Production of food feed and fiber - a challenge for a sustainable bioeconomy

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Greening the economy

Sheng Fulai, UNEP
Biomass production and agriculture

Perennial grasses
Sorghum wheat
Salix
Populus
Corn
Cereals
Crop residues
Global carbon stocks (%)

- Ocean: 77.4%
- Fossil fuel: 14.9%
- Soil: 5%
- Biotic: 1.2%
- Atmosphere: 1.5%

Lal 2011 Bioscience
How to produce the biomass?

Land use in EU-27

- Arable land
- Permanent pastures
- Permanent crops
- Forests
- Other areas

Land use change
Agricultural intensification
Crop development

Eurostat 2013
Land use change

Grass to Wheat  Grass to Oilseed rape  Grass to Sugar beet

Grass to Miscanthus  Grass to SRC  Grass to SRF

Richards et al  2016 Global Change Biology
Agricultural intensification

Tsiafouli et al 2015, Global Change Biology
Perennial vs annual crops

Annual wheat (on left in each panel) and Perennial wheatgrass
Agriculture & soil carbon change

<table>
<thead>
<tr>
<th>Management</th>
<th>C decline per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensive cereal production</td>
<td>-1.0%</td>
</tr>
<tr>
<td>Inorganic fertilisers</td>
<td>-0.5%</td>
</tr>
<tr>
<td>Farm yard manure (5 ton/ha)</td>
<td>-0.2%</td>
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<tr>
<td>Straw addition (3 ton/ha)</td>
<td>-0.2%</td>
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<table>
<thead>
<tr>
<th>Management</th>
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</thead>
<tbody>
<tr>
<td>Cover crops</td>
<td>0.2%</td>
</tr>
<tr>
<td>Straw addition (12 ton/ha)</td>
<td>0.3%</td>
</tr>
<tr>
<td>Farm yard manure (35 ton/ha)</td>
<td>0.4%</td>
</tr>
<tr>
<td>Ley 2 yrs (in 8 yr rotation)</td>
<td>0.3%</td>
</tr>
<tr>
<td>Miscanthisus grass</td>
<td>2.0%</td>
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</tbody>
</table>
Sustainable bioeconomy and ecosystem services?

Intensive farming

Grassland
“Natural Capital” - The ecosystem services from nature which are essential for human life.

http://bankofnaturalcapital.com/category/ecosystem-services/agriculture/
Ways towards a sustainable "green economy"?

- Optimise multiple ecosystem services
- Estimate indirect effects of the biomass production
- Long term investments in soil carbon by the biomass plants