Value in EO Workshop
Measuring the Socio-Environmental Impacts

Lefteris Mamais, EARSC and Nikolay Khabarov, IIASA
# Focussing on socio-environmental benefits

<table>
<thead>
<tr>
<th></th>
<th>ECONOMIC</th>
<th>ENVIRONMENTAL</th>
<th>REGULATORY</th>
<th>INNOVATION &amp; ENTREPRENEURSHIP</th>
<th>SCIENCE &amp; TECHNOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farming in Denmark</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td></td>
<td>★</td>
</tr>
<tr>
<td>Flood management in Ireland</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td></td>
<td>★</td>
</tr>
<tr>
<td>Ice navigation off Greenland</td>
<td>★ ★ ★ ★</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td></td>
<td>★</td>
</tr>
<tr>
<td>Farming in Poland</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td></td>
<td>★</td>
</tr>
<tr>
<td>Winter navigation in the Baltic</td>
<td>★ ★ ★ ★</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td></td>
<td>★</td>
</tr>
<tr>
<td>Forestry management in Sweden</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
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<td>★</td>
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<tr>
<td>Infrastructure management in the Netherlands</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td>★ ★ ★ ★ ★ ★</td>
<td>★</td>
</tr>
<tr>
<td>Growing potatoes in Belgium</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td></td>
<td>★</td>
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Advancing the understanding and measurement of the societal benefits of Earth Observations, Rome, July 2019
What have we done to measure such benefits

• In SEBS, we have systematically tried to understand socio-environmental benefits associated with the use of Sentinel-enabled services

• In practice, socio-environmental impacts are primarily felt at the far end of the value chain → thus our focus was to establish links with the availability of Sentinel data at the entry point of the chain (“looking inside the black box”)

• This has been pursued through interviews with researchers and practitioners in relevant institutions (e.g. Hydrology, Eco-toxicology, etc.) and complemented by desk research (led by IIASA)
Advancing the understanding and measurement of the societal benefits of Earth Observations, Rome, July 2019
### Measuring socio-environmental benefits

<table>
<thead>
<tr>
<th>Category</th>
<th>What it can mean</th>
<th>Specific Examples of Indicators</th>
<th>How we measured it</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced pollution (RP)</td>
<td>Reduced amounts of pollutants in key resources (e.g. water or air)</td>
<td>Reduced usage of fertilisers Reduced usage of pesticides Reduced usage of fuel Reduced emissions</td>
<td>Stakeholders estimations of usage of pesticides/fertilisers Stakeholder estimations of reduced travels and fuel consumption</td>
</tr>
<tr>
<td>Improved public health (IPH)</td>
<td>Less toxicological risk</td>
<td>Hospitalisation rate in association with environmental events/risks</td>
<td>We have not attempted to measure this yet</td>
</tr>
<tr>
<td>Reduced impact on natural resources (RR)</td>
<td>Improved preparedness or response to flooding</td>
<td>Reduced erosion Reduced impact on habitats Reduced “unsocial” logging</td>
<td>We have not attempted to measure this yet</td>
</tr>
<tr>
<td>Common Understanding (CU)</td>
<td>Maps that provide a common point of reference on a phenomenon</td>
<td>Better communication between EM authorities Better compliance of public to instructions</td>
<td>Expert opinion on reduced transmission of erroneous information in media outlets</td>
</tr>
</tbody>
</table>
Environmental Benefits across the cases

**Environmentally friendly Agriculture**
- Reduced use of inputs (fertilisers and pesticides)
- Decreased risk of pollution to watercourses (see eutrophication and loss of aquatic life)

**More efficient ship routing**
- Reduced use of fuel
- Reduced risk of accidents and potential oil spills

**Increased preparedness/response capacity wrt to disasters**
- Minimising damages associated with natural or man-made disasters
- Reducing the loss of wildlife, erosion, pollution, damage to habitats, etc.
Other societal benefits we have encountered

Common understanding – The ability to convey information in an easily understandable manner is critical for the effectiveness of certain operations

• Prime example: In Ireland, the use of flood delineation maps, allowed disaster management actors, politicians, journalists and citizens to effectively communicate on the impact and evolution of the floods

Whereas in previous events:
“The main difficulty in this case was a disjoint between the meteorological and the hydrological system information, the failure to convert this into a coherent picture of what might happen, and then communicate this assertively to the relevant public as a specific flood warning.”

Source: NDFEM, Report on the review of the response to exceptional severe weather events of 2009 – 2010
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Steven Krekels, VITO
WatchItGrow: crop monitoring with Sentinels

A digital platform for the entire value chain

Looking through the clouds with CropSar

More on WatchItGrow
More on CropSar

https://watchitgrow.be/en
https://blog.vito.be/remotesensing/cropsar2019

Advancing the understanding and measurement of the societal benefits of Earth Observations, Rome, July 2019
WatchItGrow: crop monitoring with Sentinels

<table>
<thead>
<tr>
<th>Interests</th>
<th>Input Suppliers</th>
<th>Credit &amp; Finance</th>
<th>Farmers</th>
<th>Traders</th>
<th>Food Processors</th>
<th>Retailers</th>
<th>Consumers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problems</td>
<td>Purchasing capacity farmers</td>
<td>Agri = Risks</td>
<td>Climate Change Information gap Soil Nutrients</td>
<td>Unstable quality &amp; yields</td>
<td>Sustainable sourcing</td>
<td>Critical consumers</td>
<td>Food Quality</td>
</tr>
<tr>
<td>Impact</td>
<td>Higher quality input</td>
<td>Increase loan portfolio</td>
<td>Higher yield &amp; income – higher efficiency of resources</td>
<td>Sustainable sourcing &amp; supply</td>
<td>Sustainable supply of quality products</td>
<td>Reducing risk factors</td>
<td>Increased Trust</td>
</tr>
</tbody>
</table>

Applications adding value to all actors in the value chain
A digital platform for agriculture

- Improve quality & quantity
- Rebalance profits via transparent information
- Deliver automatic crop advice via WatchItgrow
  - New insights / pattern detection using deep learning algorithms.
  - Combination of:
    - Remote sensing data
    - Meteo Data
    - Soil data
    - Field Management data - parcel fiche!
    - IoT data
  - Precision Agriculture to reduce fertilizers, irrigation...

Why potato?

- Per m2 & compared to rice
  - Feed more people
  - Consume less water
  - Emit less methane
- Economic activities for further processing
- Replacing staple food in quite some countries
Limitations and areas for improvement

• It is **hard to establish a measurable correlation, let alone causation**, between socio-environmental benefits at the end of the chain and the availability of Sentinel data at the start of it.

• For some cases with clear environmental perspective (e.g. air quality monitoring) but **“composite” final products relying primarily on modelling**, it is hard to understand the value of satellite data.

• Overcoming this limitation would require **heavier involvement of specialists/researchers** (e.g. hydrologists, eco-toxicologists, epidemiologists, etc.) in the studies.
What have we learned – key findings

• The use of Sentinel-enabled services often brings indirect yet not negligible environmental and societal benefits to actors down the chain.

• Socio-environmental benefits are not (and certainly should not) be seen only as a by-product of the use of a satellite-enabled service.

• In Poland, the farmer we interviewed was clear “Even if my savings were not as large, I would still use services that allow me to do good for the environment.”

• In Ireland, the authorities underlined that “the use of Copernicus EMS maps helped significantly to build stronger trust among the citizens on our ability to handle the situation. This was further supported by the media, where reporters were using the flood delineation maps in their news stories.”
Next steps and open questions

• We are planning to analyse cases which should have direct socio-environmental impacts, e.g. water or air quality monitoring, protection of biodiversity, etc.

Questions

• Would anyone in the audience be willing to undertake complementary analyses of niche (e.g. turlough monitoring) or more complex (e.g. correlation of algal blooms in the Baltic with agricultural activities in Poland) processes?

• Are there any datasets (at local or national level) that could help us in our efforts to solidify the socio-environmental part of our analyses?

• Have you developed solid methodologies for the quantification of socio-environmental indicators?
THANK YOU

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