TEEB Agrifood
Virtual Inception Workshop

3 pm IST
The Economics of Ecosystems and Biodiversity
TEEB for Agriculture & Food – India

EU Partnership Instrument project on TEEBAgriFood Initiative
13 July 2020 Inception Workshop Day 2
Dr. Salman Hussain, TEEB Coordinator

Image credit: Anup Deodar
I. What is TEEBAgriFood?
TEEB initiative (2008-2012)

G8+5 Potsdam 2007

“Potsdam Initiative – Biological Diversity 2010”
The economic significance of the global loss of biological diversity....
Importance of recognising, demonstrating & responding to values of nature...

CBD COP11 India
National TEEB Work
Sectoral TEEB Work
Business Externalities Work
Rio+20 Brazil
TEEB for business

The Economics of Ecosystems and Biodiversity in Business and Enterprise

Edited by Joshua Bishop

NATURAL CAPITAL AT RISK:
THE TOP 100 EXTERNALITIES OF BUSINESS

teebweb.org
## Why select the agriculture sector?

### 7.1.2 THE GLOBAL 20 REGION-SECTORS

Ranking of the 20 region-sectors with the greatest total impact across the 6 EKPIs when measured in monetary terms.

<table>
<thead>
<tr>
<th>RANK</th>
<th>SECTOR</th>
<th>REGION</th>
<th>NATURAL CAPITAL COST, US$ BN</th>
<th>REVENUE, US$ BN</th>
<th>IMPACT RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>COAL POWER GENERATION</td>
<td>EASTERN ASIA</td>
<td>452.8</td>
<td>4431</td>
<td>1.0</td>
</tr>
<tr>
<td>2</td>
<td>CATTLE RANCHING AND FARMING</td>
<td>SOUTH AMERICA</td>
<td>353.8</td>
<td>166</td>
<td>18.8</td>
</tr>
<tr>
<td>3</td>
<td>COAL POWER GENERATION</td>
<td>NORTHERN AMERICA</td>
<td>316.8</td>
<td>2467</td>
<td>1.3</td>
</tr>
<tr>
<td>4</td>
<td>WHEAT FARMING</td>
<td>SOUTHERN ASIA</td>
<td>266.6</td>
<td>318</td>
<td>8.4</td>
</tr>
<tr>
<td>5</td>
<td>RICE FARMING</td>
<td>SOUTHERN ASIA</td>
<td>235.6</td>
<td>658</td>
<td>3.6</td>
</tr>
<tr>
<td>6</td>
<td>IRON AND STEEL MILLS</td>
<td>EASTERN ASIA</td>
<td>225.6</td>
<td>6047</td>
<td>0.4</td>
</tr>
<tr>
<td>7</td>
<td>CATTLE RANCHING AND FARMING</td>
<td>SOUTHERN ASIA</td>
<td>163.0</td>
<td>1740</td>
<td>0.8</td>
</tr>
<tr>
<td>8</td>
<td>CEMENT MANUFACTURING</td>
<td>EASTERN ASIA</td>
<td>147.0</td>
<td>58</td>
<td>23.0</td>
</tr>
<tr>
<td>9</td>
<td>WATER SUPPLY</td>
<td>SOUTHERN ASIA</td>
<td>111.7</td>
<td>141</td>
<td>7.9</td>
</tr>
<tr>
<td>10</td>
<td>WHEAT FARMING</td>
<td>NORTHERN AFRICA</td>
<td>100.1</td>
<td>74</td>
<td>13.6</td>
</tr>
<tr>
<td>11</td>
<td>RICE FARMING</td>
<td>EASTERN ASIA</td>
<td>99.3</td>
<td>912</td>
<td>1.1</td>
</tr>
<tr>
<td>12</td>
<td>WATER SUPPLY</td>
<td>WESTERN ASIA</td>
<td>86.7</td>
<td>184</td>
<td>4.7</td>
</tr>
<tr>
<td>13</td>
<td>FISHING</td>
<td>GLOBAL</td>
<td>86.1</td>
<td>1360</td>
<td>0.6</td>
</tr>
<tr>
<td>14</td>
<td>RICE FARMING</td>
<td>NORTHERN AFRICA</td>
<td>84.2</td>
<td>12</td>
<td>69.6</td>
</tr>
<tr>
<td>15</td>
<td>CORN FARMING</td>
<td>NORTHERN AFRICA</td>
<td>80.4</td>
<td>17</td>
<td>47.8</td>
</tr>
<tr>
<td>16</td>
<td>RICE FARMING</td>
<td>SOUTH-EASTERN ASIA</td>
<td>79.7</td>
<td>410</td>
<td>1.9</td>
</tr>
<tr>
<td>17</td>
<td>WATER SUPPLY</td>
<td>NORTHERN AFRICA</td>
<td>76.4</td>
<td>34</td>
<td>22.2</td>
</tr>
<tr>
<td>18</td>
<td>SUGARCANE</td>
<td>SOUTHERN ASIA</td>
<td>75.6</td>
<td>60</td>
<td>15.5</td>
</tr>
<tr>
<td>19</td>
<td>PETROLEUM AND NATURAL GAS EXTRACTION</td>
<td>EASTERN EUROPE</td>
<td>72.6</td>
<td>3716</td>
<td>0.2</td>
</tr>
<tr>
<td>20</td>
<td>NATURAL GAS POWER GENERATION</td>
<td>NORTHERN AMERICA</td>
<td>69.4</td>
<td>1227</td>
<td>1.0</td>
</tr>
</tbody>
</table>
The visible and invisible flows of agricultural production

Nature (December 2016)

Fix food metrics

For sustainable, equitable nutrition we must count the true global costs and benefits of food production, urge Pavan Sukhdev, Peter May and Alexander Müller.
The visible and invisible flows of agricultural production
The visible and invisible flows of agricultural production
The visible and invisible flows of agricultural production
The visible and invisible flows of agricultural production

HUMAN SYSTEMS
- Irrigation
- Fertilizers
- Pesticides
- Bio-technology
- Labor
- Employment
- Fibers
- Food and nutrition
- Fuels
- (Agro)tourism

AGRICULTURE & FOOD SYSTEMS
- Seeds
- Crops
- Yields

AGRICULTURAL PRODUCTION
- Erosion control
- Pest control
- Soil formation
- Genetic diversity
- Nutrient cycling
- Pollination
- Moderation of extreme events
- Freshwater provisioning
- Climate regulation

BIODIVERSITY & ECOSYSTEMS

teebweb.org
The visible and invisible flows of agricultural production

**HUMAN SYSTEMS**
- Irrigation
- Fertilizers
- Pesticides
- Breeding
- Machinery
- Labor
- Employment
- Food and nutrition
- Fibers
  - (Agri)tourism

**AGRICULTURE & FOOD SYSTEMS**
- SEEDS
- CROPS
- YIELDS

**AGRICULTURAL PRODUCTION**
- Erosion control
- Soil formation
- Genetic diversity
- Nutrient cycling
- Pest control
- Pollination
- Moderation of extreme events
- Freshwater provisioning
- Climate regulation
- Habitat encroachment
- Loss of ecosystem complexity
- Species reduction
- Soil erosion
- Pollution
  - (air, land & water)
- GHG/Climate

**Biodiversity & Ecosystems**

[teebweb.org]
The visible and invisible flows of agricultural production
The visible and invisible flows of agricultural production

**HUMAN SYSTEMS**
- Irrigation
- Fertilizers
- Breeding
- Bio-technology
- Labor
- Employment
- Fibers
- Health impacts
- Culture heritage
- Access to recreation

**AGRICULTURE & FOOD SYSTEMS**
- SEEDS
- CROPS
- YIELDS

**BIODIVERSITY & ECOSYSTEMS**
- Erosion control
- Pest control
- Genetic diversity
- Moderation of extreme events
- Freshwater provisioning
- Habitat encroachment
- Soil erosion
- Pollution (air, land & water)
- Nutrient cycling
- Pollination
- Climate regulation
- Loss of ecosystem complexity
Figure 2.1 Capital stocks and value flows in eco-agri-food systems (Source: Hussain and Vause 2018)
II. Why should the Indian government and private sector be engaged with the project?
Agro-forestry [or ZBNF, or organic production, or agro-ecology, or a multi-use landscape...] versus monoculture: current assumption

Financial flows

- Agroforestry products
- Monocrop (or an alternative)

Time

2020

2050
Agro-forestry versus monocrop: Assumption about changes over time

Financial flows

2020

2050

Time

Agroforestry products

Monocrop (or an alternative)
Agro-forestry versus monocrop: 2020 including externalities

Economic flows (including externalities)
Agro-forestry versus monocrops: 2050 for the monocrop

Financial/Economic flows

- Agroforestry products
- Monocrops (or an alternative)
- Agroforestry including externaities
- Monocrops including externaities

Time

2020 2050
Agro-forestry study

- Agroforestry is a practice involving the deliberate integration of trees or shrubs in farming landscapes involving crops or livestock in order to obtain benefits from the interactions between trees and/or shrubs the tree and crop or livestock component
# Agro-forestry case studies

<table>
<thead>
<tr>
<th>Selection criteria</th>
<th>Cocoa agroforestry Ghana</th>
<th>Coffee agroforestry Ethiopia</th>
<th>Ngitili system Tanzania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trend of agroforestry system</td>
<td>Increased by about twice the area in the 1990s to about 1.6 million ha (FAOSTAT 2013)</td>
<td>Increased by 100% since the 1990s to about 520,000 ha (FAOSTAT 2013)</td>
<td>Increased from 600 ha in 1986 to &gt;350,000 ha in 2003 (Mlengi 2004)</td>
</tr>
<tr>
<td>Number of people benefiting from the system</td>
<td>Between 1.9 million (Coulombe &amp; Wondon 2007) to 6 million people (Anthonio and Aikins, 2009) - 700,000 smallholder farmers (Kolavalli &amp; Vigneri 2011)</td>
<td>7 million to 15 million people (Petit 2007): 95% of the coffee produced by smallholder farmers About 4.5 million smallholder farmers (Central Statistical Agency 2013)</td>
<td>No data available, but estimated about 1500 households employed in Shinyanga’s formal and informal forestry sector, in which ngitili products play a major role</td>
</tr>
<tr>
<td>Contribution to national economy</td>
<td>18.9% of the agricultural GDP: 8.2% of the Ghana’s GDP and 30% of total export earnings (GAIN, 2012)</td>
<td>36% of national export income in 2006/07 (Ejigie 2005) Approximately 10% of national GDP (Economic Report on Africa 2013)</td>
<td>No data available but estimated to contribute approximately 0.43% of Shinyanga region’s GDP</td>
</tr>
</tbody>
</table>
Agro-forestry: Scenarios and modelling

- Scenarios include conversion of existing systems to heavy shade system, or growing alternative crops such as maize.

- The WaterWorld model was also used to model ecosystem services change:
  - freshwater provision and runoff
  - increased water quality
  - above ground carbon stock
  - reduction of soil erosion
## Agro-forestry valuation methods

<table>
<thead>
<tr>
<th>Ecosystem Service</th>
<th>Agroforestry System</th>
<th>Valuation Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cocoa</td>
<td>Coffee</td>
</tr>
<tr>
<td><strong>Provisioning</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash Crops</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Food Crops</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Tree Crop Products</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Medicines</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Wild Food and all other NTFP</td>
<td>*</td>
<td>***</td>
</tr>
<tr>
<td>Timber and Poles</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Energy (Wood fuel and Charcoal)</td>
<td>*</td>
<td>***</td>
</tr>
<tr>
<td><strong>Regulating and Supporting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil and biomass C stocks</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Erosion control</td>
<td>ND</td>
<td>***</td>
</tr>
<tr>
<td>Soil fertility (Soil N also P and K where available)</td>
<td>++18</td>
<td>++</td>
</tr>
<tr>
<td>Biological Pest Control</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Pollination</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td><strong>Biodiversity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avian Diversity</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Vegetative Diversity</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Other mammalian diversity</td>
<td>**</td>
<td>ND</td>
</tr>
</tbody>
</table>

*** Sufficient data for biophysical quantification and monetary valuation;
** Quantitative biophysical data available, but insufficient data for monetary valuation;
* Qualitative information available; ND No relevant data available; N/A No applicable
Agro-forestry Scenario analysis

![Graph showing the gross output of coffee agroforestry ecosystem services (in $ million) across different scenarios. The graph includes categories for Maize, Coffee, Other provisioning ES (fuel wood, honey), Carbon regulation, Water yield, and Erosion control.](www.teebweb.org/agriculture-and-food/agroforestry)
III. The EU Partnership Instrument
Project specifics
Project Objectives

➢ The core project goal is to **stimulate biodiversity conservation and ecosystem service provisioning** for agricultural landscapes for the seven countries in scope (Brazil, China, India, Indonesia, Malaysia, Mexico, Thailand)
## Project log frame (overview)

<table>
<thead>
<tr>
<th>Year</th>
<th>Work Packages and activities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WP 1</td>
</tr>
<tr>
<td></td>
<td>WP 2</td>
</tr>
<tr>
<td></td>
<td>WP 3</td>
</tr>
<tr>
<td></td>
<td>WP 4</td>
</tr>
<tr>
<td></td>
<td>WP 5</td>
</tr>
<tr>
<td></td>
<td>WP 6</td>
</tr>
<tr>
<td></td>
<td>WP 7</td>
</tr>
<tr>
<td></td>
<td>WP 8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
</tr>
<tr>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
<td>Q1</td>
</tr>
<tr>
<td>Q3</td>
<td>Q4</td>
<td>Q1</td>
<td>Q2</td>
</tr>
<tr>
<td>Q4</td>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
</tr>
<tr>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
</tr>
<tr>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
<td>Q1</td>
</tr>
<tr>
<td>Q3</td>
<td>Q4</td>
<td>Q1</td>
<td>Q2</td>
</tr>
<tr>
<td>Q4</td>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
</tr>
</tbody>
</table>

[Project log frame diagram]
IV. Developing scenarios
Developing scenarios

➢ Selection of which policy interventions to test/apply using the TEEBAgriFood Framework will be determined by government and stakeholder priorities

➢ In carrying out the scenario analysis, Business-as-Usual and the policy-on scenarios includes known changes

➢ Urbanization
➢ Population demographics
➢ Changing dietary patterns
➢ Climate change scenarios
➢ Covid19 responses
**TEEB Six-Step Approach**

**TEEB 6 step approach**

1. **STEP 1:** Refine the objectives of a TEEB Country Study by specifying and agreeing on the key policy issues with stakeholders.
2. **STEP 2:** Identify the most relevant ecosystem services.
3. **STEP 3:** Define information needs & select appropriate methods.
4. **STEP 4:** Assess and value ecosystem services.
5. **STEP 5:** Identify and outline the pros and cons of policy options, including distributional impacts.

**Scenario development steps**

*Iterative approach in which scenarios are revised based on feedback from decision makers.*

- Select the right scenario approach
- Develop scenario storylines
- Create scenario maps: how ecosystem service provisioning alters tomorrow compared to today
- Scenario modeling: analysis of marginal change over time
- Use results: comparative change of ecosystem services under different scenarios

[teeeweb.org]
TEEB: Challenges and Policy Options for Agriculture and Food Systems in India

Dr Harpinder Sandhu

Virtual Inception Workshop for UNEP Project
TEEB Implementation: Promoting a Sustainable Agriculture and Food Sector
13-14 July 2020
Transformations of global agriculture and food systems

• Global agriculture and food systems are at crossroads — struggling to produce nutritious food in adequate quantity for a growing population and reduce risks to ecosystems and society

• 0.8 billion people still go to bed hungry

• 2 billion people suffer from malnutrition

• 1.9 billion adults are overweight, and of these, 0.65 billion are obese (FAO, 2018)
Status of agriculture and food in India

Food grain requirement (million tonnes)

<table>
<thead>
<tr>
<th>Year</th>
<th>1950</th>
<th>2020</th>
<th>2050 (Projected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement</td>
<td>50.8</td>
<td>285</td>
<td>333</td>
</tr>
<tr>
<td>48 million</td>
<td>tonnes</td>
<td></td>
<td></td>
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</tbody>
</table>

Population (billion)

<table>
<thead>
<tr>
<th>Year</th>
<th>1950</th>
<th>2020</th>
<th>2050 (Projected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.37</td>
<td>1.35</td>
<td>1.62</td>
<td></td>
</tr>
</tbody>
</table>

Share of agriculture in Indian GDP (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>1951</th>
<th>2018/19</th>
</tr>
</thead>
<tbody>
<tr>
<td>51.81</td>
<td>15.87</td>
<td></td>
</tr>
</tbody>
</table>
Challenges in agrifood systems in India

- Produced capital
- Social capital
- Human capital
- Natural capital
Produced capital

GROSS VALUE ADDED $271 BILLION

GVA SHARE 14%

LABOUR EMPLOYED 42%
Social capital

• Small and marginal land holdings
• 90 million agricultural households
• **Social inequity:** For example, smallholders or ‘resource poor’ farms in rainfed dryland landscapes, without access to private tube-well irrigation, have remained largely exempt from the benefits of agrarian policies such as free electricity for pumping groundwater experienced by more prosperous farmers in Punjab.

• **Low income:** average income of farmers, which is Rs 36,938 from cultivation of crops and Rs 9,176 from livestock per year per household, much below the average income from non-farm sector.
Food and nutritional security and health

India ranks 76th amongst 113 countries with a score of 50.1 (world average is 58.4) in GFSI
Rising burden of non-communicable diseases in Indian States

• the largest disease burden from 1990 to 2016 was observed for diabetes, at 80%, and ischaemic heart disease, at 34%.

• 1081 disability-adjusted life-years (DALYs) per 100,000 population were lost in India in 2013 due to deficiencies of Fe, Zn and vitamin A.

• 2489 disability-adjusted life-years per 100,000 population were lost due to high serum total cholesterol or BMI.

• An estimated 20% of men and 21 % of women aged ≥20 years were obese in 2013 using South Asian-specific obesity cut-offs.

(Joy, E. et al. 2017)
Human capital

Employment in Agriculture (% of Total Employment)

![Image of a rural village scene with a person walking and cattle in the foreground.](image_url)

The graph shows a downward trend in employment in agriculture from 1995 to 2018, with a projected decrease to 2050.
Water

- Current water supply is 740 billion m³.
- By 2030, demand in India will grow to almost 1.5 trillion m³,
- Driven by domestic demand for rice, wheat, and sugar for a growing population.

![Per capita water availability (m³/year)](image)
Climate change

3-4 degree Celsius rise by 2100 agricultural incomes will fall by 12% on average, and by as much as 18% in unirrigated areas by the end of the century. impacts farmers’ incomes and GDP.

Soil health

• 120.7 Million hectare (Mha) or 36.7% of the total arable and non-arable land surface of the country suffers from various forms of degradation.

• 15.35 tonnes per hectare of soil is lost resulting in loss of 5.37 to 8.4 Million tonnes (Mt) of nutrients, reduction in crop productivity, occurrence of floods/droughts, reduction in reservoirs capacity (1 to 2% annually), and loss of biodiversity.
Policy options
Timeline of major agricultural policies and outcomes

<table>
<thead>
<tr>
<th>Target</th>
<th>Policy</th>
<th>Outcome</th>
<th>Time Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eradication of Hunger</td>
<td>Area Expansion, Green Revolution</td>
<td>Food Self-Sufficiency</td>
<td>1950-2000</td>
</tr>
<tr>
<td>Diversification</td>
<td>Focus of Vegetables, Fruits, Livestock</td>
<td>Increase in Non-Grains Food Output</td>
<td>2000-2010</td>
</tr>
<tr>
<td>Food For All</td>
<td>Food Subsidies (The National Food Security Act, 2013)</td>
<td>Targeted Public Distribution System</td>
<td>2010-2014</td>
</tr>
<tr>
<td>Farmer Welfare</td>
<td>Natural Farming</td>
<td>Doubling Farmers’ Incomes (in progress)</td>
<td>2015-Onward</td>
</tr>
<tr>
<td>Theme</td>
<td>Challenges</td>
<td>Policy response</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Social capital</strong></td>
<td>Food security</td>
<td><strong>TPDS</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Human capital</strong></td>
<td>Health</td>
<td>Nation Commission on Macroeconomics and Health</td>
<td></td>
</tr>
<tr>
<td><strong>Natural capital</strong></td>
<td>Sustainable agriculture</td>
<td>National Mission for Sustainable Agriculture (NMSA), Rainfed Area Development (RAD), Pradhan Mantri Krishi Sinchai Yojana-Per Drop More Crop (PMKSY-PMDC), Sub-mission on agroforestry (SMAF), Integrated Nutrient Management (INM), Soil Health Management (SHM), Paramparagat Krishi Vikas Yojana (PKVY), Soil and Land Use Survey of India (SLUSI), National Rainfed Area Authority (NRAA), Mission Organic Value Chain Development in North-Eastern Region (MOVCDNER), National Centre for Organic Farming (NCOF), Central Fertilizer Quality Control and Training Institute (CFQC&amp;TI)</td>
<td></td>
</tr>
</tbody>
</table>
TEEB has been applied in three sectors –

• Forests, Inland wetlands, Coastal and marine ecosystems

• to identify the importance, issues, and the challenges of economic valuation of ecosystems and biodiversity

• In addition to this, there are several Natural Resource Accounting (NRA) Projects being undertaken in India
TEEBAgriFood in India

TEEBAgriFood can help in identifying

• best practices or management systems that can be promoted by relevant policies.

• transitions to sustainable agriculture must follow three distinct non-linear phases: efficiency, substitution and redesign.
FOUR Options

1. EVALUATING ZERO BUDGET NATURAL FARMING
2. PROMOTING SUSTAINABLE LAND MANAGEMENT FOR AGRICULTURE IN DROUGHT PRONE AREAS
3. STRENGTHENING AGROFORESTRY INITIATIVES IN INDIA
4. MOVING TOWARDS A SUSTAINABLE RICE AGRONOMY
What is ZBNF?

It is a farming practice involving natural growth of crops without adding any fertilizers and pesticides.

Why is TEEB useful for this option?

Multi-location studies are needed to scientifically validate the long-term impact and viability of the model before it can be scaled up.

What should the study include?

- Go beyond productivity per hectare analysis.
- Assess impact on soil health and yields for different crops over time.
- Identify potential region with opportunity for impact.
Increasing fertilizer use - Between 1977 and 2019, per hectare usage increased from 24 kg to 138 kg (ICRIER, 2019).

Growing body literature on the impact of ZBNF (placed in increasing order of credibility)

1. Blogs - farmers success stories
2. Newspaper articles - Moongbay and down to earth
3. Scientific journals - Andhra Government / independent Several studies- positive impacts on yields, increase in income

More needs to be done to test the robustness of ZBNF
Impact - ORGANIC FARMING Umbrella

- **Paramparagat Krishi Vikas Yojana (PMKSY)** launched to promote organic farming among small and marginal farmers.

- **The National Project on Organic Farming** of MoAFW saw a significant jump in allocation between 2018-19 and 2020-21 (from 20 million INR to 125 million INR).

- **High level Panel at NITI Aayog** reiterated the importance of natural farming and the need to look beyond yields at diversity and nutrition. (May 2020)

Impact - ZBNF

- **Finance minister’s announcement** “there will be “strengthening organic farming in the country,..., and also ZBNF (February, 2019)
Option 2: Sustainable Land Management for Agriculture in Drought Prone Areas

What is SLM?
• It is defined as “use of land resources ... to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions” (IPCC Report - Climate Change and Land, 2019)
• Long term-> zoom in long terms scenarios of Climate Change deeply

Why is TEEB needed for this option?
• To investigate, land-water- climate change and agriculture with a systems approach in drought prone areas

What should the study do?
➢ Include Scenario Analysis for agriculture (modelled with climate)
➢ Include Human and Social dimensions - impact of climate variability on land-water- crops- biodiversity and livelihoods
➢ Identify potential region with opportunity for impact
Context:

- 96.4 million ha of the country is affected by land degradation (29.32% of the Geographic Area of India) (SAC, 2016)
- Water erosion (10.98%), vegetation degradation (8.91%) are top two causes of land degradation. (SAC, 2016)
- During 1996-2015, nearly 17.5 million people annually were affected by droughts in India. (United Nations World Water Development Report, 2019)
- An economic loss of 2.5 percent of GDP due to land degradation in India (TERI, 2018)
- Increasing trends in the frequency of dry days in most parts of the country. (India’s 2nd BUR to UNFCCC - Indian Meteorological Department (IMD Data))
- Climate change exacerbates land degradation (IPCC Report- Climate Change and Land Report, 2019)

Challenges

- Over extraction of groundwater, monoculture, growing high water use crops in drought areas
- Silo approach – land- water- energy- agriculture- climate
• National Mission for Sustainable Agriculture under the Sustainable Agriculture Mission, one of the eight Missions outlined under National Action Plan on Climate Change (NAPCC).

• Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)- inter-ministerial scheme of MoJS, MORD and MoAFW- to extend the coverage of irrigation and improve water use efficiency with end-to-end solutions for source creation, distribution, management, field application and extension.
Option 3: Strengthening agroforestry initiatives in India

What is Agroforestry?
• It is defined as land-use systems whereby a combinatory approach is utilized for the cultivation of woody perennials such as trees, shrubs, palm, bamboo etc. along with crops and/or animals within the same land management unit.

Why is TEEB needed for this option?
• More research is needed to identify different agroforestry models suitable for diverse ecological landscapes of India.

What should the study do?
➢ Quantify value of environmental benefits
➢ Identify potential region with opportunity for impact
Context:

- 23.25 million hectares is under agroforestry in India, i.e. 8.69% of the total geographical area - Central Agroforestry Research Institute (ICAR-CAFRI, 2019)

- 1st country to have National Agroforestry policy- 2014 - The policy seeks to address the bottlenecks impeding large scale implementation

- Potential for agroforestry untapped - Studies show increase in farm profitability with an annual income of INR 3.64 lakhs per hectare as compared to a rice-wheat cropping system of INR 1.66 lakhs per hectare (Singh, M. et al., 2018).

Challenges:

- Lack of marketing infrastructure and agricultural extension services.

- Lack of research studies on agroforestry systems at an ecosystem or landscape level as most research focuses on small plots of land.
Option 3 Opportunity for Impact

• National Agroforestry Policy (2014)

• India’s NDC Commitments- 1) to increase forest cover to 33 per cent of its geographical area 2) increase carbon sinks- to create an additional carbon sink of 2.5 to 3 billion tons of carbon dioxide equivalent through additional forest

• Nation Mission for a Green India (2014) under India’s National Action Plan on Climate Change (NAPCC)- To enhance India’s diminishing forest cover by increasing green cover across India by five million hectares (mha) and increasing the existing quality of tree cover in another 5 mha.

• Sub-mission on Agroforestry (SMAF) under the National Mission for Sustainable Agriculture

OPTION 4: Moving towards a sustainable rice agronomy

What is ‘Sustainable Rice Agronomy’?
• Agronomy - maximise yields for profit.
• Combines sustainable rice production with Agronomy

Why is TEEB needed for this option?
• A systems approach for medium and long-term studies is required to assess costs and benefits associated with different rice management practices.

What should the study do?
➢ A range of approaches to sustainable rice production, depending on the context for instance, conservation agriculture practices such as zero-tillage, dry direct seeding of rice.
Context

- 1/3rd of the total rice cultivation in the world happens in India. (World: 157 million hectares India: 44.1 million hectares) FAOSTAT
- Largest exporter of rice in the world, 1/4th of the global exports of rice (MoAFW, 2019)
- Concerns over soil fertility, productivity and declining yields.

Challenges

- High intensity rice production resulting in salinization, water-logging, loss of soil biodiversity etc. (Shukla, A. K., and Behera, S. K. (2011)).
- Number of small and marginal farmers in the country - over 78% of farmers with limited resources for increasing efficiency and productivity.
- To meet a projected Indian population of 1.8 billion by 2050, India would need to double its current cereal production (Swaminathan, M.S., Bhavani, R.V., 2013)
• **National Food Security Mission (NFSM)** was launched in 2007-08 to increase the production of rice, wheat and pulses through area expansion and productivity enhancement; restoring soil fertility and productivity; creating employment opportunities; and enhancing farm level economy.

• **National Policy for Farmers 2007** aims to improve economic viability of farming and increase net income of farmers.

• **National Mission for Sustainable Agriculture (NMSA)** under National Action Plan on Climate Change.

• **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)** is an inter-ministerial scheme of MoJS, MoRD and MoAFW.
Thank you
PANEL 1
PANEL 1

Promoting a sustainable food and agriculture sector: The economics of biodiversity and ecosystem services

Panelists:
• Mr. T Vijay Kumar, Government of Andhra Pradesh
• Dr. Madhu Verma, Chief Economist, World Resources Institute
• Prof. Haripriya Gundimeda, IIT Bombay
• Dr. Javed Rizvi, World Agroforestry (ICRAF)
Mr. T Vijay Kumar, Government of Andhra Pradesh

- T Vijay Kumar is presently the Advisor to Govt of A.P for Agriculture & Cooperation, and Co-Vice Chairman, Rythu Sadhikara Samstha (RYSS), a company for Farmers empowerment, set up by the state government.

- As a Special Chief Secretary, Agriculture, Government of Andhra Pradesh, T Vijay Kumar is leading the implementation of the climate resilient ZBNF efforts in the state, with a vision to cover 60 lakh farmers with an area of 80 lakh hectares under cultivation.
• Madhu Verma is the Chief Economist at the World Resources Institute, India. An Environment and Developmental Economist, and Policy Analyst, Verma’s work at WRI India focuses on providing the thread of Economics across various ongoing and new programs in India, supporting the global Economics team and leading research on ‘Economic Valuation of Ecosystems and Green Accounting’ and to bring this body of knowledge in the radar of policymakers and other stakeholders.

• She has been an expert/team member/contributing author/ lead author in several international reports like the UN’s Millennium Ecosystem Assessment Report (2004-06); The Economics of Ecosystem and Biodiversity (TEEB) Reports (2007-11); and the Global Biodiversity Assessment Report of the Inter-Governmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES) (2013-19).
Prof. Haripriya Gundimeda, IIT Bombay

- Haripriya Gundimeda is a professor in the Department of Humanities and Social Sciences, at the Indian Institute of Technology Bombay, India. She is the Joint Local and Regional Policymakers and Administrators Coordinator for the TEEB study.

- Her main areas of research have been green accounting, mitigation aspects of climate change, energy demand and pricing, valuation of environmental resources, and issues relating to the development in India. Haripriya is actively involved with the Green Indian States Trust (GIST) in India and has been the lead author of six of the eight monographs for the GIST.
Javed Rizvi is an Agricultural Scientist with a broad experience of working on national agricultural policy, research-for-development strategies, and advocacy-related issues.

He has managed several large multi-disciplinary agricultural programs including aspects of research, extension, technology transfer and capacity development, all aimed at improving food and nutritional security, diversification and intensification of crop-livestock-silviculture production systems, soil-water conservation, alternative livelihoods and small-scale processing and marketing of agricultural and forest products through community-based organizations.
PANEL 2
Mainstreaming Biodiversity and Ecosystem Services in India: Challenges and Opportunities

Panelists:
• Dr. Rita Pandey, Senior Fellow, National Institute of Public Finance and Policy
• Dr. J. Ranna, Alliance of Biodiversity International and the International Center for Tropical Agriculture
• Prof. A. Damodaran, Professor, IIM Bangalore
• Mr. Ravindra Singh, Director, Biodiversity Programme, GIZ
Dr. Rita Pandey, National Institute of Public Finance and Policy (NIPFP)

- Rita Pandey is a Professor at the National Institute of Public Finance and Policy, New Delhi.
- Her primary area of research is environmental economics. She has been a member of the Technological and Finance Standing Committee to implement the Montreal Protocol, appointed by the Ministry of Environment and Forests, Government of India.
- She has undertaken a broad range of studies examining the different links between environment and the economy and has worked extensively on market-based instruments to protect and improve environment including the potential benefits of using tradable permits, non-tax and differential tax instruments for sustainable development. She has obtained her Ph.D. in economics from Indian Institute of Technology Kanpur.
Dr. Jai Rana, Alliance of Biodiversity International and the International Center for Tropical Agriculture

- He has held the position as the Head of the Division of Germplasm Evaluation at the Indian Council of Agricultural Research (ICAR) – National Bureau of Plant Genetic Resources from 2014 to 2018.
- As a scientist his areas of research include plant genetic resources management, on-farm conservation and climate change.
Prof. A. Damodaran, Indian Institute of Management, Bangalore

- Damodaran is a professor of Economics and Social Sciences at the Indian Institute of Management, Bangalore.
- He has worked extensively on climate change and biodiversity financing; he led the initiative on Biodiversity Financing for the United Nation’s Convention on Biological Diversity (CBD) in 2011 which has morphed into the UNDP driven BIOFIN Project. Since 2015 he has been the Chairperson of the GOI Technical Advisory Committee of BIOFIN India. He was part of India’s delegation to CBD to negotiate biodiversity Financing issues in COP 11.
Mr. Ravindra Singh, Director, Biodiversity Programme, GIZ

- Ravindra Singh is the Director for the Biodiversity Programme at GIZ with a progressive experience of over 15 years in programme development and management in the fields of natural resources management and rural livelihoods, adaptation to climate change and biodiversity management.

- He joined GIZ in 2004 and has been involved with designing and implementation of various projects in natural resource management, adaptation to climate change and biodiversity management.
PRIVATE SECTOR ENGAGEMENT
We are a global collaboration transforming the way decisions are made by including the value provided by nature, people and society.

We work through collaboration with 370+ organizations from across the entire system at the core & thousands more engaged around the world.

This systems approach provides us with a unique oversight of the gaps and challenges, and also provides inspiration, ideas and resources to get things done. The Coalition shares a common belief that we can do more together than we can alone.
The Economics of Ecosystems and Biodiversity: promoting a sustainable agriculture and food sector

**TEEBAgriFood Framework Implementation**

Public sector engagement

Private sector engagement

![Public sector engagement](UN_TEEB_capitals_coalition)

![Private sector engagement](CAPITALS_COALITION)

Funded by the European Union
Engagement with business

**WHAT?**

- Engagement with agri-businesses

**HOW?**

- Guidelines for business
- Country-by-country collaboration
- Roundtables
- Trainings
- Gather application
Guidelines for business

- Country-by-country collaboration
- Roundtables
- Trainings
- Gather application
Country by country collaboration

India

CRB
Centre for Responsible Business
Enabling Change for Impact

CII
Confederation of Indian Industry

wbcbsd

Global

DHI

cebds
Brazilian Business Council for Sustainable Development (BCSD-Brazil)

ibcbsd
Indonesia Business Council For Sustainable Development

GoldenBee
Corporate Social Responsibility Consulting

giz
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

AMEBIN
Alianza Mexicana de Biodiversidad y Negocios
Roundtable discussions
Training and gathering applications

Roundtable

Training session 1
- Initiate application
- Follow-up
- ~2 months later
- ~2 months later

Training session 2
- Complete application
- Gather application
- ~2 months later

Gather applications

Guidelines for business
Contry-by-country collaboration
Roundtables
Trainings
Roundtable and training timeline

- **2020**
  - Mexico
  - Brazil

- **2021**
  - China
  - India
  - Indonesia

- **2022**
  - Thailand
  - Malaysia
Mainstreaming the Economics of Nature
The Economics of Ecosystems and Biodiversity foundation report

Natural Capital Protocol
Framework to measure business impact and dependency on nature developed by the Natural Capital Coalition

TEEB AgriFood Evaluation Framework
The case for measuring impacts and dependencies in agriculture and food systems

Social & Human Capital Protocol
Framework to measure business impact and dependency on people developed by the Social & Human Capital Coalition

Our project
Specific guidance for agri-businesses based on TEEBAgriFood framework and the Natural and Social & Human Capital Protocols
Natural and Social & Human Capital Protocols Framework

Stage 1: FRAME
- Step 1: Get started
- Step 2: Define the objectives
- Step 3: Scope the assessment
- Step 4: Determine the impacts and/or dependencies

Stage 2: SCOPE
- Step 5: Measure impacts and/or dependencies
- Step 6: Measure changes in the state of capitals
- Step 7: Value impacts and/or dependencies

Stage 3: MEASURE AND VALUE
- Step 8: Interpret and test results
- Step 9: Take action

Stage 4: APPLY
Frame Stage: WHY?

Capital impacts and dependencies: conceptual model for business

Work in progress
Frame Stage: WHY?

Example of interactions between capitals
Scope – WHAT?

Table 4.1 Indicative Materiality matrix

<table>
<thead>
<tr>
<th>DEPENDENCIES</th>
<th>VALUE CHAIN</th>
<th>IMPACT DRIVERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NATURAL</td>
<td>INPUT MATERIALS</td>
<td>NATURAL</td>
</tr>
<tr>
<td>HUMAN</td>
<td>AGRICULTURAL PRODUCTION</td>
<td>HUMAN</td>
</tr>
<tr>
<td>SOCIAL</td>
<td>MANUFACTURING &amp; PROCESSING</td>
<td>SOCIAL</td>
</tr>
<tr>
<td>PR.</td>
<td>DISTRIBUTION &amp; RETAIL</td>
<td></td>
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<tr>
<td></td>
<td>CONSUMPTION</td>
<td></td>
</tr>
</tbody>
</table>

**INPUT MATERIALS**
- Water quality
- Energy
- Regulation of physical environment
- Regulation of biological environment
- Skills and Knowledge
- Experience
- Workforce availability
- Social networks and cooperation
- Property rights
- Social acceptance and trust
- Law and order
- Accessibility to infrastructure and technology

**AGRICULTURAL PRODUCTION**
- Water use
- Terrestrial ecosystem use
- GHG emissions
- Pesticide and herbicide use
- Fertilizer use

**MANUFACTURING & PROCESSING**
- Soil degradation
- Livestock conditions
- Nutritional content of food
- Use of harmful substances for consumers
- Food safety practices
- Salaries and benefits
- Workers living conditions
- Labour rights
- Gender rights
- Worker’s representation
- Access to infrastructure and technology

**DISTRIBUTION & RETAIL**
- Health of workers
- Social networks and cooperation
- Responsibility for communities
- Integrity of communities
- Benefit sharing with indigenous people
- Skill development
- Access to infrastructure and technology

**CONSUMPTION**
- Soil degradation
- Livestock conditions
- Nutritional content of food
- Use of harmful substances for consumers
- Food safety practices
- Salaries and benefits
- Workers living conditions
- Labour rights
- Gender rights
- Worker’s representation
- Access to infrastructure and technology

**IMPACT DRIVERS**
- Water availability
- Water quality
- Regulation of biological environment
- Regulation of physical environment
- Skills and Knowledge
- Experience
- Workforce availability
- Social networks and cooperation
- Property rights
- Social acceptance and trust
- Law and order
- Accessibility to infrastructure and technology

**Scope – WHAT?**

**Table 4.1 Indicative Materiality matrix**

*Work in progress*
Measure and Value Stage: HOW?

Example of indicators and assessment approaches

**Indicator**: Kilograms of Phosphorus in fertilizers applied

**Data source**: On farm data

**Step 05: Measure impact drivers**

**Impact**: Loss of fish stocks

**Method**: Valuation of changes in ecosystem services

**Step 07: Value impacts**

**Indicator**: Change in number of species in water ecosystems due to changes in nutrient level in water (eutrophication)

**Method**: Life Cycle Impact characterization factors

**Step 06: Measure changes in capitals**

*Work in progress*
CASE STUDY
OLAM Sugar Cane

WHAT:
Use of natural capital assessments on sugar cane plantation in Maharashtra and Madhya Pradesh

Result:
✓ Overall productivity increased by 15%
✓ 62 billion liter water avoidance over 3 years
Contact

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OPEN DISCUSSION
Summary
Way Forward