Sustainable Agriculture, Forestry and Fisheries in the Bioeconomy
A Challenge for Europe

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12 January 2017
The sustainable bioeconomy: premises and preconditions

In 2012 EC launched the strategy for “Innovating for sustainable growth: A bioeconomy for Europe”, aiming "to pave the way to a more innovative, resource efficient and competitive society that reconciles food security with the sustainable use of renewable resources for industrial purposes, while ensuring environmental protection".
The bioeconomy concept

• Bio-economy or bio-based economy “… encompasses the production of renewable resources and their conversion into food, feed, bio-based products and bio-energy. It includes agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries” (EC, 2012)

• However, bio-economy is more than simple addition of sub-sectors: set of existing relations between human societies and the biosphere in several aspects:
  – provision of goods and services,
  – emission of pollutions and negative externalities
  – but also of positive externalities
  – in order to keep biosphere capacities and functionalities viable and sustainable for future generations.
Two premises

1. Biomass **is underexploited**: 
   1. Too much fractions not used optimally
   2. More material and energy can be extracted from current biomass streams

2. The biomass potential **can be upgraded** by
   1. Closing yield gaps
   2. Introducing new or improved species
   3. Introducing new and improved extraction and processing technologies
Underlying idea

• Efficient and Sustainable Bio-economy is based on the principle of **fractionation**
• Based on fact that nutritional needs of animals and humans is never fulfilled by one crop only, such that a combination of fractions of plants and animals is always necessary
• Increases the **resilience** of the food system
Source: http://www.comitesucre.org/site/about-sugar/sugar-production/
Mobile grass refinery unit ensures farmers can capture value added of bio-economy.

Actors and activities will be reassembled in time and in space.
But

• Not all is “recycled” and “reused”
• Main challenges of agriculture relate to water-soluble and gaseous substances, mainly N and P related
OPTIONS:

A. Reduce the arrows (resource efficiency)

B. Close the system (e.g. horticulture)

C. Redesign the system (e.g. high-moisture meat analogues, insects)
Potential benefits and concerns: values

• Predominantly positive perception

• Concerns:
  – global food security and resource overexploitation (LDCs)
  – tension between policy focus on quality production and rural development versus cheap biomass as feedstock for non-food uses
  – impact of large-scale exploitation of feedstocks on primary sectors
Addressing societal challenges

• Ensuring food security
• Managing natural resources sustainably:
  – New region-specific balance between production and ecosystem carrying capacity:
    • Sustainable intensification in areas with growth potential
    • Sustainable extensification in areas with high negative externalities
  – Better use of waste: circular economy
• Reducing dependence on non-renewable resources
• Mitigating and adapting to climate change
• Creating jobs and maintaining competitiveness
## Scope
(billion tonnes dry matter)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Status 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>1.75 (14%)</td>
</tr>
<tr>
<td>Feed</td>
<td>7.06 (58%)</td>
</tr>
<tr>
<td>Bio-based chemicals &amp; materials</td>
<td>1.24 (10%)</td>
</tr>
<tr>
<td>Bioenergy</td>
<td>2.98 (16%)</td>
</tr>
<tr>
<td>Biofuels</td>
<td>0.15 (1%)</td>
</tr>
<tr>
<td><strong>Total supply of biomass</strong></td>
<td><strong>12.18 (99%)</strong></td>
</tr>
<tr>
<td><strong>Total demand for biomass</strong></td>
<td><strong>12.18</strong></td>
</tr>
</tbody>
</table>
Estimated employment and turnover in EU-28 in 2011

**Employment in the EU bioeconomy (EU28, 2011), Total: 19 million**

- Agriculture: 53.0%
- Forestry: 1.5%
- Fishery: 10.5%
- Manufacture of food products: 3.4%
- Manufacture of beverages: 2.2%
- Manufacture of tobacco products: 0.9%
- Manufacture of textiles and textile products: 0.2%
- Manufacture of paper and paper products: 21.3%
- Forest-based industry: 2.5%
- Biofuels: 0.1%
- Manufacture of chemicals (excl. biofuels), chemical products and plastics: 0.0%

**Turnover in the EU bioeconomy (EU28, 2011), Total: 2 trillion Euro**

- Agriculture: 42.8%
- Forestry: 18.7%
- Fishery: 10.6%
- Manufacture of food products: 8.7%
- Manufacture of beverages: 4.0%
- Manufacture of tobacco products: 2.1%
- Manufacture of textiles and textile products: 7.1%
- Manufacture of paper and paper products: 0.3%
- Forest-based industry: 0.0%
- Biofuels: 3.8%
- Manufacture of chemicals (excl. biofuels), chemical products and plastics: 0.0%
Five key principles for a sustainable bioeconomy

• **Food first**: ensure the primacy of food security
• **Sustainable yields**: amount harvested < regrowth → agriculture?
• **Cascading approach**: sequential use of biomass according to ‘value added’ → value?
• **Circularity**: reduce/reuse/recycle
• **Diversity**: systems are diverse, using context-specific practices at different scales, producing a diversity of outputs
Policy frameworks

• Many regulations and strategies in Europe: CAP, EU forest strategy, Common fisheries policy, Blue growth agenda, New EU framework for aquaculture, quality schemes, Renewable Energy Directive, 2030 framework for climate and energy, standards for bio-based products and circular economy,…

• Conflicting interests but need for coherence: an integrated policy framework
ISSUE 1: Governance

• Outcomes of bioeconomy will depend on the rules put in place to *regulate* the system.
• Bio-based materials and bio-energy may create pressure on natural resources and on *social inequalities* in a scarcity-dominated world.
• Bioeconomy involves both positive and negative *externalities* influencing the future of the biosphere and the ways in which societies will use it.
• So bioeconomy *governance* is critical.
• *Research* should help develop framework aimed at fostering the bioeconomy - policies that are coherent, create a level playing field, avoid the overexploitation of natural resources and foster a diversity of practices.
ISSUE 2: Business models

• Circularity = new ways of designing and manufacturing products, new relationships between economic actors, new ways of recycling components and waste, etc.

• Actors and activities will be **reassembled** in time and in space

• Different production models in terms of scope and size should not **co-exist** and work together

• **Public goods** are part of the new production (ecosystem services) and could involve public sector
ISSUE 3: Socio-cultural dimensions

• Knowledge on impacts and mechanisms of social change should **co-evolve** with technology
• All **stakeholders** should be fully involved in governance of bioeconomy
• Science may radically **change food production and consumption patterns**, with potential to reduce pressure on ecosystems
• This may break established routines and create **resistance**, which needs to be better understood.
• Approaches have **legal** implications that need to be understood and addressed by research.
ISSUE 4: Down the chain

- By-products are exploited upstream, but waste and losses occur mainly downstream.
- Particularly at the level of the consumer: largest share of waste in rich countries + no “end-of-life” valorisation of food.
- Probably the biggest challenge of the bioeconomy.