Using Remote Sensing for an Ecologically Oriented Development in the Aral Sea Region – Examples from Different Sectors

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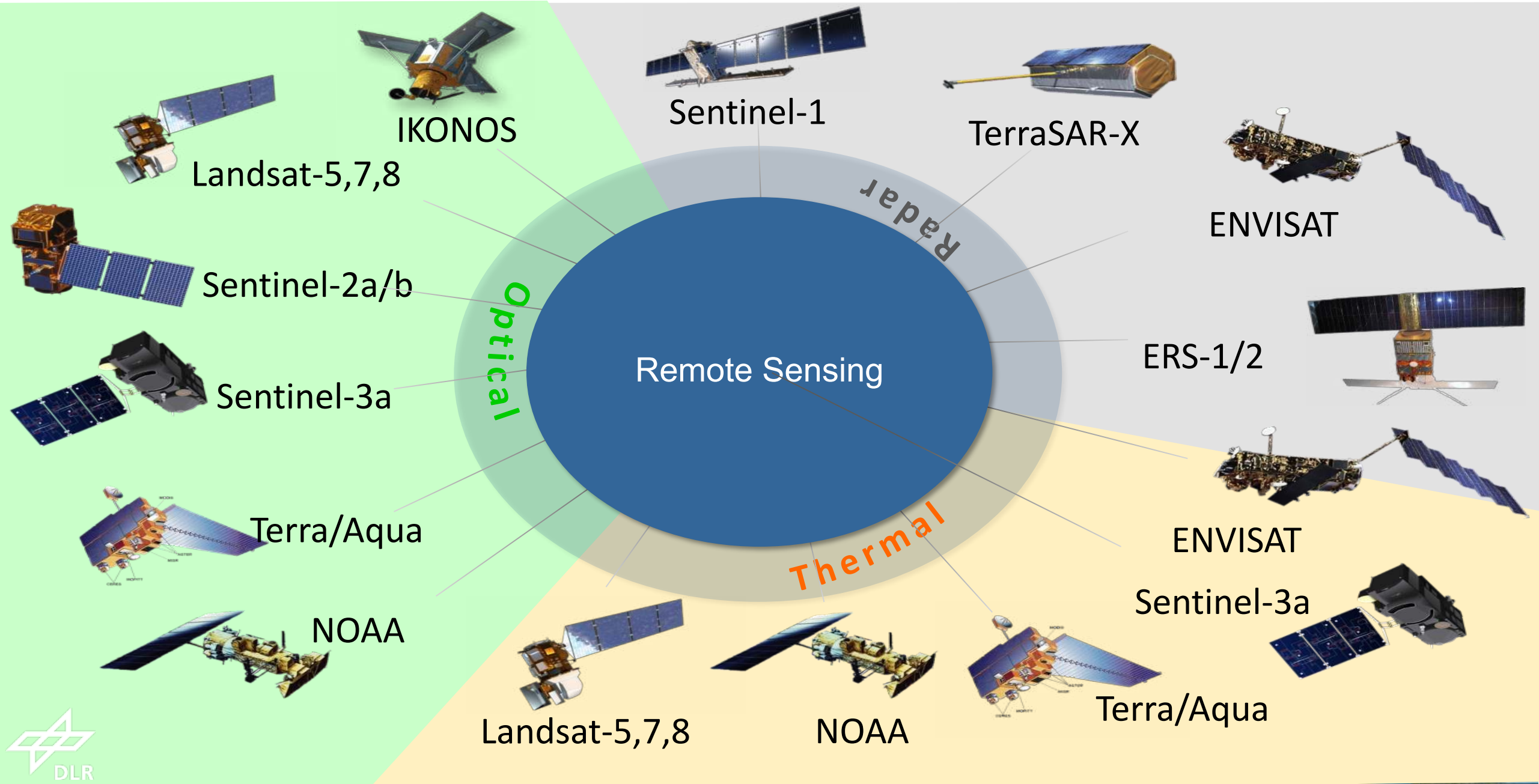
Ecologically oriented development

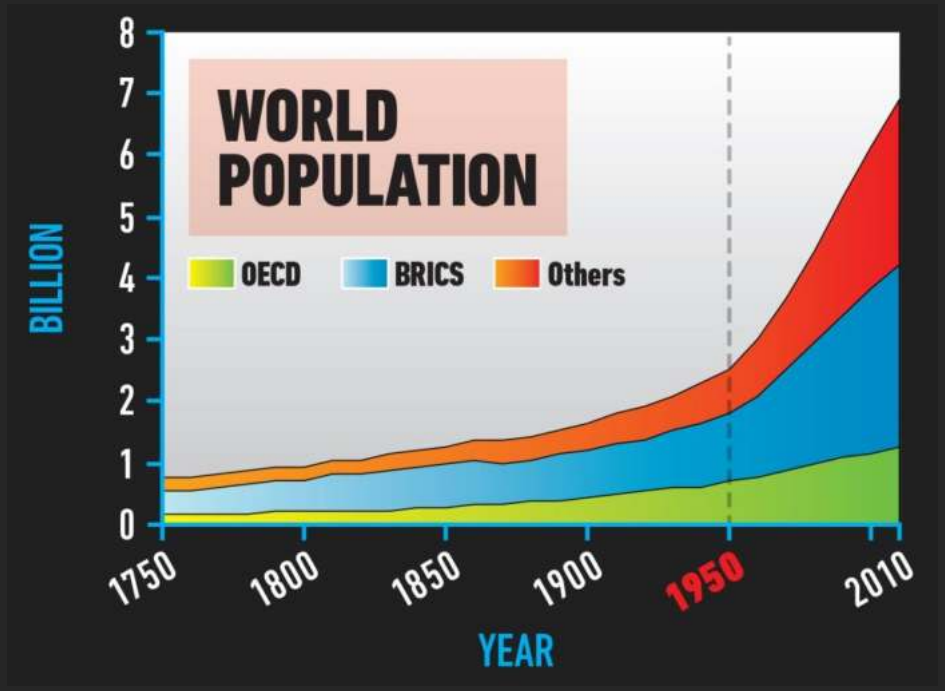
- **Earth observation-based monitoring and spatial planning** to achieve and support 10 measures for ecologically sustainable resource use (4 cross borders).

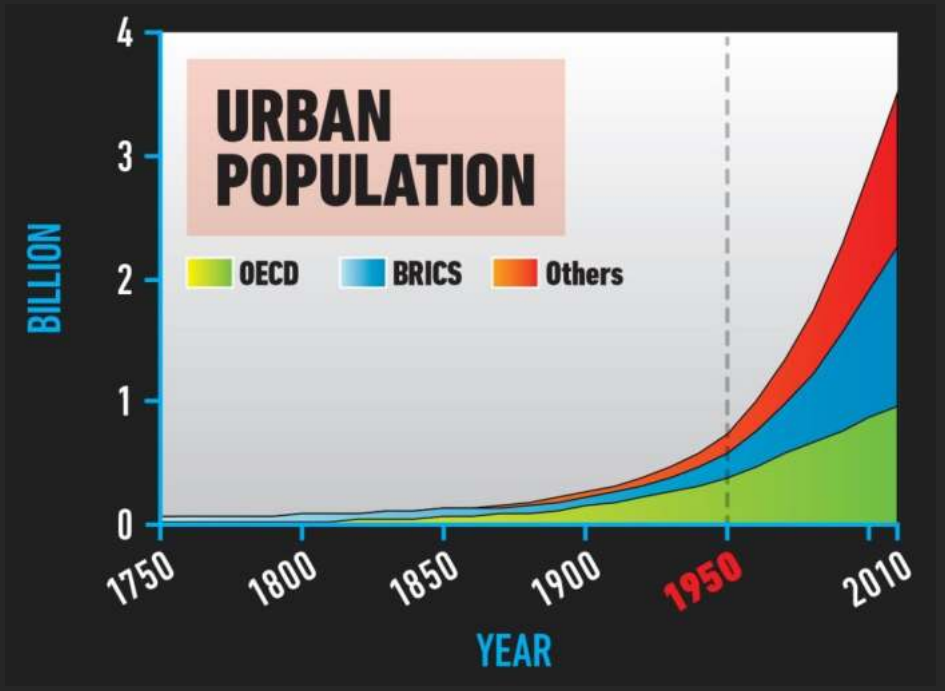
- **Potential disciplines**: Water resource management, climate change adaptation, agriculture and forestry, landscape and infrastructure development, nature conservation, and sustainable economic development including tourism.

- **Measures include**, e.g., resource-conserving agricultural cultivation techniques, cultivation of climate-resilient crops and woody plants, increasing energy efficiency, soil protection and rehabilitation, agri-environmental and ecological compensation measures, establishing ecological corridors or biotope networks etc.


Optical
Radar
Thermal
Remote Sensing
IKONOS
Landsat-5,7,8
Sentinel-2a/b
Sentinel-3a
Terra/Aqua
NOAA
Sentinel-1
TerraSAR-X
ENVISAT
ERS-1/2
ENVISAT
Sentinel-3a
Terra/Aqua
Landsat-5,7,8
NOAA
DLR

Global Change – Context for project „Infrasturcture“



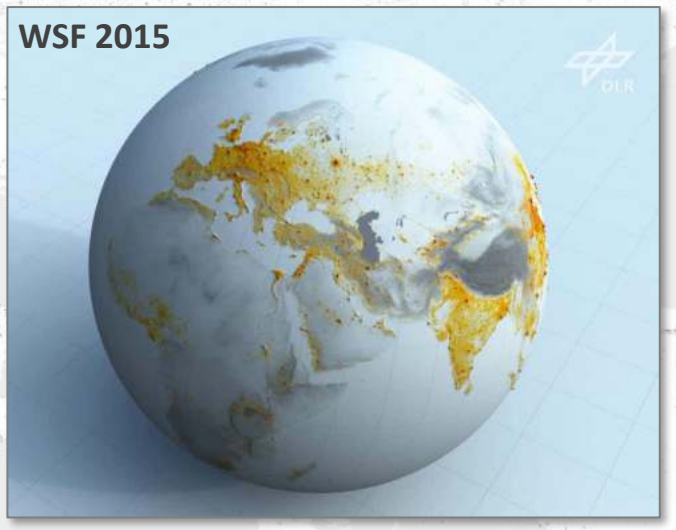


Steffen *et al.* The trajectory of the Anthropocene: The Great Acceleration (*Anthropocene Review)* 16 January 2015. Design: Globaia

Tracing Global Urbanization – New Data from Space

- ***Global Urban Footprint (GUF)***
  - Data base: 182,249 TerraSAR-X/TanDEM-X images (3m) collected in 2012 (308 TB)
  - Spatial resolution: 12 m (scientific use), 84m (non-profit use)
  - Release: November 2016
  - Users: >300 institutions from 43 countries

- ***World Settlement Footprint (WSF)***
  - Use of free and open data
  - Multi-sensor (Sentinel-1, Landsat/Sentinel-2)
  - Multi-date (use of all scenes acquired)
  - Multi-facility (DLR, U-TEP, GEE)



Esch, T.; Heldens, W.; Hirner, A.; Keil, M.; Marconcini, M.; Roth, A.; Zeidler, J.; Dech, S.; Strano (2017): Breaking new ground in mapping human settlements from space – The Global Urban Footprint. ISPRS Journal of Photogrammetry and Remote Sensing 134, 30-42.


Shanghai
1985
WSF Evolution


Shanghai
1990
WSF Evolution

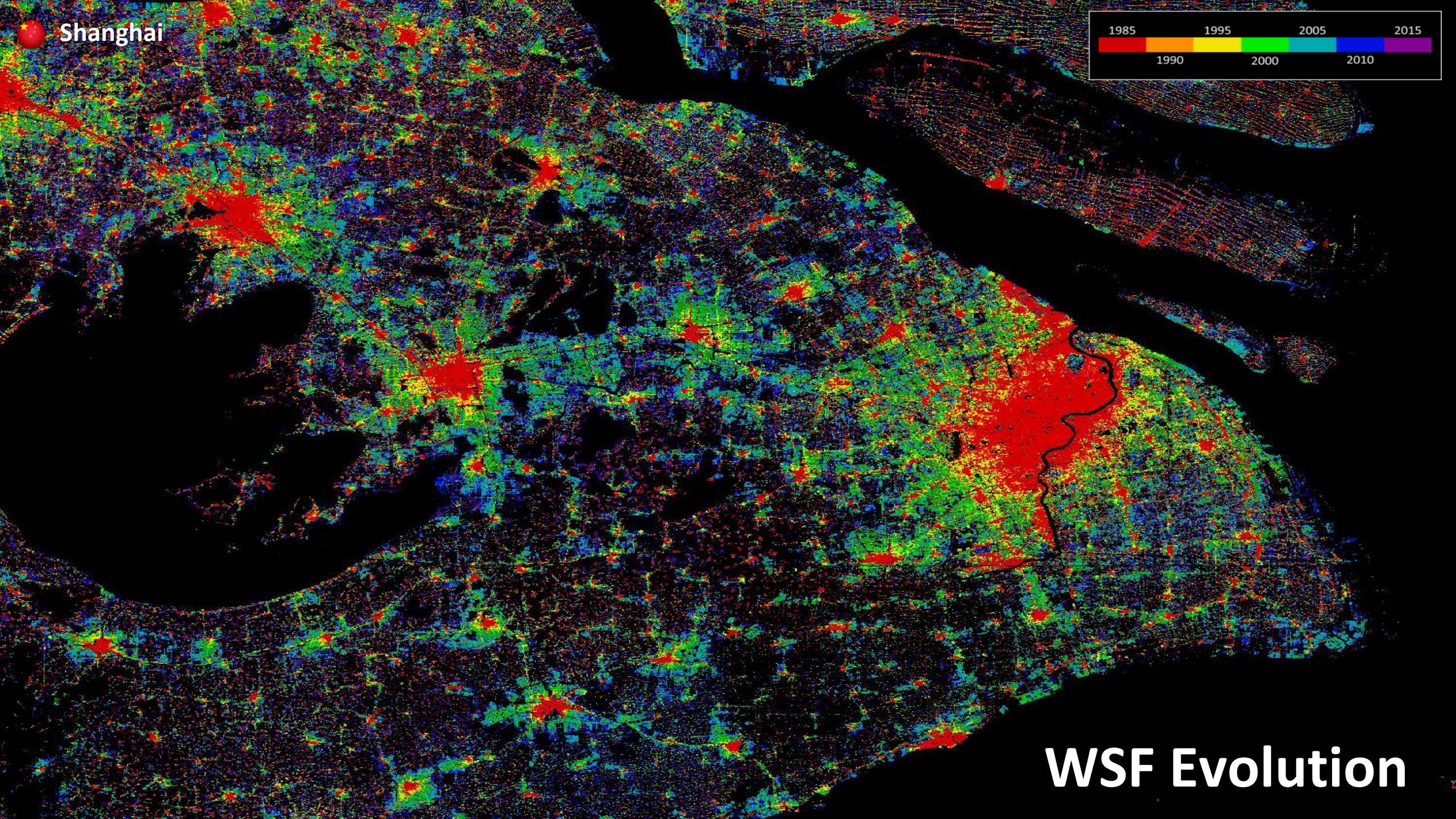

Shanghai
1995
WSF Evolution


Shanghai
2000
WSF Evolution

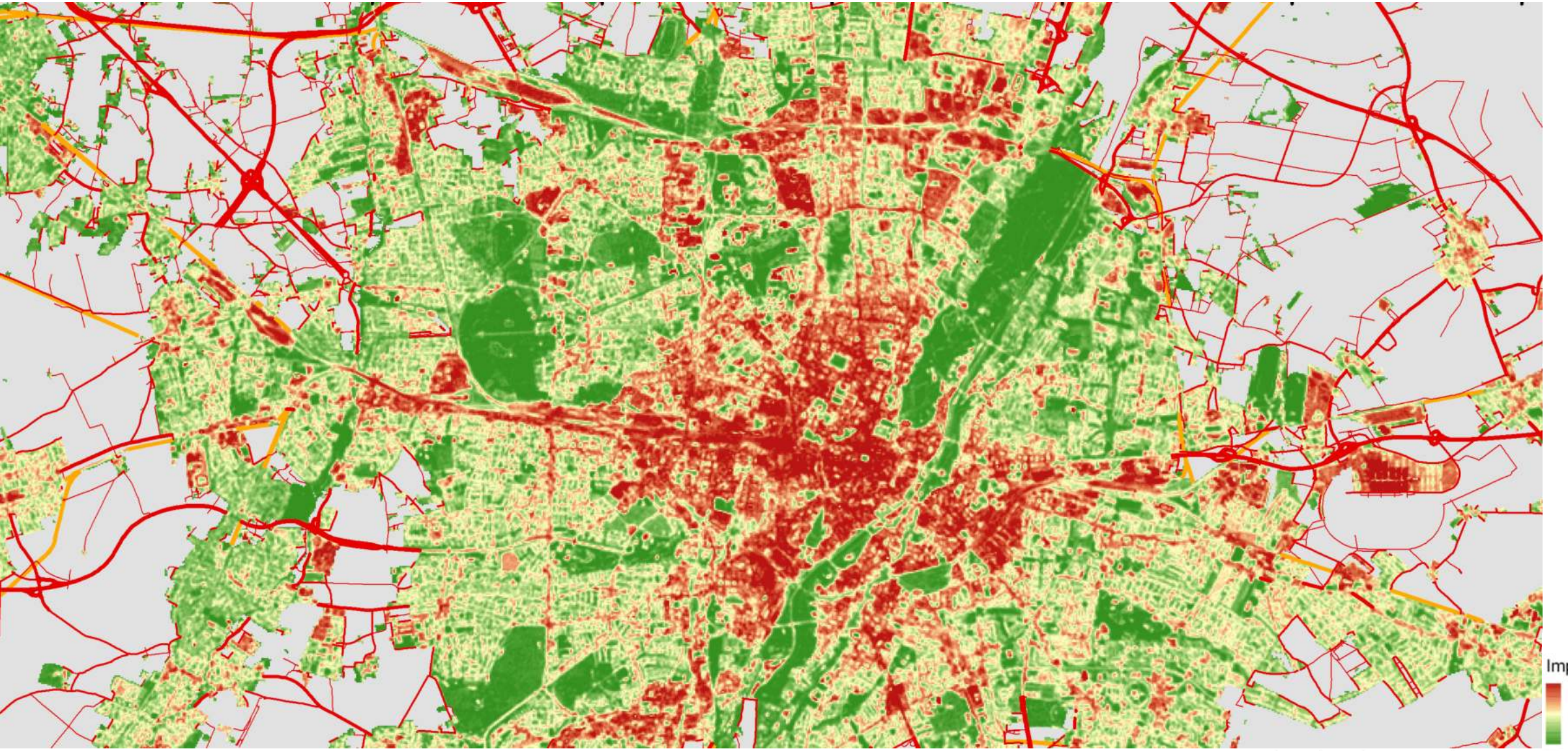

Shanghai
2005
WSF Evolution


Shanghai
2010
WSF Evolution


Shanghai
2015
WSF Evolution


Shanghai
1985
1990
1995
2000
2005
2010
2015
WSF Evolution

Imperviousness Munich

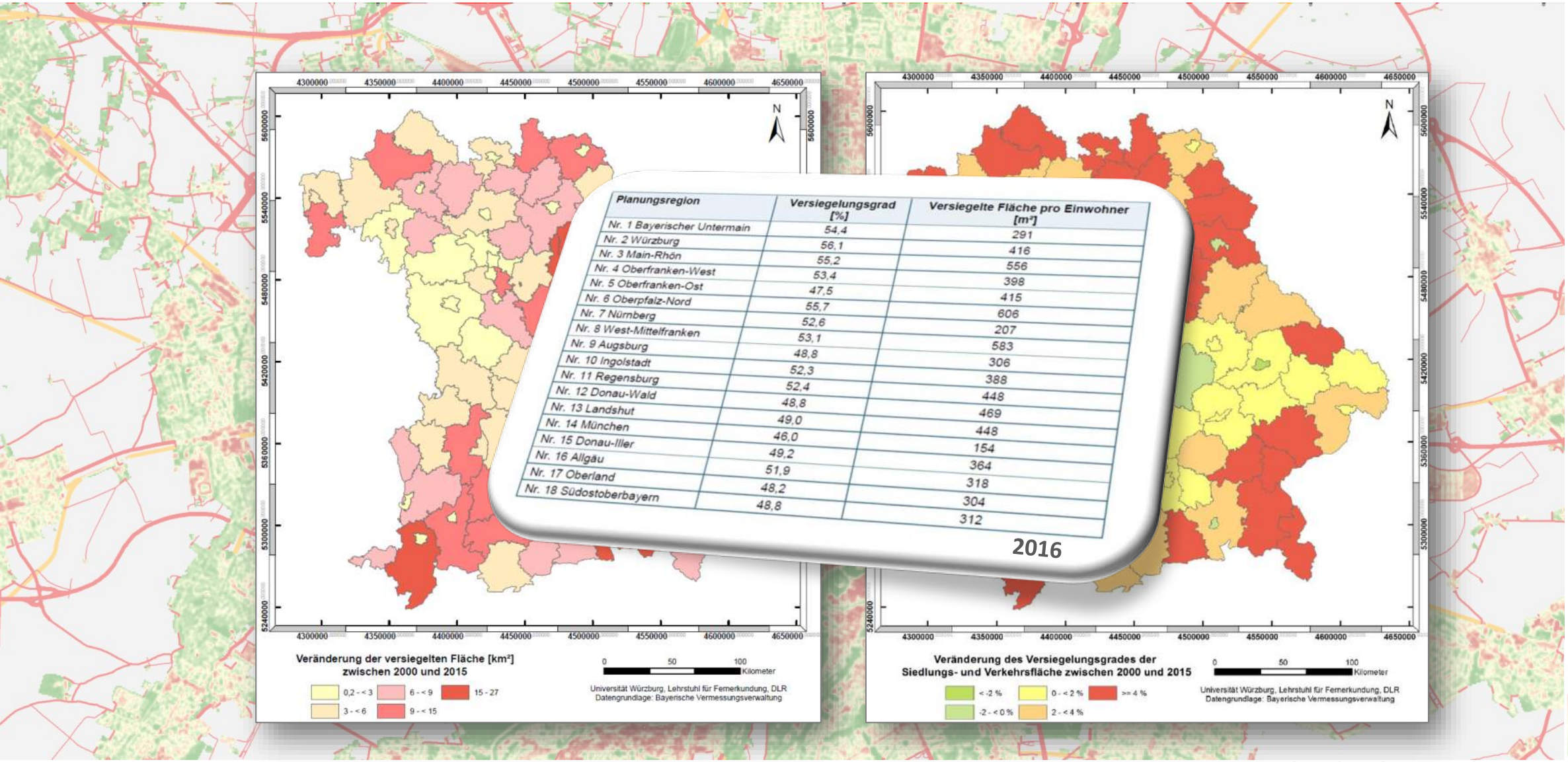


Üreyen, S.; Marconcini, M.; Esch T.: Characterizing Spatial Distribution and Dsity of Impervious Surface Area – From Local to Global Scale (in prep.)

Üreyen, S.; Thiel, M. (2017): Satellitengestützte Erfassung der Bodenversiegelung in Bayern 2015. Bayerisches Landesamt für Umwelt (LfU).

Esch, T., Himmler, V., Schorcht, G., Thiel, M., Conrad, C., Wehrmann, T., Bachofer, F., Schmidt, M., Dech, S. (2009): Large-area Assessment of Impervious Surface based on integrated analysis of Single-date Landsat-7 Images and Geospatial vector Data. – In: Remote Sensing of Environment, Vol. 113 (2009), issue 8, pp. 1678 - 1690.

Imperviousness – Monitoring and Trends



Planungsregion	Versiegelungsgrad [%]	Versiegelte Fläche pro Einwohner [m²]
Nr. 1 Bayerischer Untermain	54,4	291
Nr. 2 Würzburg	56,1	416
Nr. 3 Main-Rhön	55,2	556
Nr. 4 Oberfranken-West	53,4	398
Nr. 5 Oberfranken-Ost	47,5	415
Nr. 6 Oberpfalz-Nord	55,7	606
Nr. 7 Nürnberg	52,6	207
Nr. 8 West-Mittelfranken	53,1	583
Nr. 9 Augsburg	48,8	306
Nr. 10 Ingolstadt	52,3	388
Nr. 11 Regensburg	52,4	448
Nr. 12 Donau-Wald	48,8	469
Nr. 13 Landshut	49,0	448
Nr. 14 München	46,0	154
Nr. 15 Donau-Iller	49,2	364
Nr. 16 Allgäu	51,9	318
Nr. 17 Oberland	48,2	304
Nr. 18 Südostoberbayern	48,8	312

2016

Üreyen, S.; Marconcini, M.; Esch T.: Characterizing Spatial Distribution and Dsity of Impervious Surface Area – From Local to Global Scale (in prep.)

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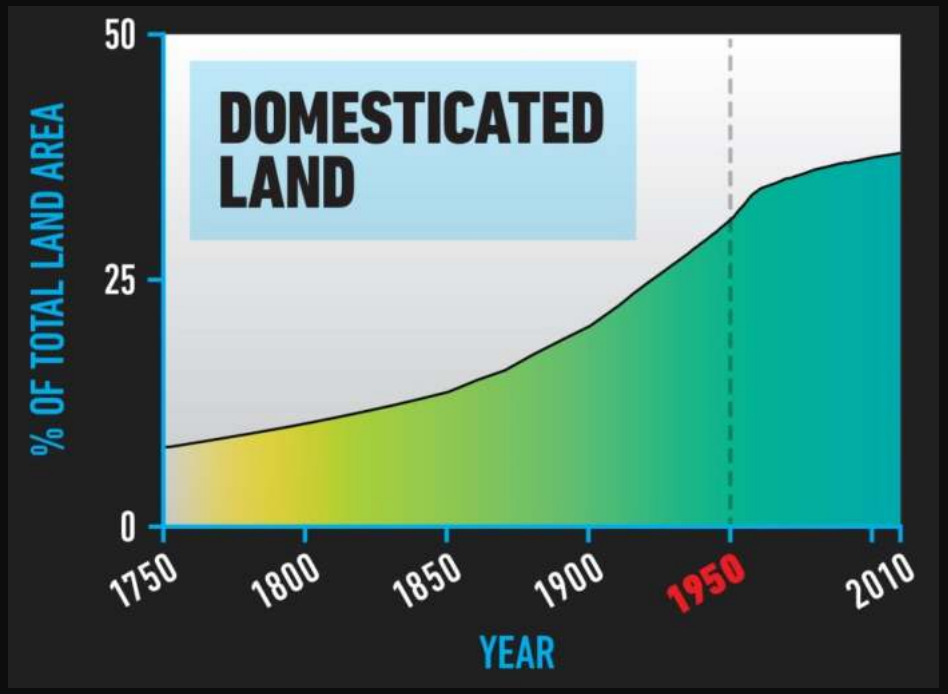
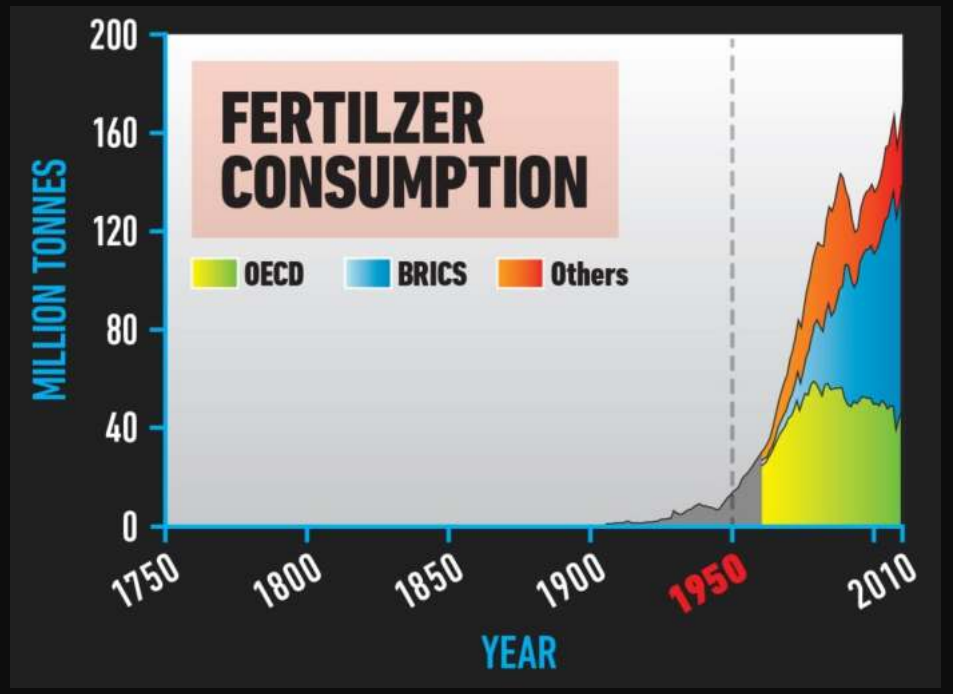
Global Change - Context for project „Agriculture“





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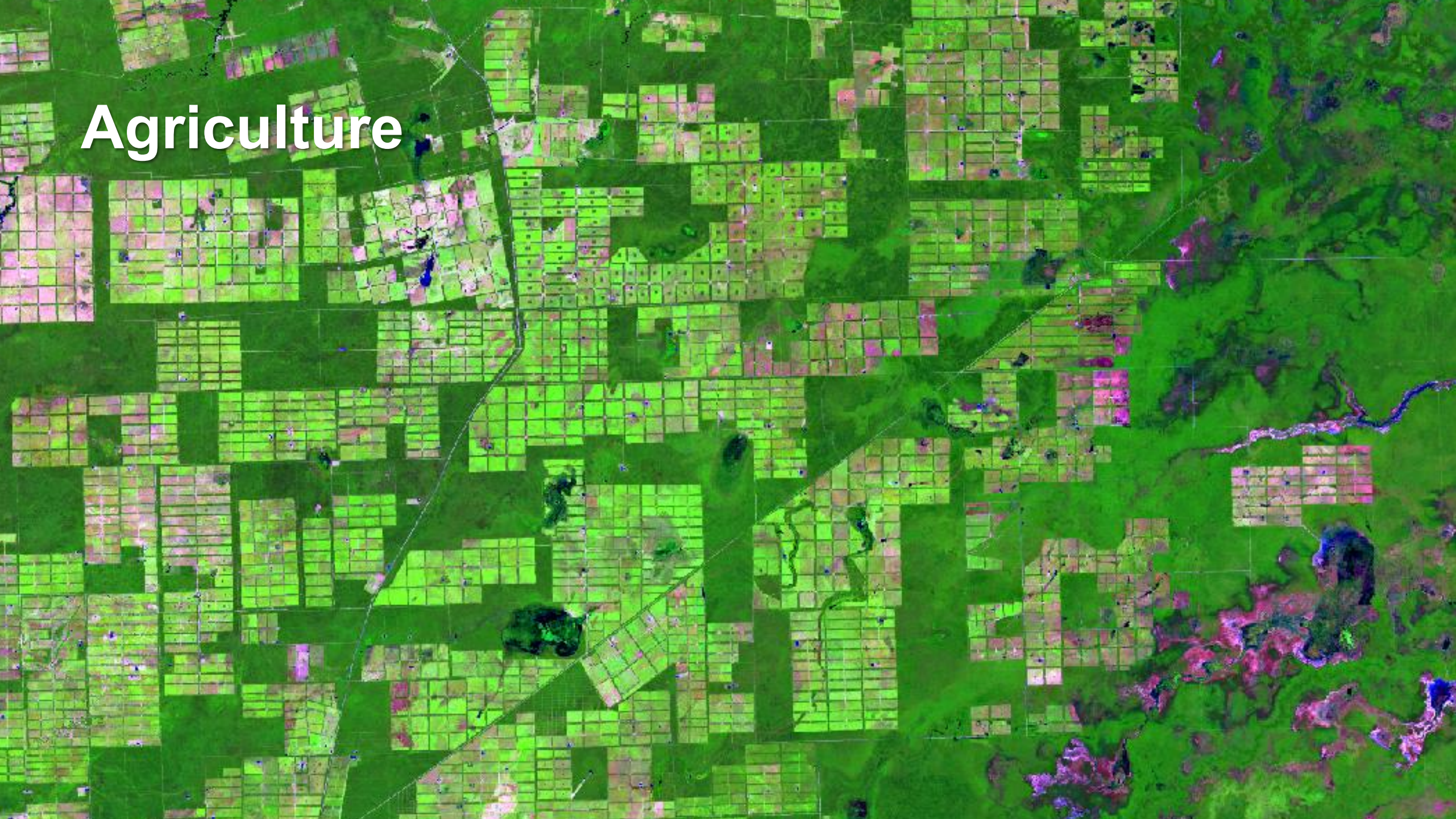
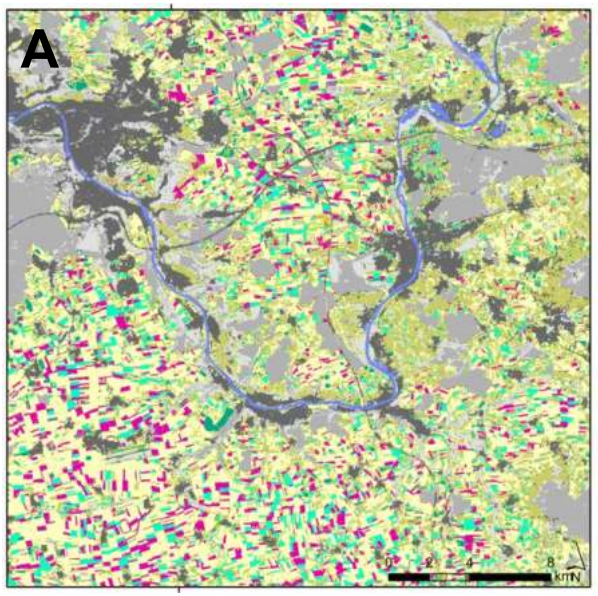
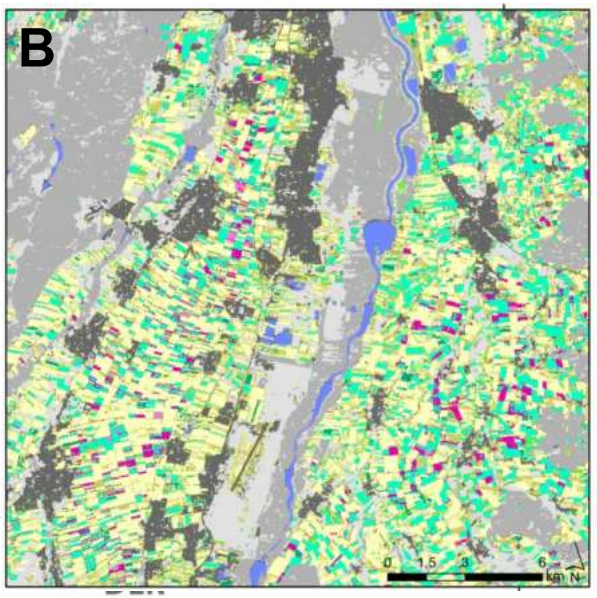
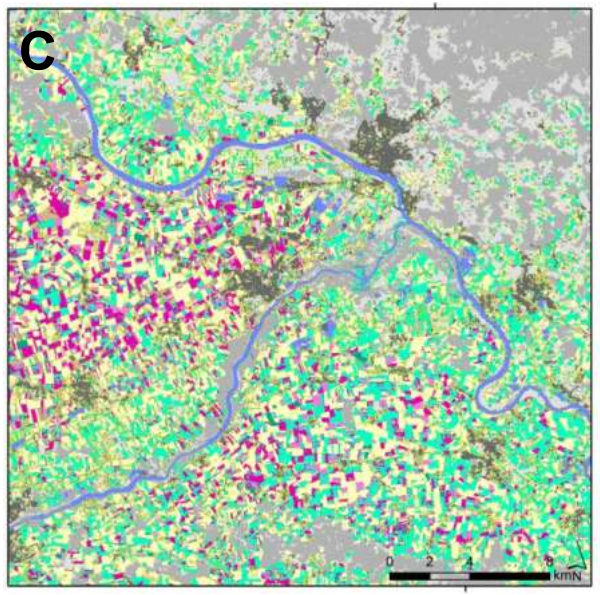

Agriculture

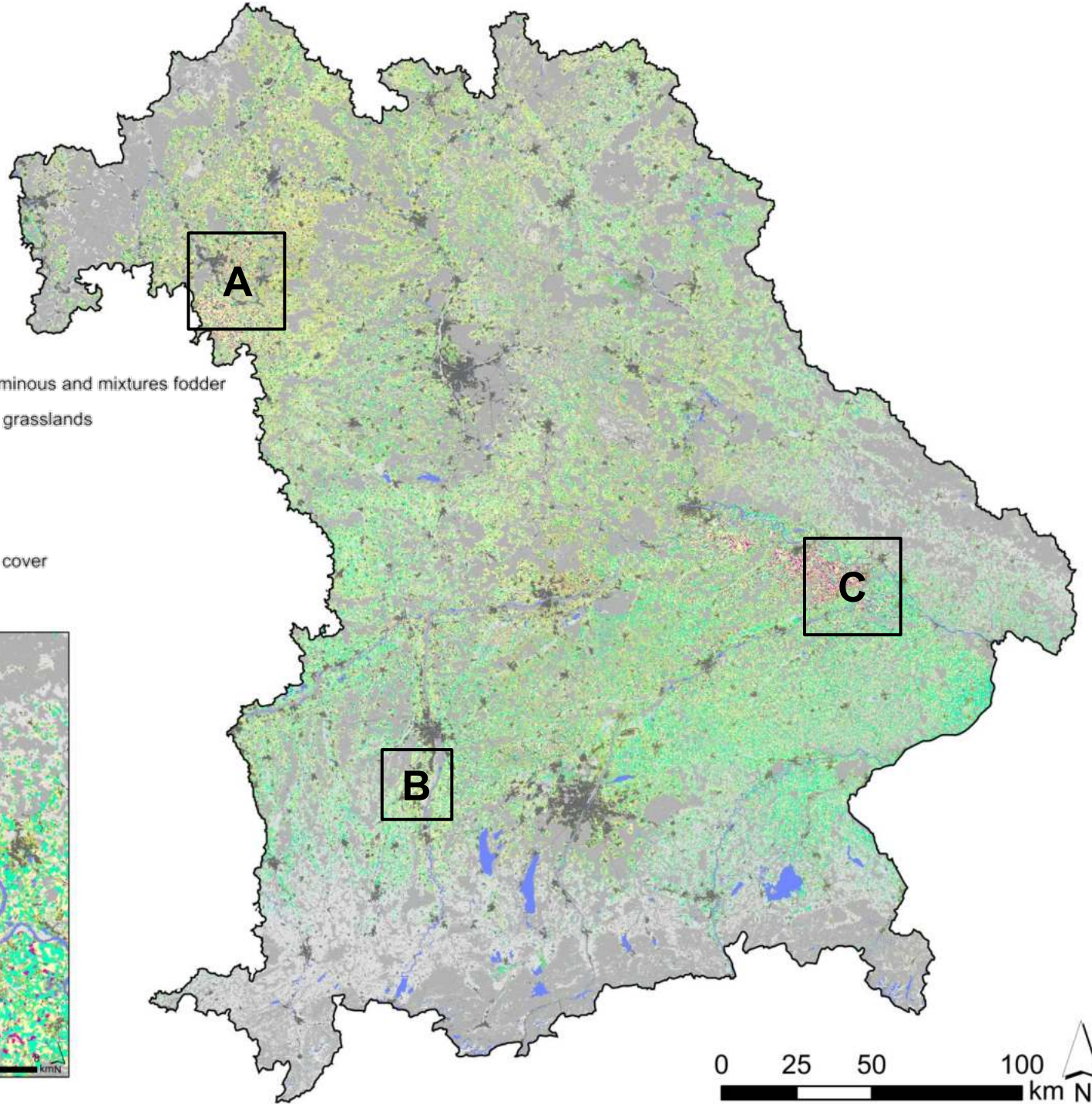
Croptype mapping

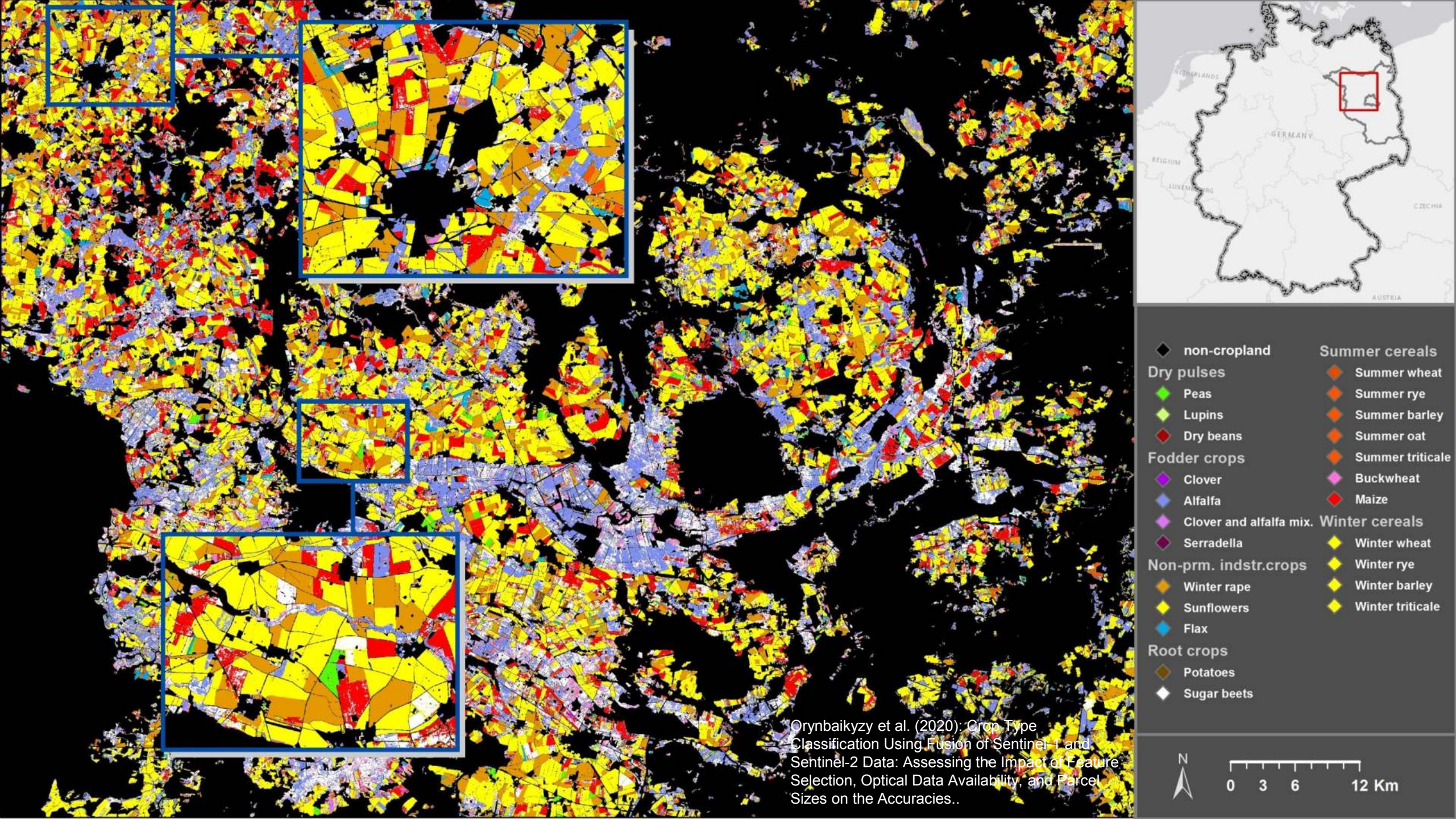




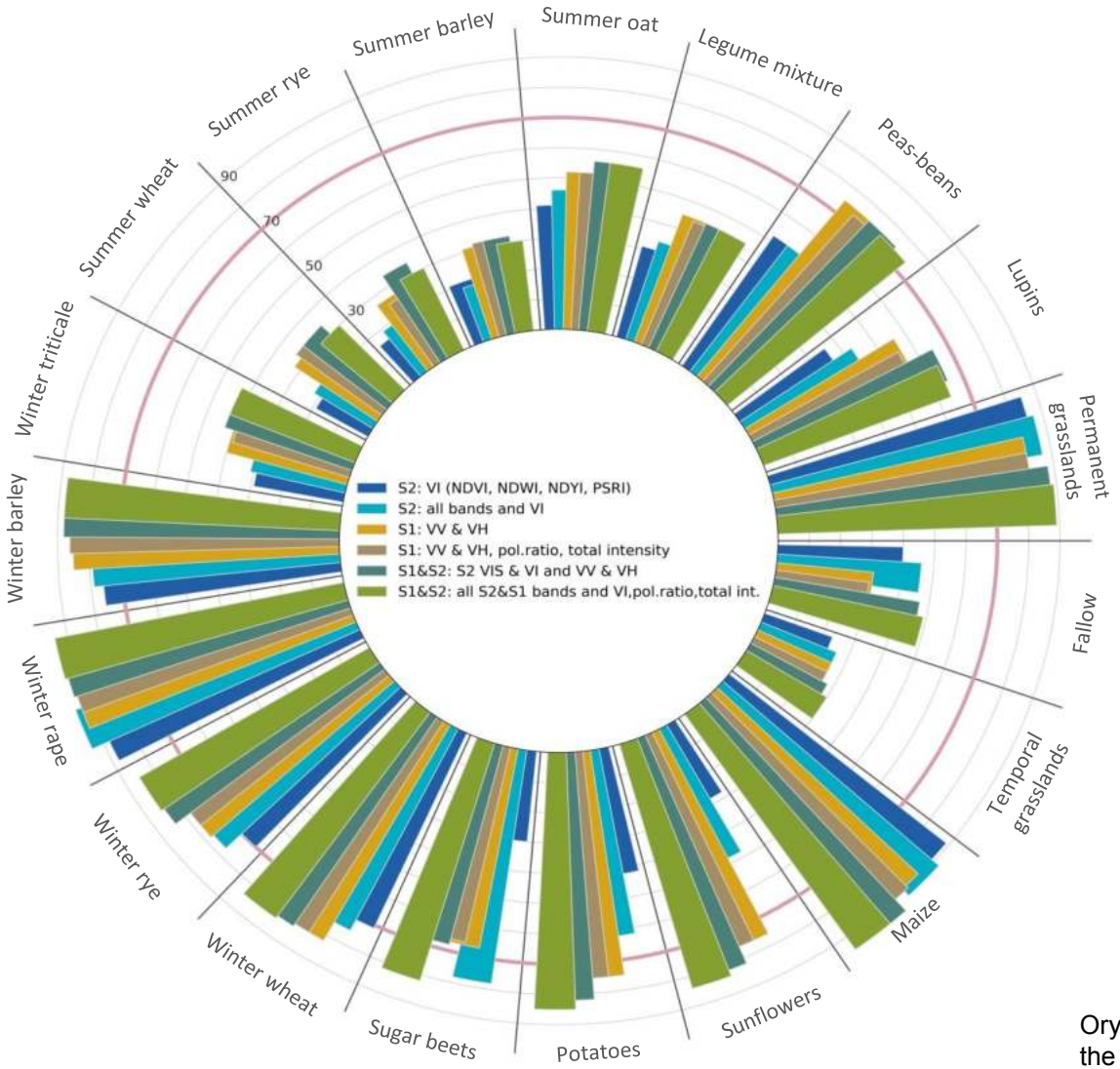


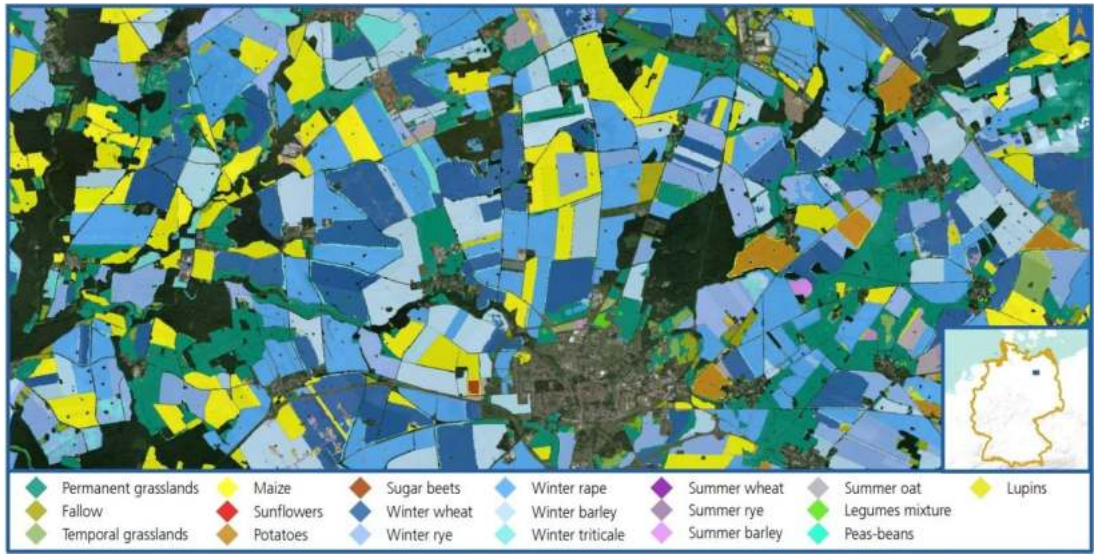
common wheat
barley
rye
triticale
maize
potatoes
sugar beet
rape and turnip rape
dry pulses
clovers
other leguminous and mixtures fodder
temporary grasslands
fruit trees
built-up
forests
other land cover
water




GERMANY
BELGIUM
CZECHIA
AUSTRIA
non-cropland
Dry pulses
Peas
Lupins
Dry beans
Fodder crops
Clover
Alfalfa
Clover and alfalfa mix.
Serradella
Non-prm. indstr.crops
Winter rape
Sunflowers
Flax
Root crops
Potatoes
Sugar beets
Summer cereals
Summer wheat
Summer rye
Summer barley
Summer oat
Summer triticale
Buckwheat
Maize
Winter cereals
Winter wheat
Winter rye
Winter barley
Winter triticale
Orynbaikyzy et al. (2020): Crop Type Classification Using Fusion of Sentinel-1 and Sentinel-2 Data: Assessing the Impact of Feature Selection, Optical Data Availability, and Parcel Sizes on the Accuracies..
N
0 3 6 12 Km

Crop specific accuracies (f1-score) for various classification approaches

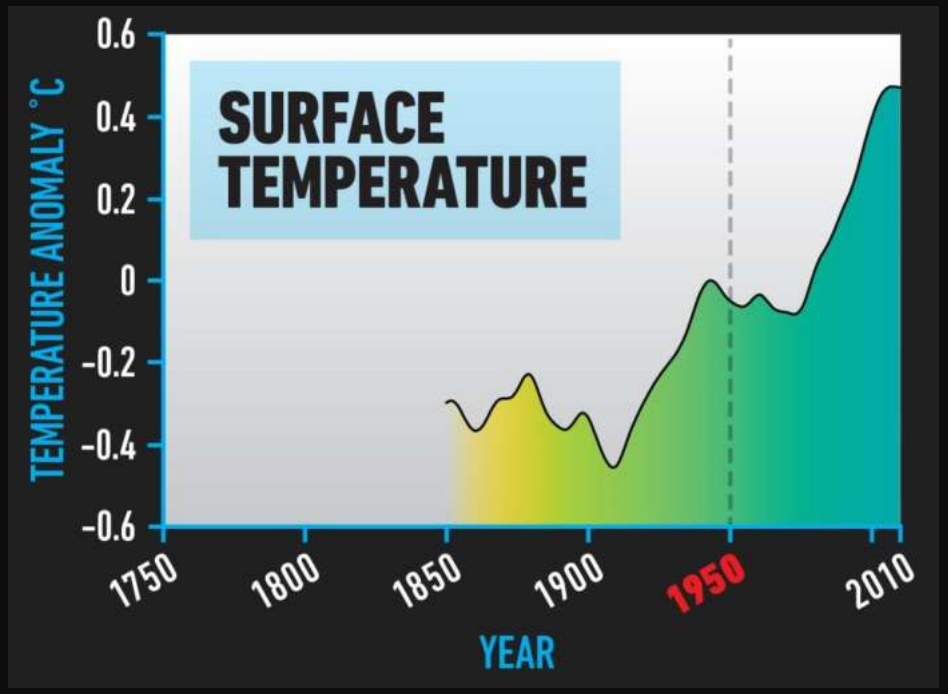




Example of classification map in the study site

Orynbaikyzy et al. (2020): Crop Type Classification Using Fusion of Sentinel-1 and Sentinel-2 Data: Assessing the Impact of Feature Selection, Optical Data Availability, and Parcel Sizes on the Accuracies..

Global Change - Context for project „Climate change adaptation“



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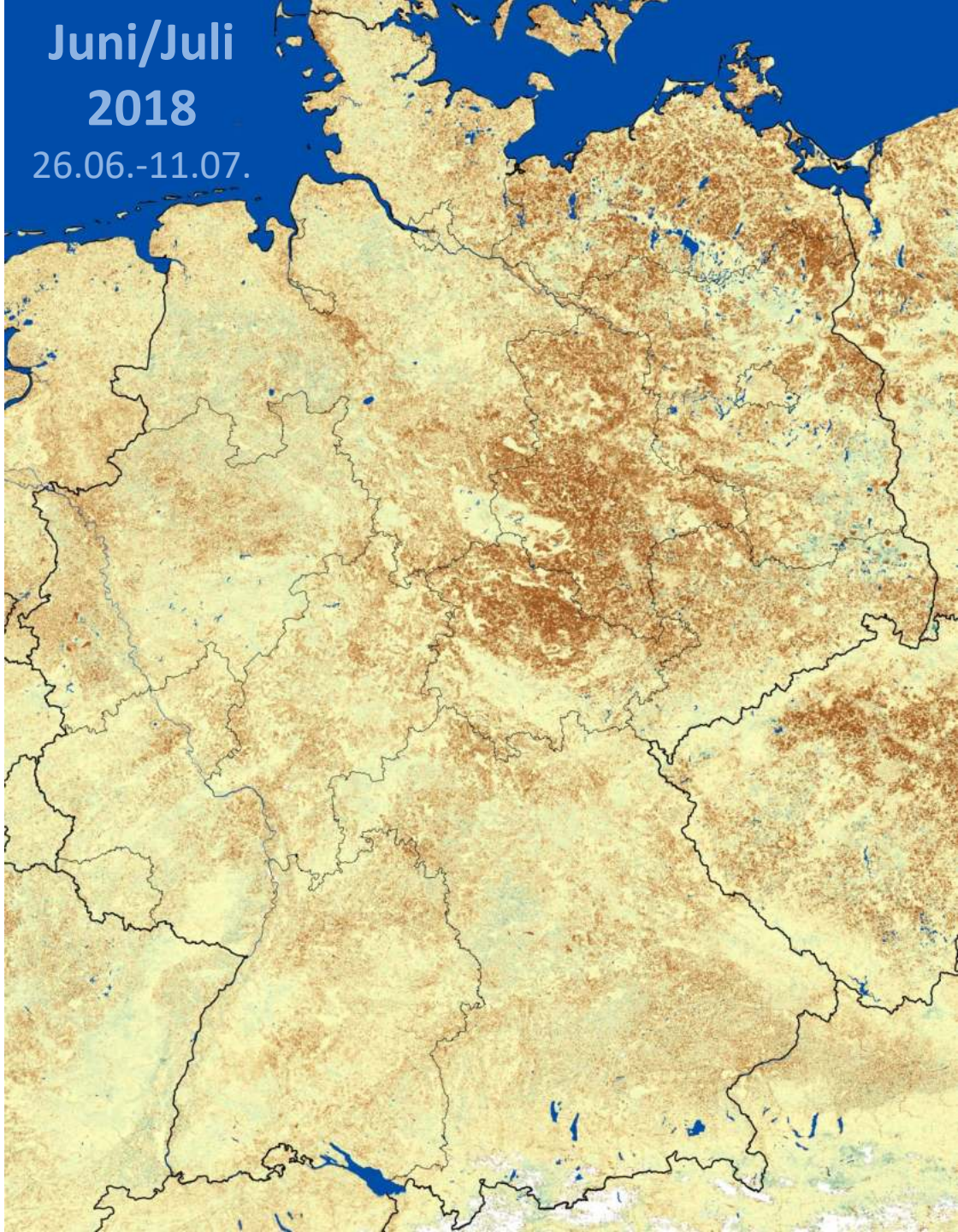
Monitoring and assessment of droughts and heat waves



Reinermann, S.; Gessner, U.; Asam, S. Kuenzer, C. Dech, S. (2019): Extreme Hot and Dry Summers in Germany - Analysis of Long-term Earth Observation Time Series of Vegetation Condition.

Monitoring and assessment of droughts and heat waves

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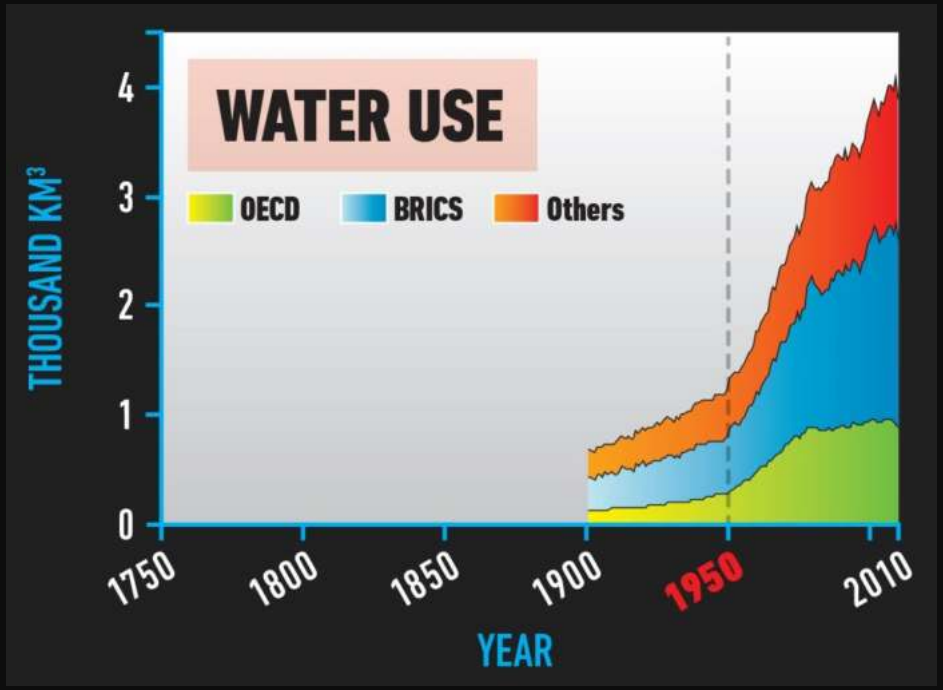
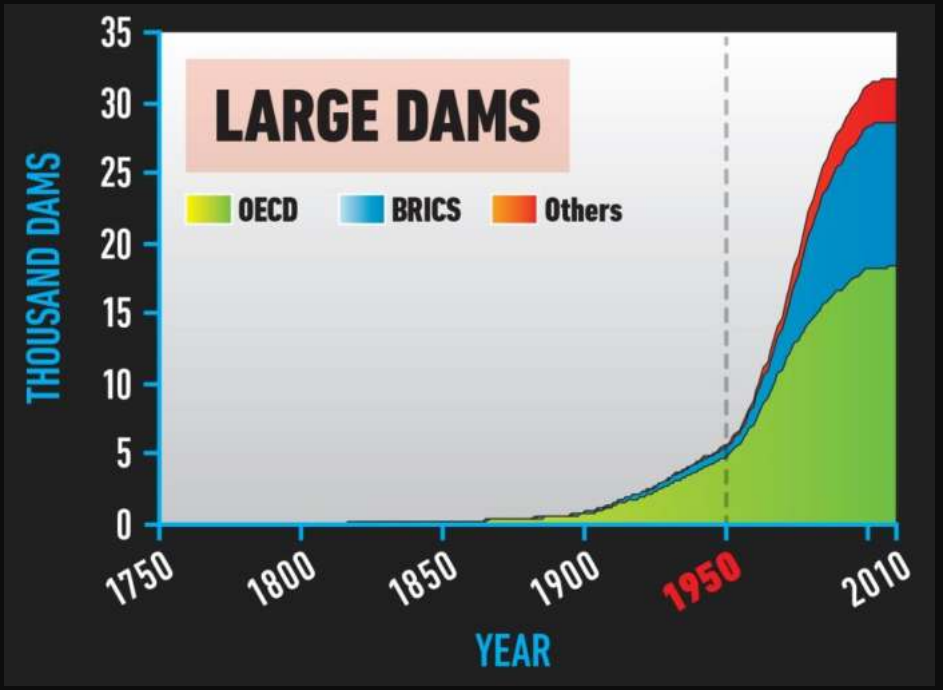
Monthly anomaly for monthly MODIS-EVI (compared to 2000-2018 mean)

-0.2 -0.02 +0.02 +0.17

Global Change – Context for project „Water recources“





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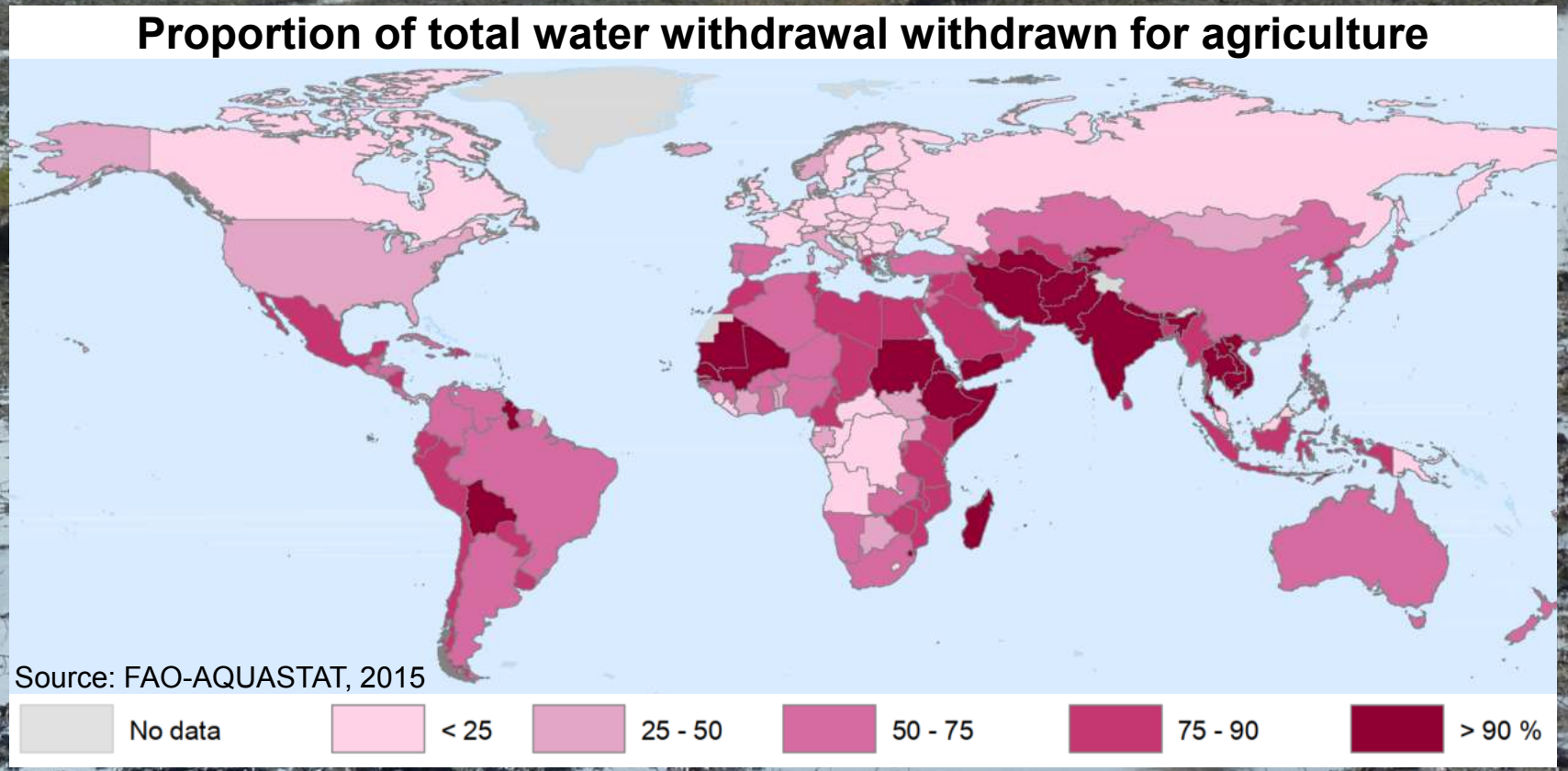
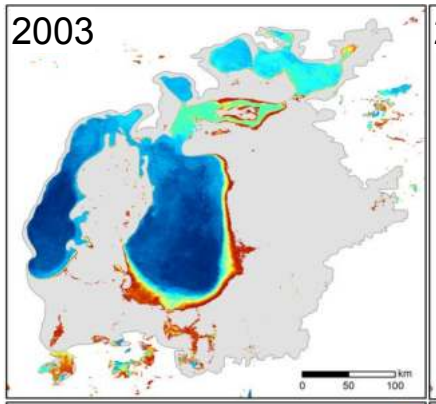
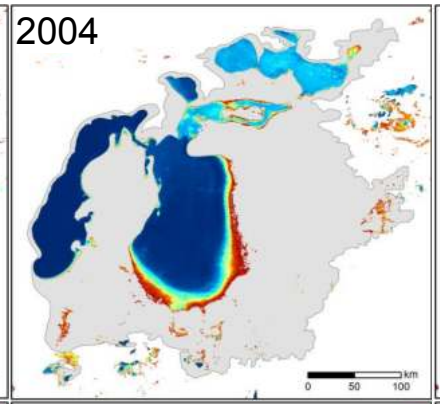
70%

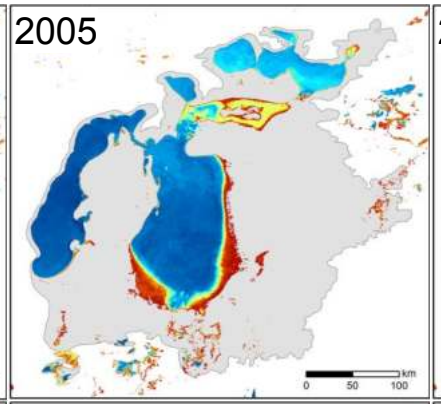
of the extracted freshwater is used for agriculture

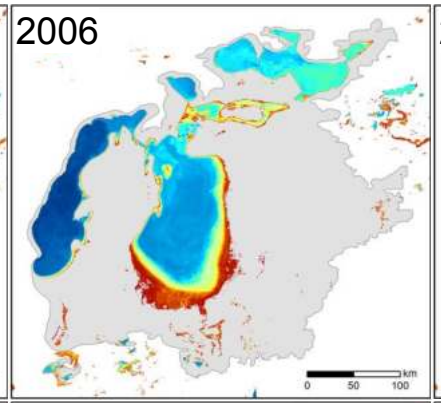


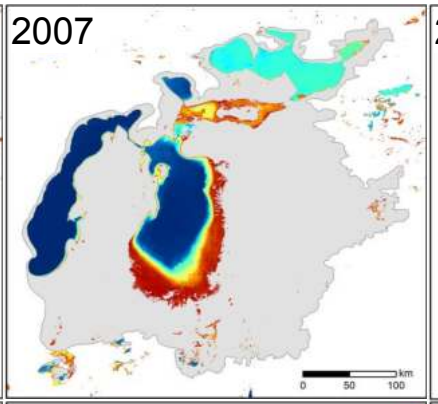
Global WaterPack – Aral Sea

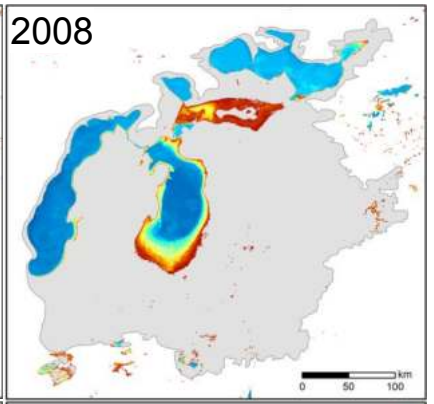


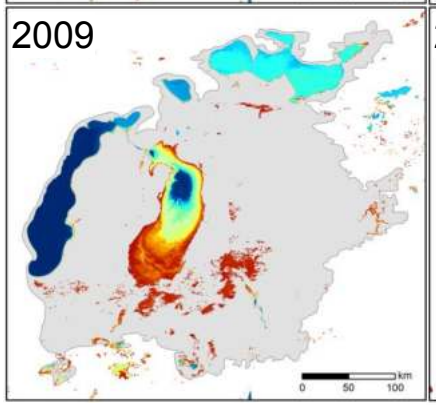


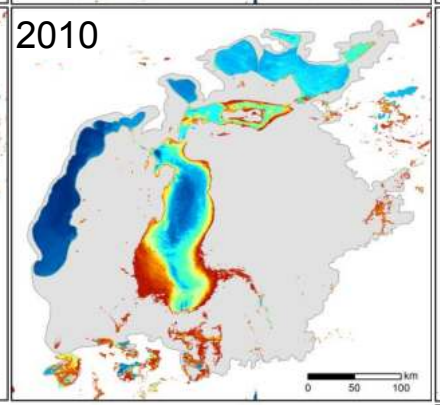


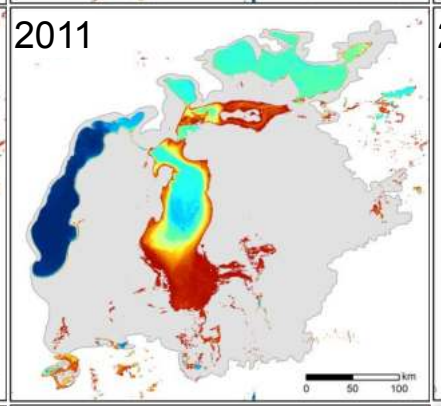


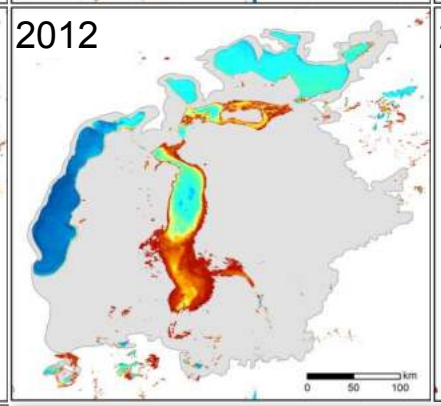


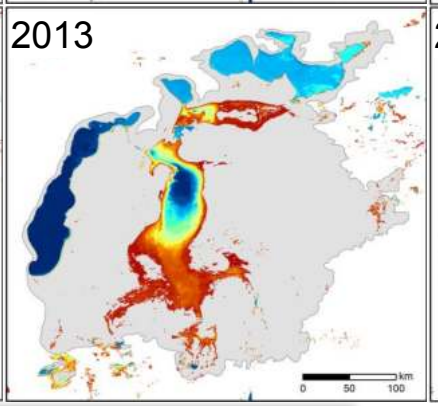


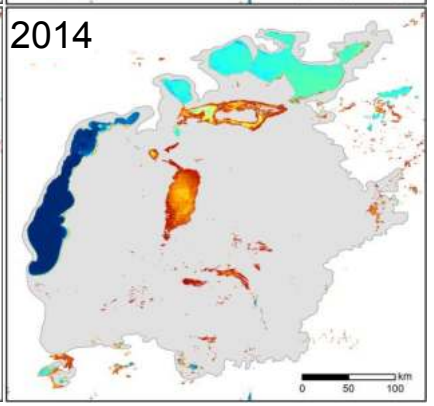


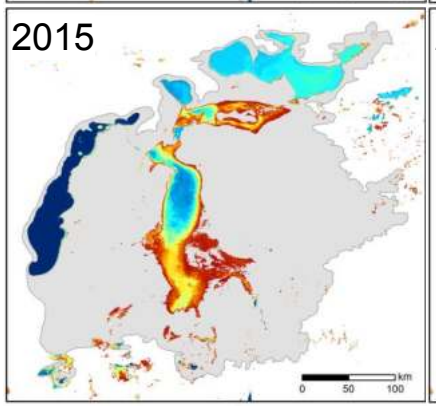


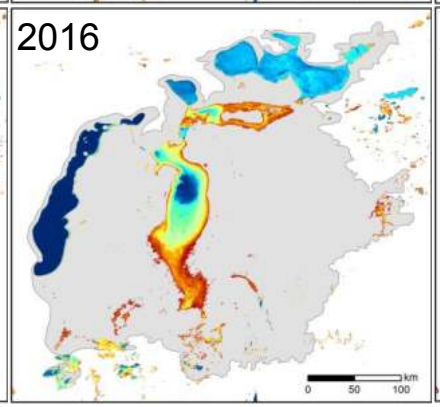


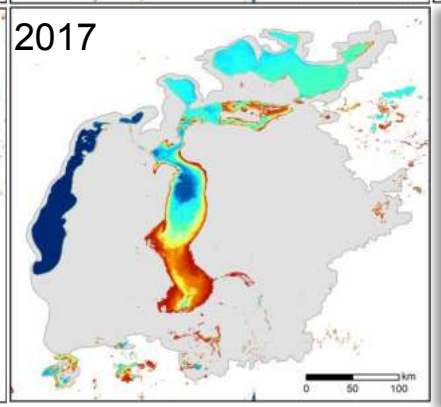


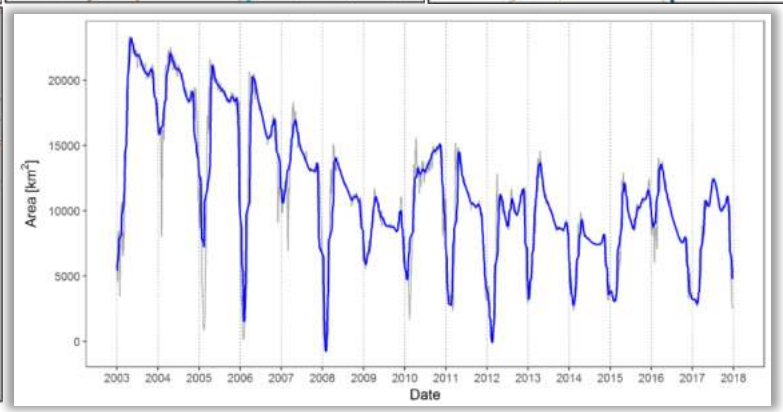








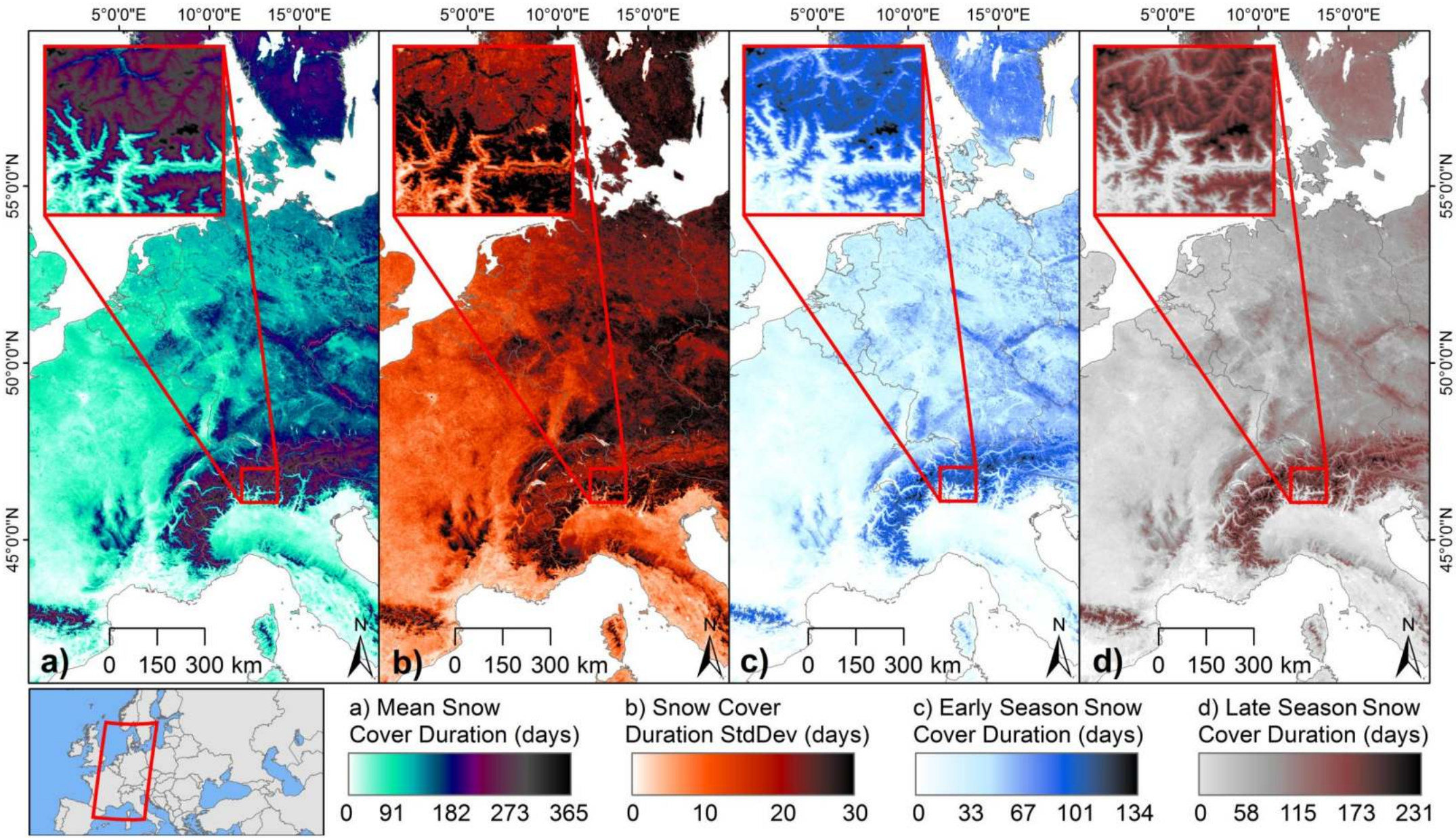




surface water cover (days)

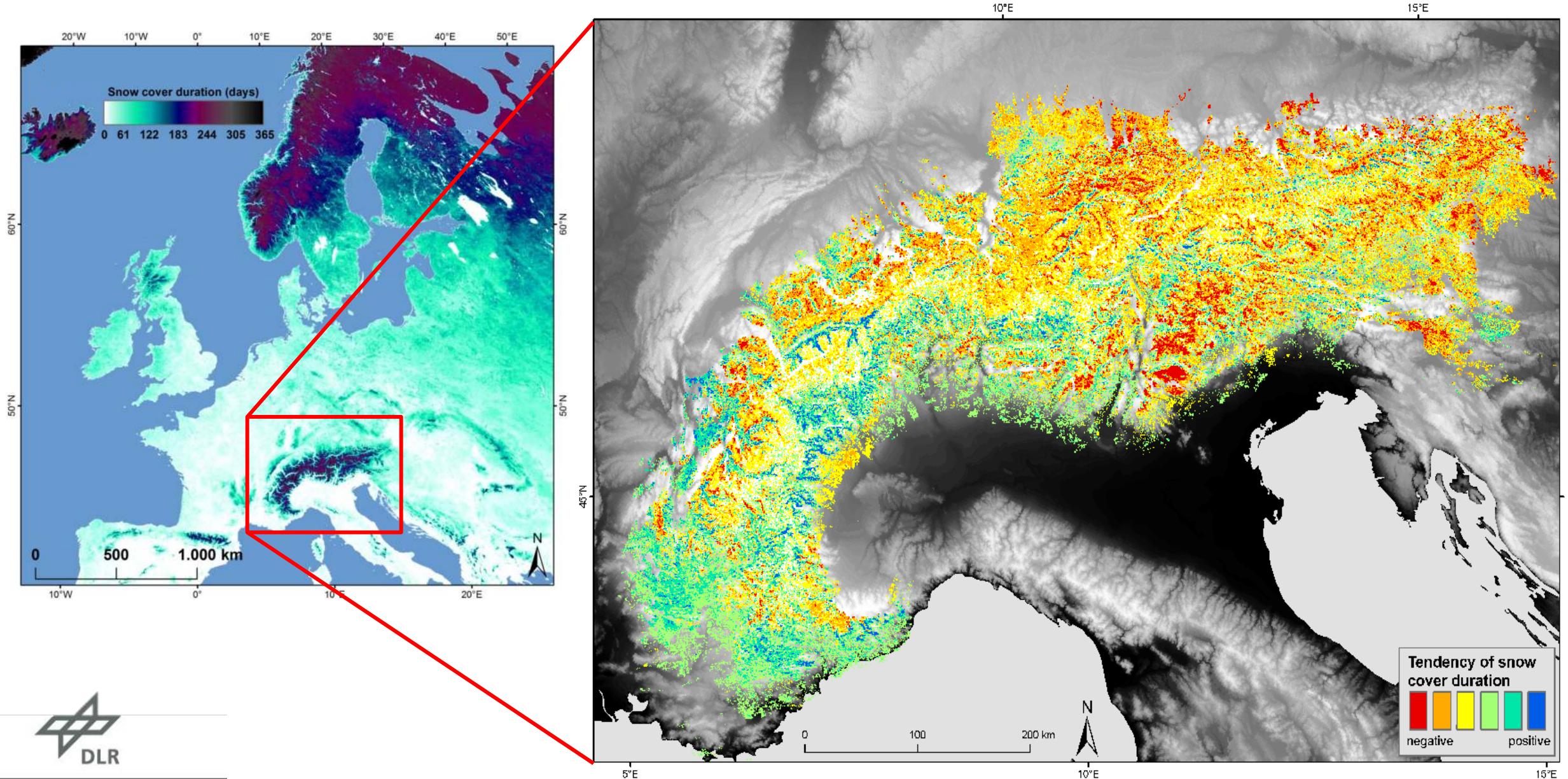
0 365

Global SnowPack – Products



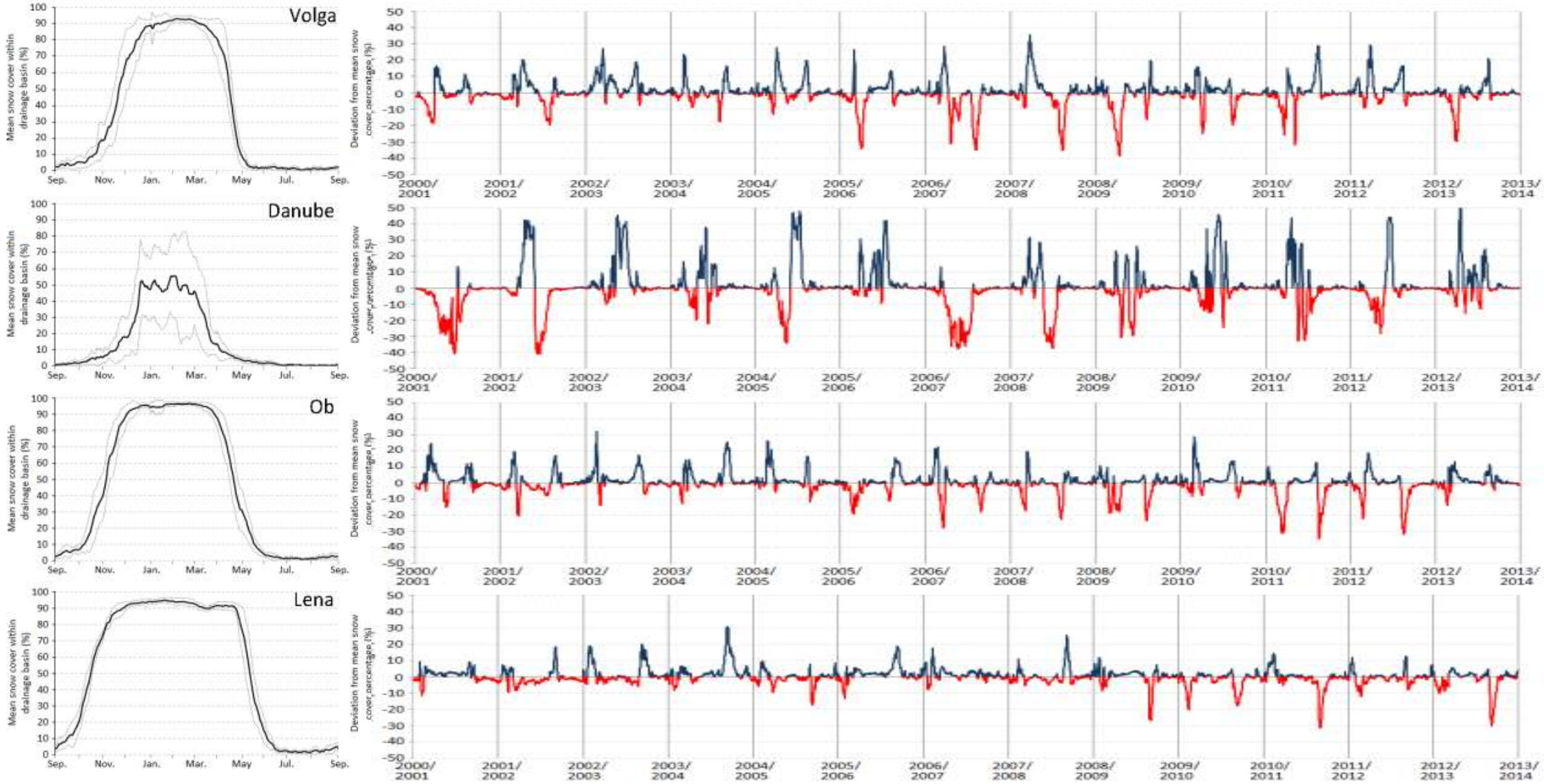
Dietz, A., Kuenzer, C., Dech, S.: Global SnowPack: a new set of snow cover parameters for studying status and dynamics of the planetary snow cover extent, *Remote Sensing Letters*, **2015**, 6(11)

Tendency of snow cover duration in European Alps

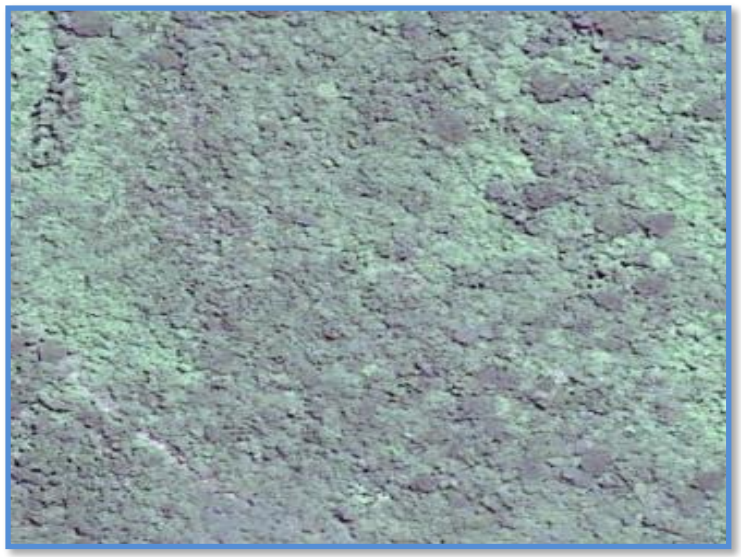


Dietz, A., Kuenzer, C., Dech, S.: Global SnowPack: a new set of snow cover parameters for studying status and dynamics of the planetary snow cover extent, *Remote Sensing Letters*, **2015**, 6(11)

Global SnowPack – monitoring of daily snow cover

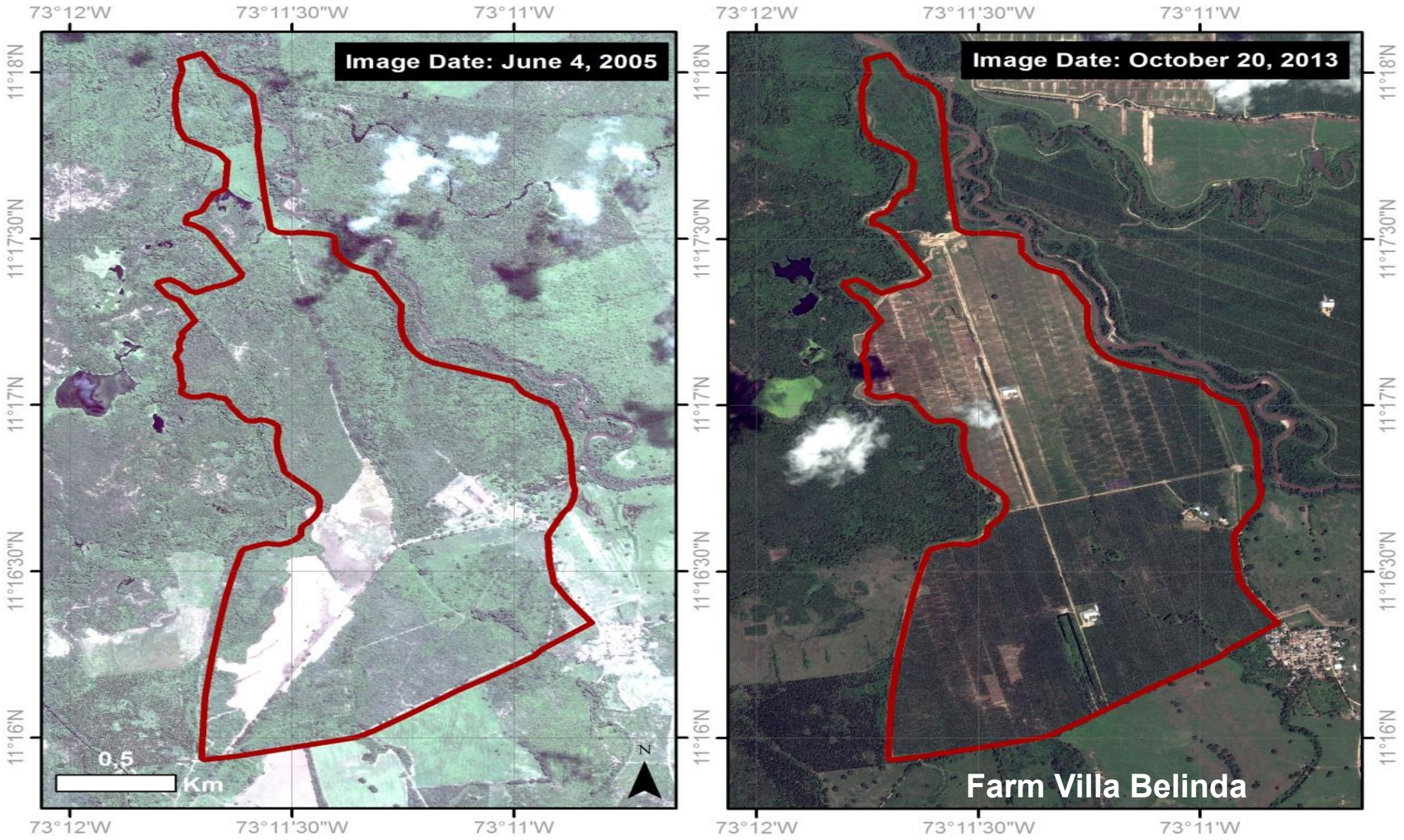


DLR



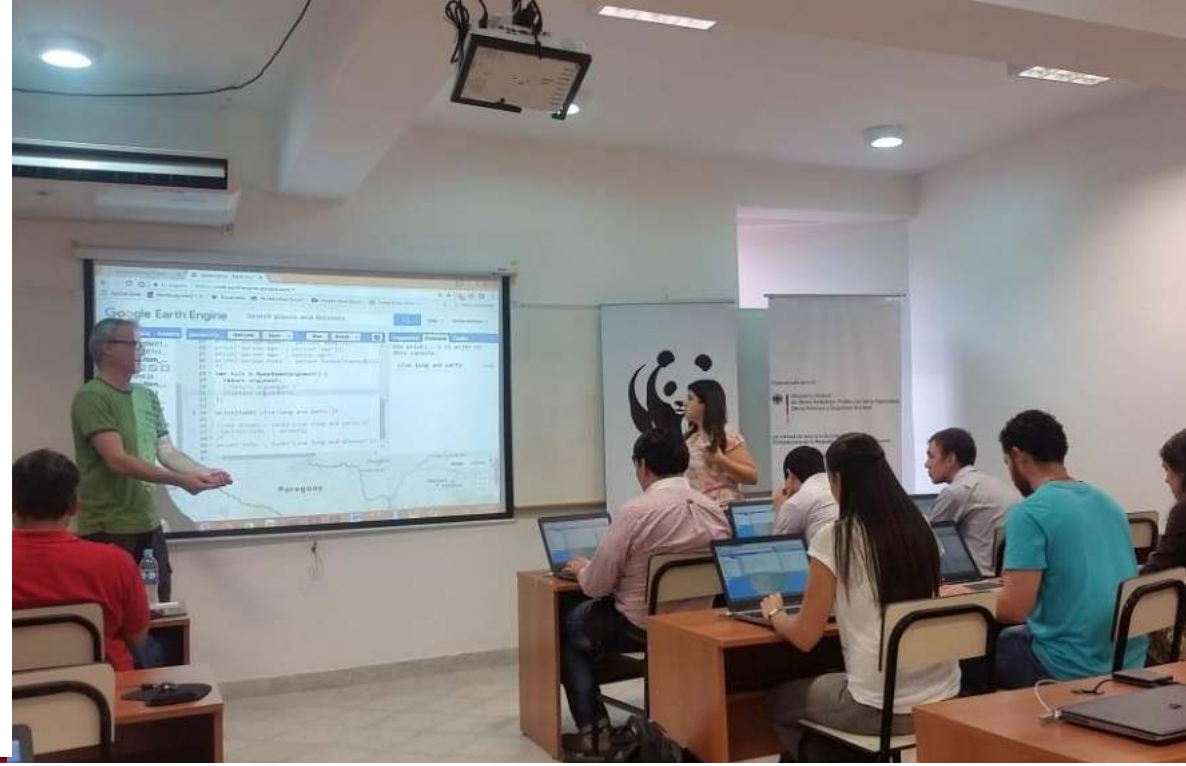
Conversion
of natural forest ecosystems

DLR


73°12'W
73°11'30"W
73°11'W
11°18'N
11°17'30"N
11°17'N
11°16'30"N
11°16'N
Image Date: June 4, 2005
0,5
Km
N
Image Date: October 20, 2013
Farm Villa Belinda

Remote Sensing Training, WWF Paraguay

SULU Project 9.04.2018 – 13.04.2018



DFD Organization

The World Data Center for Remote Sensing of the Atmosphere

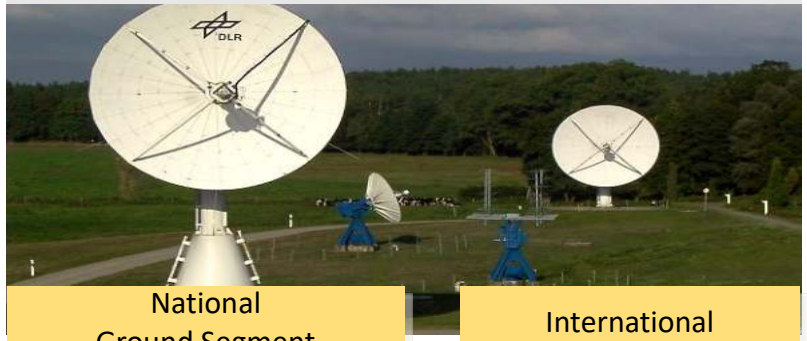
Software Development

Information Technology

Center for Satellite Based Crisis Information – Emergency Mapping & Disaster Monitoring –

Bundesministerium des Innern

System Engineering and Operations



National Ground Segment (Neustrelitz)

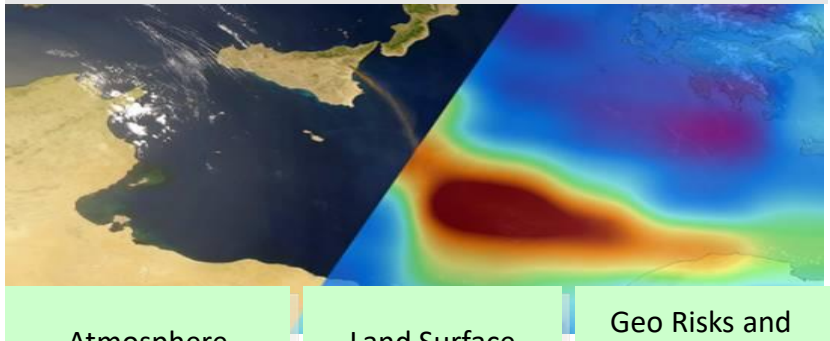
International Ground Segment

EO end-to-end Systems

Missions

International Networks
User Services

Geoscientific Research/Application Development



Atmosphere

Land Surface

Geo Risks and Civil Security

Communications

Science Communication and Visualization

DSDA Deutsches Satellitendatenarchiv

Bundesministerium für Wirtschaft und Technologie

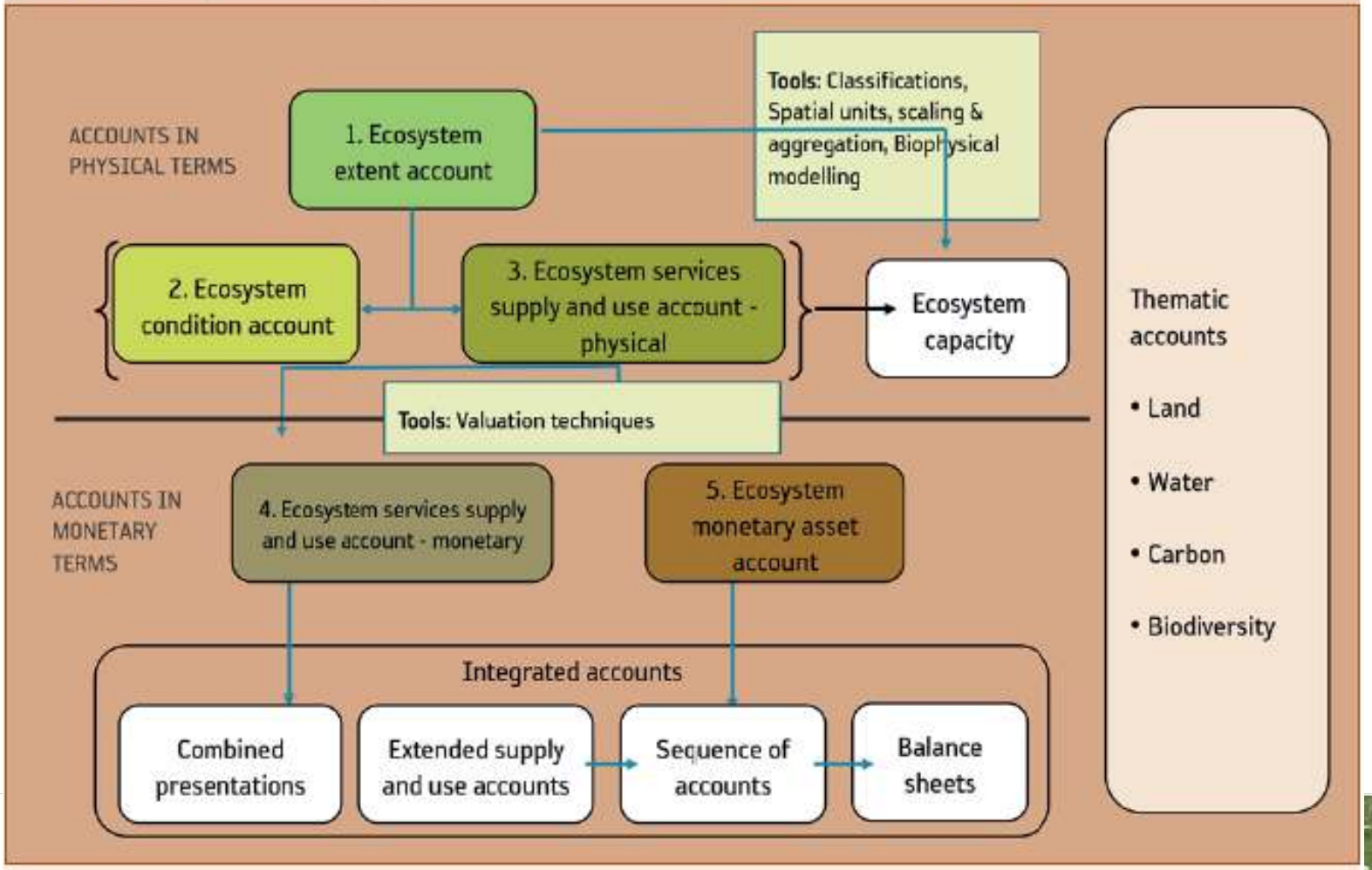
DLR

System of Environmental-Economic Accounting Experimental Ecosystem Accounting (SEEA EEA).

The main goal of SEEA is to establish the link between the environment and the economy in a consistent, comparable and coherent manner. The SEEA EEA starts from the perspective of ecosystems and links ecosystems to economic and other human activity. In particular, it brings the spatial dimension into environmental accounting and the need to link statistical accounts to geospatial information and Earth observation.

The SEEA EEA is underpinned by a set of accounts and tools, as shown below. The main accounts of extent, condition, and ecosystem services are complemented by thematic accounts of land, water, carbon and biodiversity, altogether supported by tools, such as classifications, spatial units, scaling and biophysical modelling.

SEEA EEA Accounts, Tools and Linkages



Source: CEOS and ESA (2018)

Thank you for your attention!