The evolution of the Project
Paris workshop, May 2016

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The Economics of Ecosystems and Biodiversity in Business and Enterprise

Edited by Joshua Bishop

NATURAL CAPITAL AT RISK:
The Top 100 Externalities of Business

APRIL 2013
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$ BН</th>
<th>REVENUE, US$ BН</th>
<th>IMPACT RATIO</th>
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<tbody>
<tr>
<td>1</td>
<td>COAL POWER GENERATION</td>
<td>EASTERN ASIA</td>
<td>452.8</td>
<td>443.1</td>
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<td>2</td>
<td>CATTLE RANCHING AND FARMING</td>
<td>SOUTH AMERICA</td>
<td>353.8</td>
<td>16.6</td>
<td>18.8</td>
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<td>IRON AND STEEL MILLS</td>
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<td>174.0</td>
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<td>8</td>
<td>CEMENT MANUFACTURING</td>
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<td>9</td>
<td>WATER SUPPLY</td>
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<td>14.1</td>
<td>7.9</td>
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<td>NORTHERN AFRICA</td>
<td>100.1</td>
<td>7.4</td>
<td>13.6</td>
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<td>12</td>
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<td>15</td>
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<td>22.2</td>
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<td>SUGARCANE</td>
<td>SOUTHERN ASIA</td>
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<td>6.0</td>
<td>12.5</td>
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<td>19</td>
<td>PETROLEUM AND NATURAL GAS EXTRACTION</td>
<td>EASTERN EUROPE</td>
<td>72.6</td>
<td>371.6</td>
<td>0.2</td>
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<td>NATURAL GAS POWER GENERATION</td>
<td>NORTHERN AMERICA</td>
<td>69.4</td>
<td>122.7</td>
<td>1.0</td>
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</table>
Summary statement

The **TEEBAgriFood** study is designed to:

1. provide a comprehensive economic evaluation of the ‘eco-agri-food systems’ complex
2. demonstrate that the economic environment in which farmers operate is distorted by *significant externalities*, both negative and positive, and a lack of *awareness of dependency on natural and social capital*
Agriculture employs 1 in 3 of the world’s economically active labour force, or about 1.3 billion people. For the 70 per cent of the world’s poor living in rural areas, agriculture is the main source of income and employment.

Smallholder farms (i.e. less than 2 hectares) represent over 475 million of the world’s 570 million farms and, in much of the developing world, they produce over 80 per cent of the food consumed.

Food production systems produce approximately 2,800 calories per person per day which is enough to feed the world population.
NC Accounting: Distribution

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The need to assess landscapes

- Eighty per cent of new agricultural land has replaced tropical forests since the 1980s, a trend resulting in significant biodiversity loss and ecosystem degradation.

- Crop and livestock farming produce between five and six billion tons of CO$_2$-equivalent in greenhouse gas (GHG) emissions each year, mostly in developing countries where the agricultural sector has expanded in recent years.

- The agricultural sector utilizes 70 per cent of the water resources we withdraw from rivers, lakes and aquifers, raising serious concerns in terms of sustainability and security.
February 2014: developing the Concept
Eco-agri-food systems complex – impacts and dependencies
The visible and invisible flows of agricultural production
The visible and invisible flows of agricultural production

**HUMAN SYSTEMS**

**AGRICULTURE & FOOD SYSTEMS**

**BIODIVERSITY & ECOSYSTEMS**

- Inputs
- Outputs
- Invisible positive flows
- Invisible negative flows
The visible and invisible flows of agricultural production

HUMAN SYSTEMS
- Irrigation
- Fertilizer
- Pesticides
- Bio-Technology
- Labor
- Breeding
- Machinery

AGRICULTURE & FOOD SYSTEMS
- Seeds
- Crops
- Yield

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**AGRICULTURE & FOOD SYSTEMS**
- Seeds
- Crops
- Yield
- Erosion control
- Pest control
- Soil formation
- Genetic diversity
- Nutrient cycling
- Moderation of extreme events
- Freshwater provisioning
- Pollination
- Climate regulation

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- Soil formation
- Genetic diversity
- Freshwater provisioning
- Nutrient cycling
- Pollination
- Climate regulation
- Habitat encroachment
- Soil erosion
- Loss of ecosystem complexity
- Pollution (air, land & water)
- Species reduction
- GHC / Climate

**Biodiversity & Ecosystems**
- Inputs
- Outputs
- Invisible positive flows
- Invisible negative flows
Feeder studies on NCA

Competitive tendering process (April 2014):

- No single consortia submitted a bid that included full value chain impacts/dependencies
- Health impacts were barely considered
- Range of case studies did not fully cover the heterogeneity in production systems/socio-cultural and ecological contexts within sectors
- Research consortia led by experts in bio-physical assessment
- **ESs scope:** range and depth of assessment dependent on data availability, resources and time
- Therefore some subset of the eco-agri-food systems complex would be valued
Valuation Approaches

**TEEB Framework**

- Human (Economic and Social) Systems
- Agricultural and Food Systems
- Ecosystems and Biodiversity

**Assessments**

1. Top down
   - **[Livestock]**
   - Goal: Identify ‘hotspots’ and key impact areas
   - Biophysical data: Use of global or country-specific data
   - Valuation data: Global or country-specific valuations
   - Key strengths: Broad coverage

2. Hybrid
   - **[Rice, Palm Oil]**
   - Goal: Wide scope of analysis using a ‘systems based’ approach
   - Biophysical data: Mix of local and modelled data
   - Valuation data: Global, country-specific, or local valuations
   - Key strengths: Contextualization of local data

3. Bottom-up
   - **[Livestock]**
   - Goal: Analysis of farming systems/regional contexts
   - Biophysical data: Local quantitative and qualitative datapoints
   - Valuation data: Global, country-specific, or local valuations
   - Key strengths: Robustness for decision making

**Increasing geographic specificity**
Trucost valuation approach to Eutrophication
1. OVERVIEW

GENERAL PROCESS

FIGURE 1: GENERAL OVERVIEW OF TRUCOST VALUATION PROCESS

- **Eutrophication**
  - Change in pollutant concentration in local water body
    - Ecological impact
      - Measured by change in Secchi depth (m)
      - Loss of water clarity
      - Loss of biodiversity
      - Reduced recreation in water bodies
      - Property prices drop ($)
    - Human health impact
      - Treating drinking water (Avoiding Human Health Impact)
      - Treatment Costs Associated with Increases in Pollutant
      - Untreated drinking water
        - Establish relationship between pollutant concentration and DALYs (EXIOPOL, 2008)
        - Attain value of DALY (NEEDs, 2006)
        - Adjust DALY value for income level and calculate median

Total Impact of eutrophication (2013 $/kg$)
Trucost approach to Eutrophication II: scope assessment

➤ Out of scope:
  - Recreational values
  - Health impacts from lack of water for sanitation
  - *Specific* distance to water bodies

<table>
<thead>
<tr>
<th>Trophic Class</th>
<th>Concentration of P (µg/L)</th>
<th>Secchi Depth¹ (m)</th>
<th>Chlorophyll (µg/L)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oligotrophic</td>
<td>0-12</td>
<td>&gt;4</td>
<td>0-2.6</td>
<td>Clear water, low levels of nutrients, very infrequent algae blooms, sufficient oxygen, high quality drinking water, high biodiversity</td>
</tr>
<tr>
<td>Mesotrophic</td>
<td>12-24</td>
<td>2-4</td>
<td>2.6-20</td>
<td>Clear water, moderate nutrients, infrequent algae blooms</td>
</tr>
<tr>
<td>Eutrophic</td>
<td>24-96</td>
<td>0.5-2</td>
<td>20-56</td>
<td>Abundance of aquatic plants and algae blooms, opaque waters, lower levels of oxygen, less fish, can smell</td>
</tr>
<tr>
<td>Hypereutrophic</td>
<td>&gt;96</td>
<td>&lt;0.5</td>
<td>&gt;56</td>
<td>Low transparency, frequent algae blooms, little or no fish, episodes of severe odour</td>
</tr>
</tbody>
</table>
Further Trucost valuation methodologies
TruePrice Bottom-up: Measurement Approach

- **Quantification**
  - Data from experts, peer reviewed literature and databases
  - Biophysical models of farming systems
  - Site-level, specific to a particular production system

- **Limitations**
  - High data requirements, limited data availability
  - Comparability is determined by scope
  - Results are situation specific and contextualisation is necessary for interpreting

**Quantification**
- Farming operations and supply chain (at least production of feed) for 5 countries and 10 practices
- LCA approach to supply chain; modelling of local systems
- Data from peer-reviewed literature, GLEAM, FAOSTAT amongst others

**Non-monetary valuation**
- Land occupation
- Impact on biodiversity

**Monetary Valuation**
- Natural capital costs of GHG, water pollution
- Natural capital dependency on water

Example: Livestock (Supply chain)
What did we learn from the Feeder Studies?

• **Process:**
  - Initial results expected (contractually) by December 2014; now close to completion/published in 2016

• **Outcomes:**
  - Some robust, defensible value estimates for invisible impacts and dependencies
  - Care needed in presenting partial results
  - Need for a consistent, comprehensive valuation framework but (I) categories of value addition non-additive, and (II) impossible to fully populate

• **Research consortia:**
  - Cross-disciplinary research challenging
Interim Report Launch

TEEB for Agriculture & Food

Interim Report

A report by 'The Economics of Ecosystems & Biodiversity'

- A comprehensive economic evaluation of the eco-agri-food systems complex, and demonstration that the economic environment in which farmers operate is distorted by significant externalities, both negative and positive, and a lack of awareness of depending on natural and social capital.
Rice Study

- Worldwide, about 80 million hectares of irrigated lowland rice provide 75% of the world’s rice production

- This predominant type of rice system receives about **40% of the world’s total irrigation water** and 30% of the world’s developed freshwater resources
Rice Study
Conventional vs SRI production

• The System of Rice Intensification (SRI) includes intermittent flooding as part of the production package.
• SRI advises transplanting of young (eight to ten days old) single rice seedlings, with care and spacing, and applying intermittent irrigation and drainage to maintain soil aeration.
• In addition, the use of a mechanical rotary hoe or weeder to aerate the soil and control weeds is encouraged.
Increasing rice yields, Reducing water consumption

- Senegal (Water costs): 801, 626
- Senegal (Rice yields): 2302, 2422
- Philippines (Rice yields): 1124, 1692
- Cambodia (Rice yields): 1099, 1422

Legend:
- Conventional
- SRI
Three different levels of action:

1. **Recognizing value** – identifying the wide range of benefits in ecosystems, landscapes and biodiversity, such as provisioning, regulating, habitat/supporting and cultural services

2. **Demonstrating value** – using economic tools and methods to make nature’s services economically visible in order to support decision-makers wishing to assess the full costs and benefits of land-use change

3. **Capturing value** – incorporating ecosystem and biodiversity benefits into decision-making through incentives and price signals
GOAL 2
END HUNGER, ACHIEVE FOOD SECURITY AND IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE

GOAL 15
PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION, AND HALT AND REVERSE LAND DEGRADATION AND HALT BIODIVERSITY LOSS
is supported by