Earth Observation for enhanced agricultural productivity

EO4SD Project Consortium, presented by Annemarie Klaasse
EO4SD consortium lead & service provider

VISION

2012

7 bn
Farmers will need to produce

Using less

2050

9 bn
70% more food by 2050

Satellite based applications and data to optimise crop production and water management

www.eLEAF.com
Established in 2000
eLEAF is a Netherlands based high-tech company with global experience offering quantitative information

Global experience (dark green countries)

Agriculture
Water Management
Crop Insurance
Crop Certification

Quantitative Remote Sensing

P MAPPING
Sustainable Development Goal 2

**ZERO HUNGER**

End hunger, achieve food security and improved nutrition and promote sustainable agriculture

**target 2.4**

Increasing agricultural productivity

Sustainable use of **land** and **water** resources

**target 15.3**
Combat desertification and achieve a land degradation neutral world

**target 6.4**
Substantially increase water use efficiency

**target 17.18**
Increase the availability of high-quality, timely, and reliable data
Raising agricultural production in a country:
- Raising the yield of individual crops
- Changing the pattern of production (intense system of cultivation, high value crops, increase the number of growing seasons, etc)
- Expand cultivated area
  → Use resources more efficiently

Agricultural productivity:
- Include resources in analysis
- Output in terms of calories or in terms of money value?

Agricultural production

\[ \text{Agricultural production} = \text{the volume of output} \]

Agricultural productivity

\[ \text{Agricultural productivity} = \text{the output in relation to resources} \]

(land, labour, capital, etc)
To increase agricultural production:

We can be more efficient about where we grow, what we grow, and how we grow.

Source: https://www.nationalgeographic.com/foodfeatures/feeding-9-billion/
Observations from space have their limitations:

- Agricultural production
- Land ownership
- Clouds
- Greenhouses

For successful M&E you need geospatial data of intervention areas.

And: complexity in the field (small plots, intercropping) = difficulties for Earth Observation.
But satellites are great for mapping the distribution, status and dynamics of agricultural production:

<table>
<thead>
<tr>
<th>√ Land utilization</th>
<th>Extent of agricultural land (its footprint) / Irrigated land / Crop type / Expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>√ Cropping intensity</td>
<td>Number of seasons per year</td>
</tr>
<tr>
<td>√ Crop production</td>
<td>Crop condition / Factors influencing yield e.g. water availability / Yield prognosis</td>
</tr>
<tr>
<td>√ Resources</td>
<td>Safeguard natural areas / competition for land and water resources</td>
</tr>
</tbody>
</table>
**EO PRODUCT**

**KEY INDICATORS (biophysical)**

- Cultivated/irrigated/crop area
- Phenology
- Vegetation index
- Crop biomass production
- Yield
- Start/end & number of seasons
- Crop dynamics
- Crop biomass production
- Crop yield prognosis

**APPLICATIONS**

- Strategic planning
- Risk assessment
- Project preparation
- Implementation
- Operational management
- M&E

**KEY QUESTIONS ADDRESSED**

- Agricultural census and crop statistics
- Screen for best intervention approach
- Select priority areas (hotspots)
- Impact of agricultural commodities expansion
- Quantify deforestation
- Identify underperforming areas
- Understand farming practices (seasons, crops)
- Determine timing of inputs/trainings/interventions
- Precision farming
- Up-to-date advice to farmers
- Determine the baseline
- Assess impact of interventions i.e. increase in productivity
Customized detailed land cover vs. freely available data

EO4SD 10 m resolution
high in detail
region/countrywide

ESA CCI 20 m resolution
generalized
continentwide (prototype)
Taï national park: Conflicts and politics displaced farmers. Farmers convert forest to cocoa, destroying high value conservation areas and affecting regional climate.
Crop intensity monitoring, Prey Veng (Cambodia)

Productivity crop intensity

2010

Productivity crop intensity

2015

Productivity crop intensity change

2010 until 2015

0 harvests
1 harvests
2 harvests
3 harvests

Increase
Decrease
Bekaa valley Lebanon: **Crop type (change)**

- **What crops do they grow?**
- **Did they change crop since the start of the project?**

**First crop**

*Increase in area under wheat and potato*

**2009**

**2017**

Detailed land cover map.
Credit: EO4SD Agriculture Cluster (eLEAF/FAO WaPOR)
Bekaa valley, Lebanon: **Start and end of 1st crop season 2017**

When do the farmers grow wheat and potato?

**Potato season:** April/May-July  |  **wheat season:** December-June

Detailed phenology.
Credit: EO4SD Agriculture Cluster (eLEAF/FAO WaPOR)
Back to Syria

Changes from 2011 (pre-conflict) to 2016 (in-conflict)

Cultivated area extent change

Changes from 2011 (pre-conflict) to 2016 (in-conflict)

Productivity (vegetation cover) change

Cultivated area: reduced by 64%

Agricultural productivity (vegetation cover): reduced by 36% (winter) and 47% (summer)

Irrigation: In 2016 only 4% of irrigation scheme was used for irrigated summer crops
Bolivia: crop type
Demonstration: crop performance
Demonstration: crop performance
Demonstration: crop performance
Changes in water stress 2013|2017

Clear change in distribution:
- Better access to water?
- Different type of crops?

Water stress similar to surrounding areas
Less water stress, clear irrigation infrastructure visible
Change Detection East Oweinat (South Egypt)
## Service fact sheet

<table>
<thead>
<tr>
<th>EO product</th>
<th>Land Cover / Deforestation</th>
<th>Cultivated area</th>
<th>biomass production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detail</td>
<td>high</td>
<td>medium/high</td>
<td>Field level &amp; regional</td>
</tr>
<tr>
<td>Period</td>
<td>Historic / NRT</td>
<td>Historic / NRT</td>
<td>Historic / NRT</td>
</tr>
<tr>
<td>Frequency</td>
<td>monthly/yearly/custom</td>
<td>monthly/quarterly/yearly</td>
<td>Daily/weekly/monthly/yearly/custom</td>
</tr>
<tr>
<td>Delivery type</td>
<td>Table/map/graph/report</td>
<td>Table/map/graph/report</td>
<td>Table/map/graph/report</td>
</tr>
<tr>
<td>Source</td>
<td>Open/Commercial</td>
<td>Open/Commercial</td>
<td>Open/Commercial</td>
</tr>
<tr>
<td>Cost range (USD)</td>
<td>1-5 USD/km2, minimum order size 34,000 USD</td>
<td>0.5 - 2.5 $ / km2 / year</td>
<td>1-10 USD/ha</td>
</tr>
</tbody>
</table>
Satellite EO for agricultural production mapping and monitoring

Satellite Earth Observation is a powerful technique for continuously assessing the status of agricultural production on a wide range of spatial and temporal scales.

It provides historical as well as actual global information on a regular basis, and thus can rapidly reveal where change has happened in a consistent, repeatable and unbiased manner.
Thank you very much

http://eo4idi.eu/
http://eo4idi.eu/publications

Data presented ready for download at
https://eo4sd.lizard.net/
Mentimeter Questions

• What type of service do you consider most valuable?

• Where do you see opportunities for these kind of services?