or initiatives</li> </ul>
Credit & Indebtedness	<ul style="list-style-type: none"> <li>▶ Small farm holdings, low income and livelihood standards make the farmer financially dependent on external fund/loan</li> </ul>	<ul style="list-style-type: none"> <li>▶ Encouraging farmers to implement new or good/sustainable practices at farm level</li> </ul>
Globalisation Challenges	<ul style="list-style-type: none"> <li>▶ Farmers are not aware of international policies, standards and practices</li> </ul>	<ul style="list-style-type: none"> <li>▶ Businesses are required to implement standards and sustainable practices specific to each product as per each buyer preference</li> </ul>
Climate Change	<ul style="list-style-type: none"> <li>▶ Crop productivity is influenced by changing weather patterns, temperature variations and irregular rainfall</li> </ul>	<ul style="list-style-type: none"> <li>▶ Developing business models to adopt nature-based solutions, innovations in alternative solutions and mitigation of climate change</li> </ul>
Lack of Awareness	<ul style="list-style-type: none"> <li>▶ Farmers are not aware of sustainable practices, alternative measures and importance of ecosystem and resource management</li> </ul>	<ul style="list-style-type: none"> <li>▶ For integration of bio-friendly and sustainable practices businesses have to ensure capacity building of farmers and other suppliers who are part of their value chain</li> </ul>
Diversification	<ul style="list-style-type: none"> <li>▶ More and more farmers are adopting alternative cash crops and look for best buy bargain for produce</li> </ul>	<ul style="list-style-type: none"> <li>▶ For businesses there is a growing concern regarding availability of desired raw material and meeting the buyers/exporters' demand.</li> </ul>
Use of chemical fertilisers and pesticides	<ul style="list-style-type: none"> <li>▶ Overuse of chemicals and fertilisers</li> <li>▶ No awareness of banned and safe chemicals</li> </ul>	<ul style="list-style-type: none"> <li>▶ Rejection of products by buyer or in export due to pesticide residue</li> <li>▶ High cost of products</li> </ul>
Market connect or accessibility	<ul style="list-style-type: none"> <li>▶ Unaware of exact value</li> <li>▶ No constant buyer due to changes in price</li> <li>▶ Many players hindering direct access to market</li> </ul>	<ul style="list-style-type: none"> <li>▶ Market price variation</li> <li>▶ Availability of continuous supplier</li> <li>▶ Meeting the required demand and standards of products</li> </ul>

Today the biggest challenge for spice companies is long-term sustainability of the supply chain. As spice trade involves a complex supply chain, there are challenges at each level.

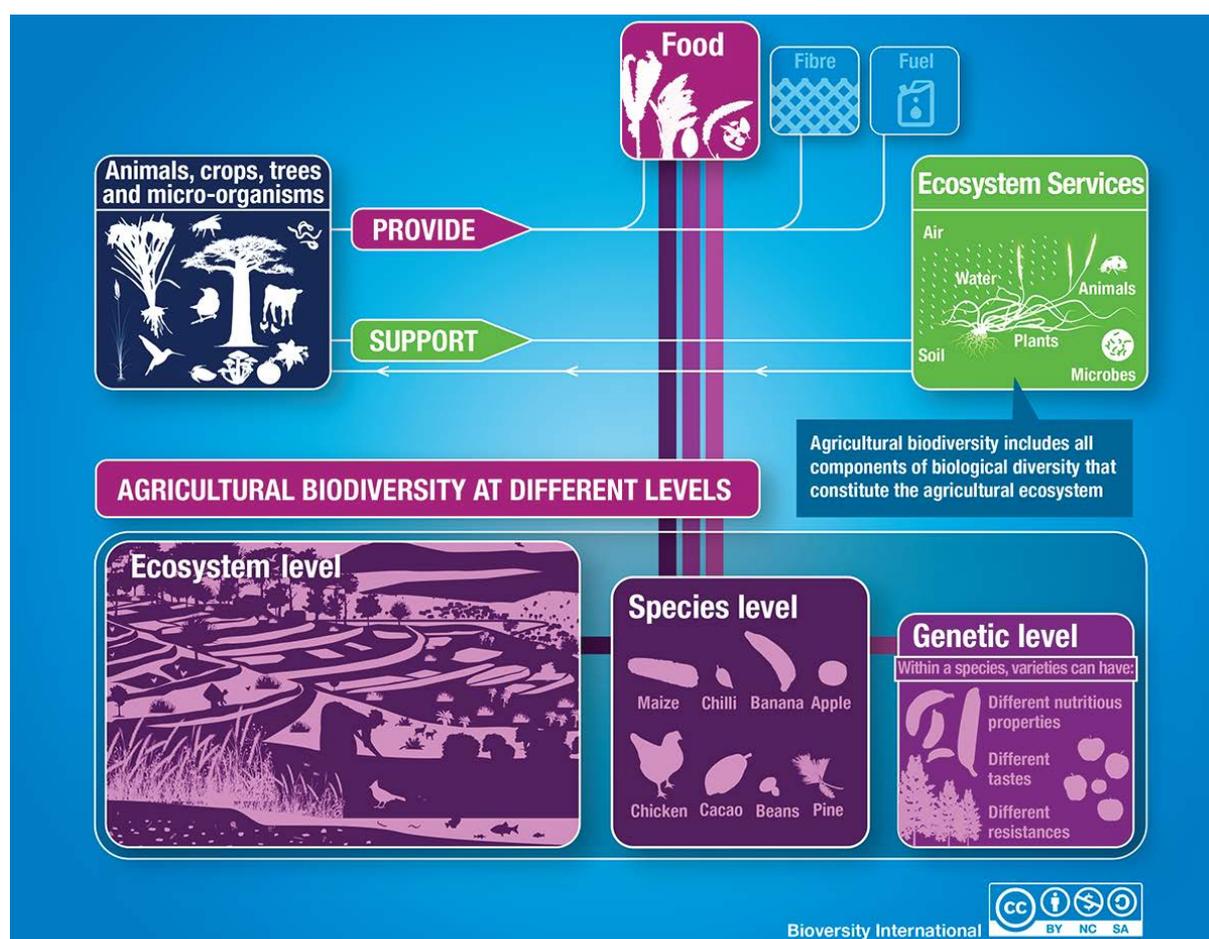
Spice Sector Supply Chain Challenges		
Supply Chain Component	Role in Supply Chain	Issues
Primary Production	<ul style="list-style-type: none"> <li>▶ Most spices are cultivated by smallholder farmers</li> </ul>	<ul style="list-style-type: none"> <li>▶ Small land holdings</li> <li>▶ Lack of storage capacity</li> <li>▶ Transport/supply of the material to market/buyer</li> <li>▶ No proper legally binding agreements with traders</li> </ul>
Local Trade	<ul style="list-style-type: none"> <li>▶ Smallholders depend on local collectors, village and district trader for marketing their products</li> <li>▶ For export, local traders select products based on the specific requirement of export-trading</li> </ul>	<ul style="list-style-type: none"> <li>▶ Small growers are not approached directly</li> <li>▶ High quality and high volume of product is of preference</li> <li>▶ Participation of intermediate players like processors, retailers and distributors</li> <li>▶ Reliable delivery on time is becoming a significant barrier for smaller players</li> </ul>
Local Processing	<ul style="list-style-type: none"> <li>▶ Processing of spices is mostly done locally</li> <li>▶ For local consumption it is done by small processing units or by medium-large processors</li> <li>▶ For international clients it is done by larger processors</li> </ul>	<ul style="list-style-type: none"> <li>▶ Most processors don't have direct farm connect</li> <li>▶ Lack of long-term commitment with farmers</li> <li>▶ Traceability of products</li> <li>▶ Accessibility to good quality of produce</li> <li>▶ Cost of produce in the local market</li> <li>▶ Following national and international standards and certifications</li> </ul>
International Trade	<ul style="list-style-type: none"> <li>▶ Spice raw material/processed product supply to the buyer involves agents/importers/aggregators and inter-trade between different trade houses.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Sourcing and processing of the products as per buyers' requirements</li> <li>▶ Avoidance of damage and loss of products</li> <li>▶ Adhering to buyer specific standards and certifications</li> </ul>
Final Use	<ul style="list-style-type: none"> <li>▶ Food processing industries</li> <li>▶ Beverage manufactures</li> <li>▶ Bakery and confectioneries</li> <li>▶ Drug and pharmaceutical companies</li> </ul>	<ul style="list-style-type: none"> <li>▶ Maintaining supply from fixed sourcing locations.</li> <li>▶ Acquiring good quality and desired quantity from single suppliers.</li> <li>▶ Rejection of material</li> </ul>

To overcome these challenges, spice companies need to identify associated risks, map their impacts and adopt mitigation measures with respect to their business operations. Mainstreaming biodiversity conservation and sustainable utilisation of resources have been identified in recent times to be the best practices for sustainable development.

Spice companies have a direct linkage to biodiversity because of production and sourcing of spices. Companies need to incorporate bio-friendly production and commercialisation for long-term sustainability.

## Part C: Mainstreaming Biodiversity and Ecosystem Services into Spice Sector

Spices are agricultural commodity and their cultivation is directly dependent on Biodiversity and Ecosystem Services (B&ES). Biodiversity plays a major role in agriculture at different levels, for example-availability of soil micro-organisms, crops and pollinators at species level, availability of variety of crops with genetic variation at genetic level and provision of rainfall for irrigation and flow of nutrients by nutrient cycle at ecosystem level. This interaction of biodiversity and agriculture is termed as 'Agricultural Biodiversity'.



“Agricultural biodiversity is a broad term that includes all components of biological diversity of relevance to food and agriculture, and those that constitute the agro-ecosystem: that variety and variability of animals, plants and micro-organisms, at the genetic, species and ecosystem levels, which are necessary to sustain key functions of the agro-ecosystem, its structure and processes”

*-defined by Convention of Biological Diversity<sup>6</sup>*

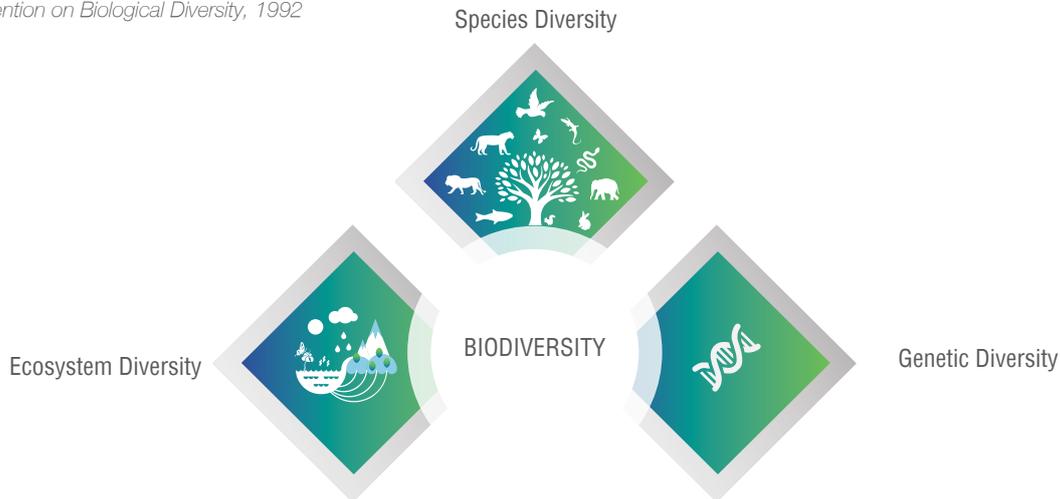
The spice sector directly depends on the crucial services provided by agricultural biodiversity. Spices are important products made available as provisioning services by the natural ecosystem (wild harvest spices) or the agro-ecosystem (farmed spices). Many other ecosystem services such as water cycling (providing rain and irrigation facilities), pollination (providing natural pest and disease control), climate regulation (providing ambient temperature and conditions for production) and genetic diversity (that provides for various spice varieties); play a role in spice production. The health of these ecosystems and their agricultural biodiversity is important for the spice sector. The spice production system forms an important network with its surrounding ecosystem that may include forest, grassland, wetland, river or pond. The productivity of spices is therefore dependent on health of these ecosystems and delivery of associated ecosystem services.

<sup>6</sup> Arwen Bailey (ed.) Mainstreaming Agrobiodiversity in Sustainable Food Systems: Scientific Foundations for an Agrobiodiversity Index. Bioversity International, 2017. Rome, Italy.

## What is Biodiversity?

Biodiversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.”

-Convention on Biological Diversity, 1992



Biodiversity is the variety of life on earth at all levels, from genes to population of species and from communities of species sharing the same habitat to large ecosystems. There are three important levels in which biodiversity can be categorised: Genetic Diversity, Species Diversity and Ecosystem Diversity. By the call of United Nations during the United Nations General Assembly in 2000, a assessment study titled 'Millennium Ecosystem Assessment (MA)' was carried out to assess the consequences of changes in ecosystem on human well-being. The assessment also involved assessing the scientific basis for actions needed to enhance conservation and sustainable use of ecosystems and their contributions to human well-being. This report elaborates the linkages between ecosystems and human well-being and the benefits derived from the ecosystem.



“Ecosystem Services are the benefits people derive from ecosystems.” These include provisioning, regulating, and cultural services that directly affect people and supporting services needed to maintain other services.

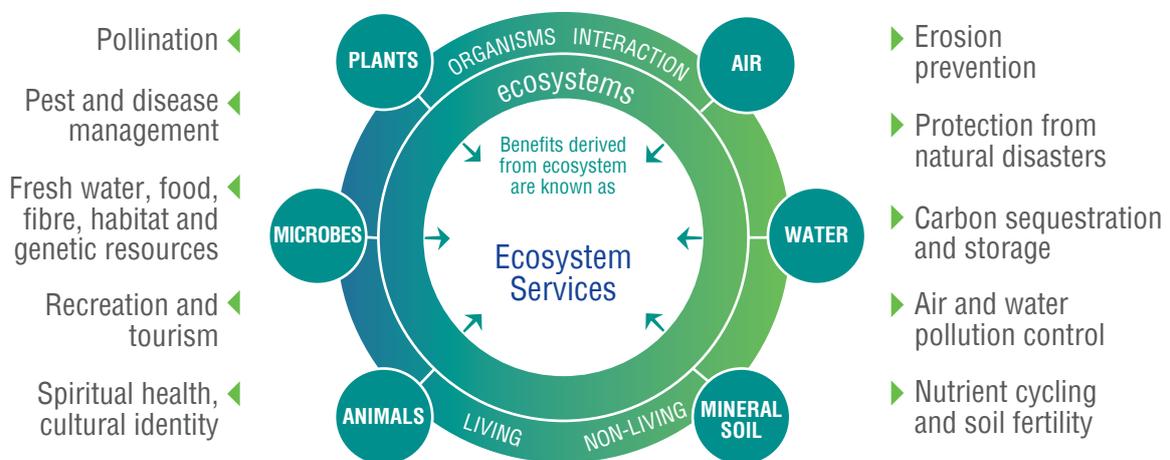
Source: Convention on Biological Diversity (CBD) (definitions) and Millennium Ecosystem Assessment (2005) Report

## Why is the Ecosystem Important?

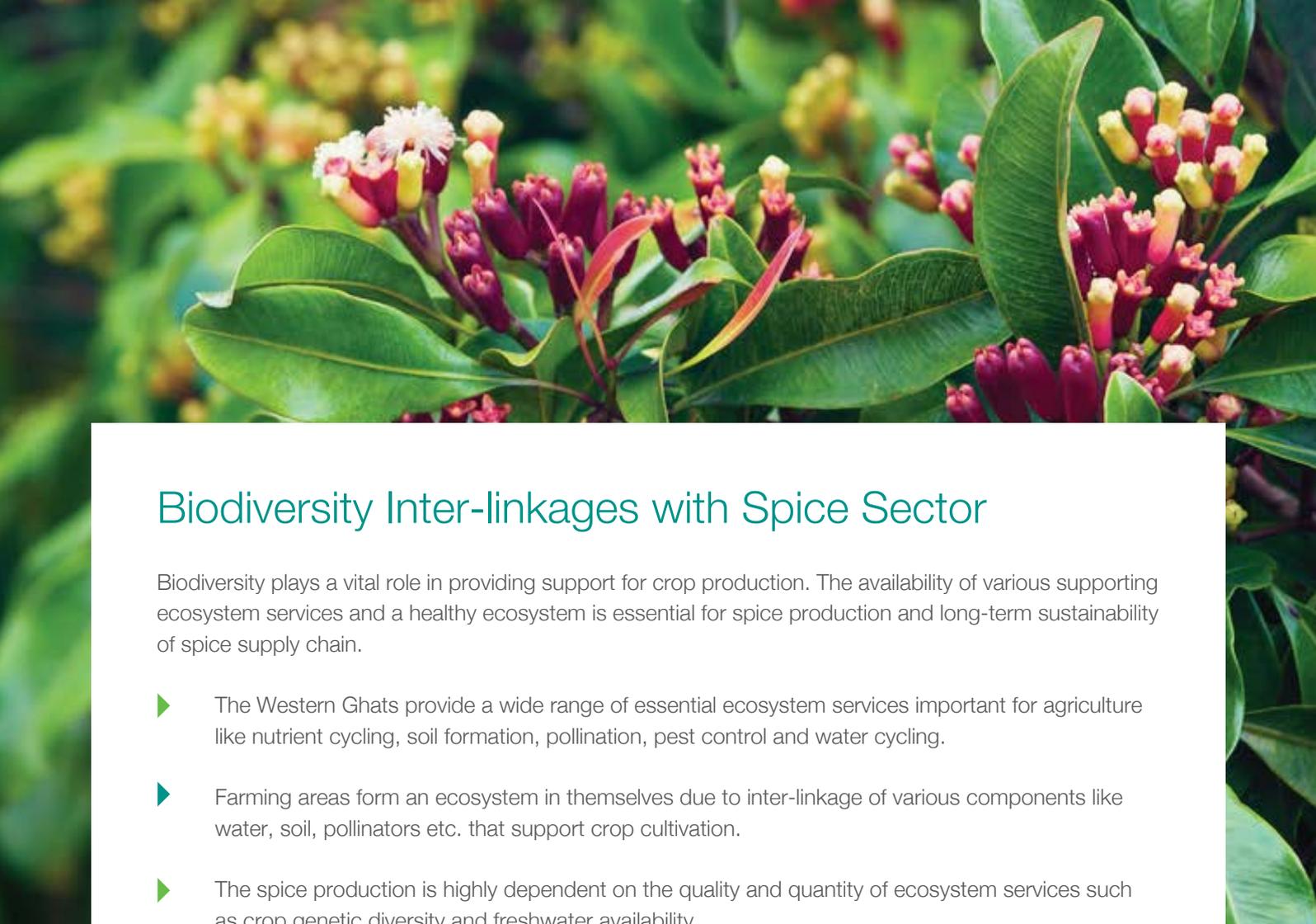
“Ecosystem” means “a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit”.

*-definition by Convention on Biological Diversity (CBD).*

Ecosystems provide for many valuable services for human well-being. In agriculture, ecosystems play an important role in providing multiple services that support and regulate crop productivity.



Agricultural productivity can be improved by managing biodiversity and ecosystem services inter-linked to farm lands. Integrating biodiversity at the farm level will also support in building resilience to climate change and enhance livelihoods of the local community.



## Biodiversity Inter-linkages with Spice Sector

Biodiversity plays a vital role in providing support for crop production. The availability of various supporting ecosystem services and a healthy ecosystem is essential for spice production and long-term sustainability of spice supply chain.

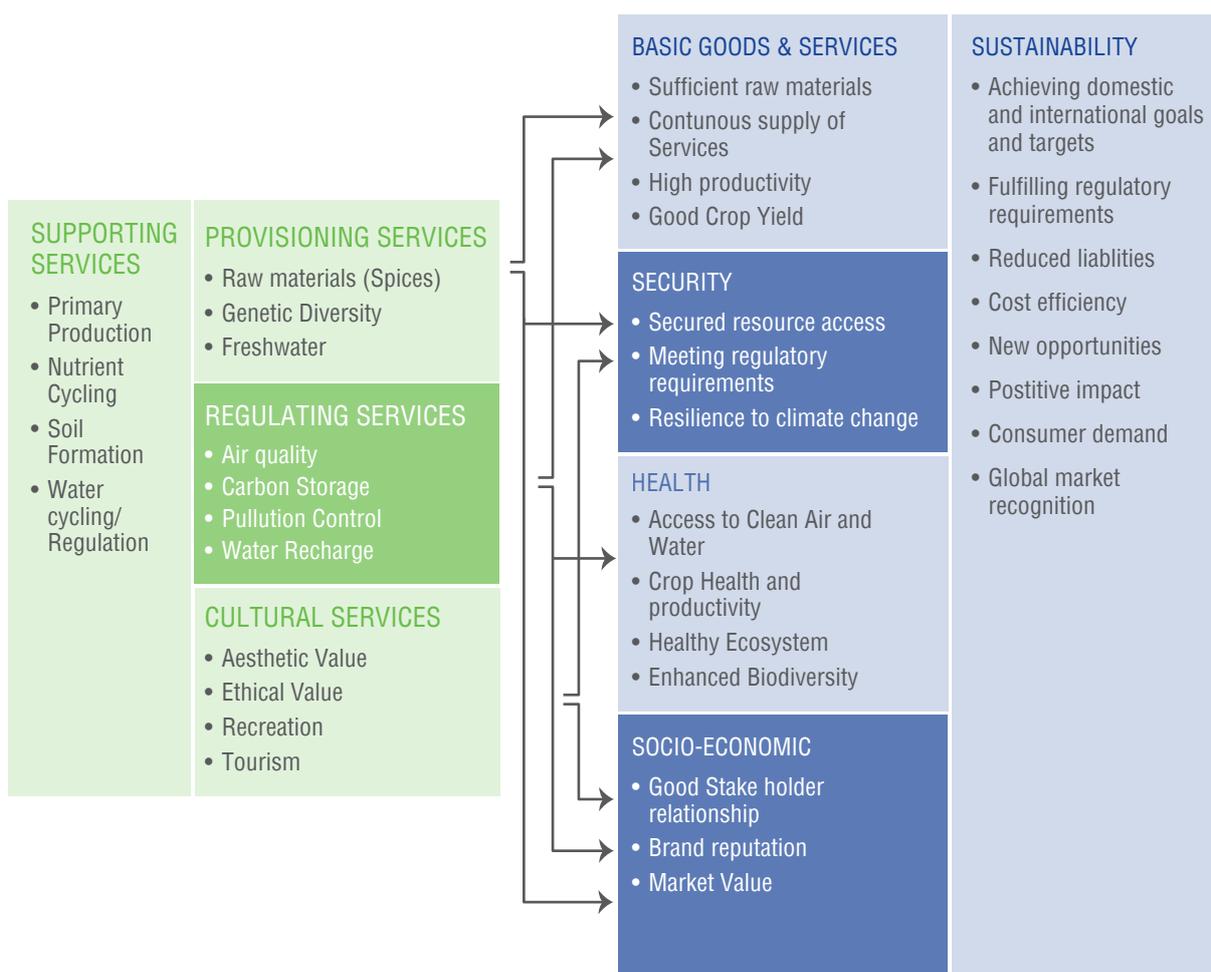
- ▶ The Western Ghats provide a wide range of essential ecosystem services important for agriculture like nutrient cycling, soil formation, pollination, pest control and water cycling.
- ▶ Farming areas form an ecosystem in themselves due to inter-linkage of various components like water, soil, pollinators etc. that support crop cultivation.
- ▶ The spice production is highly dependent on the quality and quantity of ecosystem services such as crop genetic diversity and freshwater availability.
- ▶ Other important services that influence the crop production are biological control by crop friendly birds and insects, pollination during flowering & fruiting period, species diversity & richness in farm area and stable soil health.
- ▶ The Western Ghats is a mosaic of ecosystems like forest areas, ponds and rivers which also are critical in providing ecosystem services like flood control, water recharge and cycling and soil fertility.

The growing demand and supply of various agriculture commodities, including spices has led to increasing agricultural intensification in the Western Ghats. This led to continuous land-use change and over-exploitation of resources thus impacting the Western Ghats' biodiversity and ecosystem services.

Though the spice sector is dependent on B&ES through agricultural production, however, the same operations have a considerable impact on biodiversity. The lack of sustainable practices in agriculture, lack of management of ecosystem services and absence of mitigation measures are contributing to loss of biodiversity and depletion of resources.

Biodiversity Interventions Across Spices Sector			
Value chain of Agriculture sector	Area of Intervention	B&ES Linkages	
		Dependency	Impacts
Research	Research and development on seeds, fertilisers, insecticides & pesticides, agriculture instruments, etc.	High	Low
Industry	Extraction & processing of spices	Medium	High
Agriculture production	Spice growers	High	High
Sourcing	Sourcing of raw material	High	High
Transport	Transportation of material from farm to industry and market	Low	Low

## Key Ecosystem Services for Spice Sector



source: Adapted from Ecosystem and Human Well-Being Synthesis- A report of the Millennium Ecosystem Assessment, 2005

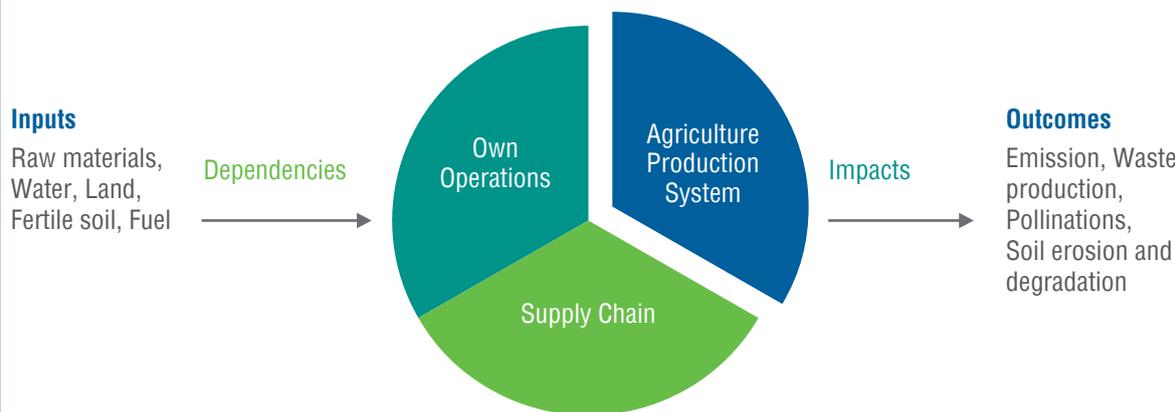
Impacts on biodiversity lead to risks associated with businesses' own operations as well as the supply chain. These risks include business risks to reputation, continuation of operations and brand name. It is important for businesses to address these risks and mainstream biodiversity promoting innovation, sustainable solutions, new products and markets.

Business and Biodiversity Risks				
Category	Risks	Operations most likely to be affected		
		Business	Farm	Market
Physical risk	Reduced productivity	✓	✓	✓
	Scarcity and increased cost of resources	✓	✓	✓
	Disruption of operations	✓	✓	✓
Regulatory and legal risk	Restricted access to land and resources	✓	✓	
	Litigation	✓		
	Reduced quotas	✓		
	Pricing and compensation regimes	✓	✓	
Market risk	Changing consumer preferences	✓		✓
	Purchaser requirements	✓		✓
Other risks	Reputational risk	✓	✓	✓
	Financing risk	✓	✓	✓
	Supply chain risk	✓		✓

Source: Developed from IBBI assessment study observations

### How are agri-business & biodiversity related?

Agri-businesses are directly related to biodiversity through the raw materials and natural resources that become the inputs to business operations across the value chain. Inputs in the form of agriculture raw materials like the crops and crop products sourced and natural resources like land, water and soil are important components for which businesses are dependent on biodiversity. Because of their continuous sourcing of raw materials and use of land and water resources businesses are impacting biodiversity through outcomes like emissions, waste production & pollution.



It is now well established that by dependency and impacts on biodiversity, business hugely influence the health of biodiversity and ecosystem services. And this ultimately reflects on the business performance in terms of sustainability in long run. It is important for companies to understand and manage their impacts and dependencies on B&ES across their value chain as they are essential for sustainable development. Managing B&ES in business own operations and supply chain have also led to opportunities such as innovation like developing sustainable solutions, creating new products and markets.

**Impacts: Land Use Change, Over-exploitation, Habitat Destruction, Pollution, Water Depletion, Emission, Deforestation and Climate Change**

**Dependencies: Land, Water, Soil Fertility, Genetic Diversity of Crops, Pollinators, Climate Regulation, Rainfall and Disease Control**

## Impacts and dependencies of biodiversity & ecosystem services

Biodiversity and Ecosystem Services are affected by a range of drivers of change starting from general drivers, like climate change to sector specific drivers, that impact genetic resources like over-exploitation and land-use change caused by changing agriculture practices. Other major drivers of negative impacts due to agriculture production include changes in water use, pollution and invasive species.



### Habitat Loss & Degradation

Forests, grasslands, wetlands and other habitats have been and continue to be converted for agriculture, industrialization and urban development. The resulting habitat loss is a serious driving force behind the loss of biodiversity.



### Fresh Water Depletion

Humans have substantially disrupted hydrological systems through rising consumptive use and impoundment of water. As a result, streams, wetlands and lakes have dried; regional atmospheric vapour flows have shifted, and river levels have changed due to increased reservoir abstraction.



### Climate Change

Anthropogenic greenhouse-gas emissions have increased since pre-industrial era. This has led to atmospheric concentrations of carbon dioxide, methane and nitrous oxide that are unprecedented. Climate change and global warming are having progressive impact on biodiversity and ecosystem.



### Over-exploitation

Unsustainable use of resources, agriculture intensification and destructive harvesting practices are major threat to biodiversity and ecosystem. Over-exploitation leads to depletion of water, degradation of soil quality and loss of many other resources.



### Pollution

Burning of fossil fuels due to industrial processes, use of fertilisers in agriculture practice and nutrient load in environment are the main cause of pollution. Pollution causes potentially irreversible effects on living organisms and the surrounding ecosystem.



### Invasive Species

Introduction of invasive species and their encroachment leads to loss of native species and alternations in ecosystem.

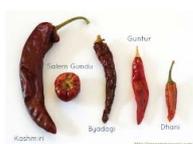
Source: Adapted from *A Guidebook for Biodiversity Management: Sectoral Outlook and Roadmap for Implementation*, CII-IBBI 2016

The Western Ghats provide a wide range of important ecological functions upon which agriculture depends. Crop production in the spice sector is highly dependent on the quality and quantity of ecosystem services such as crop genetic diversity, water for irrigation, biological control of pests and diseases (by crop friendly birds, insects and pollinators), nutrient cycling for maintaining soil health etc.

## Dependency of Agriculture on Biodiversity

**Genetic diversity** Genetic diversity is the provider of various varieties of spice crops, natural pollinators and useful soil flora and fauna. It plays a crucial role in productivity, adaptation to climate change and addressing food security.

### Dependency on crop variety



500 variety of chillies



75 variety of pepper



30 Variety of Turmeric

**Water** Crop cultivation is a major user of freshwater water. In spice production irrigation is mostly through rivers, canals and a high reliance on rainfall.

### Eg 1: Dependency on water<sup>6</sup>

Due to rainfall deficiency in the monsoon in 2016 many parts of Western Ghats faced water shortage in early 2017 including states of Karnataka, Kerala and Tamil Nadu. In Kerala, with the 2016 South West monsoon was deficient by 33.7% (July to September) and the North East monsoon short by 61% (October to December).

**Forest** Forests are essential for maintaining favorable and stable climatic conditions, provide genetic diversity for crops and pollinators, and maintain hydrological cycle for regulating water flow. The crop production is highly dependent on availability of these resources. The healthy functioning of forest ecosystems in the Western Ghats region is important for long-term spice production.

### Eg 2: Dependency on Vegetation<sup>7</sup>

Forest cover plays a vital role in maintaining source of moisture that promotes adequate rain fall. Moisture content from green cover of Western Ghats contributes to an annual rainfall ranging from 2000 mm to nearly 7,800 mm. The Western Ghats evapo-transpiration accounts for the rainfall over peninsular India.

<b>Pollination</b>	Most of the natively available insects (mainly bee) and birds play a vital role in pollination.
<b>Insects and pests control</b>	Crops are destroyed mostly by pests or rats, either in the field or as stored grain. Insectivorous and predatory birds and reptiles like snakes and lizards play a very useful role in controlling pests of crops.
<b>Nutrient Cycle</b>	In natural ecosystems C, N, P, K, Ca, Mg, S and all other mineral nutrients are cycled back into soil through litter fall and decay of the organic matter. Soil microbes which include bacteria, fungi, actinomycetes, protozoa and algae play a significant role in the nutrient cycling.

### Eg 3: Dependency on Soil Nutrient

Turmeric has high demand for plant nutrients and generally responds to increased soil fertility by increasing yield. The balance of N (Nitrogen) & P (Phosphorus) play a vital role in improving rhizome yield.

<sup>6</sup> [https://www.indiaspend.com/wp-content/uploads/2018/12/Climate\\_impacts\\_hurting\\_poor.pdf](https://www.indiaspend.com/wp-content/uploads/2018/12/Climate_impacts_hurting_poor.pdf)

<sup>7</sup> <https://www.thehindubusinessline.com/news/science/western-ghats-biodiversity-is-a-significant-source-of-moisture-for-monsoon/article23772839.ece>



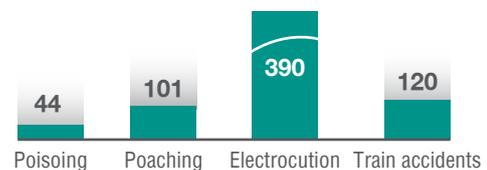
Biodiversity and several regulating services are affected due to intensive agriculture, including erosion control, maintenance of soil quality, water purification and waste control among others. Excessive use of chemical fertilisers and pesticides pose adverse toxic effects on the production potential of the land and through eutrophication there is an impact on riverine and marine ecosystems.

Impacts of Agriculture on Biodiversity	
Loss of biodiversity	Agriculture intensification and due to use of specialised crop varieties there is increasing genetic vulnerability and genetic erosion.
Land use change	Diversion of forests & wetlands and habitat destruction which results in loss of forest cover and degradation of wetlands.

**Eg 1: Decline in Asian Elephant<sup>8</sup>**

Increasing loss & degradation of wildlife habitats, elephant corridors and increased human interference is leading to decline in many species populations like the Asian Elephant.

**DEATHS OF ELEPHANTS BETWEEN 2009-10 AND 2016-17**



Pollution	<ul style="list-style-type: none"> <li>Over utilization of Nitrogen (N), Phosphorus (P) and Potassium (K) leads to loss of soil fertility, degradation of water bodies and loss of wetland habitats.</li> <li>Burning crop residues result in air pollution, damage soil fertility and nutrient cycling and cause degradation of soil microbial diversity.</li> <li>The intensive use of insecticides and pesticides have shown to effect species other than targeted pests. Many insect species, beneficial to agriculture or economically important like bees are also impacted.</li> </ul>
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**Eg 2: Endosulfan Tragedy<sup>9</sup>**

Around 1963-64 in the village of Kasaragod, Kerala cashew plantation was established and from 1976, aerial spraying of endosulfan, an organochlorine pesticide was done. For 20 years the pesticide was sprayed in the region and was found to slowly poison the local people causing various diseases like mental retardation to hydrocephalus especially in new.

Climate Change	Irregular rainfall, floods, drought and increase in ambient temperature are all attributes of climate change. Climate Change is driven by deforestation, pollution, GHG emissions and land use change.
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<sup>8</sup><https://www.livemint.com/Science/kfdxYBLOxfoxtADs7wpFNP/Over-80-elephants-killed-every-year-due-to-humanelephant-co.html>

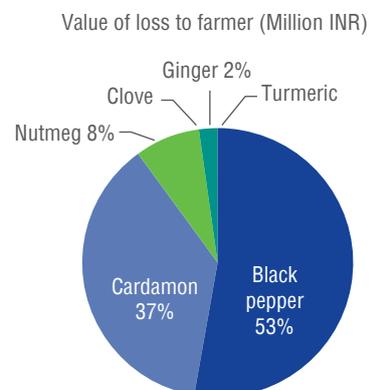
<sup>9</sup><https://www.downtoearth.org.in/coverage/health/tracking-decades-long-endosulfan-tragedy-in-kerala-56788>

Eg 3: Production loss due to rainfall

In the year 2018 the state received 2387 mm of rainfall during this period as against the normal value of 1649.5 mm. There was huge production loss of major crops of Kerala.

Production loss in spices

Crop	Area affected (ha)	Production loss in 2018-19 (tonnes)	Value (Million INR)
Black pepper	26613	10700	4027
Cardamom	15655	6600	6795
Nutmeg	4400	2749	1018
Clove	160	13	9.3
Ginger	1030	4100	605
Turmeric	395	976	86.8
Toatal	48,253	25138	12541.1



Invasive alien species

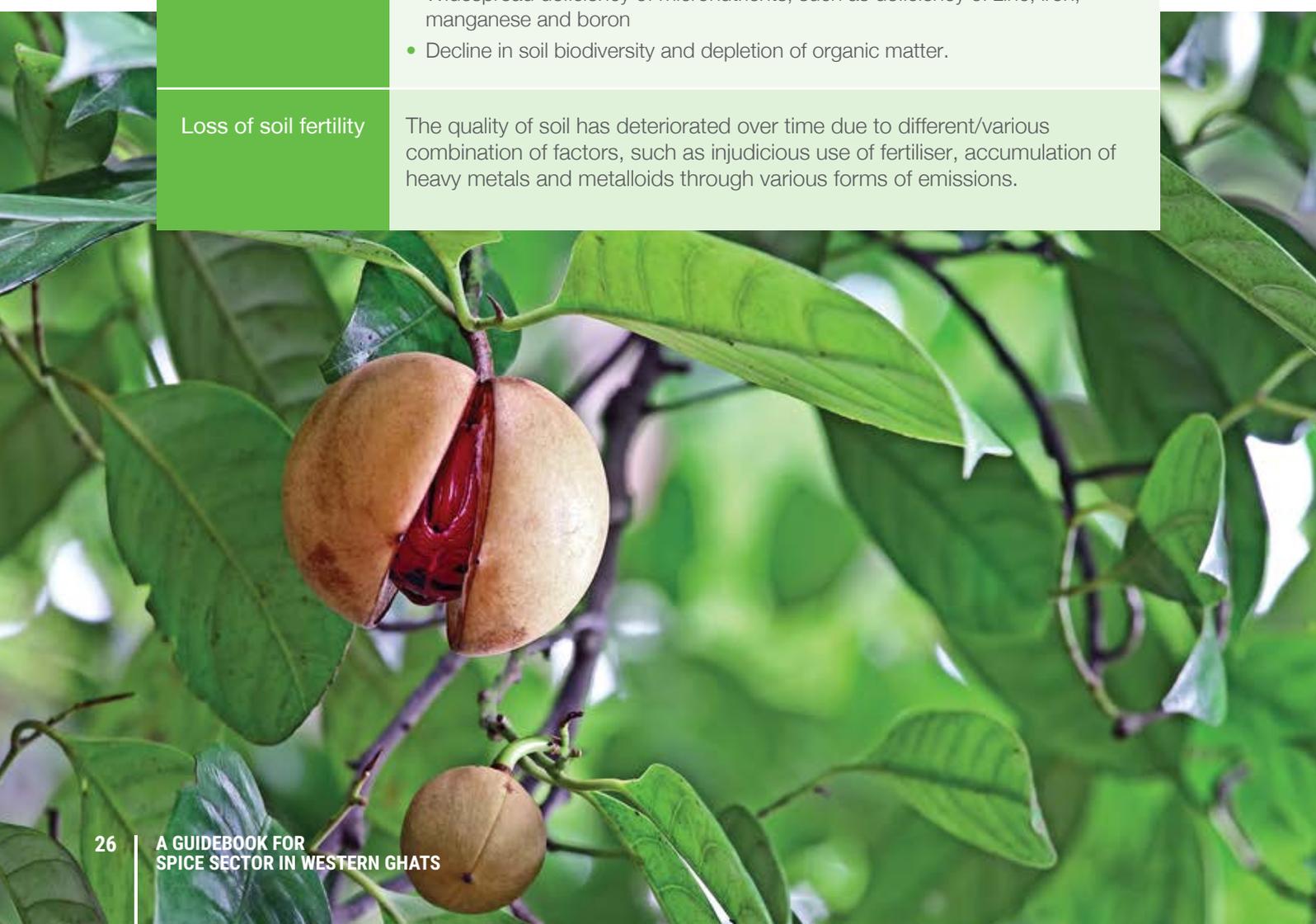
Expansion of agricultural/agrarian activities near the natural forest areas leads to introduction of invasive alien species in natural areas and in agriculture areas. This encroachment of invasive species is resulting in loss of native ground flora of forests and reduction in agriculture production.

Over exploitation

- Depletion of water table, deterioration of water quality, water logging and drainage issues
- Widespread deficiency of micronutrients, such as deficiency of zinc, iron, manganese and boron
- Decline in soil biodiversity and depletion of organic matter.

Loss of soil fertility

The quality of soil has deteriorated over time due to different/various combination of factors, such as injudicious use of fertiliser, accumulation of heavy metals and metalloids through various forms of emissions.





## Regulatory Compliance Related to Spice Sector

1. Biological Diversity Act, 2002 & Rules 2004 – Provides for conservation of biological diversity, sustainable use of its components and fair and equitable sharing of benefits arising out of the use of biological resources and knowledge.
  2. ABS Regulation: Access to Biological Resources and Associated Knowledge and Benefit Sharing Regulations, 2014 – Provides for access to biological resources and derivatives and associated traditional knowledge for bioprospecting, research, commercialisation or IP protection, with exceptions for value-added products and commodities.
  3. Food Safety and Standards Act, 2006 – Provides for science-based standards for articles of food and to regulate their manufacture, storage, distribution, sale and import, to ensure availability of safe and wholesome food for human consumption for matters connected therewith or incidental thereto.
  4. Quality Standards – Ensures that spices exported from India conform to specifications laid down by the appropriate international organisations, or to the food regulations of the buying countries especially with respect to hygiene, commercial and chemical standards.
  5. The Indian Forest Act, 1927 and Forest Acts of states within The Western Ghats- Act defines state ownership, regulated use and power over forests- Reserved Forest, Village Forests and Protected Areas.
  6. The Forest (Conservation) Act, 1980 – Act checks deforestation and conversion of forestland for agriculture, industry and other development projects. Prior approval of federal government is required for de-reservation, logging and use of forestland for non-forest activities.
  7. National Forest Policy, 1988 – Act provides for sustainable use and conservation of forests, efficient use of forest produce, management of ecosystem services and legitimises rights of communities and rural people dwelling in forest areas.
  8. The Wildlife (Protection) Act 1972 - Act defines legal framework for protection of wildlife, establishment of protected areas and management of habitats. Provides for management of Protected Areas- National Parks, Wildlife Sanctuary, Conservation Reserves, and Community Reserves.
  9. Environment (Protection) Act 1986 – Provides for protection and improvement of environmental quality, control and reduce pollution, hazardous and biomedical waste management and prohibit or restrict setting of operations by industry on environmental grounds.
- \* Policies 6-10 are applicable only in case of certain operations leading to land diversion, forest fragmentation or habitat destruction.



## Part D: Management and Monitoring of Biodiversity and Ecosystem Services in Spice Sector

Biodiversity and Ecosystem Services (B&ES) play a critical role in spice sector and to ensure sustainable production and continuous supply of spices, companies need to understand the associated business risks. This requires businesses to create policies and initiatives to measure and manage B&ES. It is important to identify the positive and negative impacts of business on biodiversity for better decision-making and building sound business strategies.

### Sustainable Initiatives of Indian Spice Sector

#### Integrated Pest Management

Integrated Pest Management (IPM) is an effective and environmentally sensitive approach to pest management. The programme uses comprehensive information on the life cycles of pests and their interaction with crop. This uses all appropriate pest management methods including, but not limited to, judicious use of pesticides.

#### Certification

Many companies follow standards related to social, environmental and sustainability aspects. To ensure that these standards are full filled as per organisations obligations the process of certification is followed. Spice sector companies follow certification for Food Safety, Traceability and Quality; Packaging & Labelling; Sustainability and Trade.

#### Sourcing Policies

The sourcing policies of a company promote sustainable production and supply of good quality sourcing material. The compliance is maintained through 'Supplier Code' or 'Responsible Sourcing Guidelines'. Support is provided for implementation and management of policies or principles across value chain.

#### Sustainable Initiative

Considering the involvement of production of spice and engagement with smallholding farmers various initiatives for implementing sustainable practices are in place. Companies, through these initiatives ensure sustainable sourcing and supply chain practices. Issues such as uncontrolled pesticide use, poor waste water and livelihood standards are addressed through these initiatives.

## Indian Spice Sector Initiatives



### Integrated Pest Management (IPM)-2.0

Insect pests, diseases and weeds are major issues for agriculture productivity that limits the growth and yield of crops. Emerging problems of insect resistance, secondary pest outbreak and resurgence increase the cost of crop protection. Initially farmers used cultural practices like crop rotation, healthy crop variety, manipulations in sowing etc. for managing pests. With growing agriculture intensification and cost effectiveness, use of chemical fertilisers and pesticides rapidly expanded. This has led to impacts of chemical pesticide on surrounding ecosystems. Indiscriminate, excessive and continuous use of pesticides not only impacted environment but also acted as a powerful driver for genetic variation leading to resistant pest species. As a mitigating measure companies started Integrated Pest Management (IPM) which takes the approach of pest management through evaluation, monitoring and identification of pests and prevention and control of disease.

IPM focuses on applied pest management which combines and integrates solutions for pest and disease control through a combination of biological and chemical control techniques.

Present Issues in IPM	Biodiversity Management Plan	Monitoring
<ul style="list-style-type: none"> <li>• Use of chemical pesticides</li> <li>• Banned pesticides are still in use due to lack of awareness</li> <li>• Traces of pesticide in sourcing material</li> <li>• Human safety and health issues</li> <li>• Pollution and contamination of soil and water due to excessive pesticide usage</li> <li>• Use of chemical pesticides impact local biodiversity</li> <li>• Lack of awareness on biodiversity and ecosystem management</li> <li>• Lack of capacity and awareness</li> </ul>	<ul style="list-style-type: none"> <li>• Documentation of traditional practices for insect and pest management</li> <li>• Identify and record native species of flora and fauna found in and around the farm</li> <li>• Identify crop friendly insects and enhance native biodiversity to promote them</li> <li>• Incorporate nature-based solutions or bio-friendly solutions for pest management</li> <li>• R&amp;D for identification of solutions and innovations to mitigate issues at farm level</li> <li>• Developing nesting and roosting places for carnivorous' birds (Owls, Bats, Eagles, etc.)</li> <li>• Capacity building on integrating biodiversity conservation at farm level</li> </ul>	<ul style="list-style-type: none"> <li>• Documentation of farmers best practices and cost saving analysis</li> <li>• Timely monitoring the number of of birds, insect pollinators and other species visiting</li> <li>• Step-wise implementation of organic and nature-based solutions</li> <li>• Monitoring the benefits of incorporating nature-based and bio-friendly solutions</li> <li>• Monitoring crop productivity and decrease in pest/disease occurrence</li> <li>• Measures for biological control</li> </ul>

## Water Restoration and Management

Freshwater is the most important resource on which agriculture is highly dependent. Water is an important ecosystem service. The healthy functioning of various ecosystems like forests, rivers, wetlands and grasslands influence the availability and quality of water. Pollution, over-extraction of ground water, climate change are impacting water availability and quality. Water management is co-beneficiary in improving ecosystem condition as well as influencing availability of freshwater.

Present Issues of Water	Biodiversity Management Plan	Monitoring
<ul style="list-style-type: none"> <li>Contamination with chemical pesticides and fertilisers</li> <li>Non-judicial use of water for irrigation or domestic purposes</li> <li>Lack of awareness of freshwater floral and faunal biodiversity and impacts due to pesticide contamination of water</li> <li>No monitoring of impacts of farming practices near water bodies</li> <li>Pollution due to pesticide run off from farm and farm waste disposal</li> <li>Lack of awareness on future risks due to water depletion and scarcity</li> </ul>	<p><b>Outside Farm</b></p> <ul style="list-style-type: none"> <li>Mapping water availability in the area (rivers, ponds, ground water)</li> <li>Record the occurrence of incidents of flood, drought and pollution</li> <li>Incorporate water management and sustainable utilisation action plans</li> <li>Identifying best practices for water conservation and restoration</li> </ul> <p><b>On Farm</b></p> <ul style="list-style-type: none"> <li>Map the amount of water withdrawals for irrigation from natural sources like ground water or pond</li> <li>Use a time chart for water usage for irrigation</li> <li>Maintain a record of irrigation practices followed and measure the water usage</li> <li>Record the electricity utilisation for farming activities and cost incurred</li> </ul>	<ul style="list-style-type: none"> <li>Identification of critical risk areas and monitoring the changes</li> <li>Monitoring the progress on action plan for water conservation</li> <li>Monitor the benefits due to implementation of water conservation and management plans</li> </ul>

## Soil Restoration and Conservation

Soil degradation is taking place at an accelerating rate. Land degradation and erosion, rising temperatures, drought and extreme rainfall are potential threats to soil. Deforestation and poor agriculture management contribute to soil loss. Soil degradation also impacts the ecosystem and services provided. The risks of soil degradation are associated with business operations through crop productivity and market price volatility.

Present Issues of Soil Health	Biodiversity Management Plan	Monitoring
<ul style="list-style-type: none"> <li>• Use of chemical pesticides</li> <li>• Soil contamination and loss of quality due to pesticide residue</li> <li>• Loss of soil biodiversity and soil flora and fauna due to use of chemical pesticides</li> <li>• Loss of soil fertility due to soil erosion and loss of soil organic carbon</li> <li>• Lack of soil restoration measures</li> </ul>	<ul style="list-style-type: none"> <li>• Awareness on soil management and restoration measures</li> <li>• Conducting regular and timely soil testing and analysis</li> <li>• Maintain or improve soil organic matter in between cropping cycle</li> <li>• Adopting measures to control soil erosion</li> <li>• Measures to maintain soil nutrient balance</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor soil properties and record soil nutrient levels at regular intervals</li> <li>• Measure soil organic matter at regular intervals</li> <li>• Monitoring intervals of pesticide applications</li> </ul>





## Improving Local and Native Biodiversity

Biodiversity is essential for ecosystem productivity and functioning. Crop productivity is highly dependent on healthy functioning of the ecosystem and its components. It is therefore very crucial to manage the local plant and animal species and support their existence.

### (i) Management of Local Biodiversity

Present Issues of biodiversity	Integration of B&ES for habitat development	Monitoring
<ul style="list-style-type: none"> <li>• Conversion of natural ecosystem</li> <li>• Monoculture plantation</li> <li>• Lack of awareness of native species of plants and animals</li> <li>• Diversion of land</li> <li>• Excessive use of pesticides impact insects other than the pests</li> <li>• Habitat destruction by land clearing other than farm areas</li> <li>• Pollution and waste generated by various farming activities may impact local species</li> </ul>	<ul style="list-style-type: none"> <li>• Map the surrounding areas to identify biodiversity rich areas in and around the farming areas</li> <li>• Identify the presence of non-native plants and animals</li> <li>• Native plant species plantation and restoration</li> <li>• Spotting and supporting the nest and habitat of birds and useful farm animals</li> <li>• Provide food and water source for native species recorded in and around farm</li> <li>• Collaboration with R&amp;D for nursery development</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor the activity of birds and insects or animals visiting the farm</li> <li>• Monitor the nesting behaviour of birds</li> <li>• Identify the pattern of wildlife incidence</li> <li>• Document the diversity of species of flora and fauna</li> <li>• Monitor the change in surrounding local biodiversity at regular intervals</li> </ul>

(ii) Promoting pollinators, control agents and other beneficial insects

Present Issues of Genetic & Species Diversity	Biodiversity Management Plan	Monitoring
<ul style="list-style-type: none"> <li>• Monoculture plantation</li> <li>• Use of invasive species</li> <li>• Diversion of land</li> <li>• Use of chemical pesticides targets both beneficial as well as harmful insects</li> <li>• Lack of awareness on traditional varieties</li> <li>• Use of modified, hybrid and resistant varieties</li> <li>• No parent planting material</li> <li>• No seed bank or germ plasma storage</li> <li>• Scientific techniques and artificial pollination practices</li> </ul>	<ul style="list-style-type: none"> <li>• Native plants may be planted along the farm useful for supporting beneficial insects and bees</li> <li>• Encouraging honey-bee rearing</li> <li>• Mixed cropping with different varieties of crop should be planned. Native and traditional crop varieties should be identified and used</li> <li>• Collaborating for R&amp;D for improving native varieties</li> <li>• Adapting nature-based solutions for pollination, crop yield improvement and good productivity</li> <li>• Identifying naturally occurring biocontrol agents, pollinators and other useful species</li> <li>• Practicing mixed cropping and plantation techniques</li> <li>• Maintenance of seeding material of varieties of crops that have good results is important</li> </ul>	<ul style="list-style-type: none"> <li>• Quantification of available insects and biocontrol agents in the region</li> <li>• Monitor different crop varieties that have given good results</li> <li>• Monitor crop specific beneficial insects and bio-control agents</li> <li>• Monitor the benefits of using nature-based solutions and reducing pesticide use</li> </ul>

## Part E: Business Opportunities for Integration of Biodiversity into Spice Sector

Biodiversity integration and management not only help in risk mitigation but also provides for various business opportunities. It is important for businesses to understand the ecological and social impacts along with biodiversity management to develop appropriate measures and mitigation plans.

The mitigation hierarchy is a process that 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 avoidance of impacts. Where avoidance is not possible, the developer must seek to minimise 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. If it is not possible to avoid, minimise or adequately offset harm, the development should not proceed.

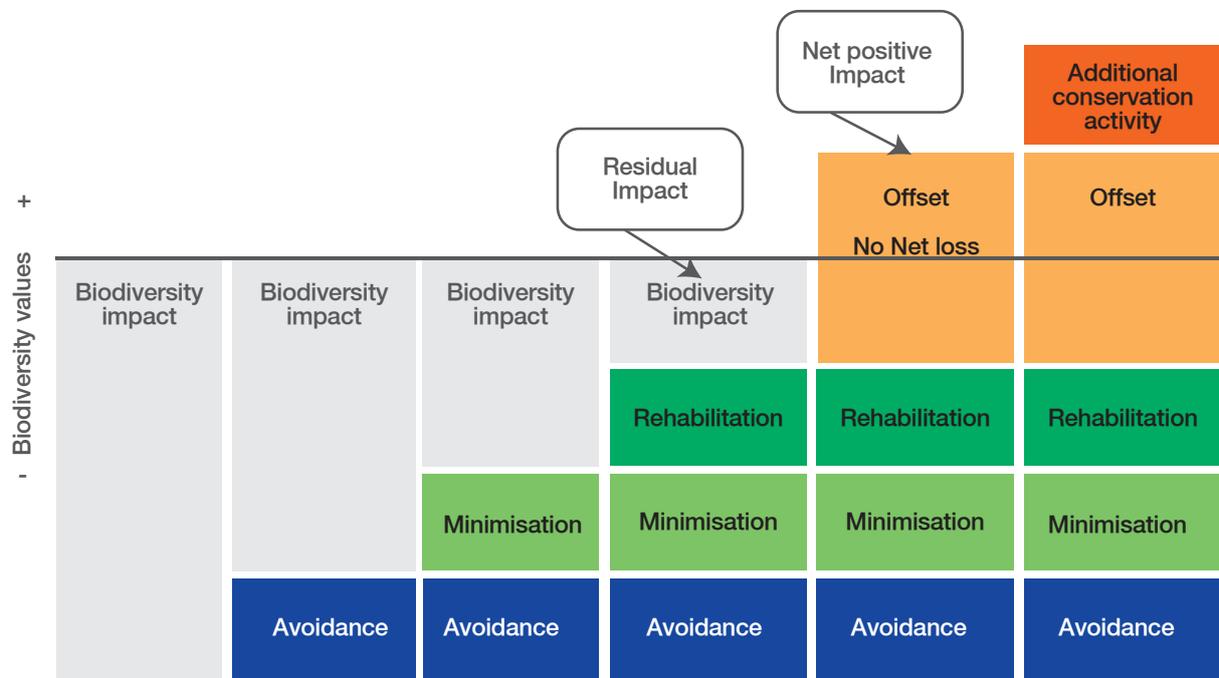
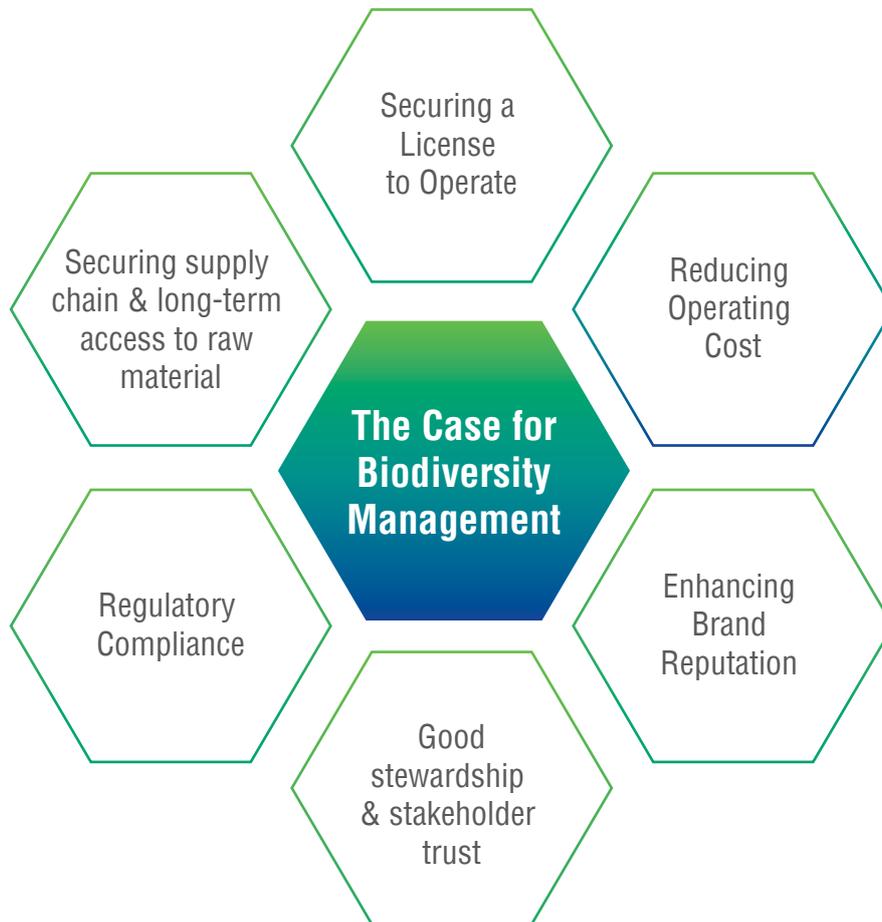


Figure 1: The mitigation hierarchy for managing biodiversity risk<sup>4</sup>

Source: Adapted from Aiama D. et. al. *No Net Loss and Net Positive Impact Approaches for Biodiversity: exploring the potential application of these approaches in the commercial agriculture and forestry sectors.* Gland, Switzerland: IUCN 2015.

The benefits to businesses of systematic biodiversity management are considerable and it can be of direct or indirect relevance for businesses to develop a case for biodiversity management. A few key factors for developing proactive management are:



*Source: Developed based on observations in Spice Sector*

**Building Business Resilience:** There is increasing threat to crop productivity due to changing climatic and extreme weather conditions. This leads to operational risks for spice companies and also has financial implications. Mainstreaming biodiversity makes them resilient and future ready to address these threats and risks.

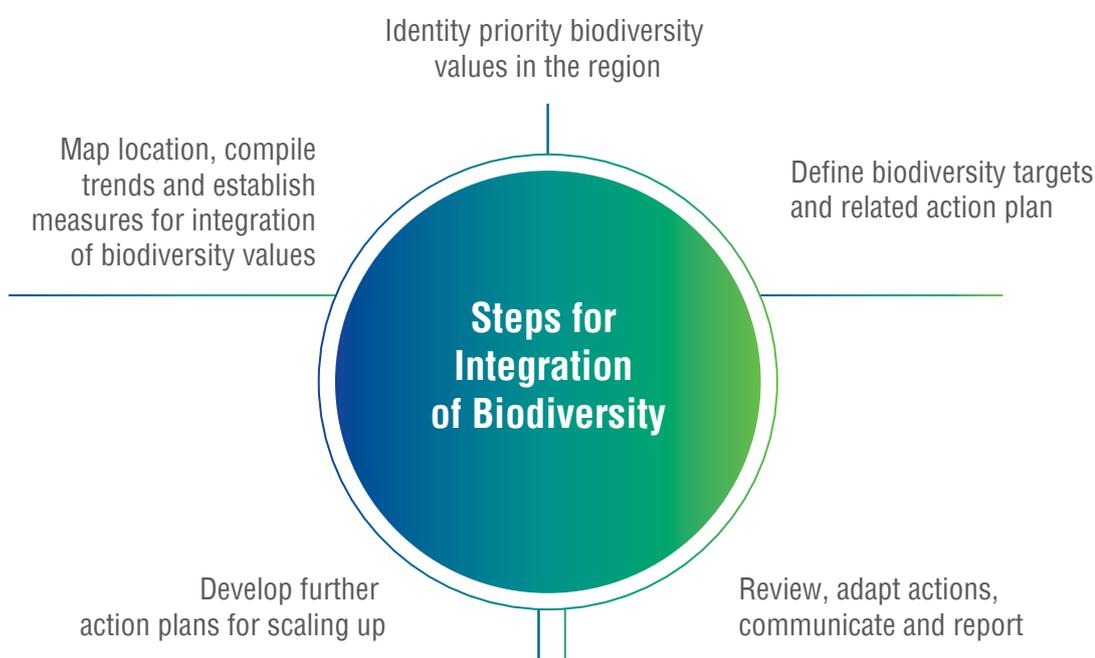
**Obtaining and maintaining a license to operate:** Western Ghats being a biodiversity rich hotspot, companies operating in this region must include biodiversity management in decision-making and mainstream across their value chain. If not considered, this would pose direct threat of legislative pressures on business operations.

**Competitive advantage (operator of choice):** Companies gain competitive advantage for being responsible towards biodiversity. Governments, stakeholders and investors recognise responsible businesses and acknowledge companies conscious of biodiversity conservation and sustainable development. Today there is growing awareness on biodiversity and environmental protection that influences community support for business operations.

Brand Reputation and Market Demand: With growing awareness on health and safety and consciousness towards environment, consumers look for goods that are healthy and with lower negative impacts. Especially in the Spice Sector there is demand for organic, pesticide or contamination free and sustainable spice products. Nowadays, consumer brand preference is influenced based on reputation of companies for considering measures to abide with healthy and environment friendly aspects.

Partnerships and Community Engagement: To achieve no net loss or a net gain of biodiversity, it is important to work with other companies to pool expertise and resources, by developing joint solutions to common issues. Measures for community engagement for spreading awareness, engaging local community for projects will endure holistic benefits for a sustainable future.

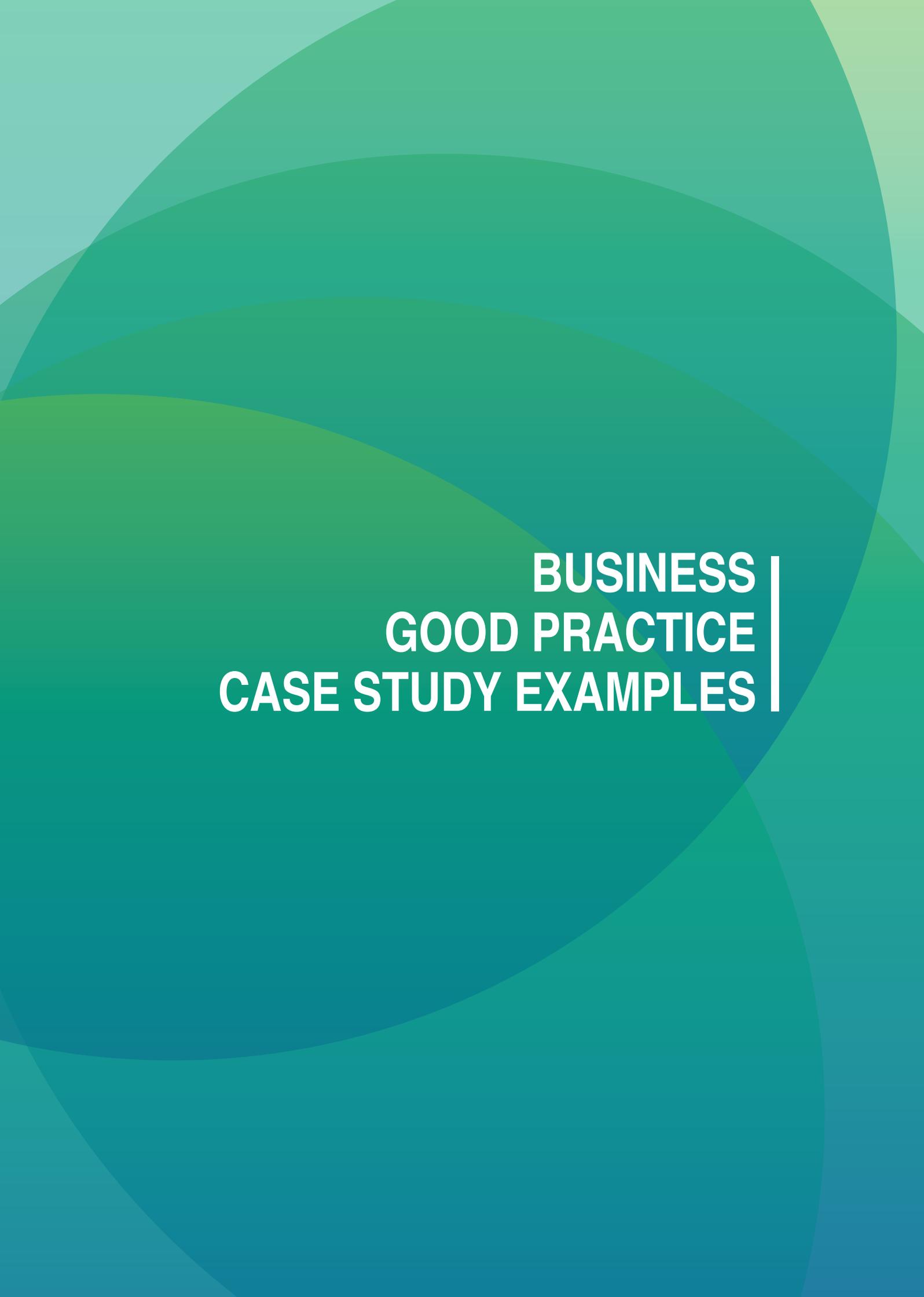
For integration of biodiversity, business activities should be considered along the whole value chain. Links between business activities and biodiversity can be observed from the early phase of sourcing of raw materials to the final processing phase. A step wise approach to integrate biodiversity as shown below in the schematic diagram will ensure positive outcomes.



Source: The schematic diagram is IBBI practice with its member companies that is tested to be robust and has been modified based on observations in spice sector.

For successful integration of biodiversity, businesses need to establish objectives for actions addressing biodiversity; define realistic, measurable targets to be monitored and develop methodologies and plans to achieve the objectives and targets.

Businesses developing biodiversity management plan can continuously improve and learn from best-practice examples to understand and improve their action plans. The next few pages provide for good practice case study examples from spice sector companies illustrating individual activities to support biodiversity across the supply chain.

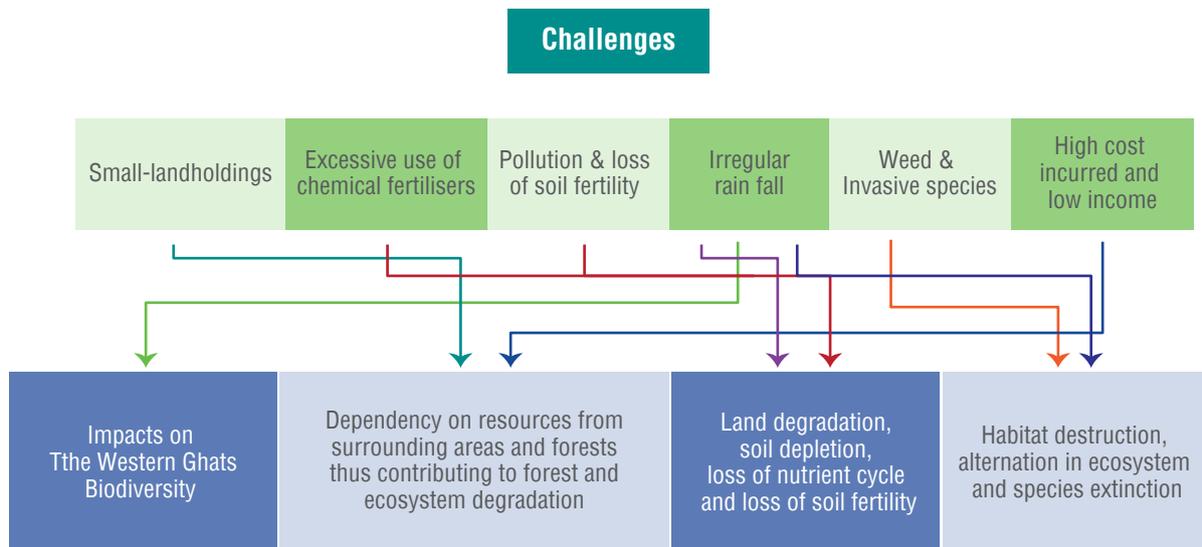


**BUSINESS  
GOOD PRACTICE  
CASE STUDY EXAMPLES**

## Background:

Agriculture impacts biodiversity due to unsustainable practices. For example, excessive use of chemical fertilisers had led to air and water pollution, soil degradation and loss of soil fertility. In The Western Ghats cultivation of spices like pepper is done on slopes of the hilly terrain. PDS Organic Spices operating in this region identified issues of disease, soil erosion and loss of soil fertility. They also identified the issue of top soil runoff due to rains and contamination of water bodies because of excessive pesticides and chemical fertilisers.

The small-landholding farmers in this region were finding it difficult to address these issues and faced with many challenges affecting their livelihoods.



## Business Best Practice:

Organic agriculture is a production system that sustains the health of soils, ecosystems and livelihoods. It relies on ecological processes, biodiversity and practices adapted to local conditions rather than inputs with harmful effects. To help farmers overcome the above mentioned challenges, PDS promoted organic farming.

PDS Organic Spices, a unit of Peermade Development Society (PDS), supports to address issues faced by the farmers and guides them to adopt environment friendly practices. Realising the need for an integrated approach on soil and water conservation for revitalising the farming areas, PDS implemented the watershed management program. Farmers are trained on the basic concept of organic farming and organic practices. They are assisted in preparing vermi composting, planting of nitrogen fixing plants, weed management etc. The farmers are encouraged to take up activities like construction of dams, gully plugging, stone terracing, soil bunding, protection of streams, construction of ponds and water tanks, spring development, agro-forestry etc.

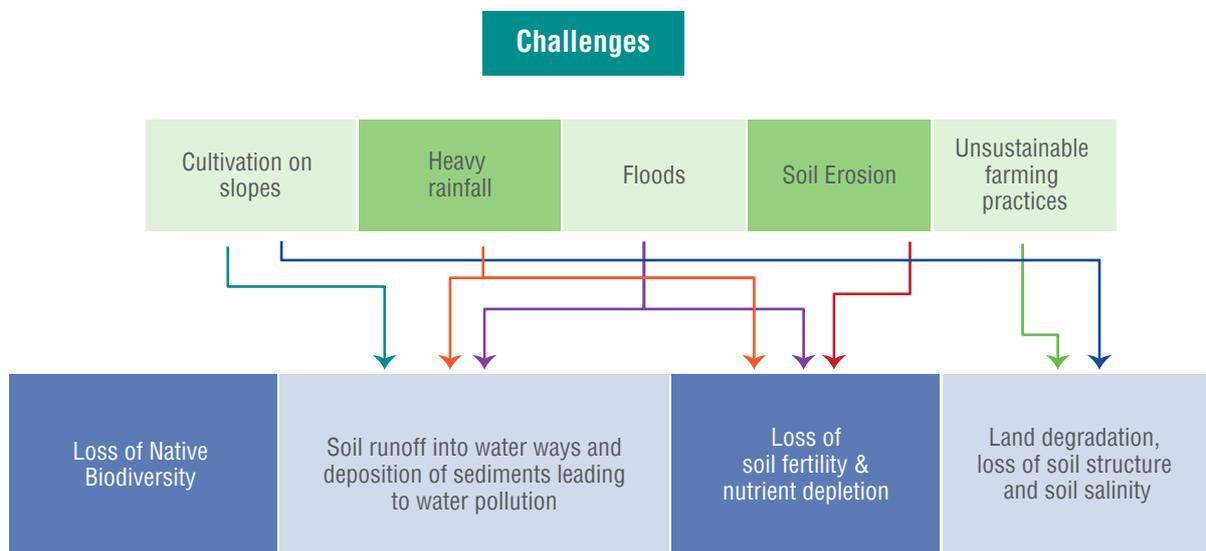


## Benefits

For Farmer	For Business operations	Future Scope
<ul style="list-style-type: none"> <li>• Good Quality</li> <li>• Soil and Water conservation</li> <li>• Improved local biodiversity</li> <li>• Livelihood enhancement</li> </ul>	<ul style="list-style-type: none"> <li>• Secured supply chain</li> <li>• Local community trust</li> <li>• Reduced impacts on biodiversity</li> <li>• Enhanced brand reputation</li> </ul>	<ul style="list-style-type: none"> <li>• Access to new markets</li> <li>• Achieving Net Positive Impact on Biodiversity</li> </ul>

### Background:

Soil health is the foundation of agriculture, it boosts the resilience of farms and the supply chain to the effects of increased climate variability and healthy soils have a critical role as carbon sinks. Idukki district, in The Western Ghats of Kerala was faced by severe soil erosion mainly because of topsoil wash off due to rains. Pepper cultivation in this district was impacted due to top soil runoff and loss of fertility. Farmers dependence on fertilisers increased.



### Business Best Practice:

PDS Organic Spices identified that this problem can be countered by introducing vetiver grass which provided a natural way of soil conservation. This grass has the capacity to slow water runoff, trap sediments, filter out nutrients and retain soil. The farmers working with PDS did pepper cultivation along the slopes, so they encouraged their farmers to grow vetiver grass along their plantations. This grass has stiff erect stems and the leaves grow profusely. This provides an added advantage of preparing handicrafts using the leaves. The women farmers were identified and trained to produce vetiver handicrafts to create an additional source of income.

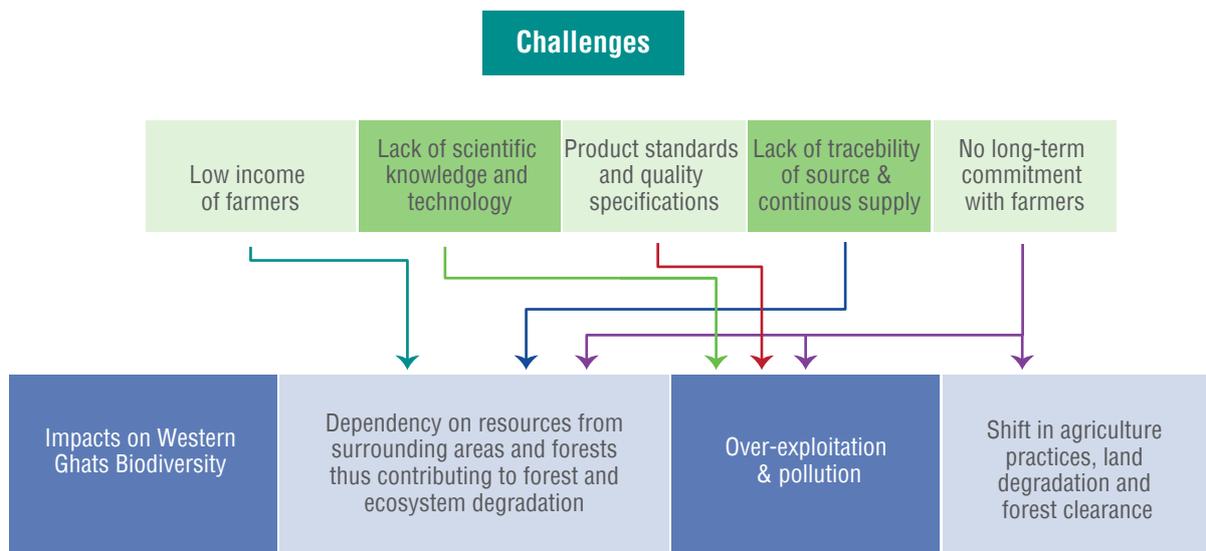


## Benefits

To Farmer	To Business	Future Scope
<ul style="list-style-type: none"> <li>• Soil erosion control</li> <li>• Soil fertility restoration</li> <li>• Additional income</li> </ul>	<ul style="list-style-type: none"> <li>• Minimizing loss of production</li> <li>• Reduced impact on natural resources</li> <li>• Better community relationship</li> </ul>	<ul style="list-style-type: none"> <li>• Good pepper production</li> <li>• Improved livelihoods</li> <li>• Reduced cultivation cost</li> </ul>

### Background:

Agriculture sector faces the challenges of poverty, water and energy use; climate change and unsustainable production and consumption. In the Western Ghats most of the spice cultivators are small-landholding farmers whose livelihoods are dependent on cultivation. The changing climate conditions, water scarcity issues and low income may impact crop productivity and livelihoods. This puts the spice supply chain under threat. Therefore, it is essential for businesses operating in Spice Sector to focus on sustainability at farm level to improve productivity and livelihoods.



### Business Best Practice:

Olam Agro India Pvt Ltd. identified issues at farm level and introduced “Olam Livelihood Charter” for farmer support and sustainable product development. This focuses on addressing the key socio-economic and environmental issues of farmers. They have identified key aspects and established principles for integration of the aspects. The livelihood charter is used as a measure to ensure productivity by implementation of good agriculture practices, sustainability by implementing quality and safety practices and environment protection by implementing resources management practices.

## Olam Livelihood Charter: 8 Principles

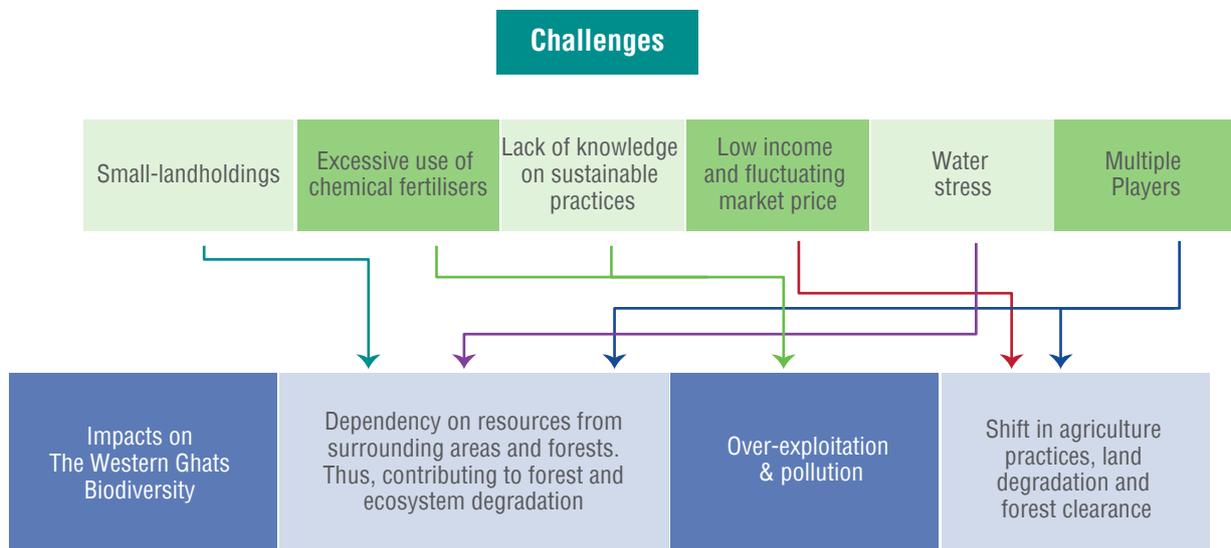
1. Finance: Group financing for crop production, purchasing and asset investment
2. Improved yield training and support farmers with the supply in inputs such as fertiliser, seeds or seedlings
3. Labour Practices: Training on health and safety, gender inclusion and avoidance of child labour
4. Market Access Offering fair and competitive prices
5. Quality Production of good quality crops
6. Traceability: Ensure products can be traced back to source and certified
7. Social Investment: Support for rural health, education and infrastructure development
8. Environmental Impact: Training on climate smart agriculture, soil, water and forest management

### Benefits

To Farmer	To Business	Future Scope
<ul style="list-style-type: none"> <li>• Good Quality and Yield</li> <li>• Soil and Water conservation</li> <li>• Improved local biodiversity</li> <li>• Livelihood enhancement</li> </ul>	<ul style="list-style-type: none"> <li>• Secured supply chain</li> <li>• Local community trust</li> <li>• Reduced impacts on biodiversity</li> <li>• Enhanced brand reputation</li> </ul>	<ul style="list-style-type: none"> <li>• Easy adaptation to bio-friendly production</li> <li>• Scaling to Net Positive Impact</li> </ul>

### Background:

One of the major threats due to loss of biodiversity is impact on inflow of raw materials thus influencing the supply chain. Spice Sector companies depend on biodiversity for raw materials i.e spices. Therefore a major component of their supply chain is the farm from where spices are sourced. There are multiple factors impacting the production of spices. And this in turn influences the spice supply chain.



### Business Best Practice:

Nedspice identified that scarcity of spices are linked to some environmental issues like land degradation, pollution, soil erosion and use of chemical fertilisers. There is also a link to the communities' health and livelihoods. They identified that it is important to address these issues to maintain supply chain sustainability. Nedspice developed a Nedspice-Farmers Partnership Program (NFPP) to address the issues impacting the sustainability of supply chain. Through this program Nedspice supports farmers in improving agricultural practices, training and on farm support for responsible use of pesticides, manage soil fertility and water use. It also provides training programme for social wellbeing.

## Nedspice Partnership Program (NFPP)

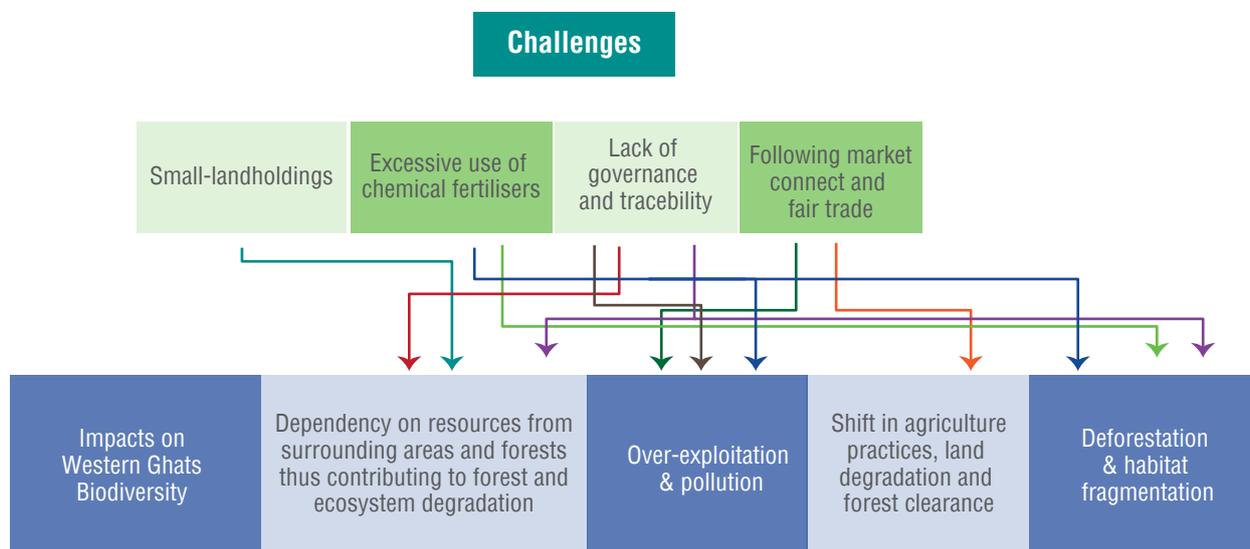
Improved Agriculture Practice	<ul style="list-style-type: none"> <li>• Compliant to domestic and international regulations</li> <li>• Implementation of specific sustainability standards</li> <li>• Responsible use of fertilisers, water and soil management</li> </ul>
Partnership Building	<ul style="list-style-type: none"> <li>• Training and Capacity building</li> <li>• Stakeholder interaction: suppliers, NGOs &amp; research organisations</li> <li>• Information service and new opportunities</li> </ul>
Community Outreach	<ul style="list-style-type: none"> <li>• Awareness creation</li> <li>• Activities for basic needs</li> <li>• Investment opportunities</li> </ul>

### Benefits

To Farmer	To Business	Future Scope
<ul style="list-style-type: none"> <li>• Sustainable farming practices</li> <li>• Secured market access</li> <li>• Premium price</li> <li>• Enhanced livelihoods</li> </ul>	<ul style="list-style-type: none"> <li>• Secured supply</li> <li>• Quality products</li> <li>• Traceability</li> <li>• Production intelligence</li> </ul>	<ul style="list-style-type: none"> <li>• Easy adaptation to bio-friendly production</li> <li>• Scaling to Net Positive Impact</li> </ul>

**Background:**

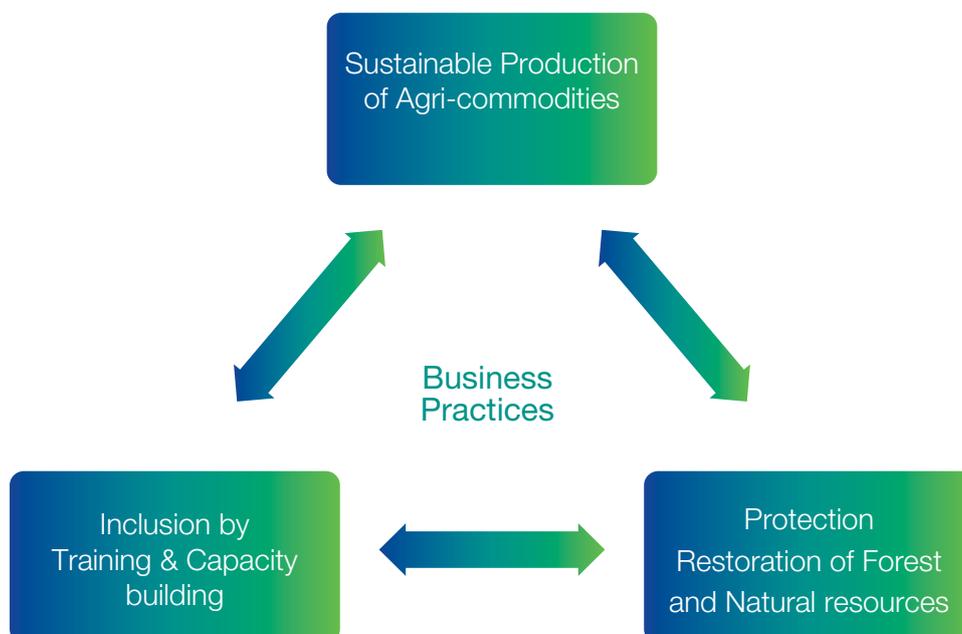
Agriculture is highly dependent as well as impacts biodiversity in many ways. The growing concerns on biodiversity loss and resource depletion is posing a threat to agriculture and food security. There are many socio-economic and environmental issues linked to agriculture productivity. To overcome these issues and achieve sustainable production, it is required to take a holistic approach that will help in meeting the needs of present without compromising the needs of future generations. A landscape approach promises to ensure synergies and minimise trade-offs between socio-economic and environmental including climate change goals.

**Business Best Practice:**

Jayanti Herbs & Spice, identified a Farm-to-Fork management system with three main objectives: Food safety, Traceability and Sustainability and incorporated this into their procurement policy. Jayanti is working towards its objectives by focusing on three main goals: Production (for achieving the objectives of food safety and traceability), Protection (for sustainable use of natural resources) and Inclusion (supporting farmers and improving community livelihoods).

Since 2012, Jayanti, has its backward-integration and sustainable pepper programme in Karnataka, in total 200 farms produce approximately 800 tonnes of sustainably grown certified pepper. In 2017, about 200 farmers and some technical officers were provided training by Jayanti on aspects of diseases treatment, integrated pest management, and post-harvest management.

Through their certification process and Sustainable Agriculture Initiative Jayanti is committed to ensure quality pepper production at a good premium price.



## Benefits

	To Business	Future Scope
<ul style="list-style-type: none"> <li>• Good quality and yield</li> <li>• Fair price and better market</li> <li>• Livelihood enhancement</li> </ul>	<ul style="list-style-type: none"> <li>• Secured supply chain</li> <li>• Local community trust</li> <li>• Reduced impacts on biodiversity</li> <li>• Enhanced brand reputation</li> </ul>	<ul style="list-style-type: none"> <li>• Easy adaptation to bio-friendly production</li> <li>• Scaling to Net Positive Impact</li> </ul>

# Spice Sector Testimonials



**Geemon Korah**  
Chief Executive Officer

## Kancor Mane

“ The baseline study conducted by Kancor with support from IBBI has helped in preliminary assessment of the back ground of project areas with a detailed analysis of habitat, species found and the ecosystems, stakeholders impacted in formulating targets and related actions.

Kancor proposes to use the learning's from this baseline study in mitigating the possible risks to environment in all our policies, processes and also during our expansion into newer territories, whether it is for processing or cultivation. ”



**Fr. Jilson James**  
Joint director

## PDS Organic Spices

“ PDS Organic Spices is engaged in the production, processing and export of organic spices. The importance of biodiversity to business was well spoken about by CII-IBBI and GIZ programme on biodiversity. PDS Organic Spices has realized the importance of different ecosystem services provided by our diverse ecology, the risks created by over exploitation, the urgent need for conservation and steps taken for sustainable uses of these services. We have identified tools for measuring and monitoring various ecosystem services.

We believe that proper knowledge, planning and execution of biodiversity programme, would definitely make PDS mission, that they may have life and have it abundantly. This truly can happen in the most sustainable way, by protecting and conserving the natural habitat and everything around us, so that world becomes a better place to live in. Thanks to CII-IBBI for its initiative to make biodiversity as an integrated part of Business plan & we look forward to your continued support on our BA ”



**Milan Shah**  
Director

## Jayanti

“ IBBI's initiative to collaborate with businesses operating in the Western Ghats to promote biodiversity conservation is noteworthy. Jayanti's business strategy will now include performance evaluation against measurable yardsticks to ascertain progress made in real terms on a year-on-year basis. Sustainable development goals will include supporting native biodiversity and generating alternative sources of farm income among others.

The Ecosystem Service Matrix (ESM) tool developed by CII-IBBI will be effectively used for identifying and mapping critical ecosystem services with our business, future risk assessment, control and mitigation. Dependency-Impact, correlation matrix explains our current status and what more needs to be done for integrating biodiversity into existing Jayanti Sustainable Program. These findings will be used for developing result-oriented strategies for preserving natural resources and ensuring Net Positive Impact on biodiversity. ”

# Annexure

Checklist for spice sector companies to identify and monitor at farm level for biodiversity integration

## Enhancing Bio Control Agents

### A. Identify the intervention of biodiversity

1. Does the farmer use any traditional method of pest control?
2. What are the types of birds, pollinators and other species frequently seen on the farm?
3. Is the farmer aware of native floral and faunal diversity of that region?

### B. Monitoring outcomes of biodiversity integration

1. How many birds, insect pollinators are seen on the farm?
2. What is cost difference before and after integration of biodiversity?
3. Are natural-based solutions and bio-friendly practices meeting the desired expectations?

## Mapping Water Availability and Usage

### A. Identify the intervention of biodiversity

1. What is the source of water you use?
2. Have you identified any water bodies in and around the farm?
3. What are the activities that involve water use in both domestic and farming?
4. Have you identified other users of the water- other farmers using water from same source or animals visiting the water source?
5. Any source of contamination of the water bodies identified in and around the farm?
6. Have you identified any alternatives for water storage or use?

### B. Monitoring outcomes of biodiversity integration

1. How much water is extracted or used per day/per season/yearly?
2. What is the capacity of rainfall recorded in the region?
3. What is the time and duration of irrigation of crops?
4. Do you practice any water harvesting or water conservation methods?
5. How much water is used for fertiliser or pesticide application, what is the amount or quality of chemical mixed in water?
6. Do you record the amount of water runoff on the farm?
7. Have you implemented any practices for water retention, runoff control and water purification/recycling?

## Maintaining Soil Health & Fertility

### A. Identify the intervention of biodiversity

1. What is the type of soil present in your farm?
2. Since how long is the farm land under cultivation?
3. What are the chemical agriculture inputs used on the farm?
4. Have you got soil health analysis done and how frequently is it done?
5. What are the techniques used for farming practices?
6. Do you have a flood control plan?

## **B. Monitoring outcomes of biodiversity integration**

1. Do you maintain a soil health record?
2. What are the levels of nutrients and contaminants in your soil?
3. What is the technique of irrigation and pesticide usage?
4. What measures are taken for soil fertility improvement and conservation?

## **Managing Local Biodiversity**

### **A. Identify the intervention of biodiversity**

1. Are there any biodiversity hotspots near the farm?
2. What are commonly found flora and fauna in the surrounding area?
3. Have you spotted any bird or animal nesting?
4. Are there any incidents of interaction or spotting of wildlife in or around the farm?

### **B. Monitoring outcomes of biodiversity integration**

1. What is the floral and faunal index of richness in the region?
2. What is the frequency of spotting wildlife?
3. What are the available resources attracting wildlife or other species?
4. What are the measures taken for habitat restoration?

## **Managing Genetic Diversity**

### **A. Identify the intervention of biodiversity**

1. How many varieties of species of flora and fauna are present?
2. What are different varieties of crops used for cultivation?
3. What is the variety of invasive species present on farm?
4. How many wild or traditional varieties used in crop cultivation?

### **B. Monitoring outcomes of biodiversity integration**

1. What is increase in yield and productivity?
2. Where is the planting material sourced from?
3. Is there a gene bank maintained?
4. What is the frequency and type of pest per variety?
5. Have you analysed the cost effectiveness per crop per variety?





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

CII-ITC Centre of Excellence for Sustainable Development is a not-for-profit, industry-led institution that helps business become sustainable organisations. It is on a mission to catalyse innovative ideas and solutions, in India, and globally, to enable business, and its stakeholders, in sustainable value creation. It's knowledge, action and recognition activities enable companies to be future ready, improve footprints profiles, and advocate policymakers and legislators to improve standards of sustainable business through domestic and global policy interventions.

CESD leverages its role of all-inclusive ecosystem player, partnering industry, government, and civil society. It has been a pioneer of environment management systems, biodiversity mapping, sustainability reporting, integrated reporting, and social & natural capital valuation in India, thus upgrading business in India to sustainable competitiveness.

With three locations in India, CESD operates across the country and has also been active in parts of South and South East Asia, Middle East, and Africa. It has held institutional partnerships and memberships of the United Nations Global Compact, Global Reporting Initiative, International Integrated Reporting Council, Carbon Disclosure Project, development agencies of Canada, the USA, the UK, and Germany.

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