

→ EARTH OBSERVATION FOR SUSTAINABLE DEVELOPMENT

Agriculture and Rural Development

Progress Meeting EO4SD Agriculture Cluster
4-5 October 2017 | ESRIN, Frascati, Italy

Bolivia and Paraguay

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Introduction

Land tenure control issues (**soy, livestock**): unbridled expansion causing deforestation and ecosystem damage, (land degradation)

South: dry forest, North west: wetland

Objective

Support building of an '**environmental cadastre**',

Promote **land allocation**: agricultural expansion in least vulnerable areas,

Payment for **ecosystem functions (services)** approach

Approach

- IADB Rural Land Regularization and Titling Program (***Land Administration Program II***). IDB - BO-L1113
- GEF Taking Deforestation out of Commodity Supply Chains (Integrated Approach Pilot (**IAP**) **Commodities** program), implemented by UNDP's Green Commodities Programme.

Add EO-based information to the cadaster:

- Assess (historical and current) **land cover/habitat quality** and **deforestation** for land price estimation and planning of agricultural expansion;
- Assess (historical and current) **crop and pasture type** and monitor **crop performance** over time at the landscape level.

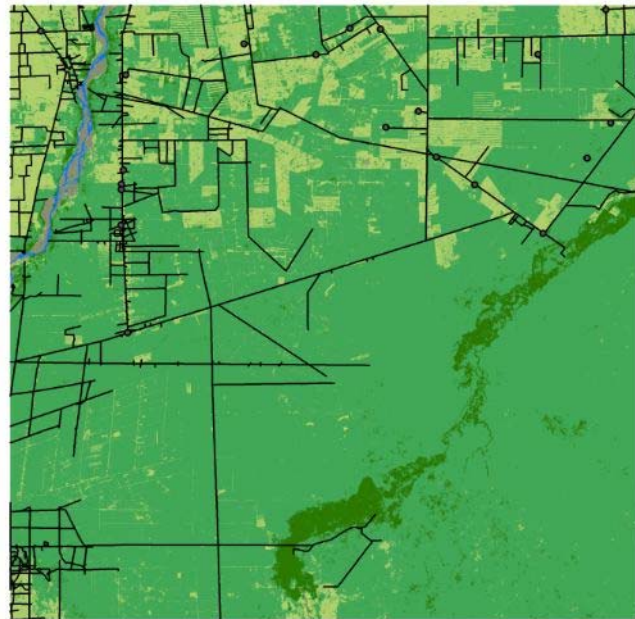
Stakeholders

- Bolivia: National Agrarian Reform Institute (**INRA**), Land and Forestry Agency (**ABT**), Ministry of Environment and Water (Ministerio de Medio Ambiente y Agua, **MMAyA**), farmer cooperation (**COA**), **IADB**
- Paraguay: National Forestry Agency (**INFONA**), **UNDP**, GEF
 - **Capabilities** are relatively **advanced** (e.g. use of Google Earth Engine)
 - Their needs: **more frequent** information and addition of **radar**
 - INRA will provide cadastre, COA will provide ground reference data
 - ABT and INFONA will contribute datasets and cooperate in mapping
 - IADB will act as liaison with government agencies, user of EO data for land price modelling

Description:

- Input data: 10-30m Sentinel-1, Sentinel-2, Landsat imagery
- Information (product/service):
 - Land cover and habitat quality (InVEST tool)
 - Crop type, intensity and performance
 - Deforestation
- Dissemination channel: geotif map data for use in ESRI geodatabase
- Feedback: very positive but early stage of project development
- Critical success factor: local interaction, translation into actionable info
- Critical issues and mitigation: none identified

Demonstration: Land allocation



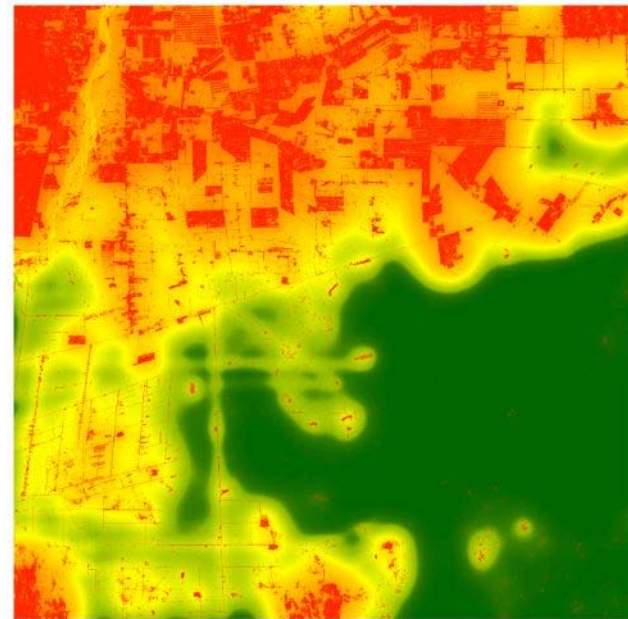
Land Cover

- Water
- Rock / Bare Soil
- Agriculture / Cattle
- Riparian forest
- Deciduous dry forest

— Road

• Populated place

0 5 10 20 km



Habitat Quality

High

Low

Habitat quality based on InVEST model.

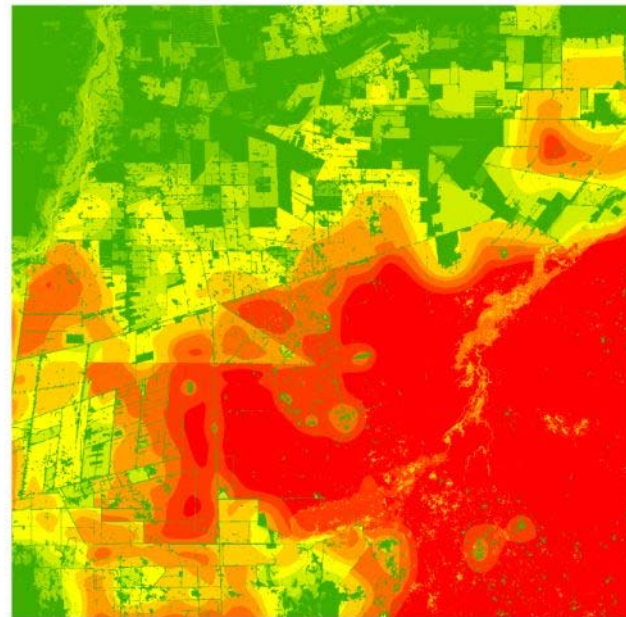
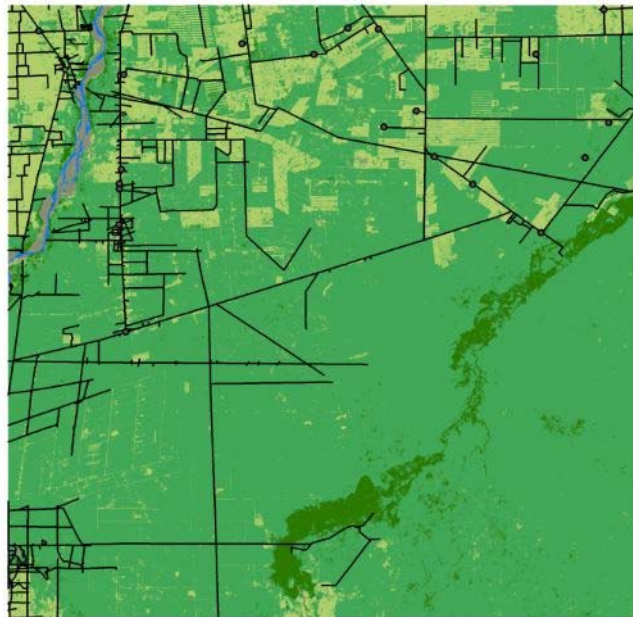


Support land allocation decisions

Habitat quality model of the Integrated Valuation of Ecosystem Service and Tradeoffs (InVEST) tool

Biodiversity value is related to the number of LC classes, but their ecological 'quality' is not considered

Demonstration: Land cover



Map indicating suitability for utilisation purposes

Advantage: first assessment and comparison of different landscapes and their variety.

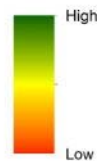
Support land allocation

Land Cover

- Water
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0 5 10 20 km

Site utilisation suitability



Integrated value based on habitat quality and patch size. Green areas indicate potential utilisation sites of low conservation value. Red indicates conservation priority sites not suitable for site utilisation.



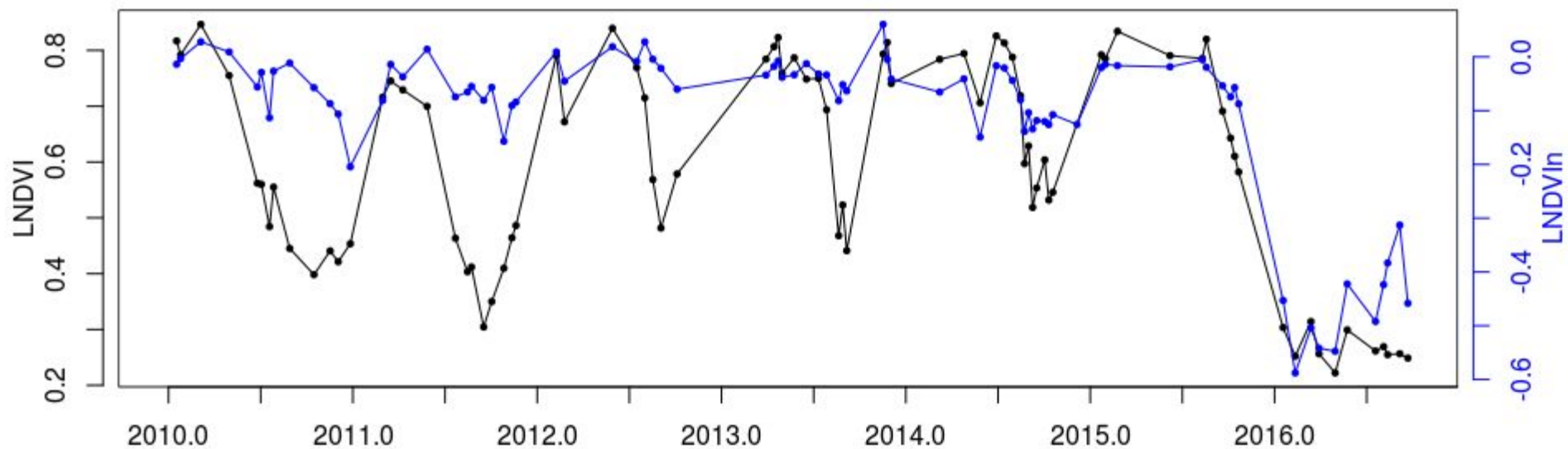
Example: Santa Cruz - Deforestation



Issue: **dry forest** leaf-off/browning: strong seasonal **signal fluctuations**

Requires special approach: image-wise **spatial normalisation**

Original **Landsat NDVI** and **spatially normalised Landsat NDVI**



Example: Santa Cruz - Deforestation



Example: Santa Cruz - Deforestation



Example: Santa Cruz - Deforestation



Example: Santa Cruz - Deforestation



Example: Santa Cruz - Deforestation



Example: Santa Cruz - Deforestation



2005

Example: Santa Cruz - Deforestation



Example: Santa Cruz - Deforestation



Example: Santa Cruz - Deforestation



Example: Santa Cruz - Deforestation



Example: Santa Cruz - Deforestation



Example: Santa Cruz - Deforestation



Example: Santa Cruz - Deforestation



Example: Santa Cruz - Deforestation



Example: Santa Cruz - Deforestation



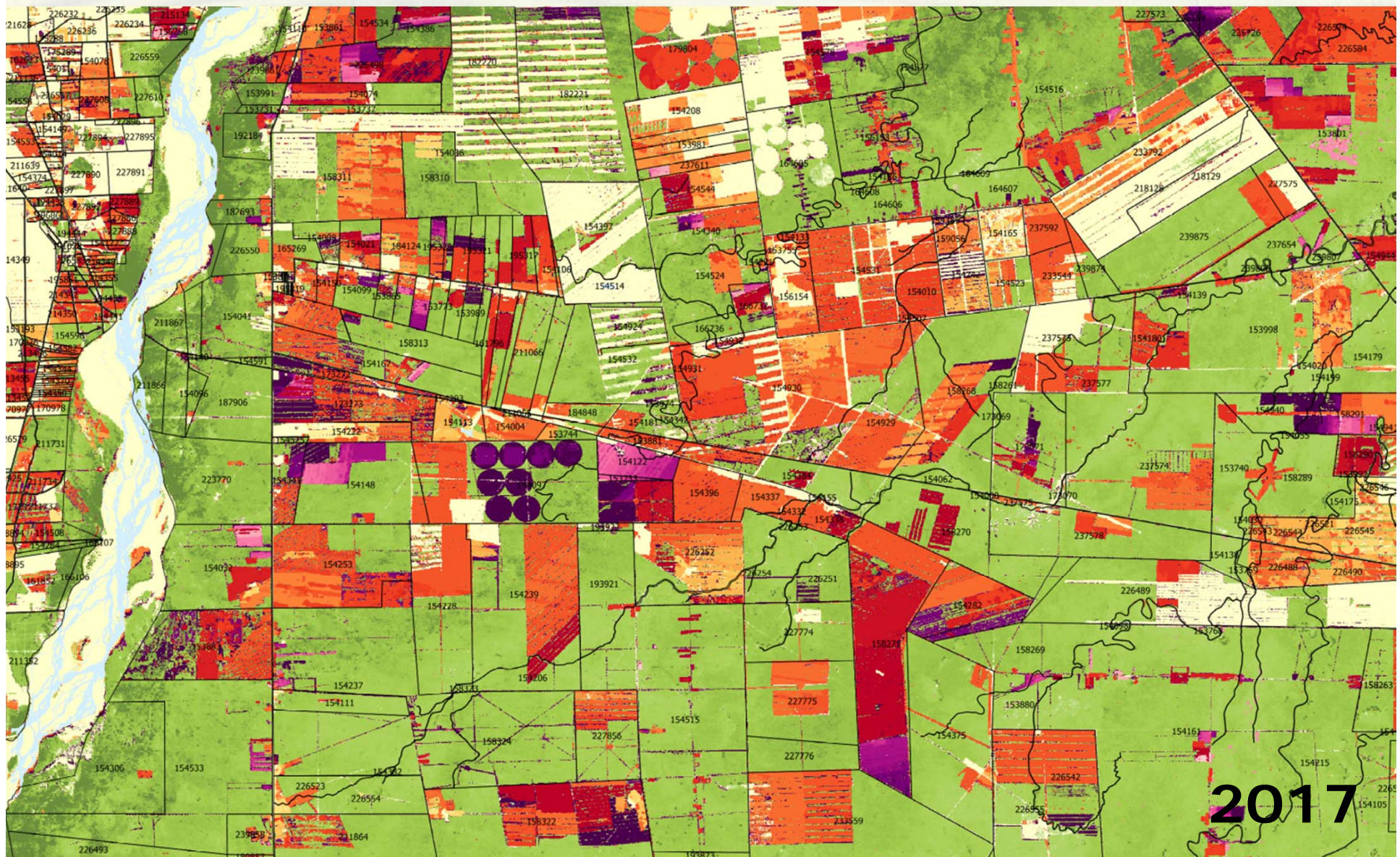
Example: Santa Cruz - Deforestation



Example: Santa Cruz - Deforestation



Example: Santa Cruz - Deforestation



Demonstration: cultivated area



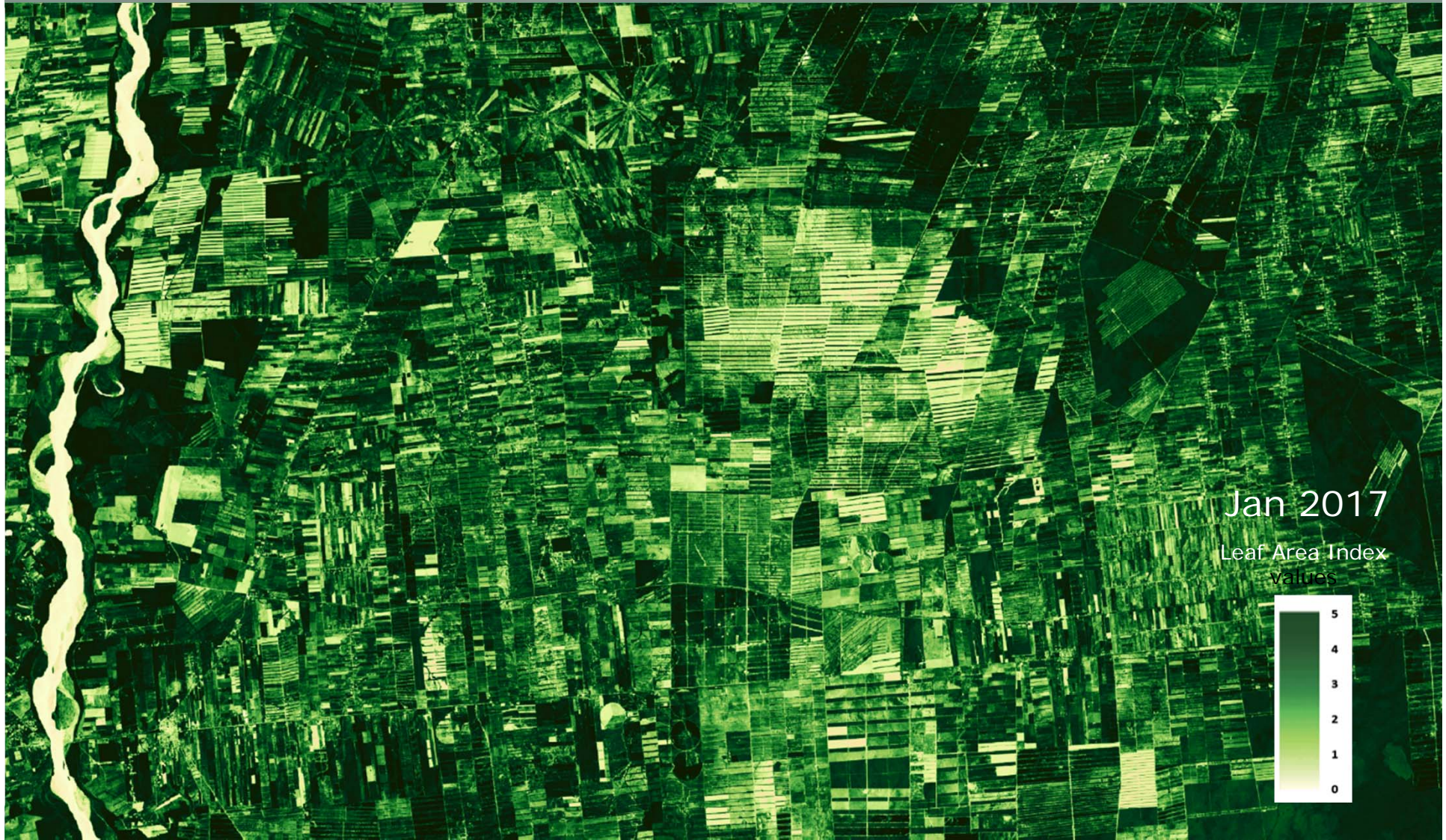
Sentinel-2 10m (Santa Cruz)



Result

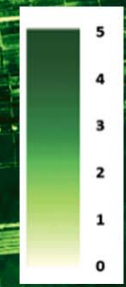
 Cultivated area

Demonstration: crop performance

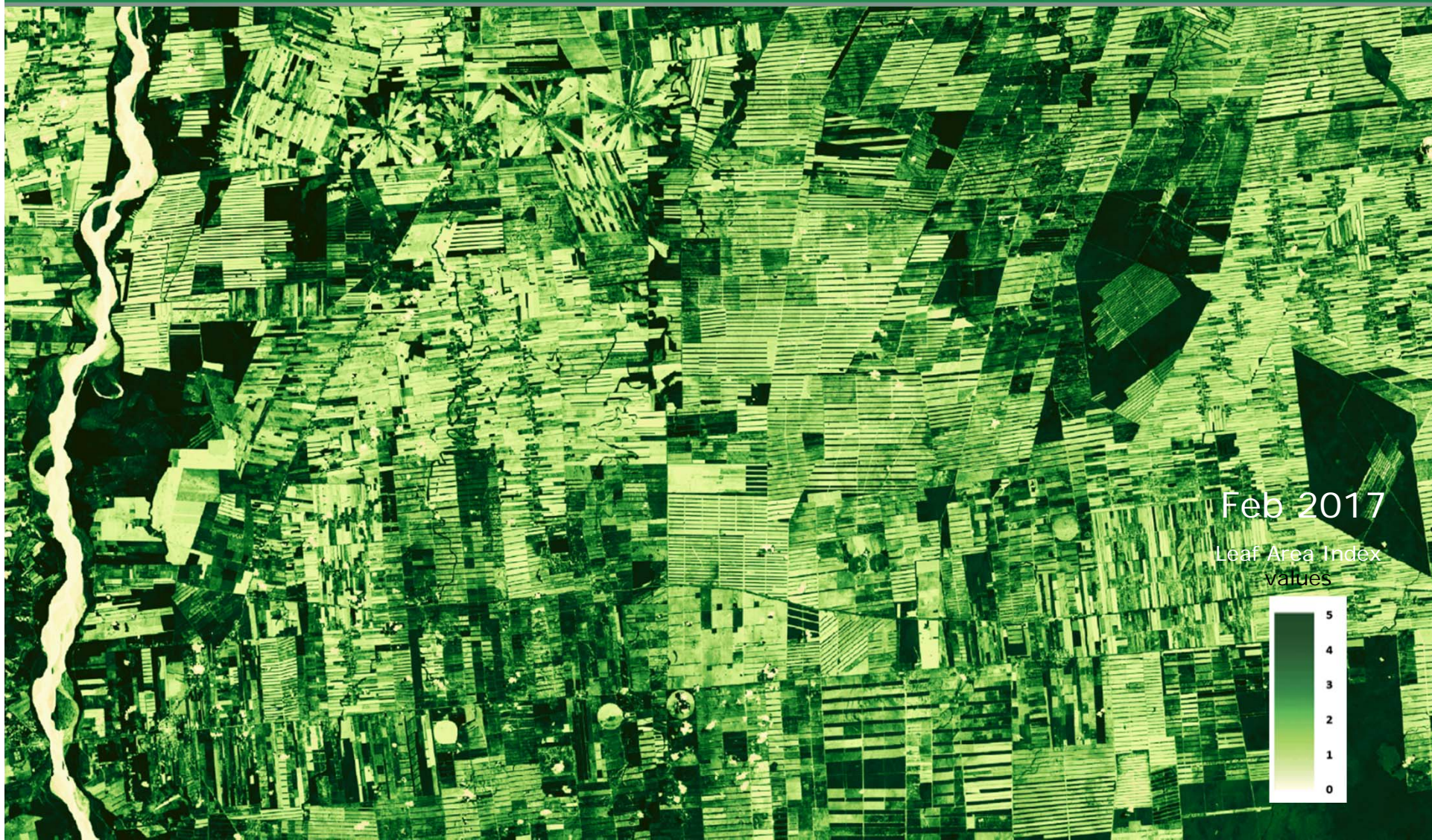


Jan 2017

Leaf Area Index
Values



Demonstration: crop performance

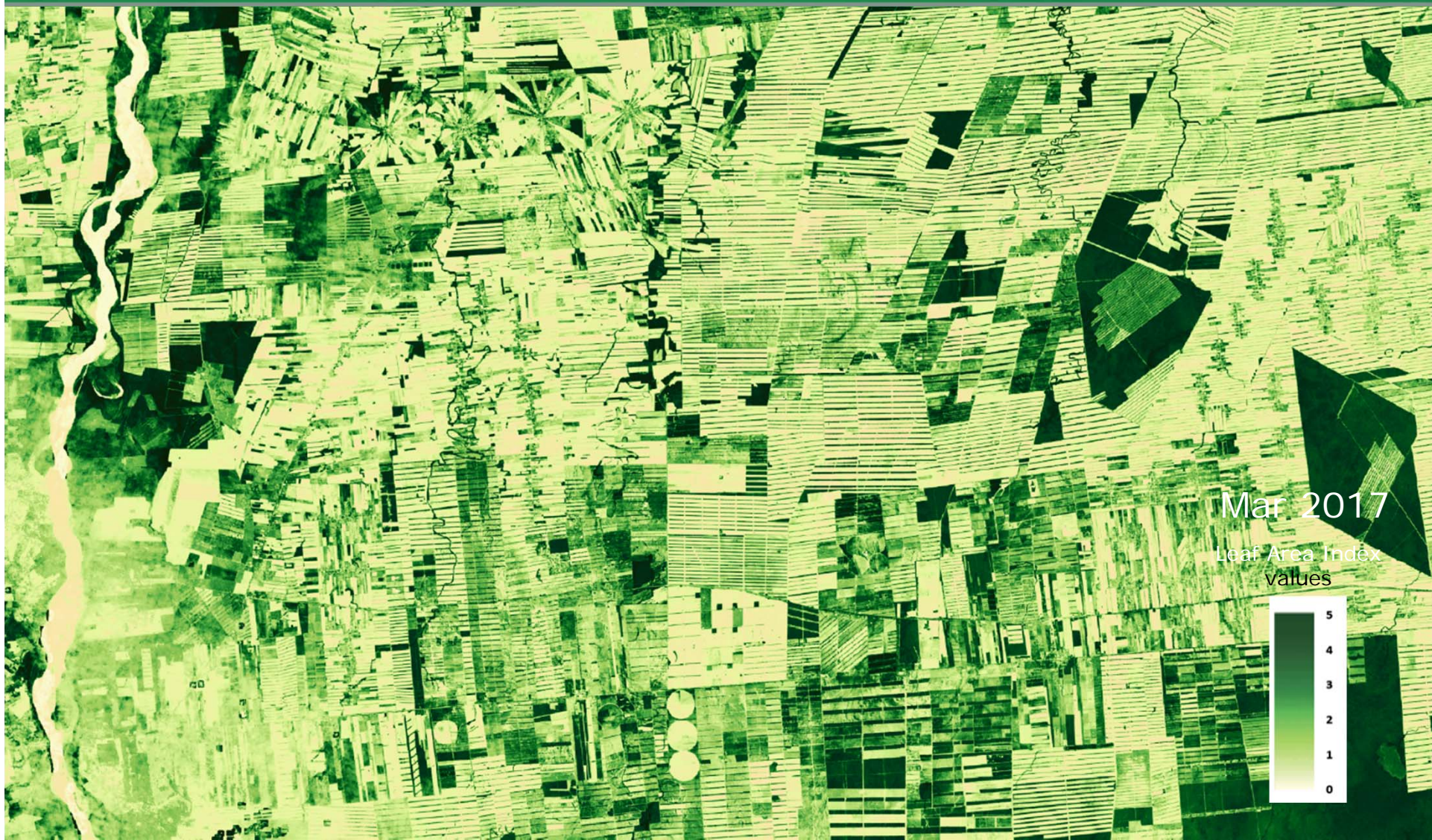


Feb 2017

Leaf Area Index
Values



Demonstration: crop performance



Mar 2017

Leaf Area Index
values



Future

- Operational monitoring of Santa Cruz province (Deforestation) and addition of Northern Paraguay
- Expansion of all products to Cochabamba province
- Spin off: further application **Paraguay, Peru, Regional (GEF/ IAP)**

