MENV PRO

Co-funded by the Erasmus+ Programme of the European Union

Applied Remote Sensing

Cornelia Gläßer , Uni Halle

The Environmental Science Education for Sustainable Human Health

Prof. Dr. Cornelia Gläßer

Martin Luther University Halle-Wittenberg, Germany
Institute of Geosciences and Geography

- Education in Geography and Geosciences
- PhD and Habilitation in multi and hyperspectral remote sensing

Research interests:

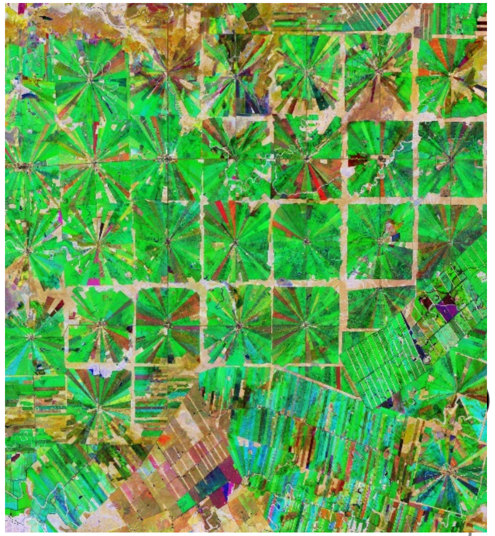
- hyperspectral remote sensing for geo-, hydro- and biochemical parameter in different landscape types and climatic regions
- Environmental Remote sensing of mining areas and whole mine cycle
- Multitemporal approaches, phenology of crops and natural phenology
- Long term experiences in Elearning and eAssessment

- Active in leading of national and international scientific organization

MENVIPRO

Objectives

- Introduction
- Short history
- Asssessment and selection of remote sensing data for thematic topics
- Application in global, regional and local scale
- Copernicus programme
- Market today and in the future
- Cooperation with Armenia



Source: ESA

Introduction

"Man must rise above the Earth, to the top of the atmosphere and beyond, for only thus will he fully understand the world in which he lives."

Socrates, classical Greek philosopher, circa 470-399 BC

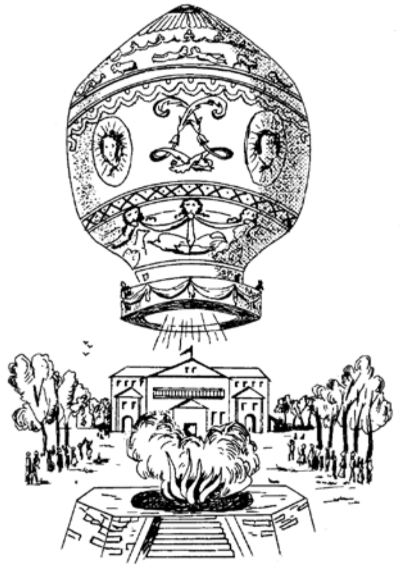
- Remote Sensing data with a long history
- RS data in your daily life
- Why remote sensing data in environmental sciences ?
- Changing data policy
- RS in the daily life

Short history

Requirements for remote sensing

Development of:

- Plattforms
- Photography
- Photogrammetry

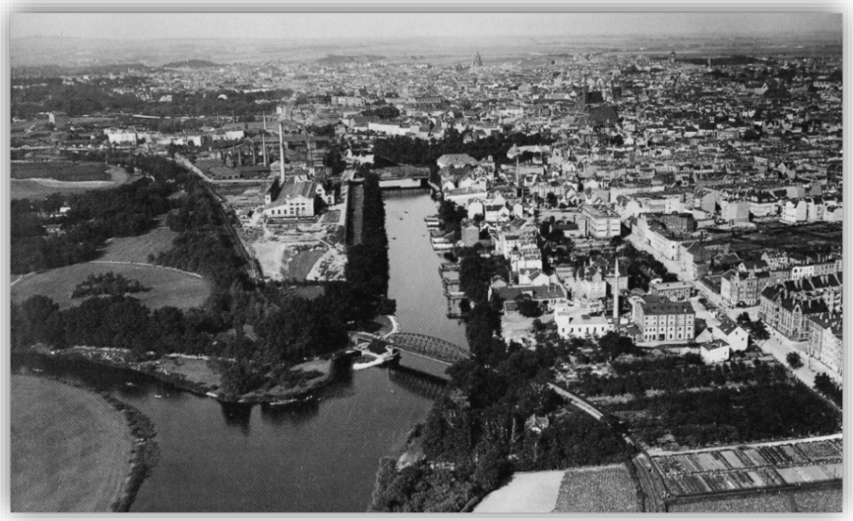


1783

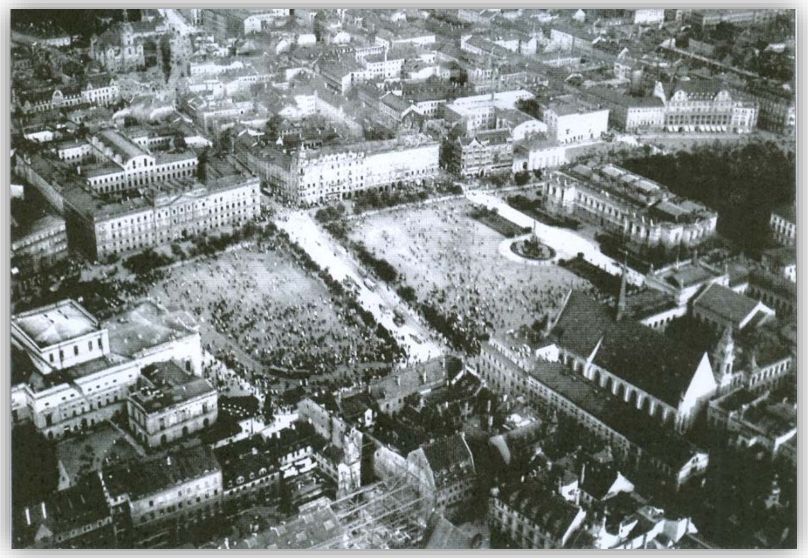
1909

Daguerrotypy, Museum Vevey

Zeppelin and first aerial photgraphy



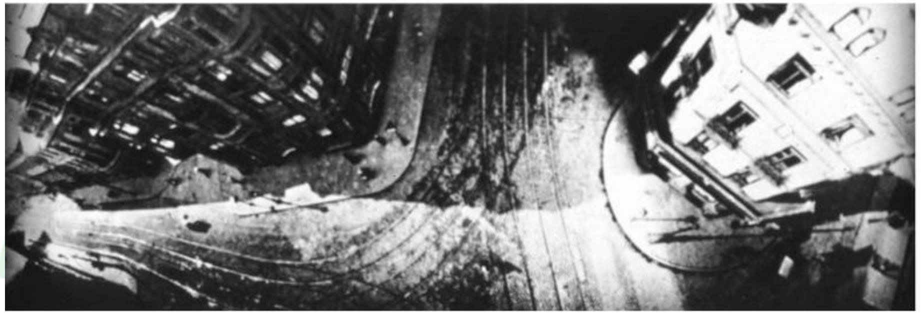
Halle, 1909



Leipzig, 1909

Köln, 1913

„Drones“ - past and future



Animatronics
ZDF/BBC

Platforms

Fixed wing

Starrflügler

http://media.defenceindustrydaily.com/images/AIR_UAV_RQ-11_Raven_lg.jpg

Ballon

http://kansan.com/media/2013/04/geology_jjakowatz21.jpg

Oktokopter

http://www.utas.edu.au/__data/assets/image/0003/276618/IMG_7323.jpg

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Platforms

- Helicopter and aircrafts
- Satelliten

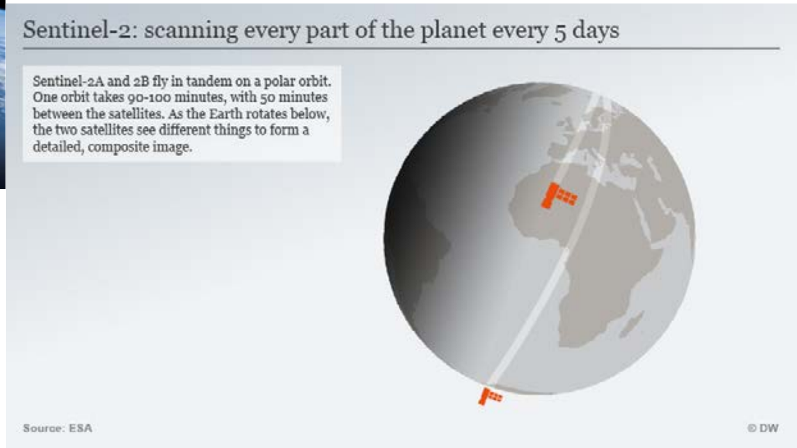
http://arsf.nerc.ac.uk/images/g-envr-image2.jpg, http://www.intergraph.com/global/de/assets/images/ILV-Flugzeug-3_Copyright_ILV-Fernerkundung-GmbH.jpg

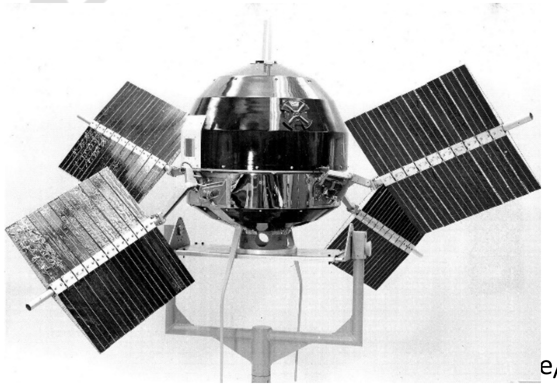
http://blog.lidarnews.com/nasa-tests-lidar-2, http://radio.aalto.fi/en/research/space_technology/hutscat-mounted.jpg

Satellites

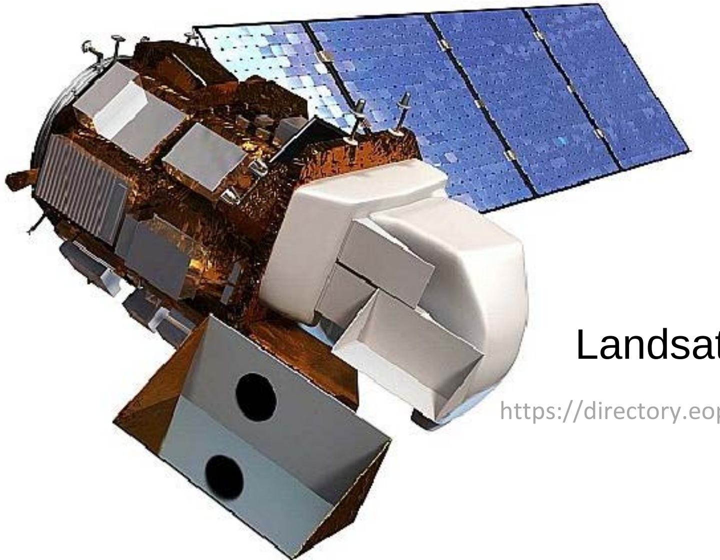
- First: Explorer 5, August 1959
- Today:more than 400

ESA: Sentinel-Family





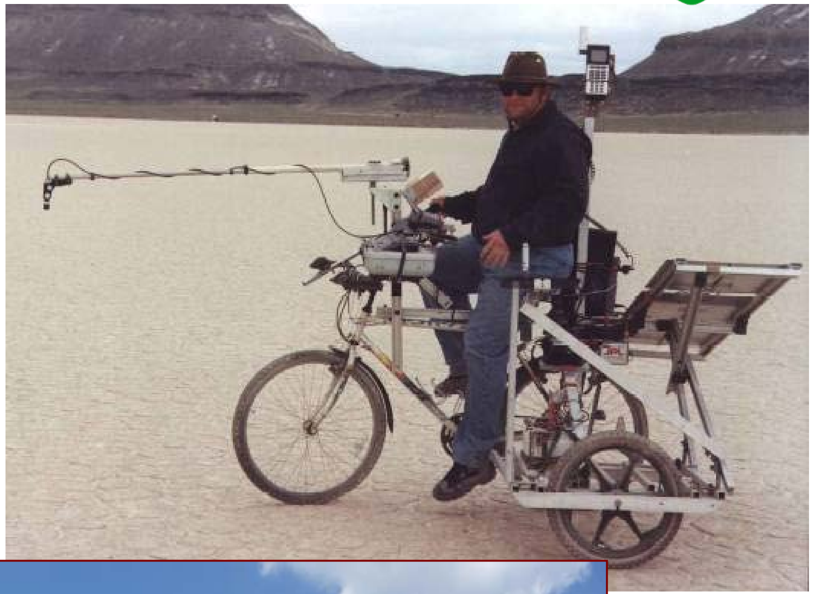
- e/explorer_6.jpgSenti



Landsat 8, 2013

https://directory.eoportal.org/image/image_gallery

Field work and spectral methods



Providing information on platforms and the manifold measurement set-ups

Spectral exploration methods

ASD FieldSPec Pro FR and operator notebook[1)]

Spectroscopic field measurements and field sampling during summer 2010. The ASD FieldSpec is placed in a backpack.

Set up for spectroscopic lab measure-ments using an artificial light source.

Providing training in operating the department´s instruments and accessories

Providing good-practice in how to conduct spectral measurements properly

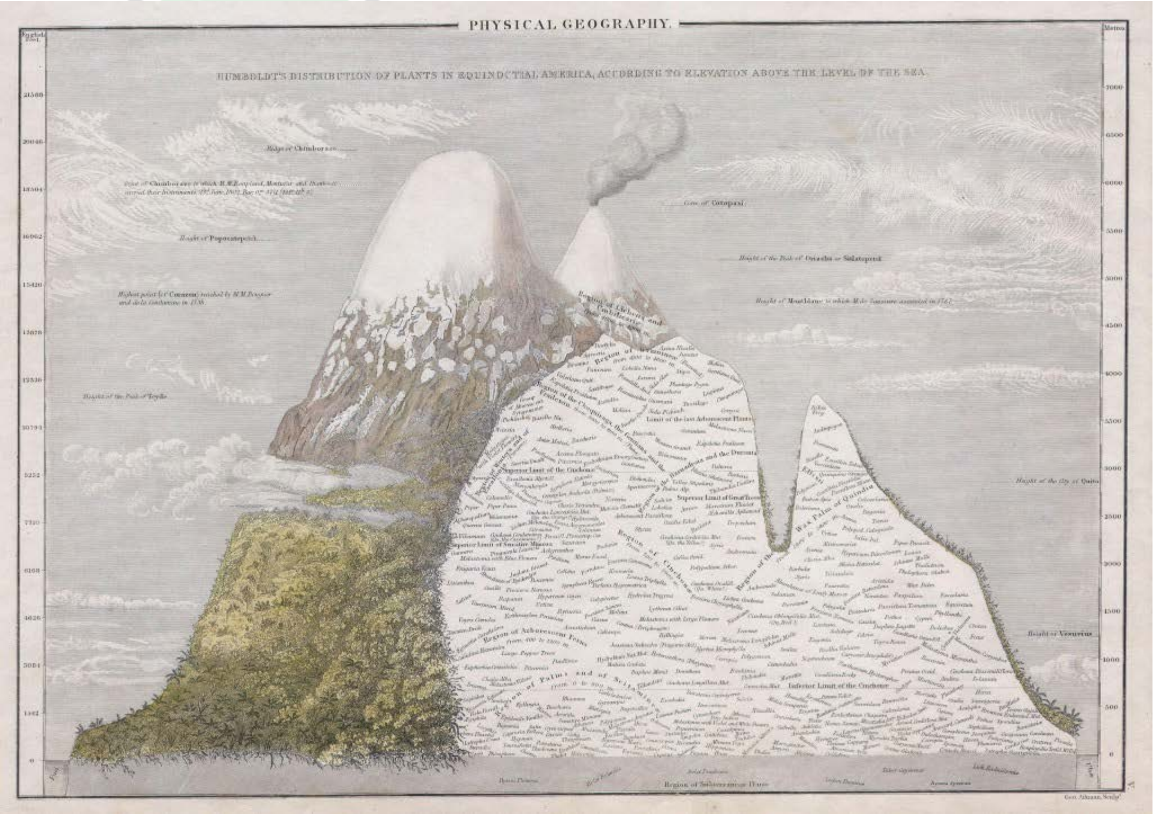
Leaf Clip

PDA

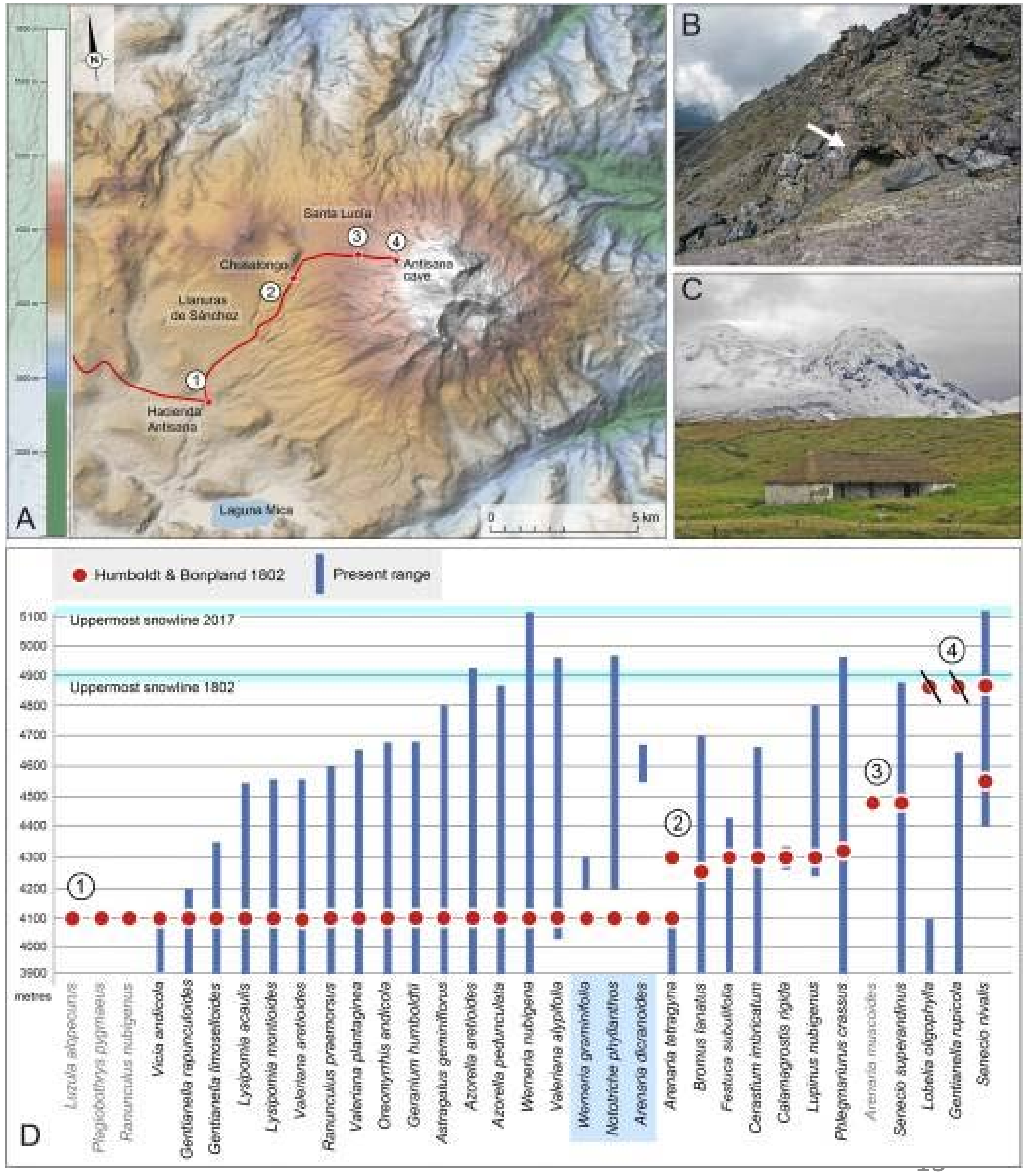
Contact Probe

ASD FieldSpec® Dual RS^3 Operation Manual 2010.; http://www.spectralevolution.com/sitebuilder/images/Trigger_leaf_clip4-178x204.png,http://www.spectralevolution.com/sitebuilder/images/Getac2-107x210.png, http://www.spectralevolution.com/sitebuilder/images/Desktop_contact_probe-201x162.jpg

Mapping in the past and present



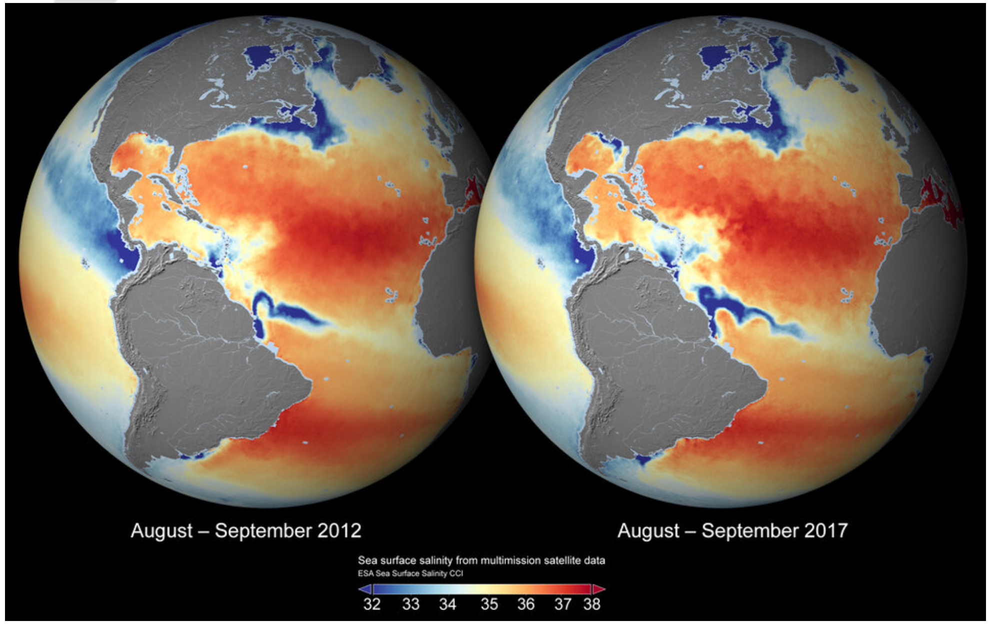
Chimborazo, Ecuador
Alexander von Humboldt, 1839



Moret et al. 2019

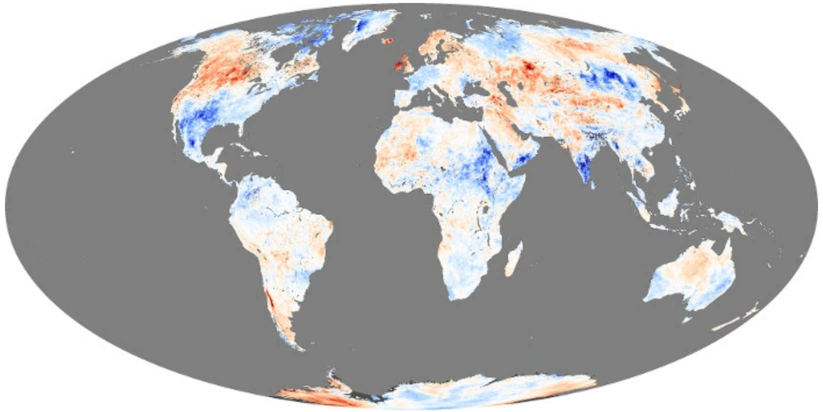
Global Monitoring

- Satellite data the only one existing data base for global monitoring, like:
    - Vegetation
    - Meteorological and hydrological parameters
    - Ocean
    - Atmosphere



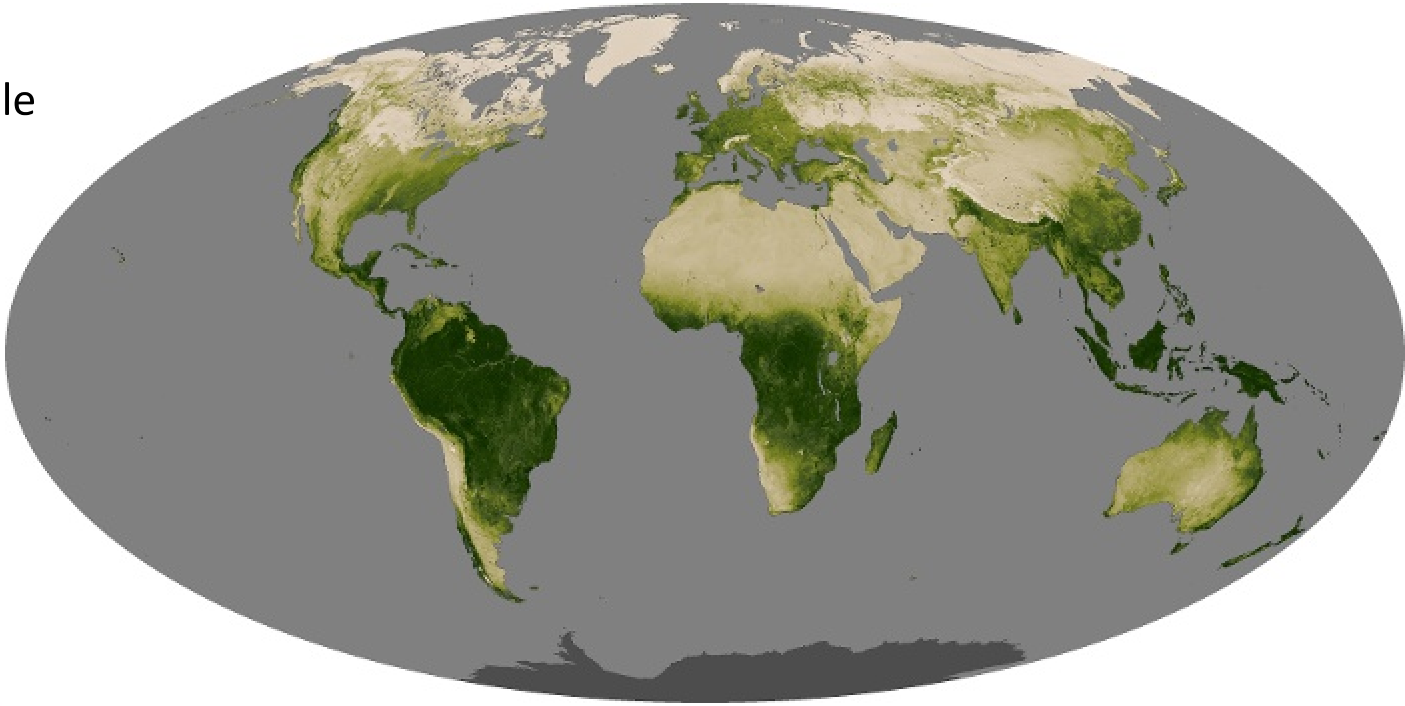
ESA’s Climate Change Initiative (CCI)
SMOS, Aquarius, and Soil Moisture Active Passive satellite missions

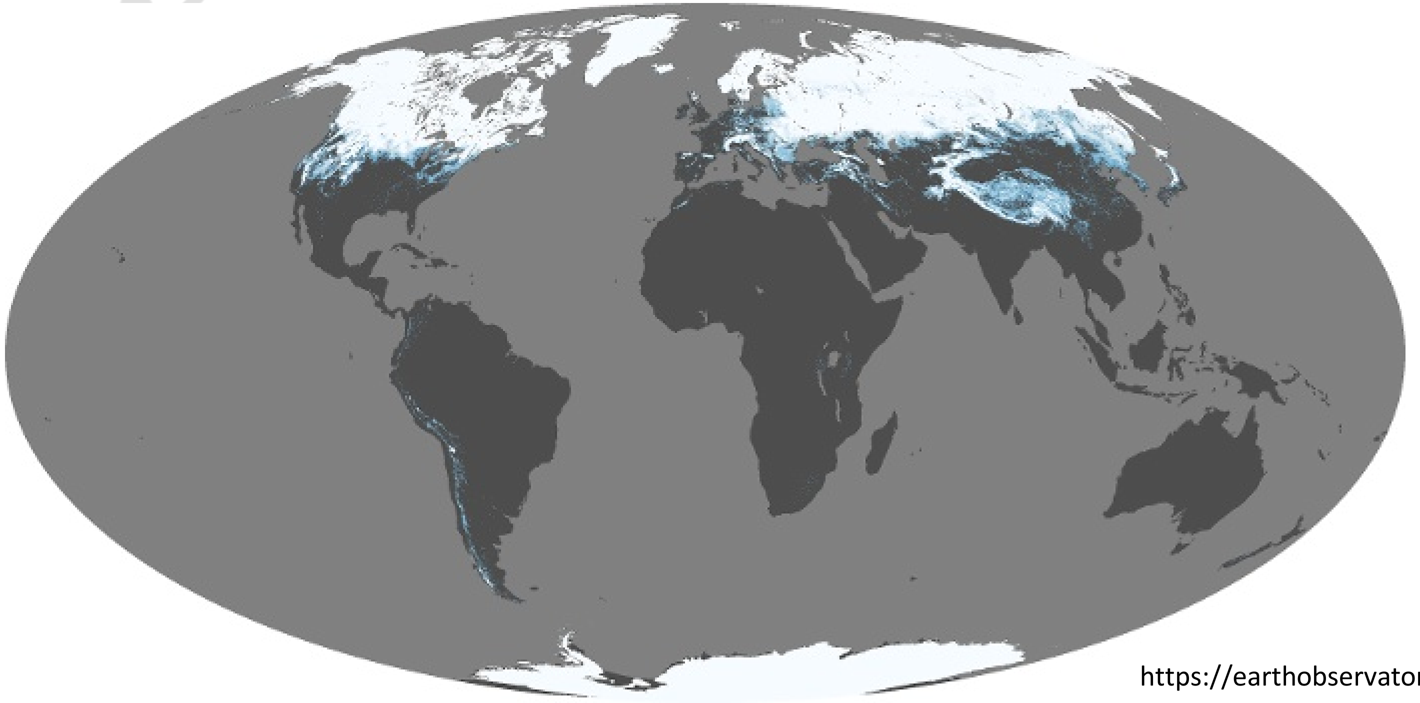
Land Surface Anomaly, Temperature,NASA



Earth observation in a global scale

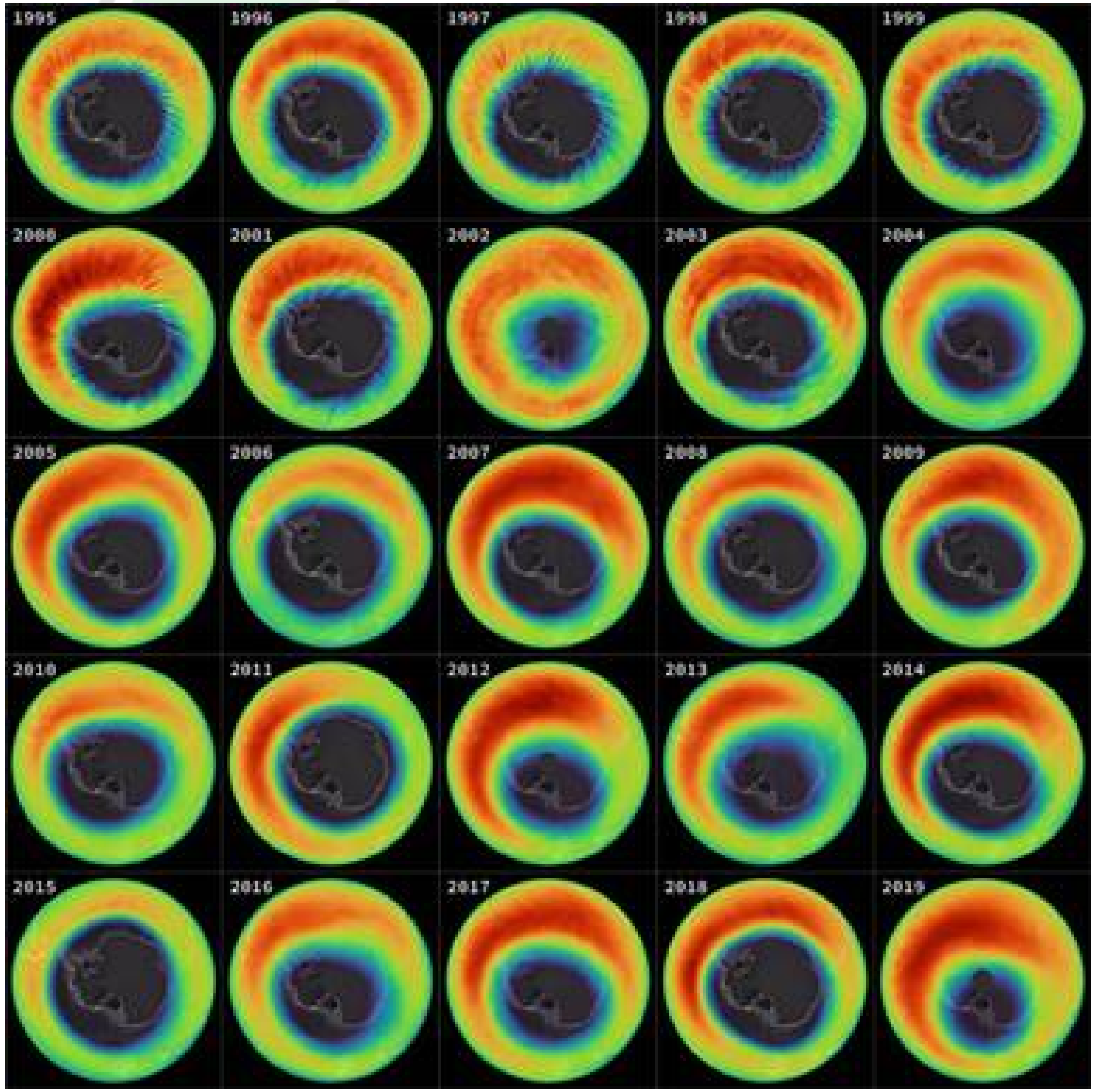
- NASA Earth Observatory
- Time Series of MODIS data





https://earthobservatory.nasa.gov/global-maps/MOD_NDVI_M/MOD10C1_M_SNOW

Ozon hole over Antarctica
Mission: Global Ozon Monitoring Experiment GOME
Time series 1995 - 2019



See: 25 years ozon monitoring as video

https://www.dlr.de/eoc/de/desktopdefault.aspx/tabid-14195/24618_read-65956/

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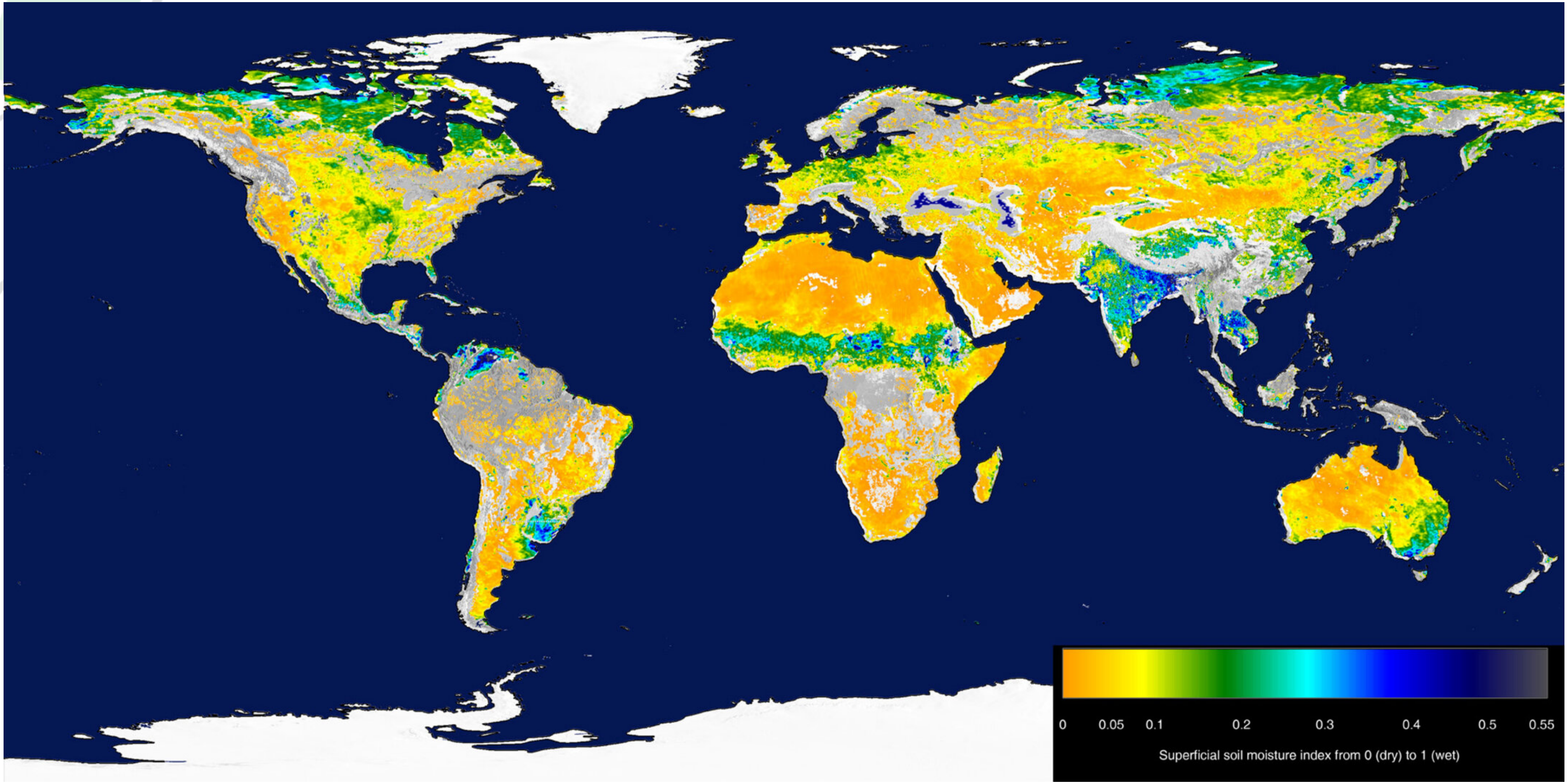
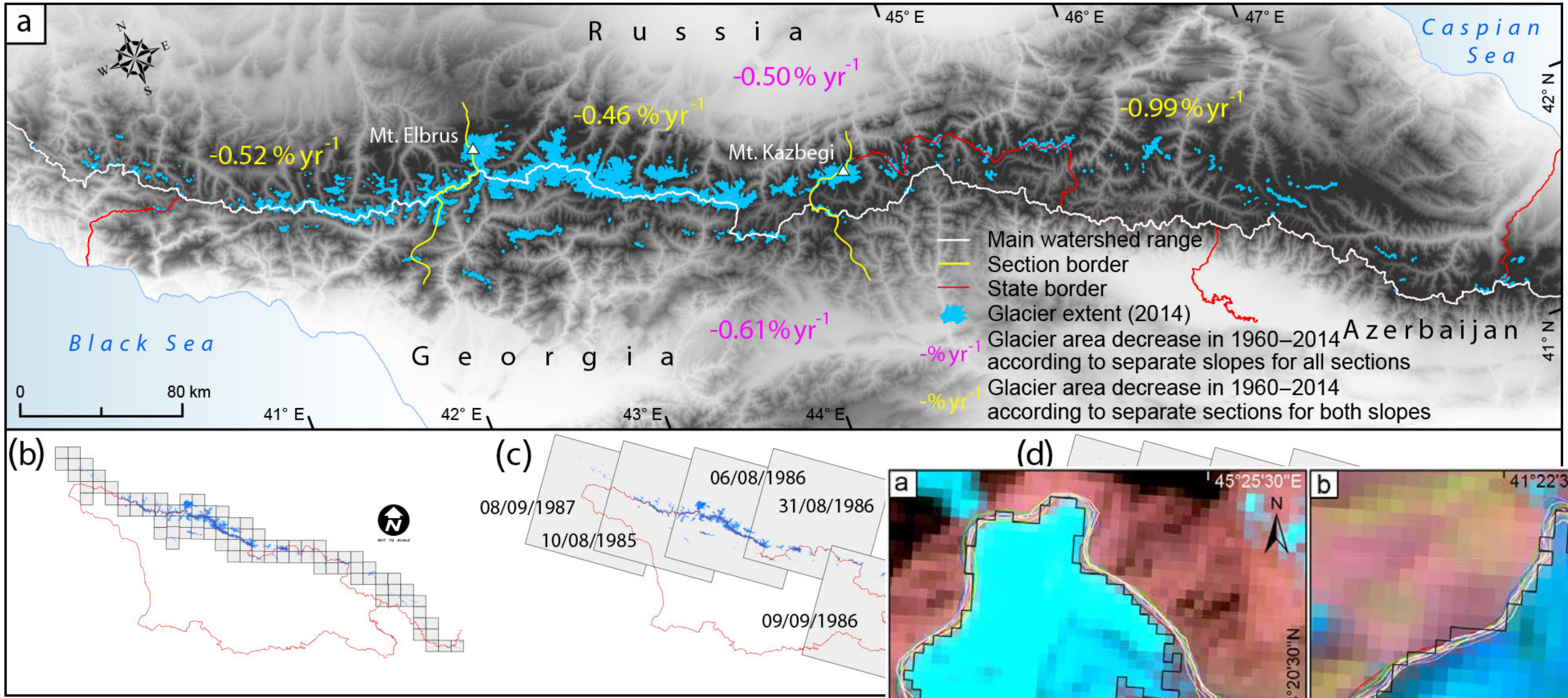
ESA‘s SMOS Mission

Soil Moisture Index Map

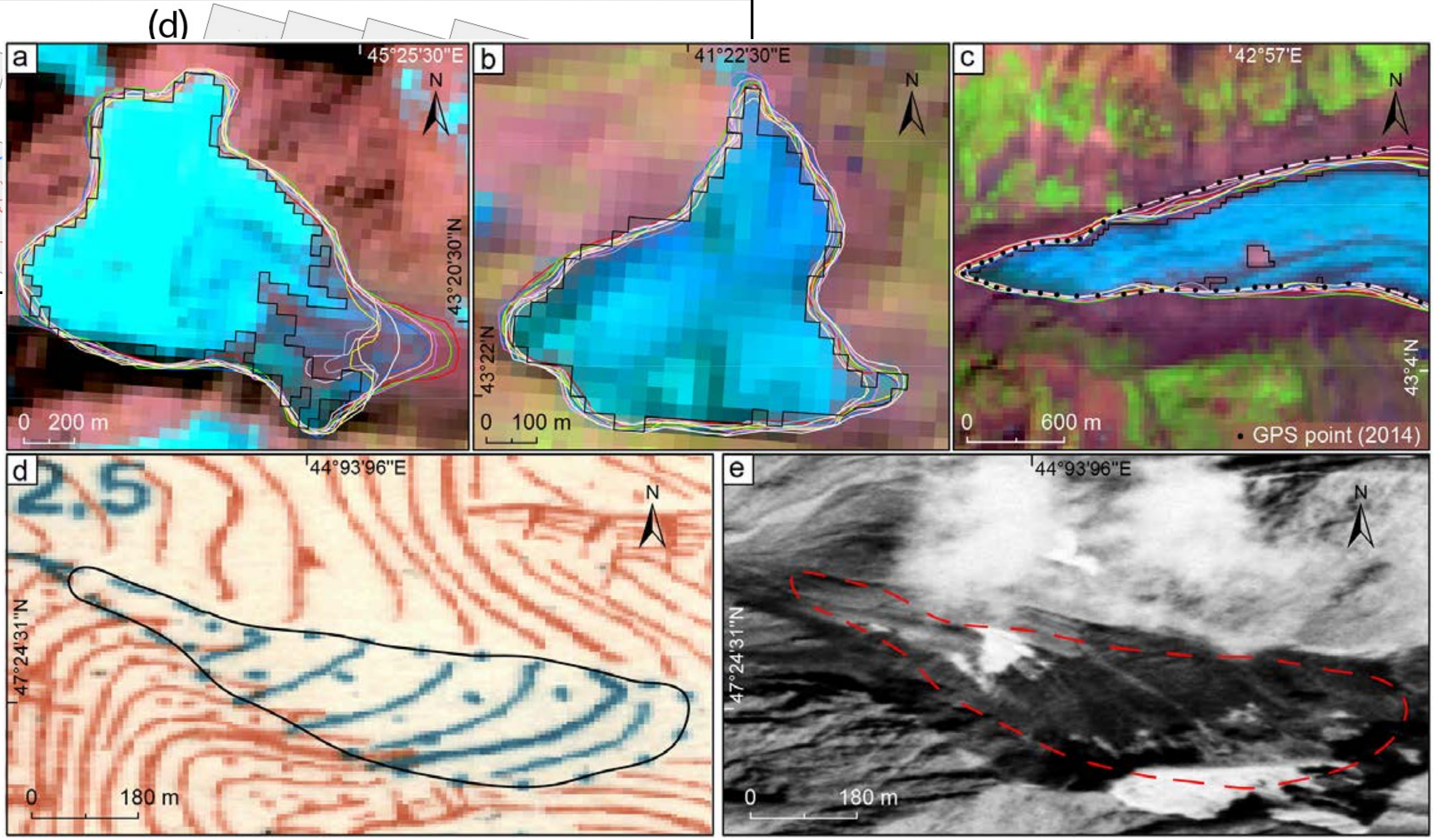


Greater Caucasian Glacier Inventory
Tielidze and Wheate, 2018

Part of the Global Land Ice Measurments from Space GLIMS data base



ASTER DGEM satelliet data and Landsat data ,



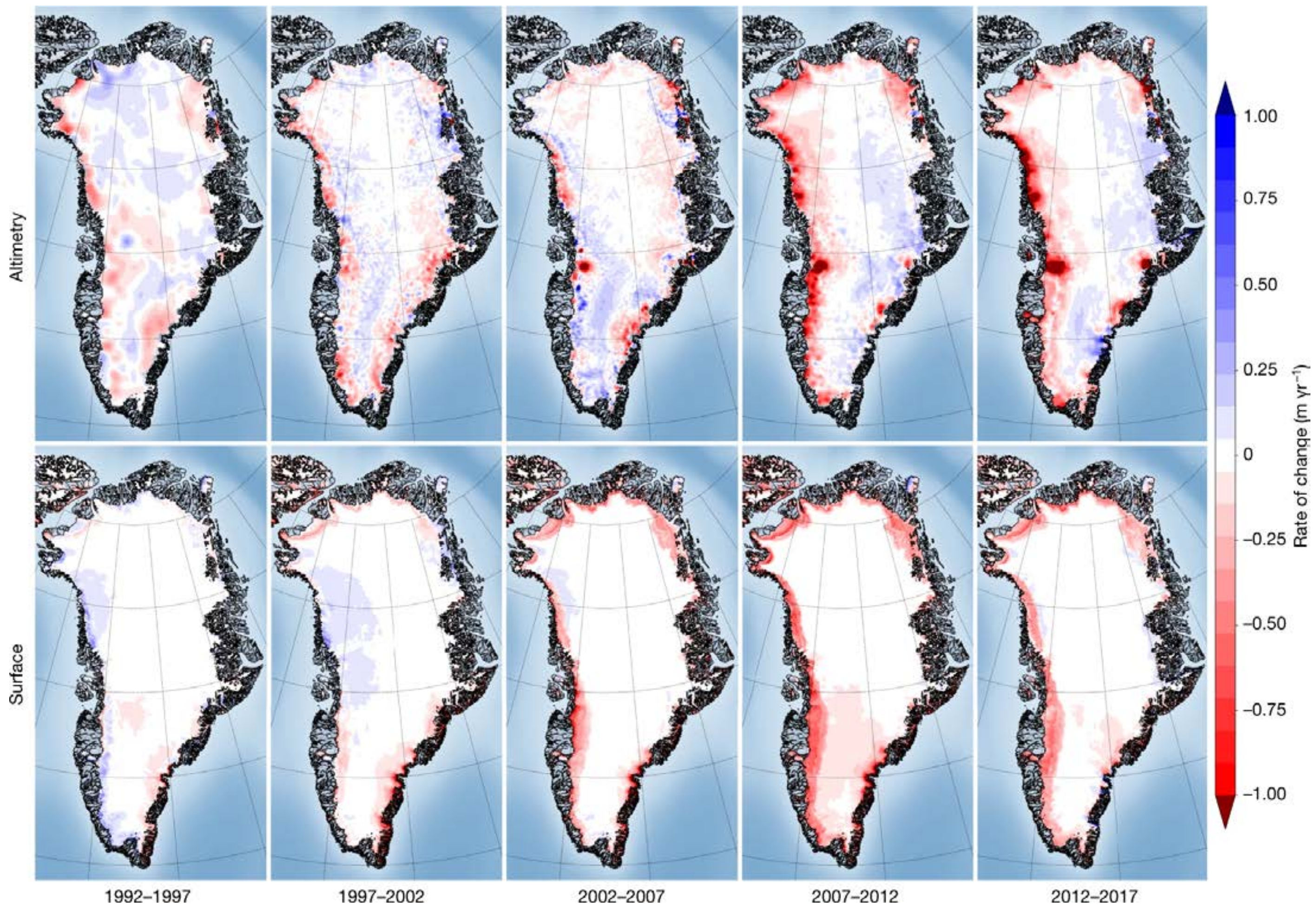
Changes:

1960: 2350 glaciers with 1674 sqkm

2014: 2200 glaciers with 1193 sqkm

Corona data 1964

Greenland Ice Sheet Changes 1992-2018



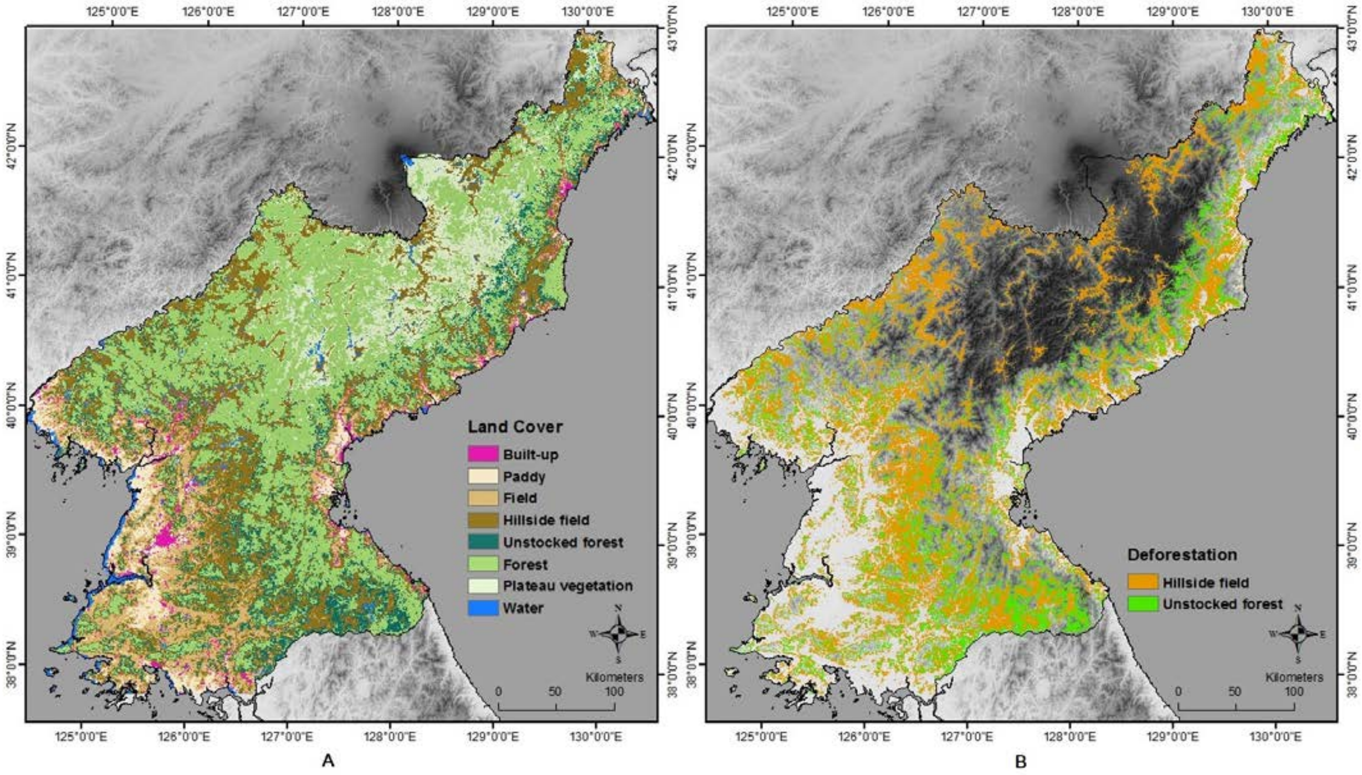
Rate of elevation change of the Greenland Ice Sheet determined from ERS, ENVISAT and CryoSat-2 satellite radar altimetry (top row) and from the HIRHAM5 SMB model (ice equivalent; bottom row) over successive 5-yr epochs. Source: IMDIE Team, 202

Copernicus program of ESA

- Data
- Services
- Products

https://www.copernicus.eu/en

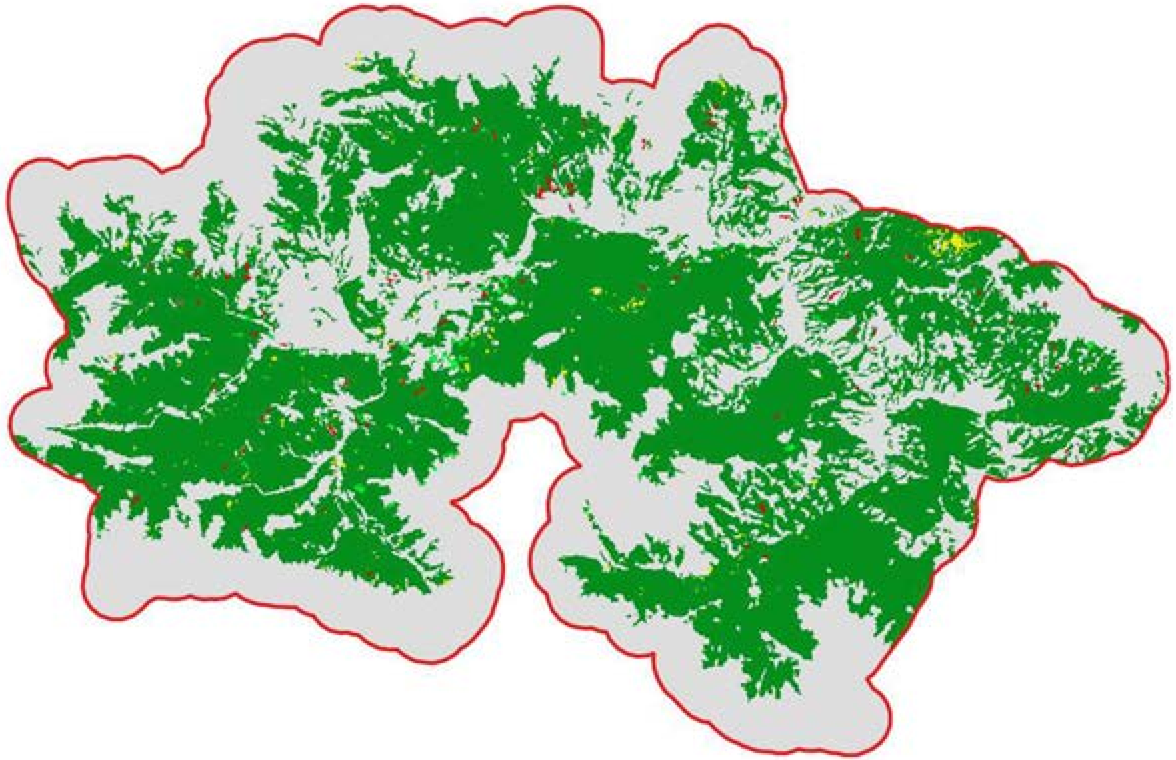
Deforesting



North Corea, Jim et al. 2016

- General land use changes
- Humand related changes
- Natural related changes
- Hazards
- Different time scales

Forest in Armenia



Grey non forest
Green stable forest
Red deforesting 2005-2010
Yellow forest degradation

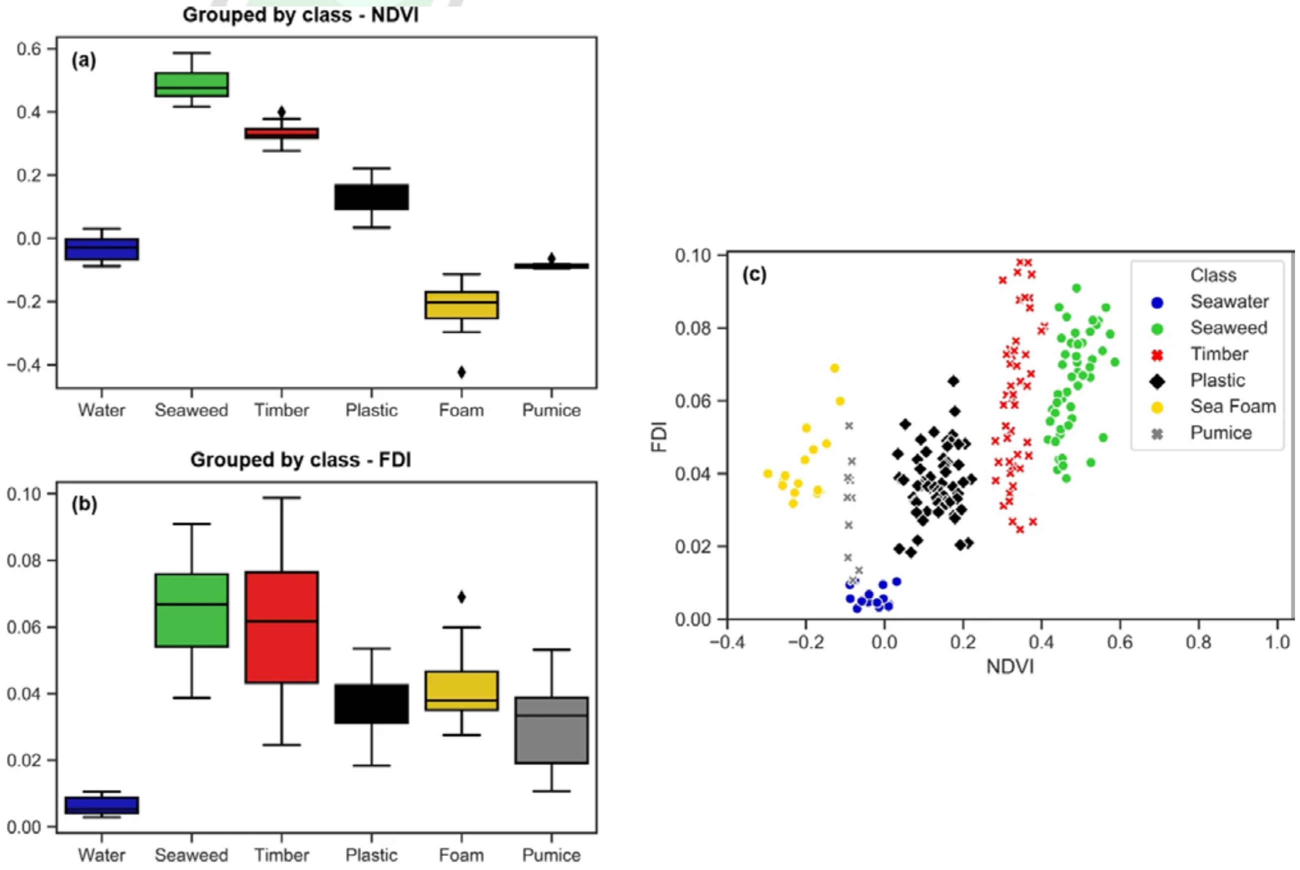
Dilijan National Park is renowned in particular for its dense forest, rich biodiversity, medicinal springs, natural and cultural monuments and extensive network of hiking trails. Despite this, the park is under threat from a dense human population living there, developing infrastructure, uncontrolled tourism, illegal logging, poaching and the unsustainable use of natural resources.

ESA’s EO Clinic, Company GeoVille and SIRS

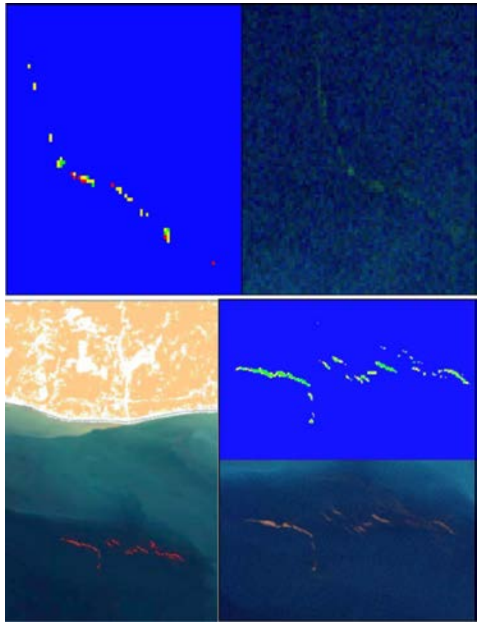
1991–2019 Forest density and class, which could be used to assess and locate deforestation or forest degradation.

https://www.esa.int/ESA_Multimedia/Images/2021/04/Characterising_forest_ecosystems_in_Armenia

Plastic Litter Patches in marine environment



Biermann et al. 2020

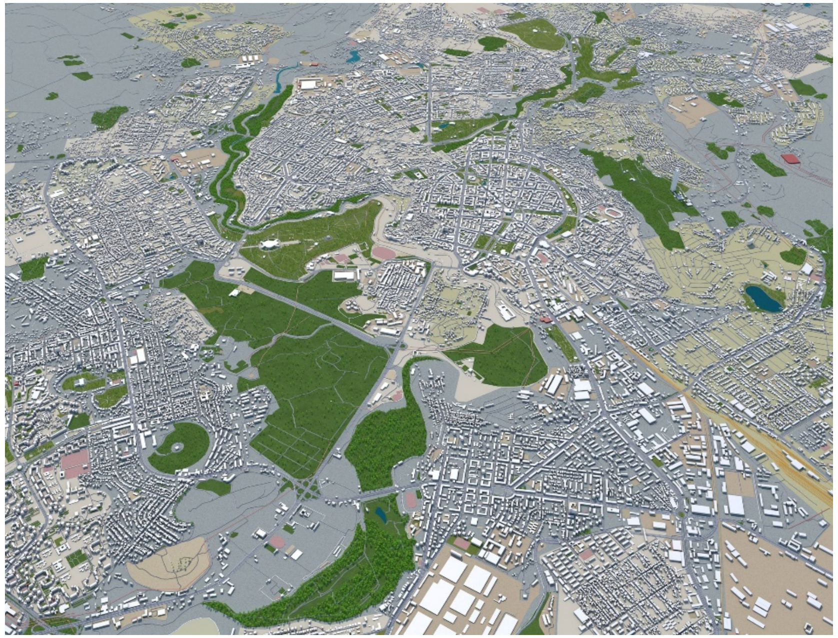


Mediterranean Sea
Sentinel 2 data
ESA 2020

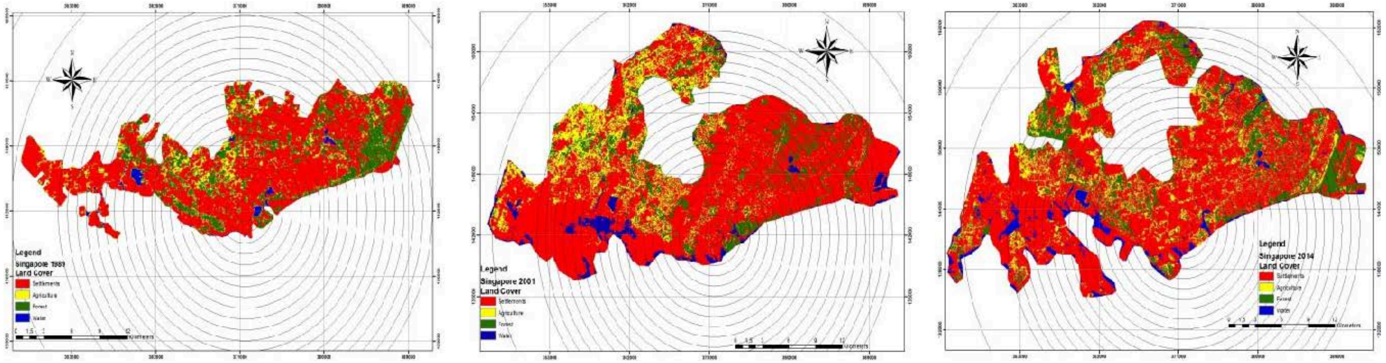
Open Space Innovation Platform – OSIP
Logos of the of the OSIP Campaign on Reselected proposals mote Sensing of Plastic Marine Litter

Urban remote sensing

- settlement development
- Green areas – versus sealing
- Material types
- Tempreture, heat islands
- Health risk
- Alternative energy …
- …

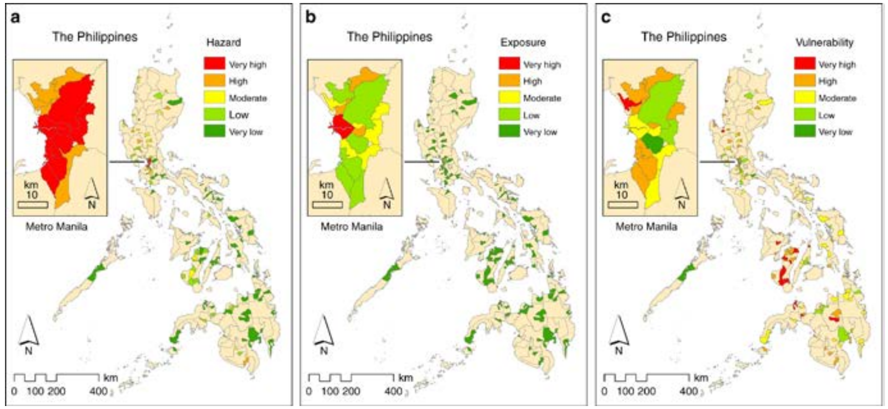


Yerevan, 3D model Flipped Normals



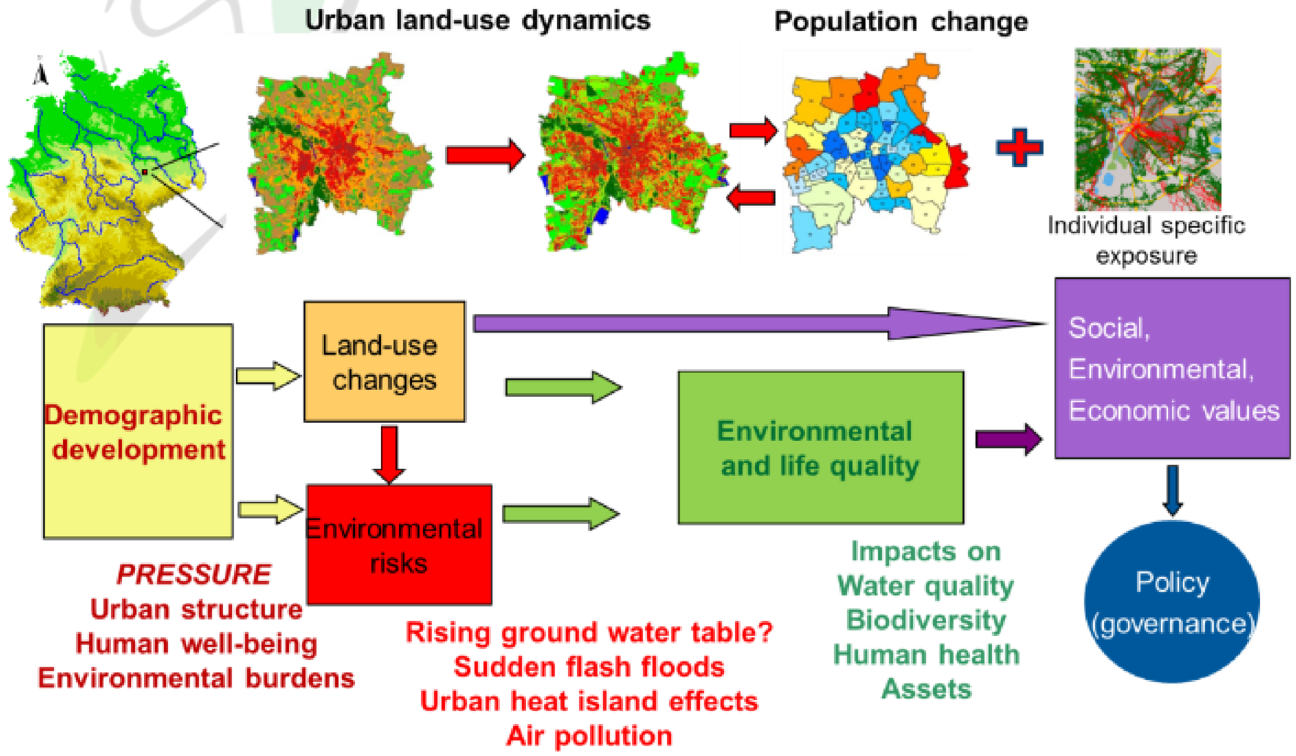
Multi-buffer ring zones around city center of Kuala Lumpur, Manila and Singapore for 1989, 2001 and 2014 map

Boori et al 2014



Health risk Philipinescities , Estoke et al. 2020

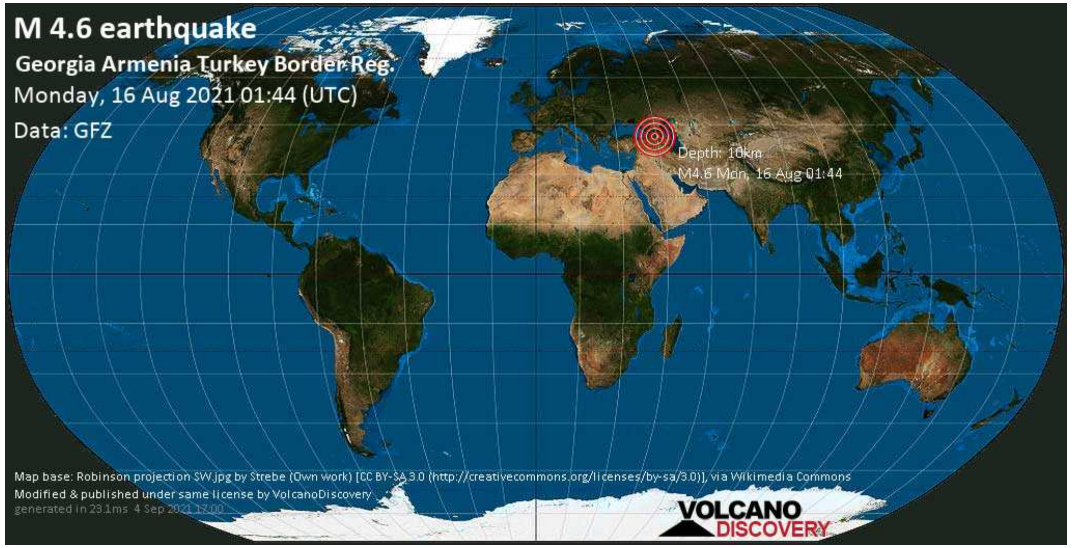
Urban system



Tereno 2019

Disasters and Natural Hazards

- Earth quake
- Volcanic eruption
- Floods
- Fires
- Droughts
- Erosion
- Landslides
- …

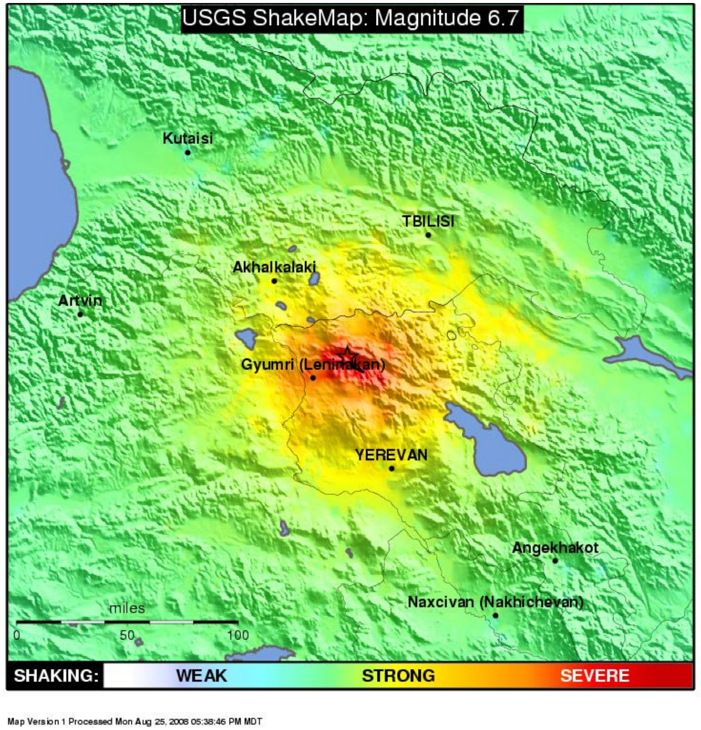


International Charter Space and Major Disasters

Center for Satellite Based
Crisis Information (ZKI)

Natural Hazards and Disaster

- World wide existing events and processes
- Needs just in time data, very actual, short term repetition
- Sensor related to the topic, like thermal data for fires, radar data for floods..
- Maps for emergency planning and aid
- Assessment under ecological aspects



1988-12- 7 Gyumri

Center for Satellite Based Crisis Information (ZKI).DLR

RND Network


DEUTSCHLAND - LK Euskirchen
Situation am 15 Juli 2021 - Übersichtskarte
1:30.000
ZKI Aktivierungsnr. 004
Produktnr. 01
Versionsnr. 02
Lechenich
Ahrem
Bliesheim
Walberberg
Sechtem
Erp
Merten
Friesheim
Hemmerich
Bornheim
Weilerswist
Weiler in der Ebene
Klein-Vernich
Borr
Scheuren
Niederberg
Metternich
Alfter
Heimerzheim
Wichterich
Derkum
Müggenhausen
Neukirchen
Lommersum
Niederelvenich
Oberelvenich
Ottenheim
Straßfeld
Bodenheim
Dünstekoven
Oberwichterich
Wüschheim
Großbüllesheim
Frauenberg
Ollheim
Kessenich
Buschhoven
Durscheven
Kleinbüllesheim
Dom-Esch
Elsig
Miel
Morenhoven
Ludendorf
Euskirchen
Weidesheim
Wißkirchen
Essig
Kuchenheim
Odendorf
Niederdrees
Peppenhoven
Flerzheim
© DLR/ZKI 2021
Niedersachsen
Niederlande
Nordrhein-Westfalen
Hessen
Belgien
Rheinland-Pfalz
km
0
50
Legende
Hydrologie
Fließgewässer
Referenzwassermaske (Basis-DLM)
Beobachtete Wasserausdehnung am 15. Juli 2021
Verkehrsinfrastruktur
Schienenverkehr
Bundesautobahn
Bundesstraße
Landes-/Kreisstraße
Interpretation
Im Westen Deutschlands haben Unwetter und langanhaltender Starkregen für zahlreiche Überschwemmungen und damit verbundene Schäden gesorgt. Besonders betroffen sind hierbei Orte in Nordrhein-Westfalen und Rheinland-Pfalz. Etliche Flüsse und Bäche sind dort über die Ufer getreten, Straßen wurden überflutet und Keller sind vollgelaufen. Zahlreiche Gebäude und Infrastrukturen wurden im Zuge der Unwetter zerstört. Aktuell kamen über 40 Menschen ums Leben und weitere werden nach wie vor vermisst.
Die Karte zeigt die Hochwassersituation im Umland von Euskirchen am 15. Juli 2021. Der Hochwasserlayer wurde mittels automatisierter Verfahren aus Sentinel-1 Satellitendaten (10 m) abgeleitet. Sentinel-2 Daten mit einer räumlichen Auflösung von 10 Meter (Aufnahmezeitpunkt 1. Juni 2021) dienen als Hintergrundbild.
Bitte beachten Sie, dass die Hochwassersituation in städtischen Gebieten, unter Vegetationsbedeckung sowie in Bereichen mit starkem Gefälle aufgrund der Radargeometrie möglicherweise nicht vollständig erfasst wird. Da die Ergebnisse keiner manuellen Bearbeitung oder Nachbearbeitung unterliegen, können verschiedene Fehler und Fehlklassifikationen in den Daten vorhanden sein.
Kartographische Information
0 500 1.000 2.000 3.000 Meter
Projektion: UTM Zone 32N, Datum: WGS 84
Geographische Projektion: Lat/Lon (DMS), Datum: WGS 84
Maßstab: 1:30.000 für DIN A1.
Datenquellen
Sentinel-1 (10 m) / Sentinel-2 (10 m) © COPERNICUS by the European Union and ESA
Vektordaten © GeoBasis-DE / BKG 2021
Rahmenbedingung
Die Karte wurde nach dem aktuellen Stand der Technik erstellt. Alle geografischen Informationen unterliegen Einschränkungen hinsichtlich des Maßstabes, der Auflösung, des Aufnahmedatums und der Interpretation der Ausgangsdaten.
Es gelten die Lizenz, Nutzungsbeschränkungen und Zitierhinweise für ZKI-Produkte gemäß den Angaben auf dem Kartenprodukt und der ZKI-Webseite.
Erstellungsdatum 15 Juli 2021
© DLR/ZKI 2021
zki@dlr.de
http://www.zki.dlr.de
Deutsches Fernerkundungsdatenzentrum
Deutsches Zentrum für Luft- und Raumfahrt

MAPPING

ice Overview
can use the service
to use the service
folio: Rapid Mapping
folio: Risk and Recovery
lity control
r Guide

MAPPING

of Activations
of Activations
RSS Feed
ne Manual

AND RECOVERY

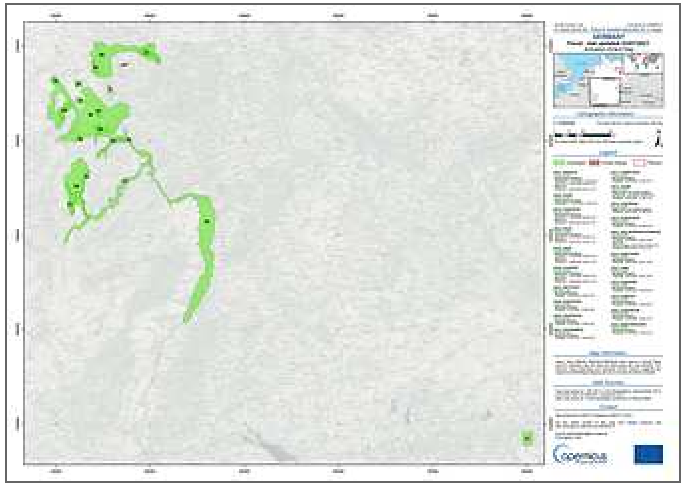
of Activations
of Activations
RSS Feed
ne Manual

EMSR517: Flood in Western Germany

Event Time (UTC): 2021-07-13 16:00
Event Time (LOC): 2021-07-13 18:00
Event Type: Flood (Riverine flood)
Activation Time (UTC): 2021-07-13 17:11
Activation Status: Closed
Affected Countries/Territories:
Federal Republic of Germany
Service Output: 27 products (80 maps)
Delineation: 11 products (43 maps)
Grading: 16 products (37 maps)
Authorised User:
Germany|Gemeinsames Melde- und Lagezentrum von Bund und Landern (GMLZ)

Activation Reason:
Heavy rains affected Rhineland-Palatinate area where a severe flood event is expected over the next few days along the river Moselle. The German Joint Information and Situation Centre (GMLZ) triggered the Copernicus EMS Rapid Mapping Service to monitor the flood evolution.

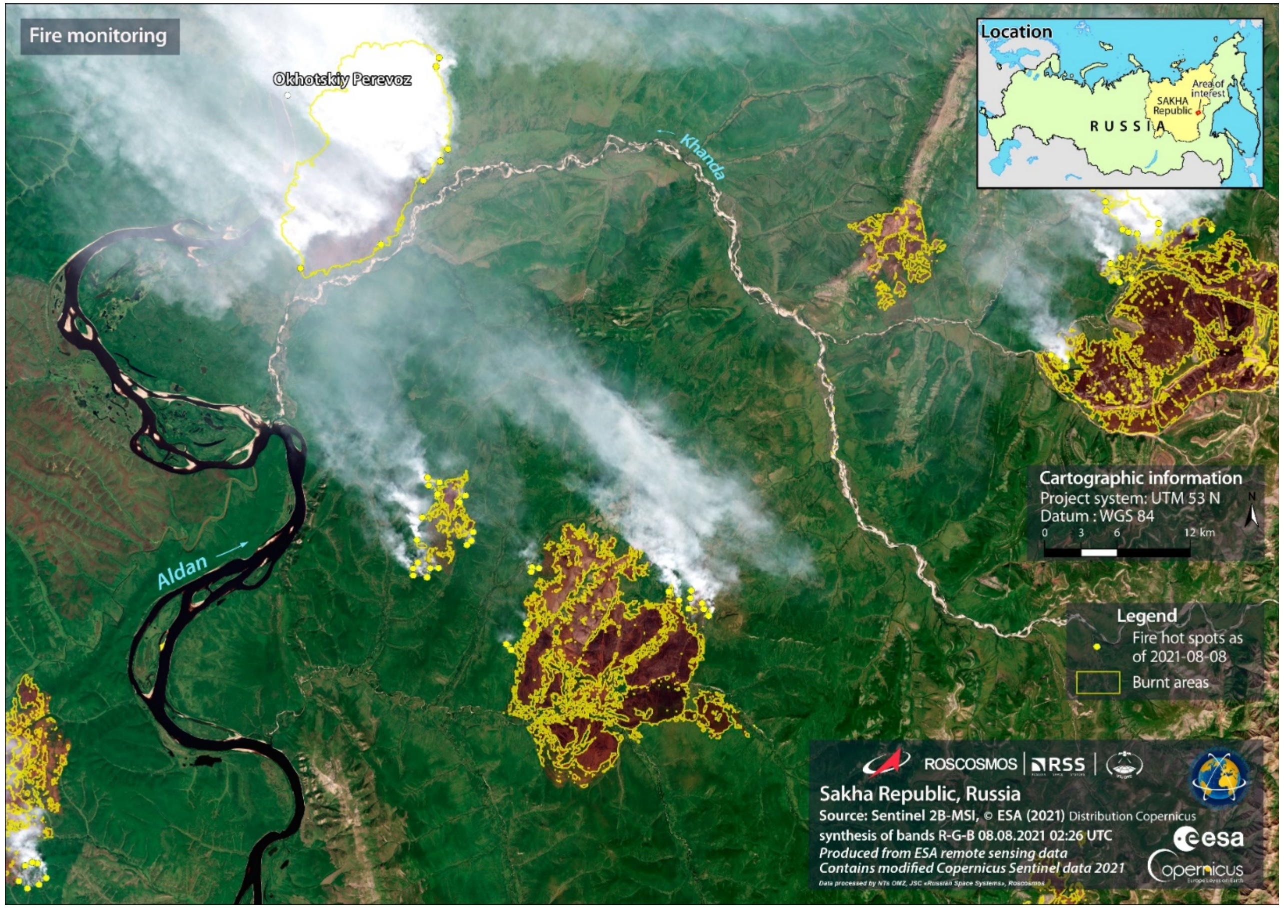
Tweet Coverage map: GeoRSS:



EMSR517 - Activation Extent Map
Release: r22 - Version: v1 - Delivered: 2021-07-23 10:03

Forest Fires

- Increasing worldwide
- Natural and man made
- Heavy influence to human
- Heavy influence to ecosystem
- Actual monitoring
- Monitoring after the event
- Asseesement of process



Floods and long term impact to the environment

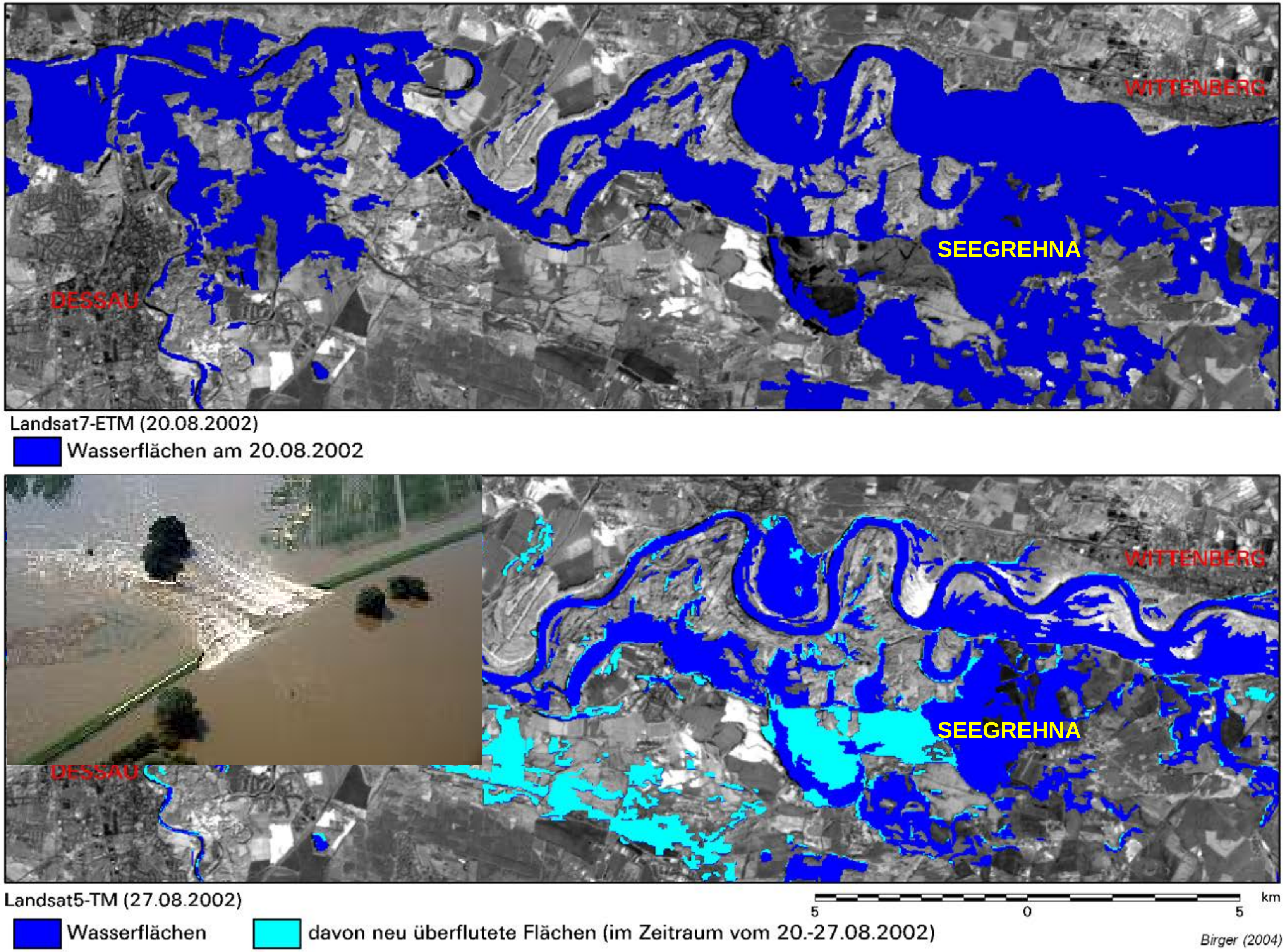
August 14, 2000

Examples from Germany

River Elbe, Mulde Saale

Extrem flood events 2002, 2006, 2010, 2013

High water level



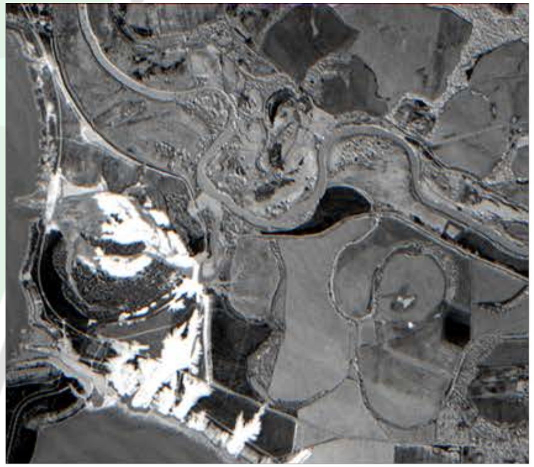
- Upper section of rivers in old industrial and abandoned mine sites
- High concentration of contaminants in river sediments
- Activating of these sediments during extreme flood events
- River water flow through brown sites

  and mine dumps
- Transportation, sedimentation and

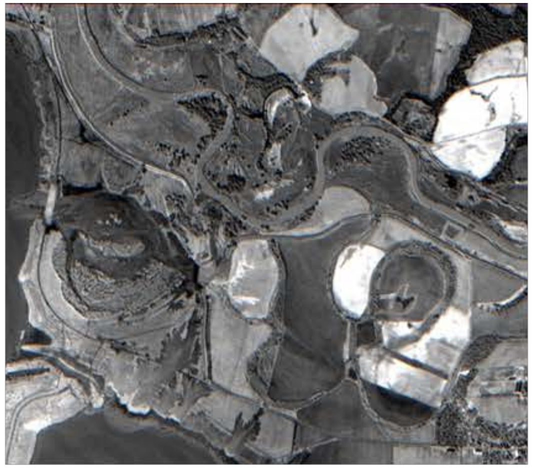
  accumulation in the lower parts of the river

Martin Luther University Halle-Wittenberg
Institute of Geosciences and Geography
Department of Remote Sensing and Cartography

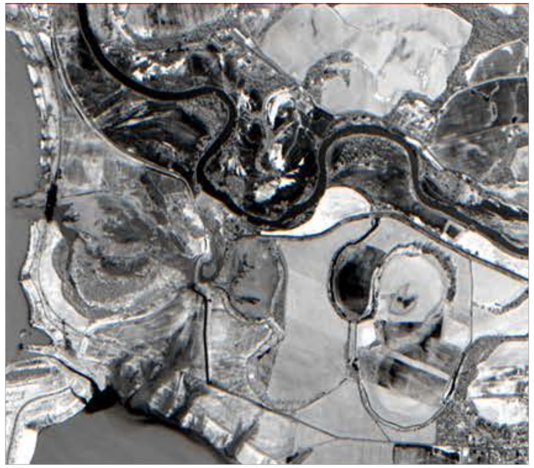
Endmember detection: classification of erosion



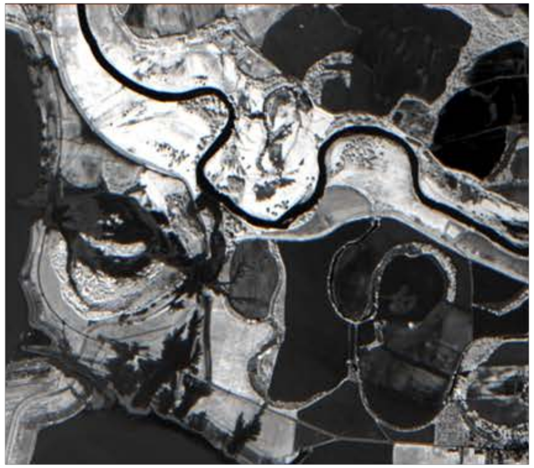
(A) Erosion holocene sediments



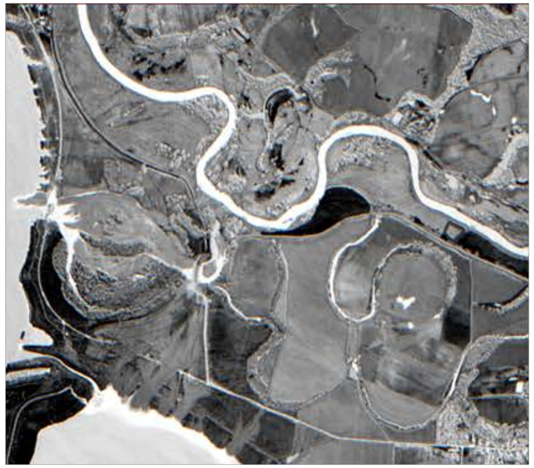
(B) Bare soils with accumulation



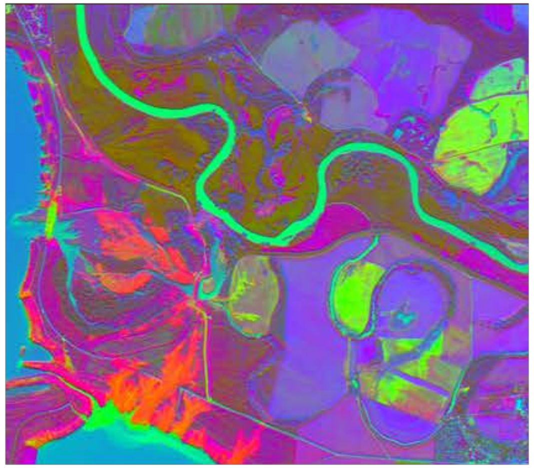
(C) Bare soils with crop residues



(D) vital vegetation



(E) Water bodies



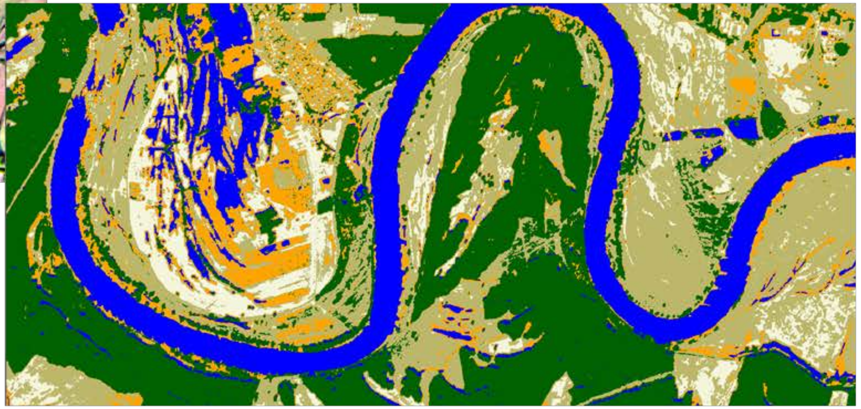
Composite Image from abundances
A (Red)
B (Green)
C) (Blue)

Low Endmember
Black 100%)

High
Endmembers
White 100%)

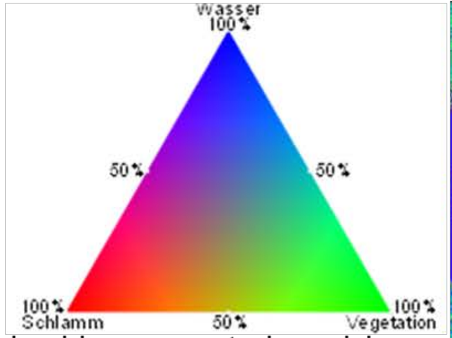
Klassifikation von Hochflutsedimenten – airbone Daedalus data

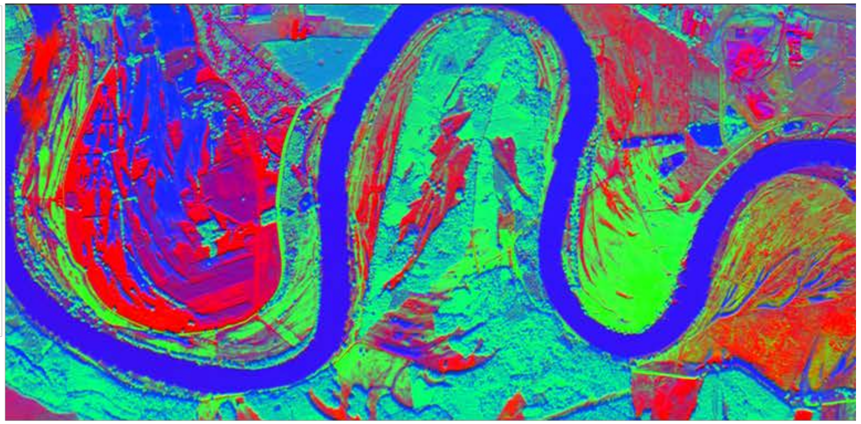
Daedalus-Airborne scanner data 4 weeks after fllod event (band 9/6/3 in R/G/B)



Clsssification of flood ediments

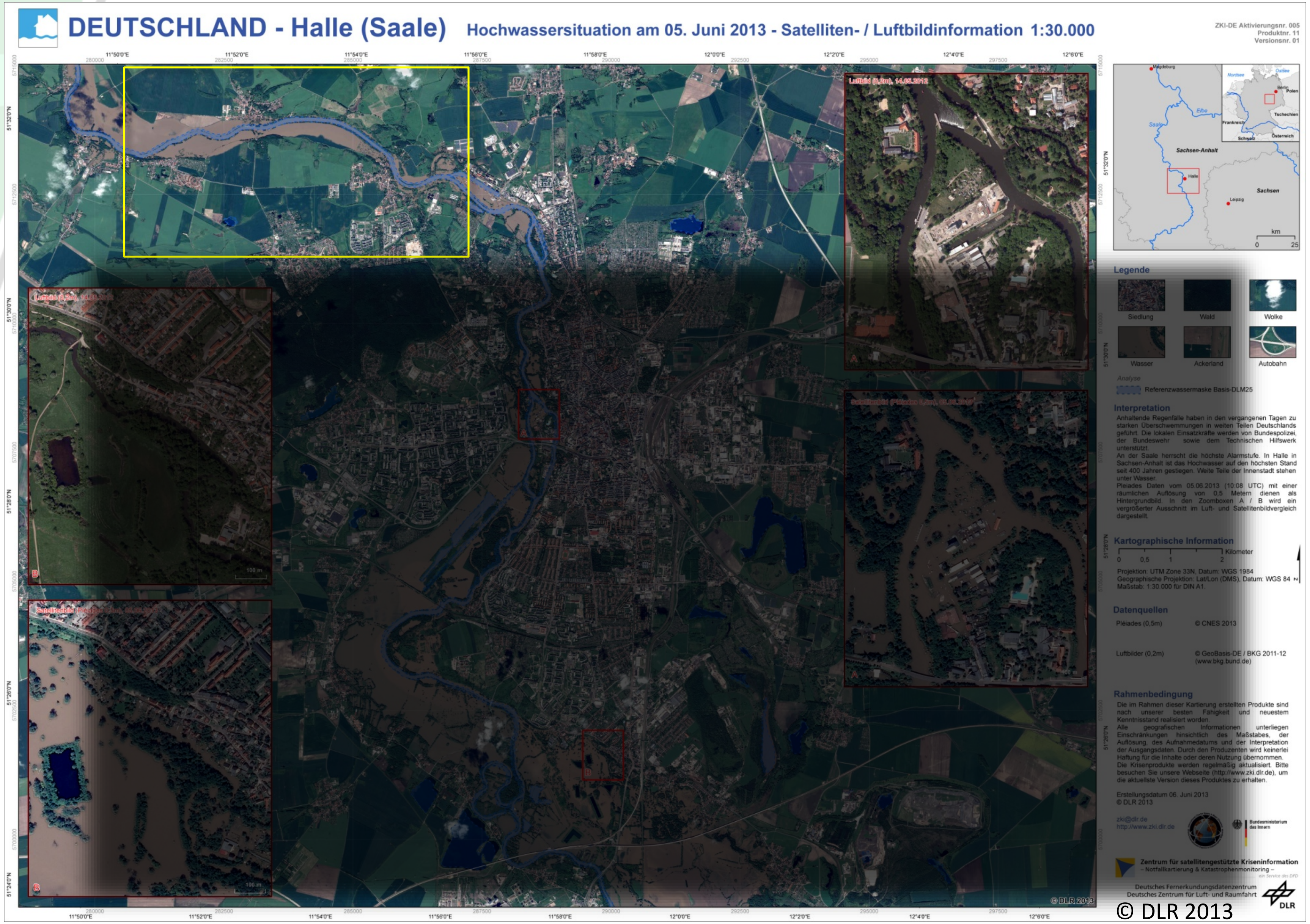
- Open water
- High mositure
- Sediments
- Greenland
- Forest





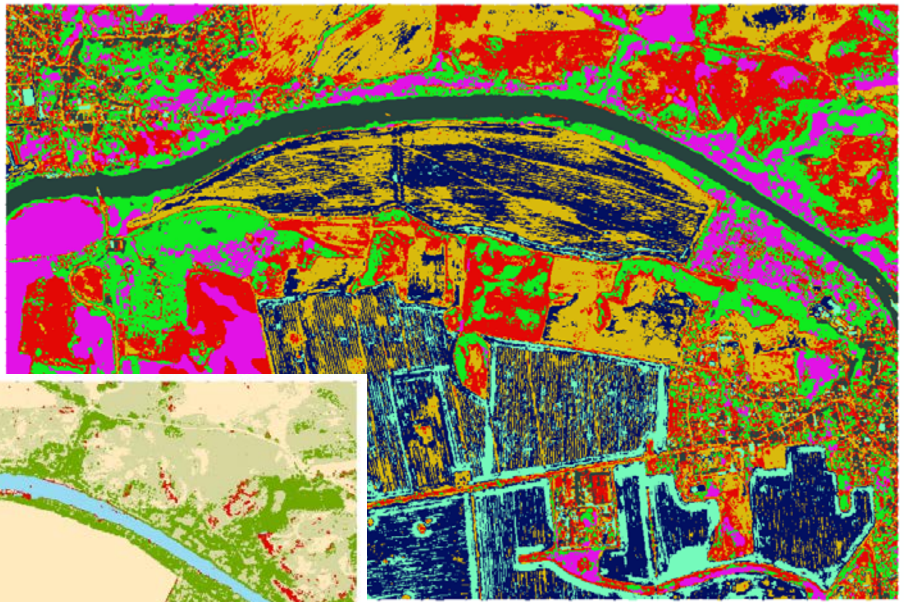
RGB-Composite Image des Linear spectral unmixing: Abundanzen Sediment (red), Vegetation (green) and Water (blue

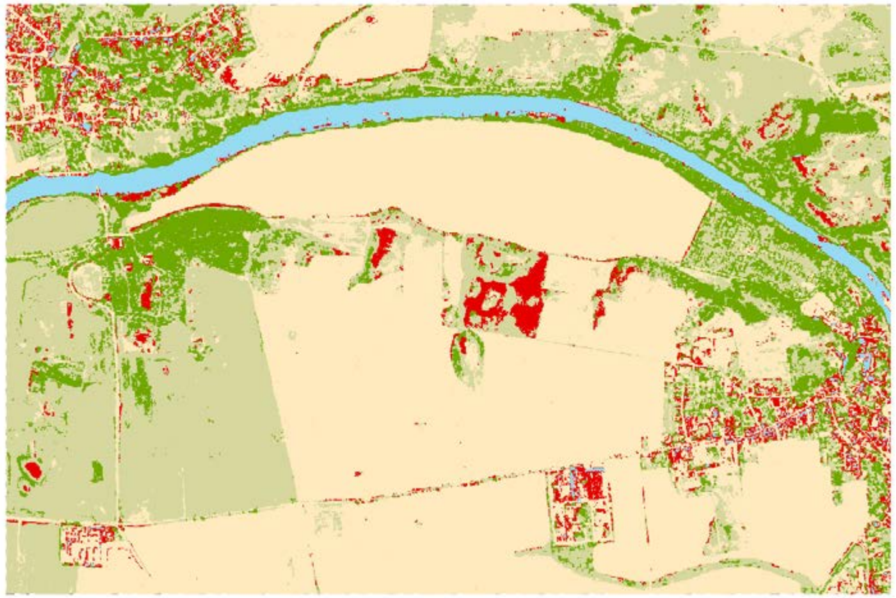
Flood event in Germany, June 2013



SPOT-6, 06.08.2018

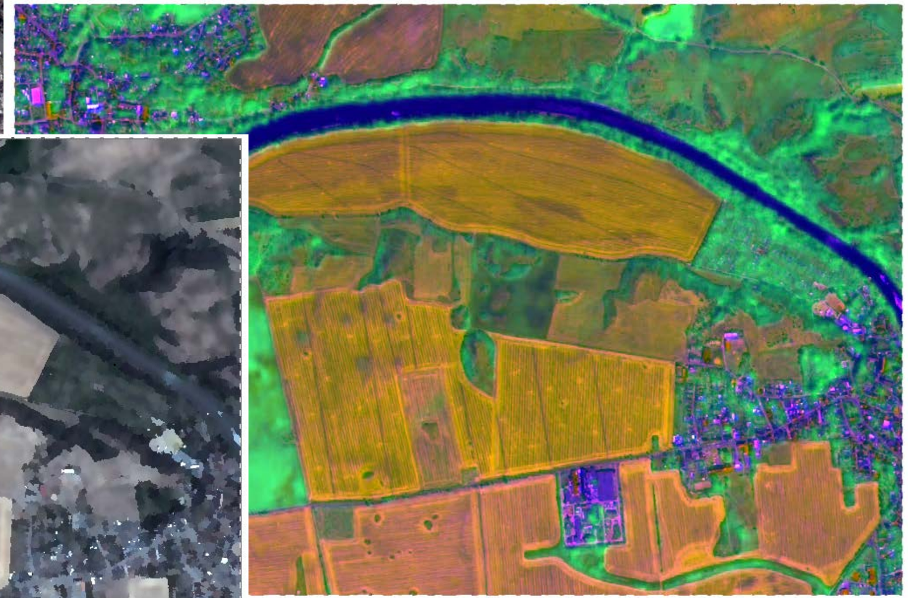
Iso Cluster
Unsupervised Classification





SPOT-6

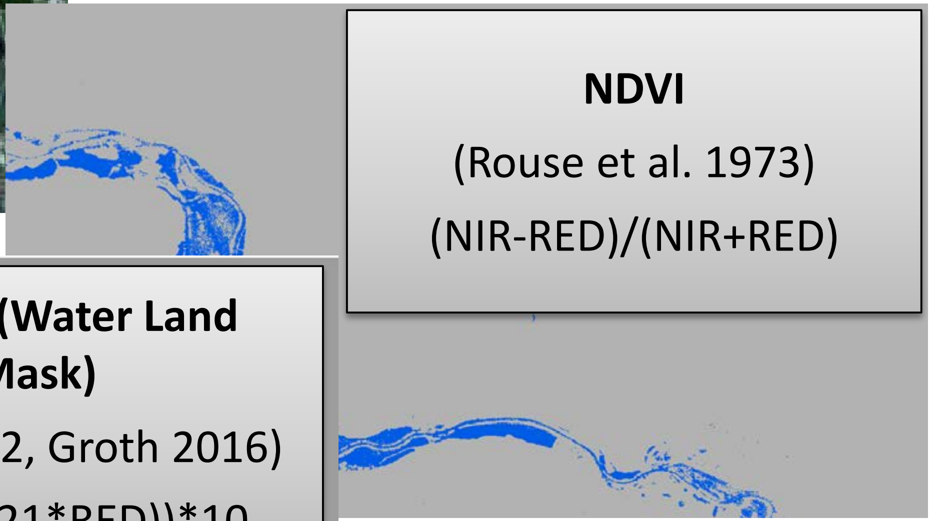
Principal Components



Segment Mean Shift

RE, 05.06.2013

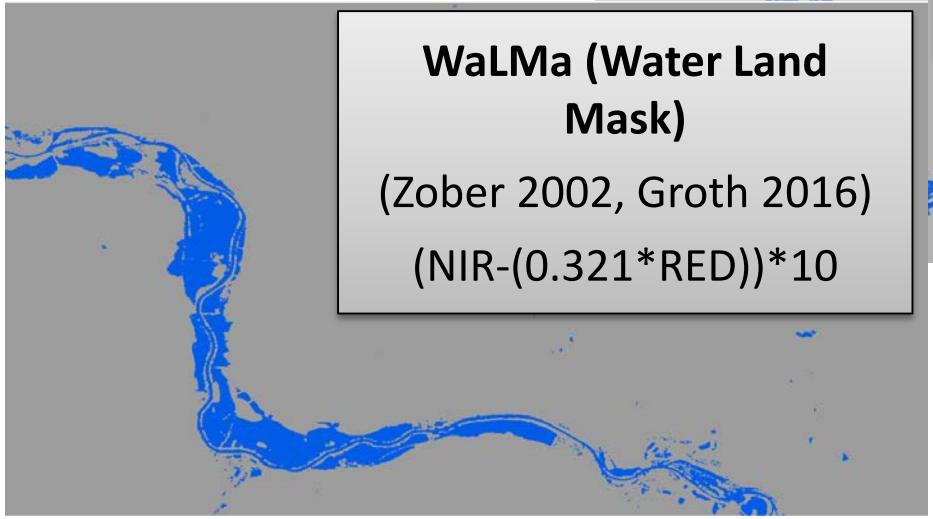
Flood detection and flood mapping -- > NDVI vs. WalMa



NDVI

(Rouse et al. 1973)

(NIR-RED)/(NIR+RED)

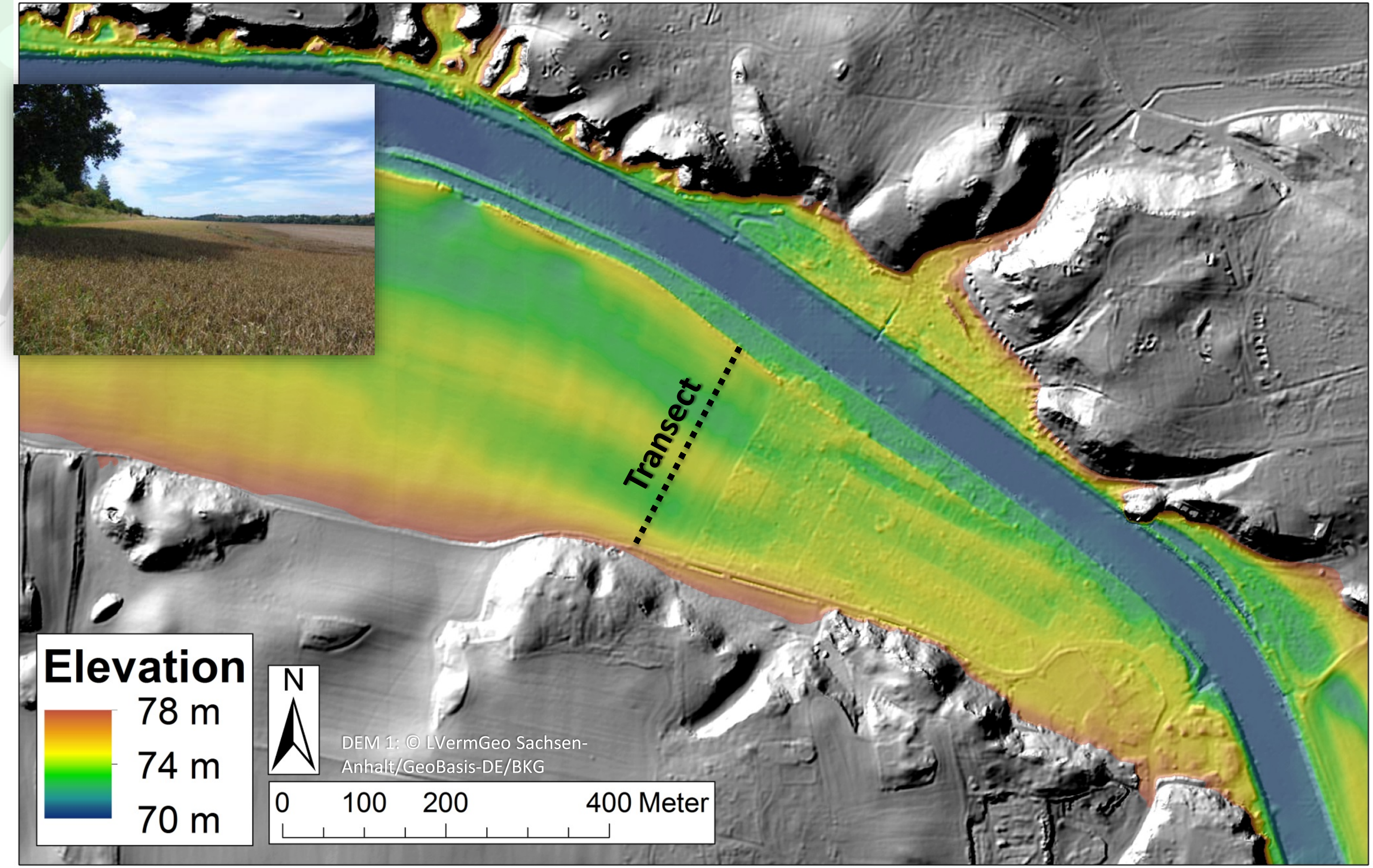


WaLMa (Water Land Mask)

(Zober 2002, Groth 2016)

(NIR-(0.321*RED))*10

Impact of floodplain morphology on flood extend



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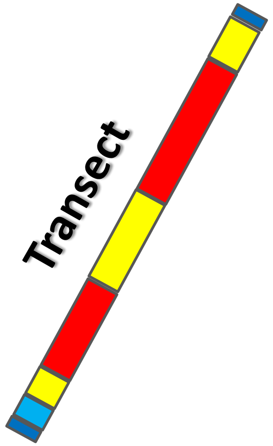
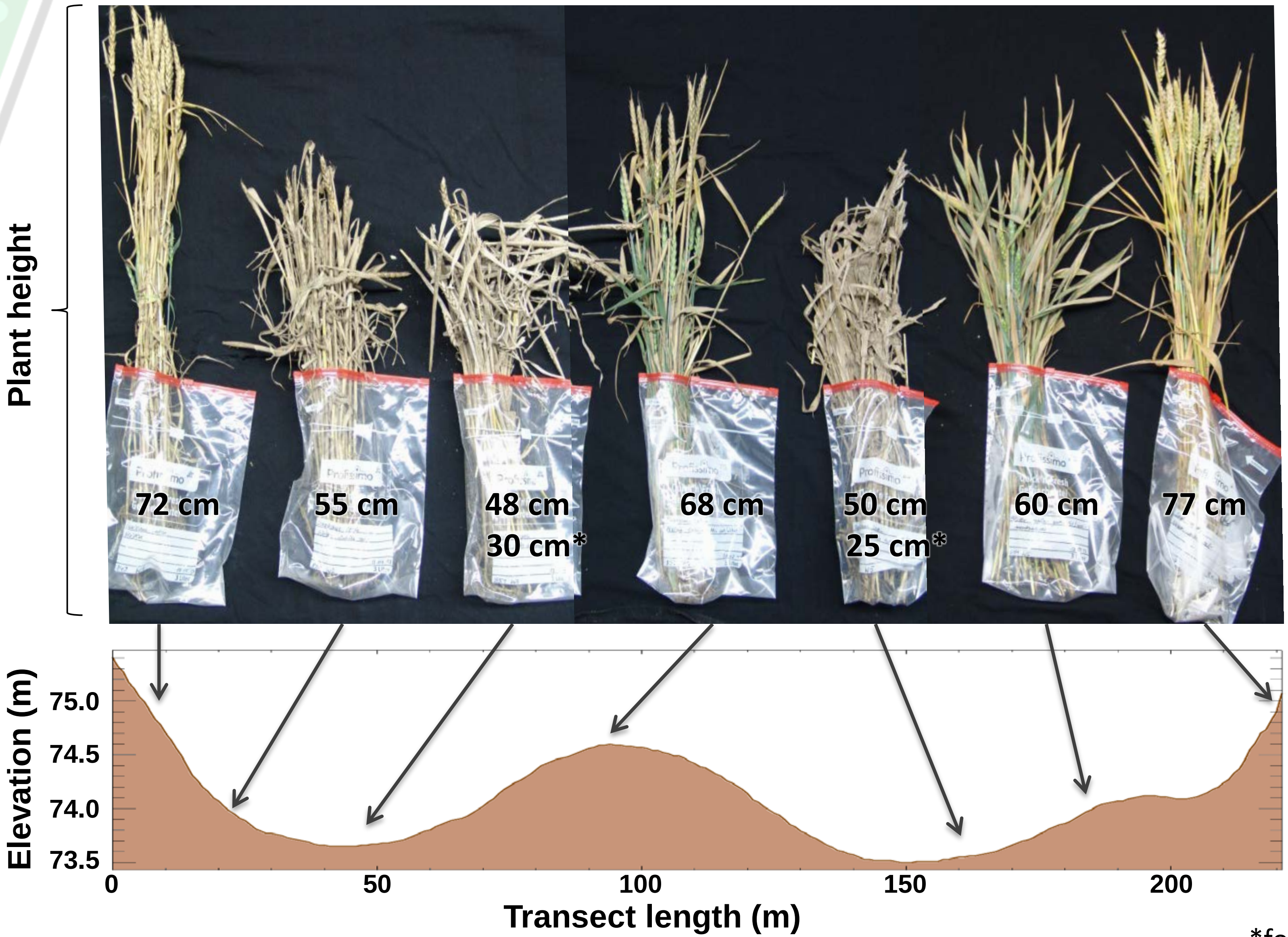
Impact of floodplain morphology on flood extend

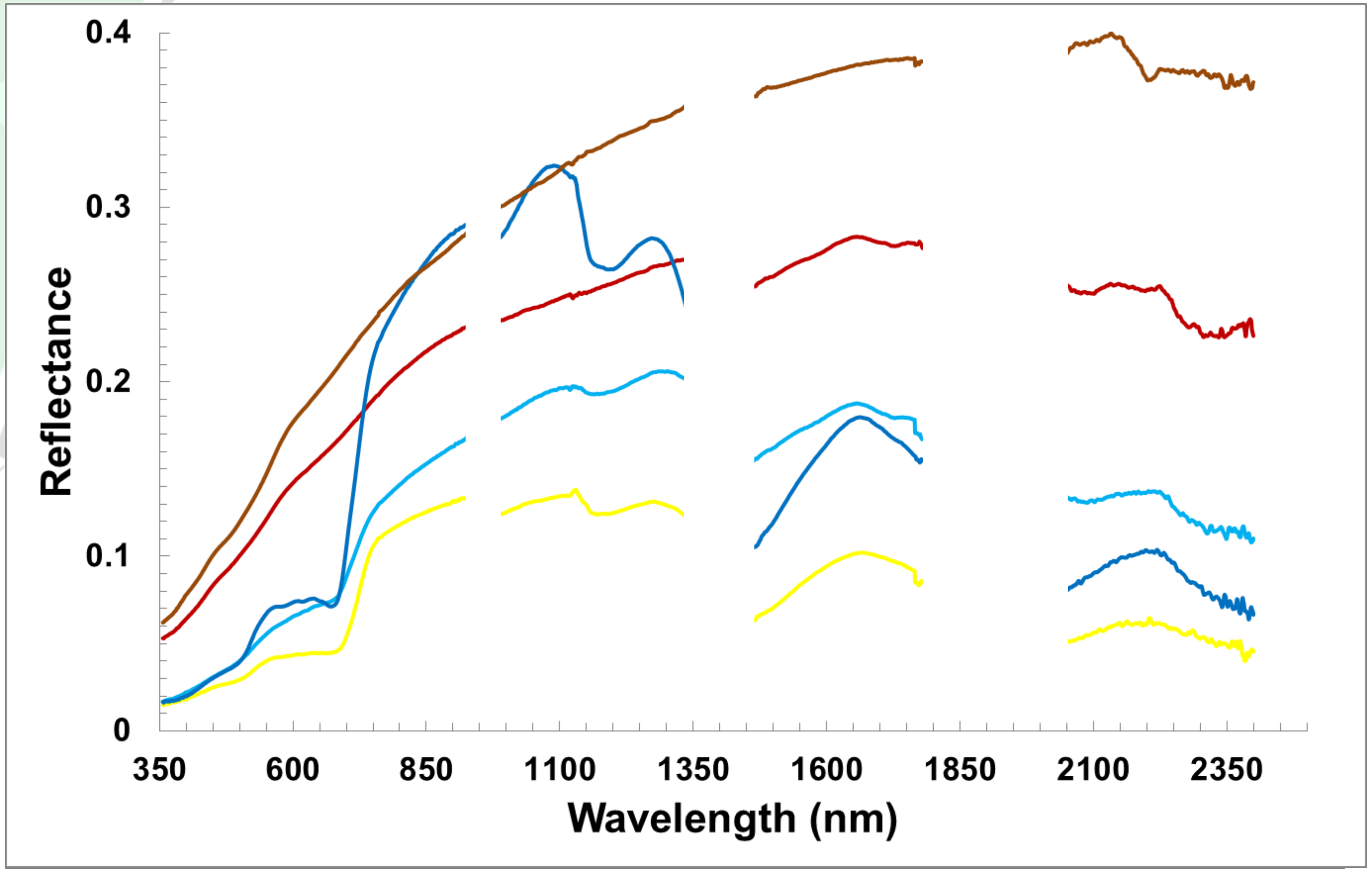


Impact of flood events on plant height



*folded stems

Impact of flood sediments on vegetation spectra



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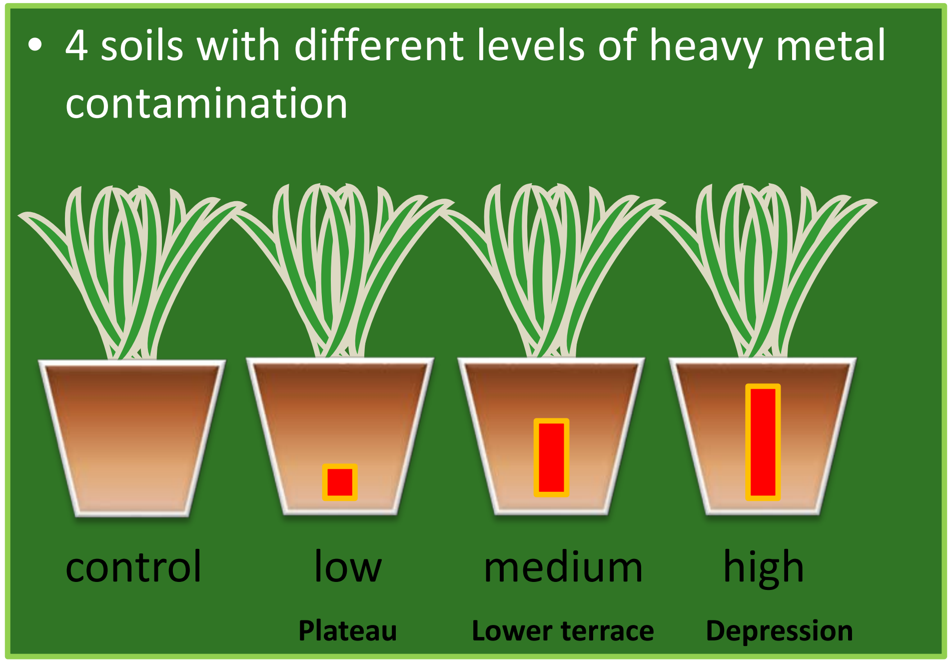
Pot experiment (3 years)



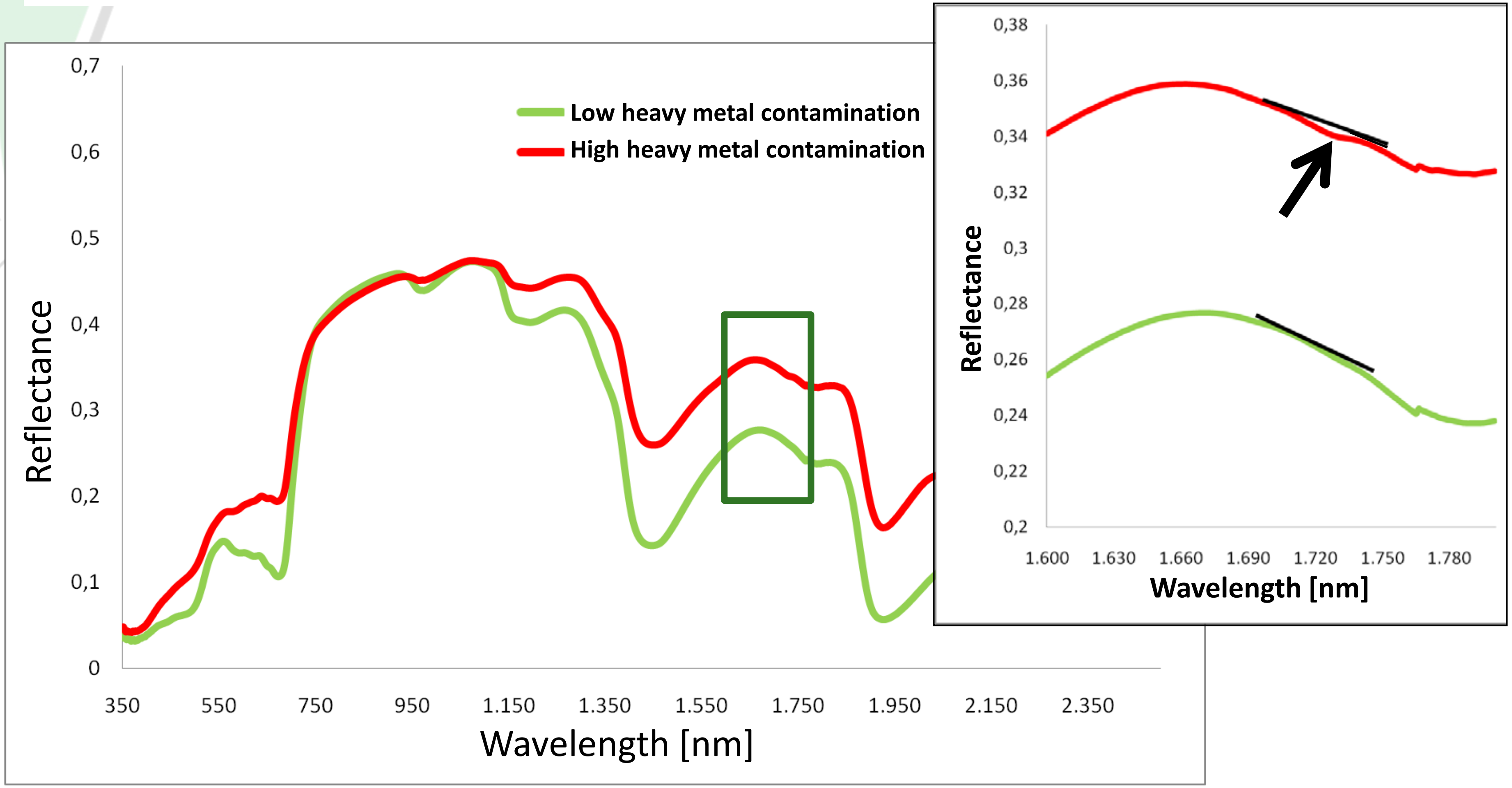
5 different dominant floodplain plants

Artemisia vulgaris,
Urtica dioica,
Phalaris arundinacea,
Alopecurus pratensis,
Alopecurus geniculatus

Götze et al.
Cent. Eur. J. Geosci 2010

Absorption feature of heavy metal content in plants

CR1725



Spectral measurements of the pot experiment, wetland vegetation with various heavy metal pollution

Götze et al. 2010

Results airbone Hymap data

Transfer to remote sensing data

Legend
Heavy metal contamination level

- **1 low**
- **2 moderate**
- **3 middle-moderate**
- **4 middle**
- **Limit for grasslands**
- **5 high**
- **6 critical**

Application

Masking

Threshold classification

Method CR1725,
HyMap from HyEurope campaigne

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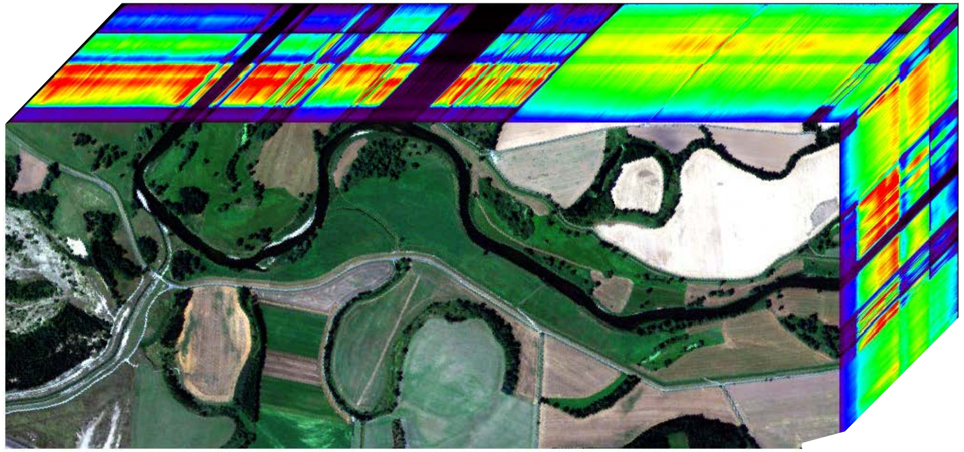
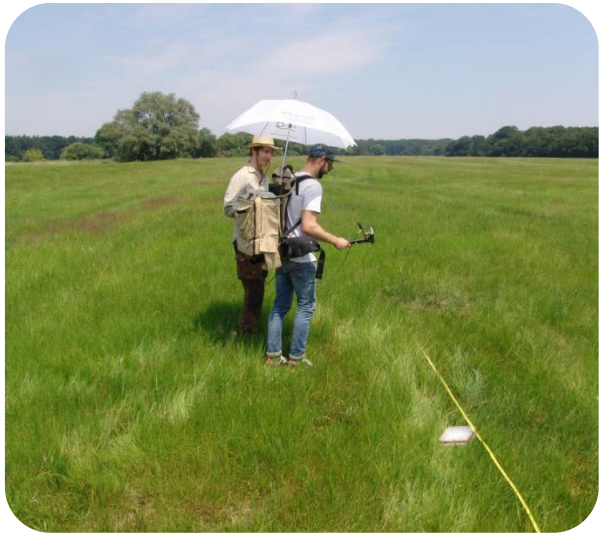
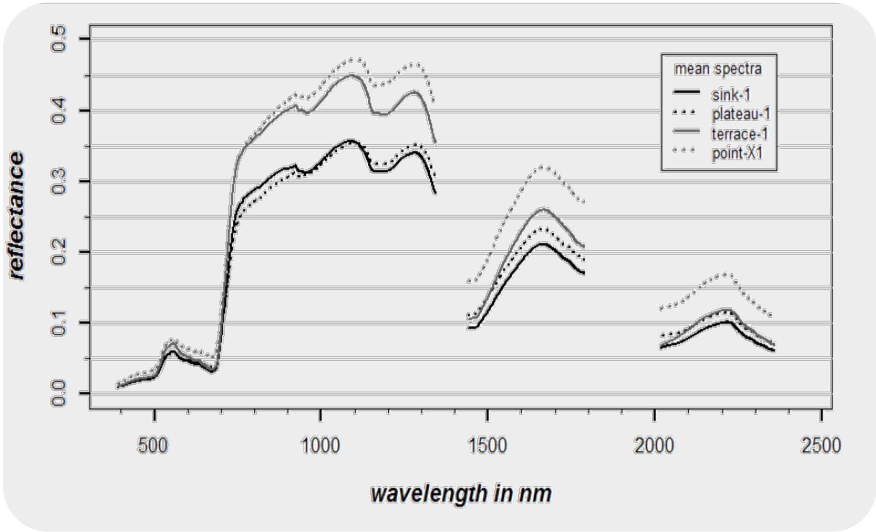
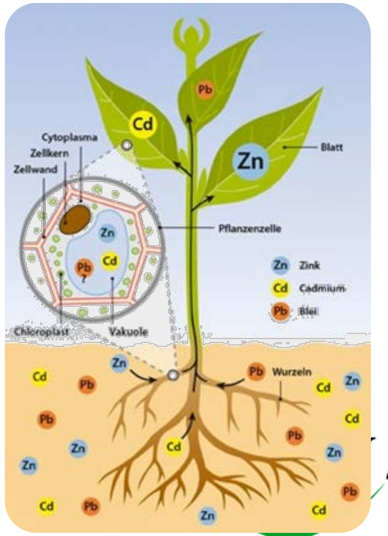
Example: Assessing vegetation stress in floodplains



Related to the project EnviMetal







Quelle: http://dradiowissen.de/beitrag/phytomining-mit-pflanzen-schwermetalle-gewinnen

Example: Assessing vegetation stress in floodplains

Background:

- Increase in frequency and intensity of flood events
- Enrichment of heavy metals (HM) in flood areas

Aim:

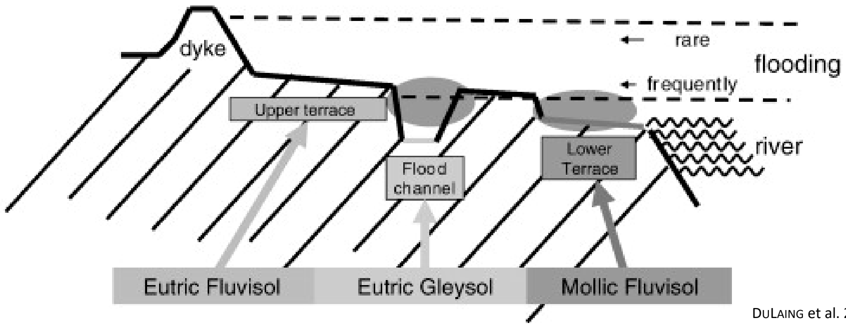
- Spatial monitoring of floodplain ecosystems
- Spatial assessing vegetation stress and potential ecotoxicological effects using FE methods

Challenges:

- Various influencing factors (vegetation, soil, terrain...)
- HM accumulation is element & plant-specific
- seasonal effects, spatial & temporal dynamics
- Natural vs HM-induced vevegtation stress

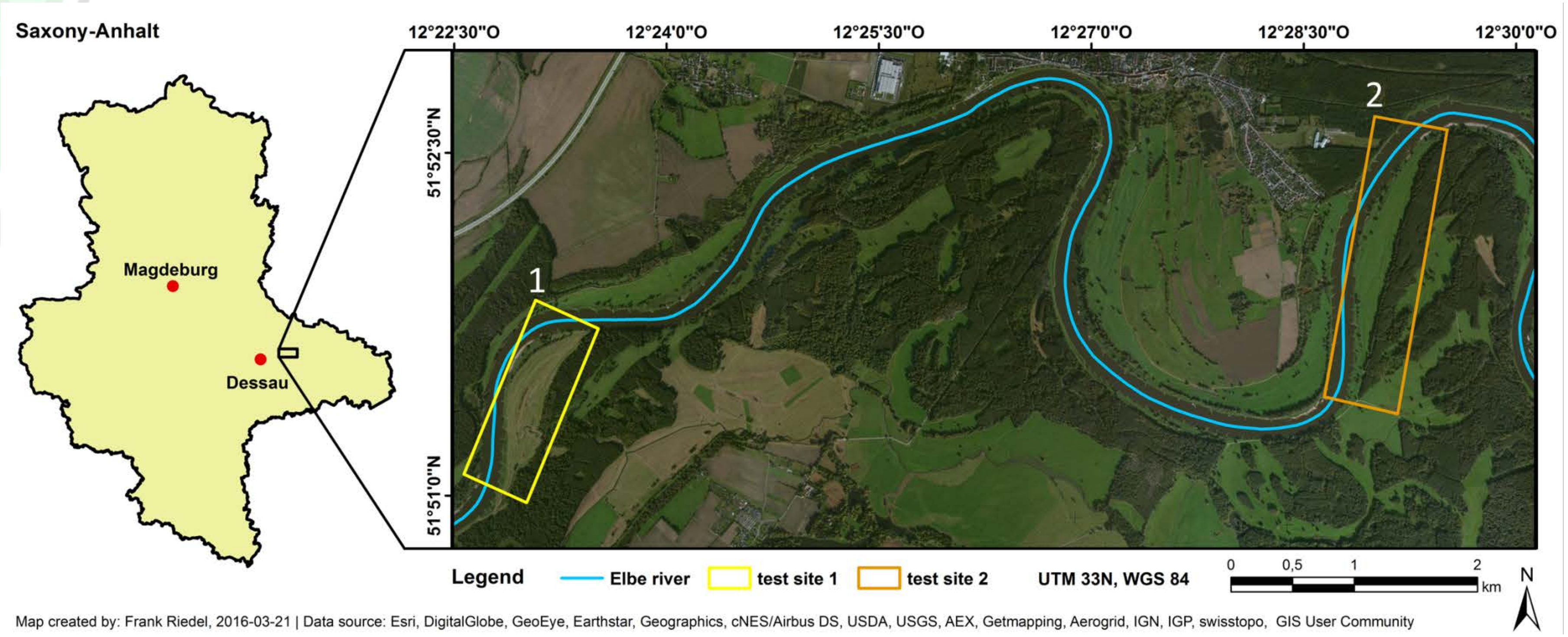
BMU & BFN 2009:27)

Relief in floodplains



DuLaing et al. 2009

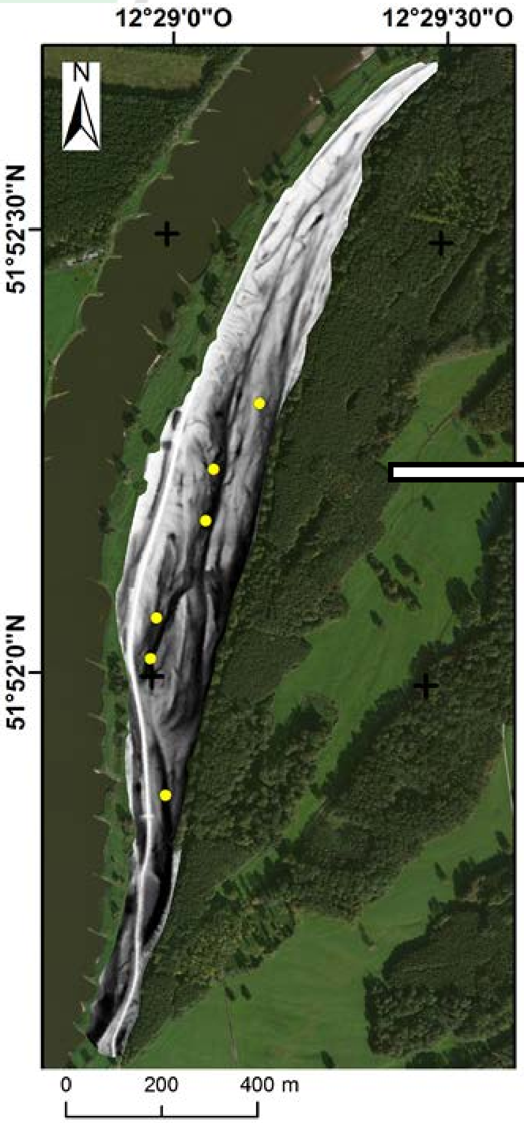
Example: Assessing vegetation stress in floodplains

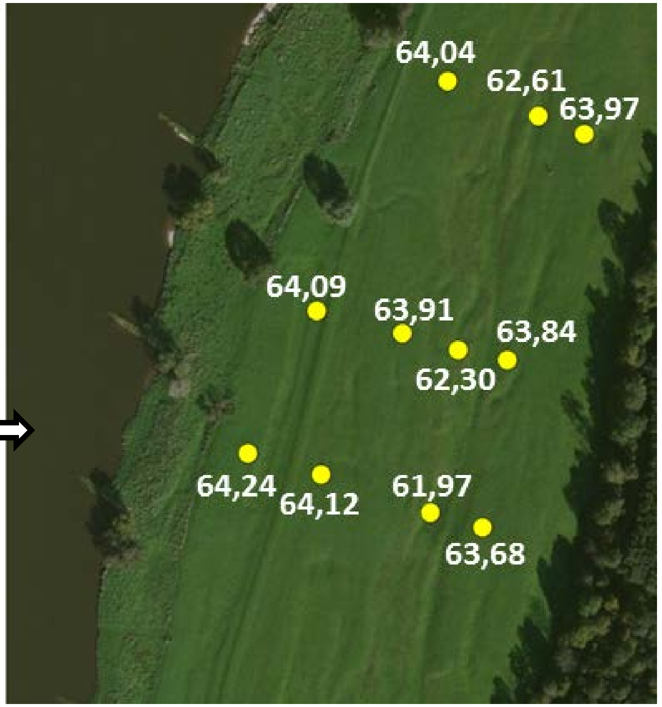


Aims in the course:

- Analysis of the relationship between vegetation spectral properties and plant parameters (growth heights, SPAD values, chemical soil and vegetation values)
- Analysis of the relationship between vegetation indices and fine relief

Example: Assessing vegetation stress in floodplains





Measurement points

- Trimble AgGPS® RTK Base 450
- X, Y, Z coordinates
- Data format: shape file

Field spectra

- Measured along cross sections in representative morphological units
- ASD FieldSpec Pro FR (350-2500 nm)

Example: Assessing vegetation stress in floodplains

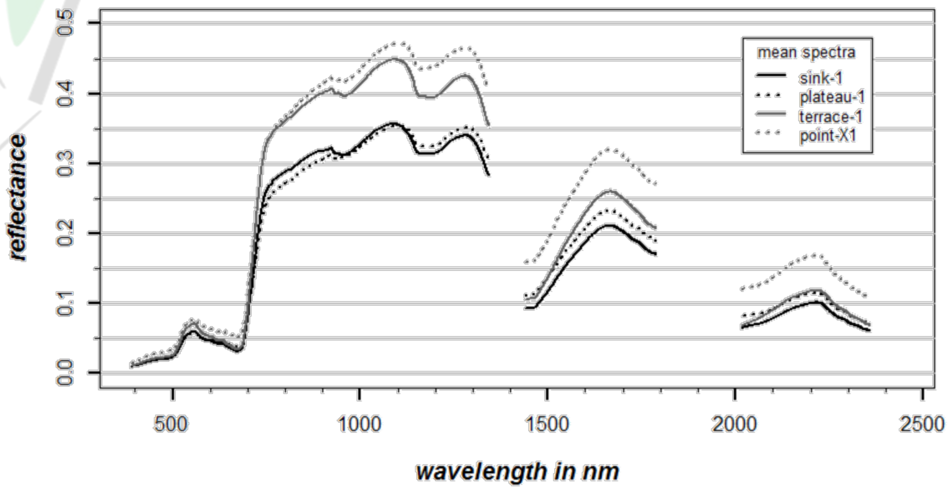
SPAD-values

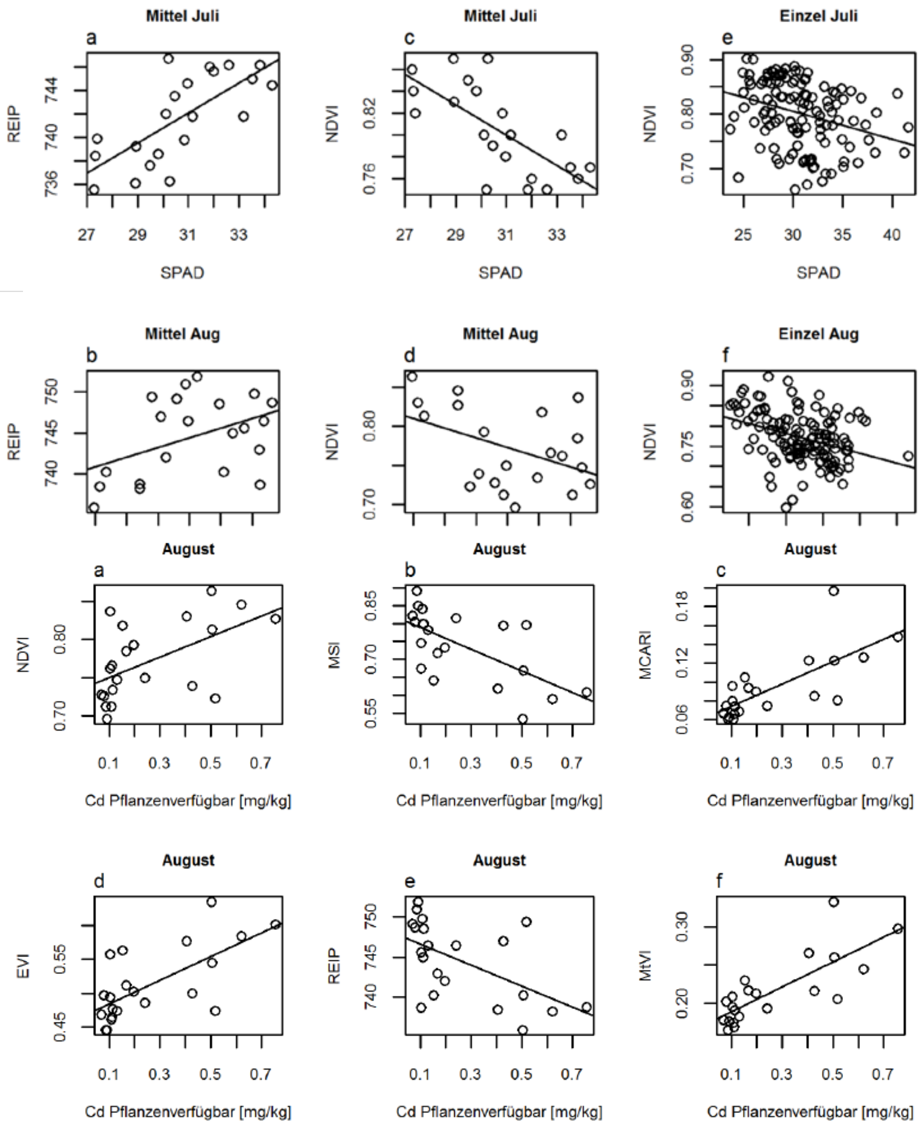
Vegetation heights

Chemical properties

	Concentration (mg kg^{-1})				
	Cu	Pb	Zn	Cd	Ni
Ø Sinks	68.19	110.64	253.00	1.54	37.24
Ø Terraces	53.33	77.40	211.77	1.16	36.71
Ø Plateaus	52.81	80.35	227.43	1.40	35.90
Ø Total	58.11	89.46	230.73	1.37	36.62
Min	40.66	60.83	165.43	0.79	31.00
Max	109.00	138.83	432.77	3.29	45.33

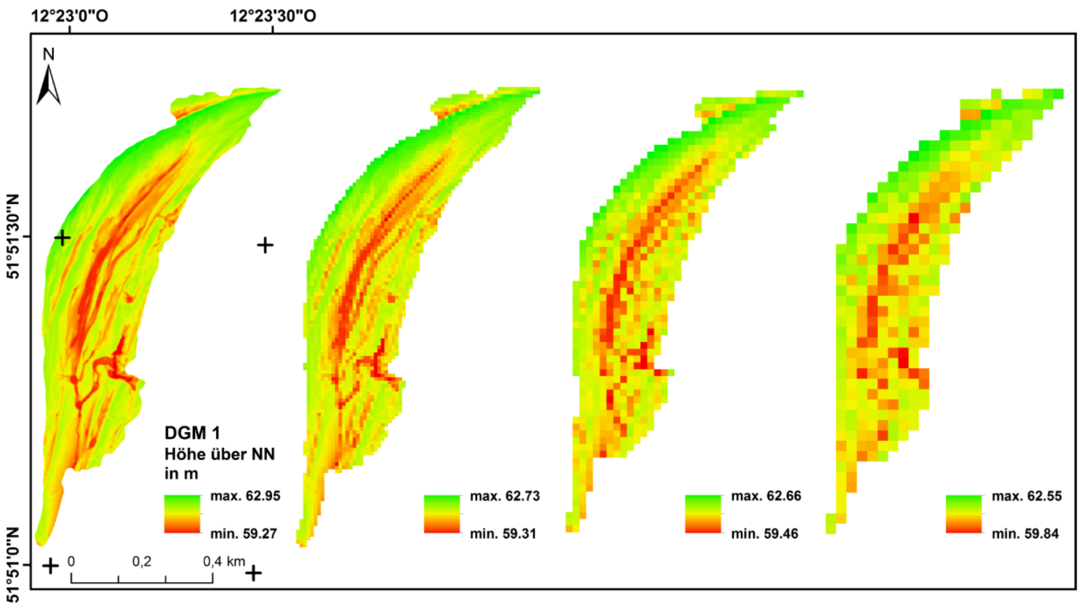
Example: Assessing vegetation stress in floodplains



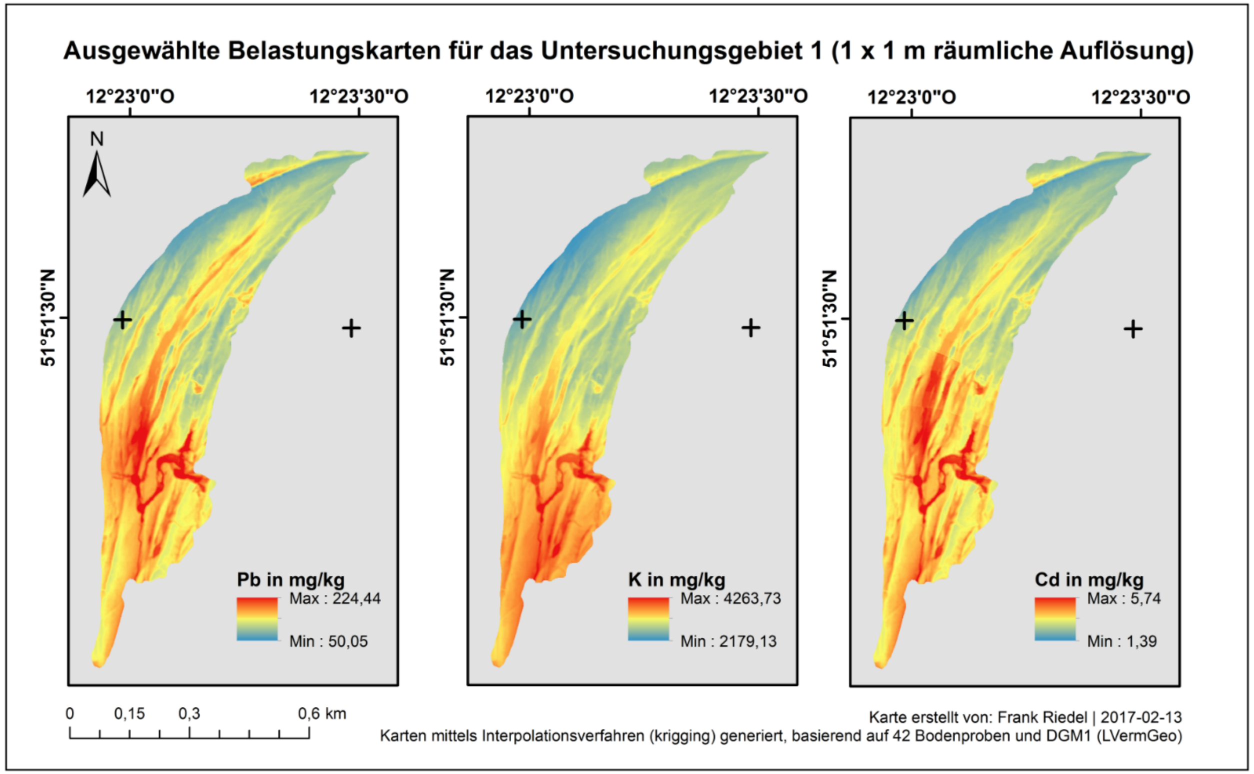


Results: Correlations between vegetation spectral data, SPAD and HM values.

Darstellung der Feinmorphologie in Abhängigkeit von der räumlichen Auflösung



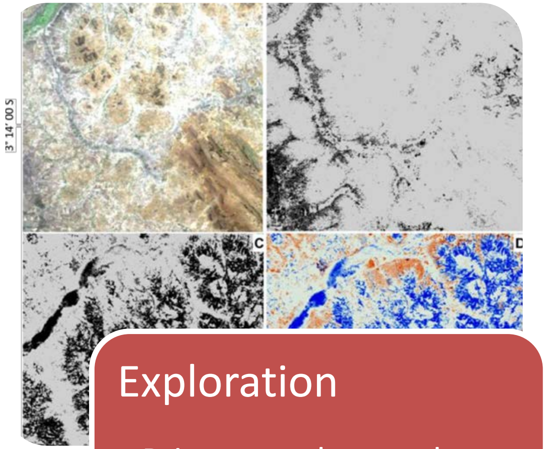
Karte erstellt von: Frank Riedel, 2017-03-03 | Datengrundlage: Landesamt für Vermessung und Geoinformation Sachsen-Anhalt



Riedel, 2018

Example: Assessing changes in post-mining landscapes

Remote Sensing in the mine life cycle



Exploration

- Primary and secondary ("man made") deposits
- Quali- and quantitative assessment of the raw material inventory

Active mining

- Monitoring of ongoing mining activities
- Mapping the spatial extend of mining areas, assessing potentiality

Reclamation

- Monitoring of bio- and geochemical processes
- Observation of mining lakes and hydrochemical parameters

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Introduction anthopogenic landscapes

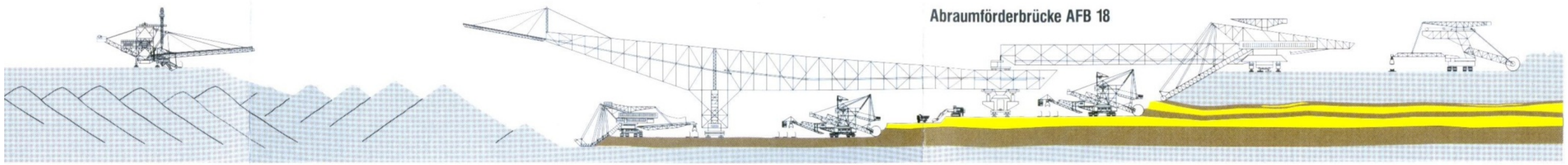
- Mining activties worldwide existing
- Devastation of the whole landscape
- After the period of active mining development of complete new landscape types with very special condition
- Parts of these new landscape are ***new nature reserve areas, like drylands, oligotrophic areas, openland areas***



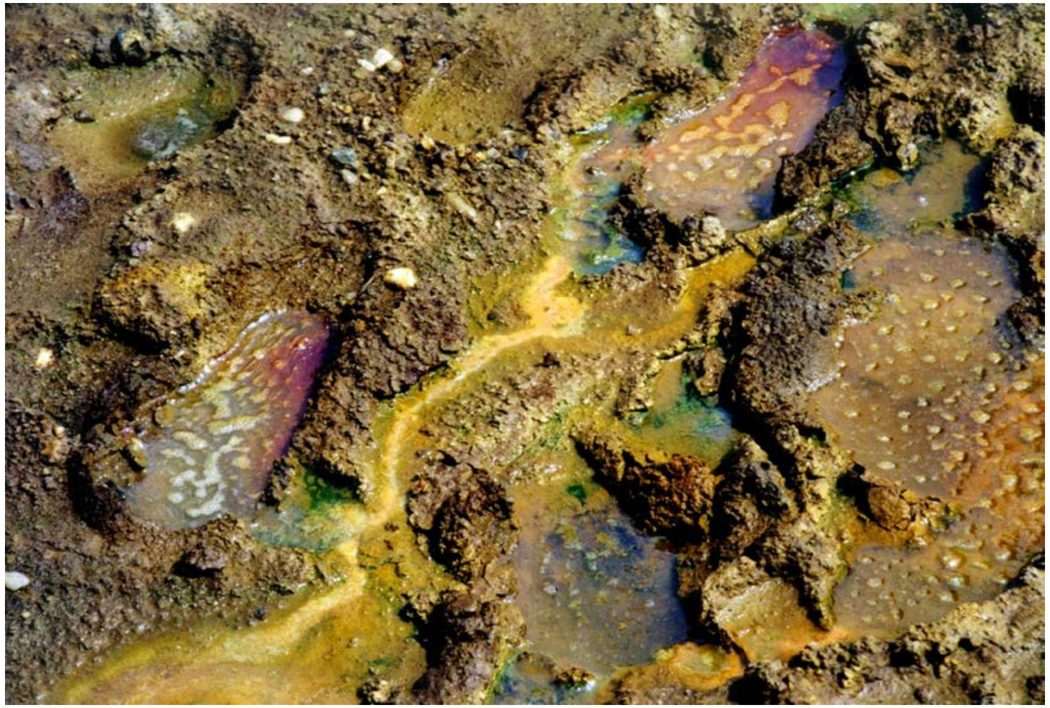


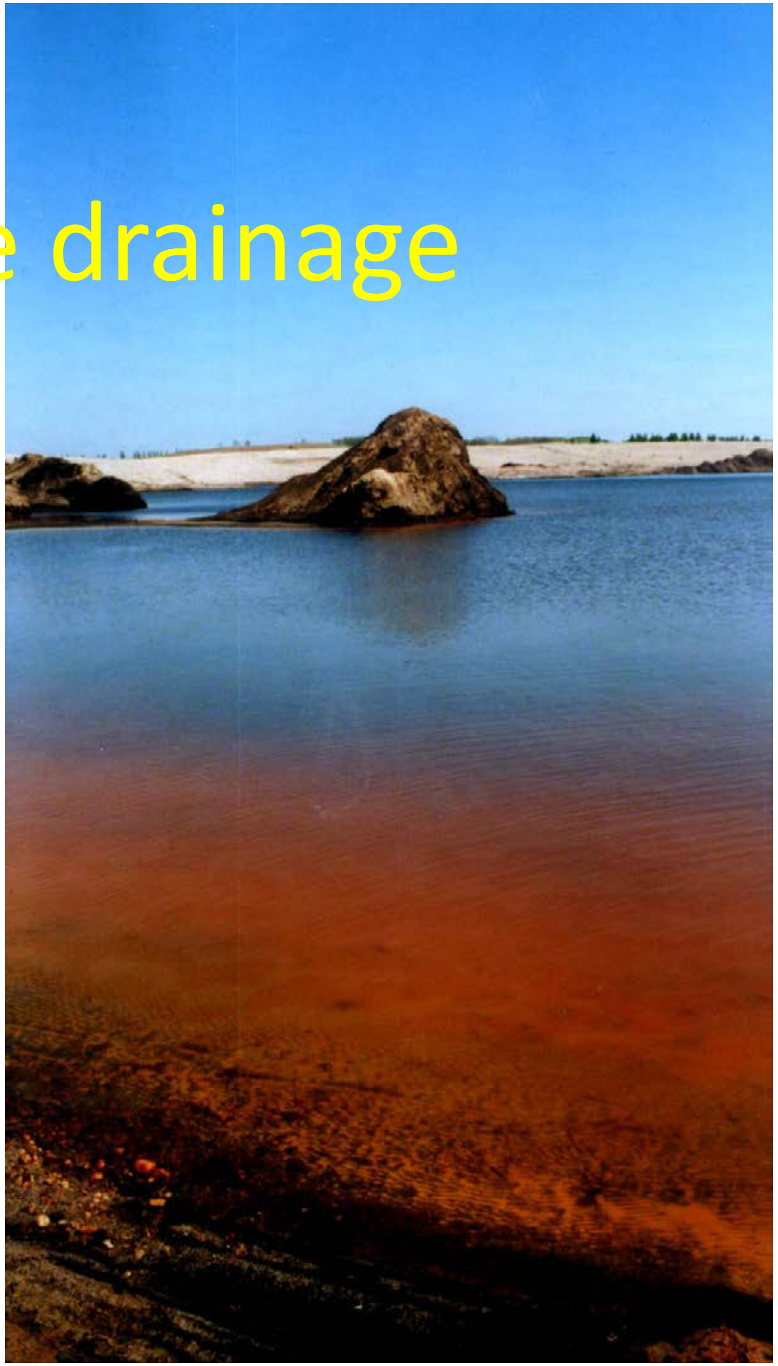
Post mining landscapes

- Complete new ecosystem, highly dynamic area
  - Anthropogenic processes (geotechnical works, reforesting, flooding of mines with surface water)
  - Natural processes (erosion, succession of vegetation, ascending ground water

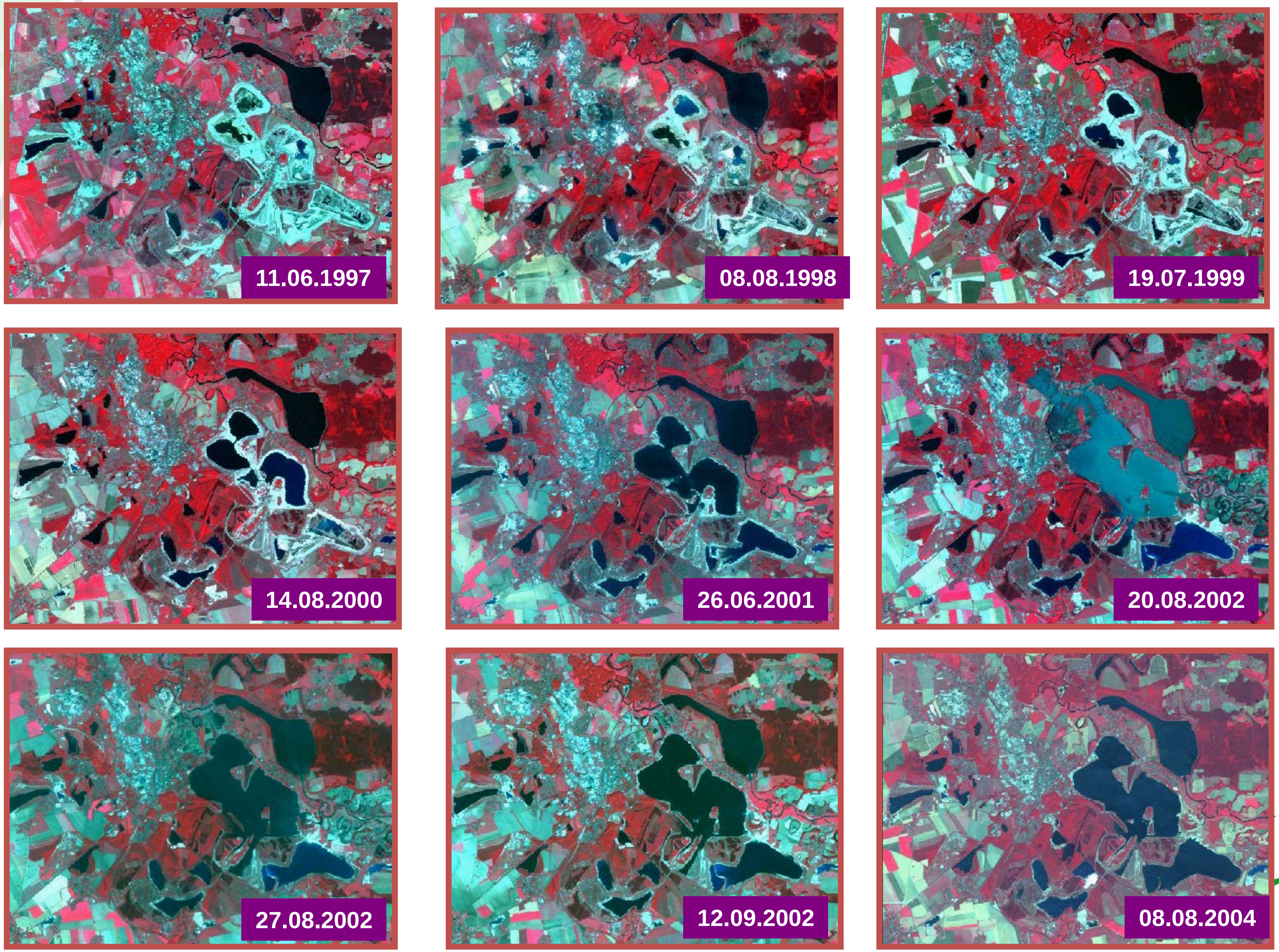


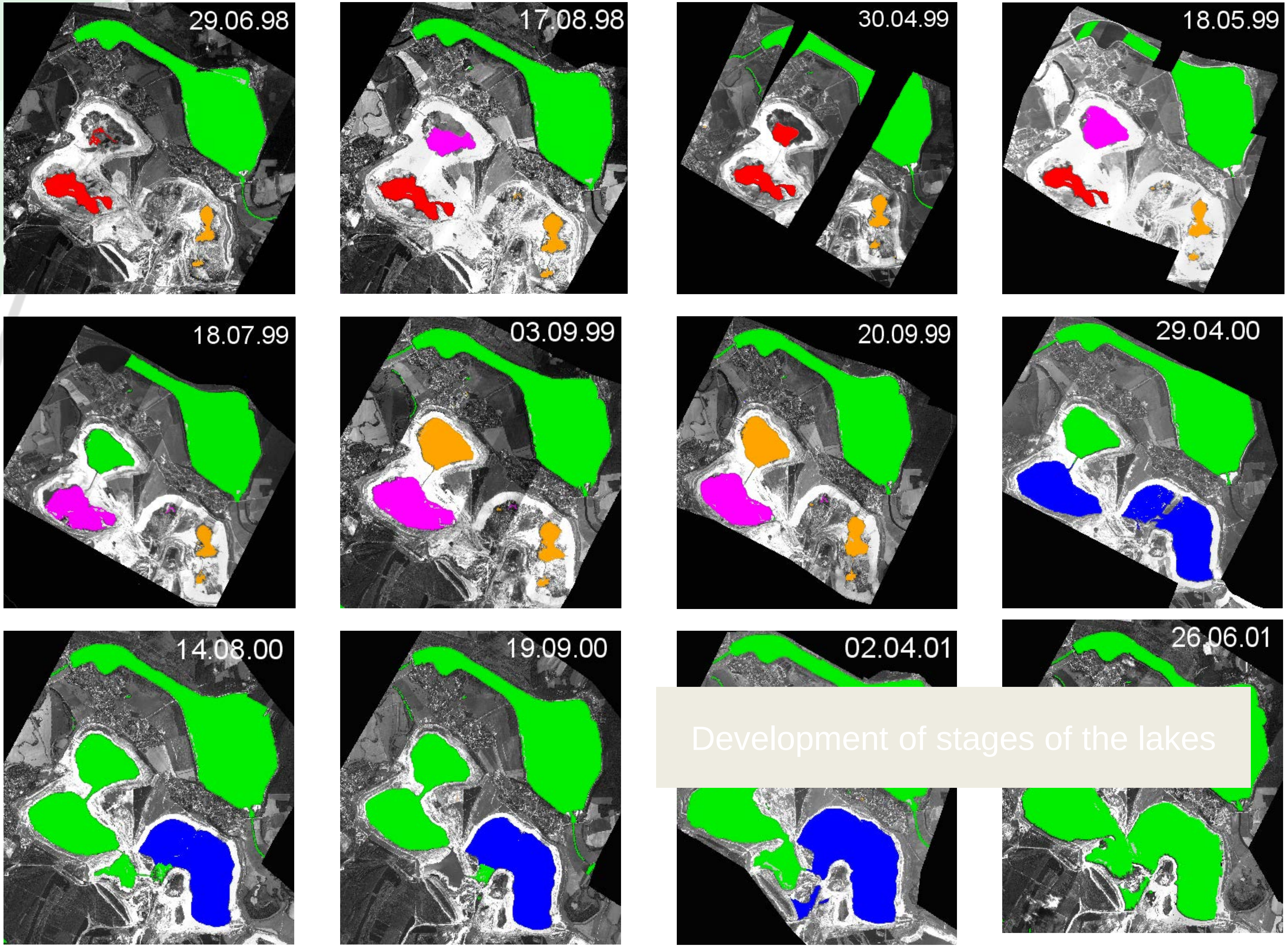
Acid mine drainage





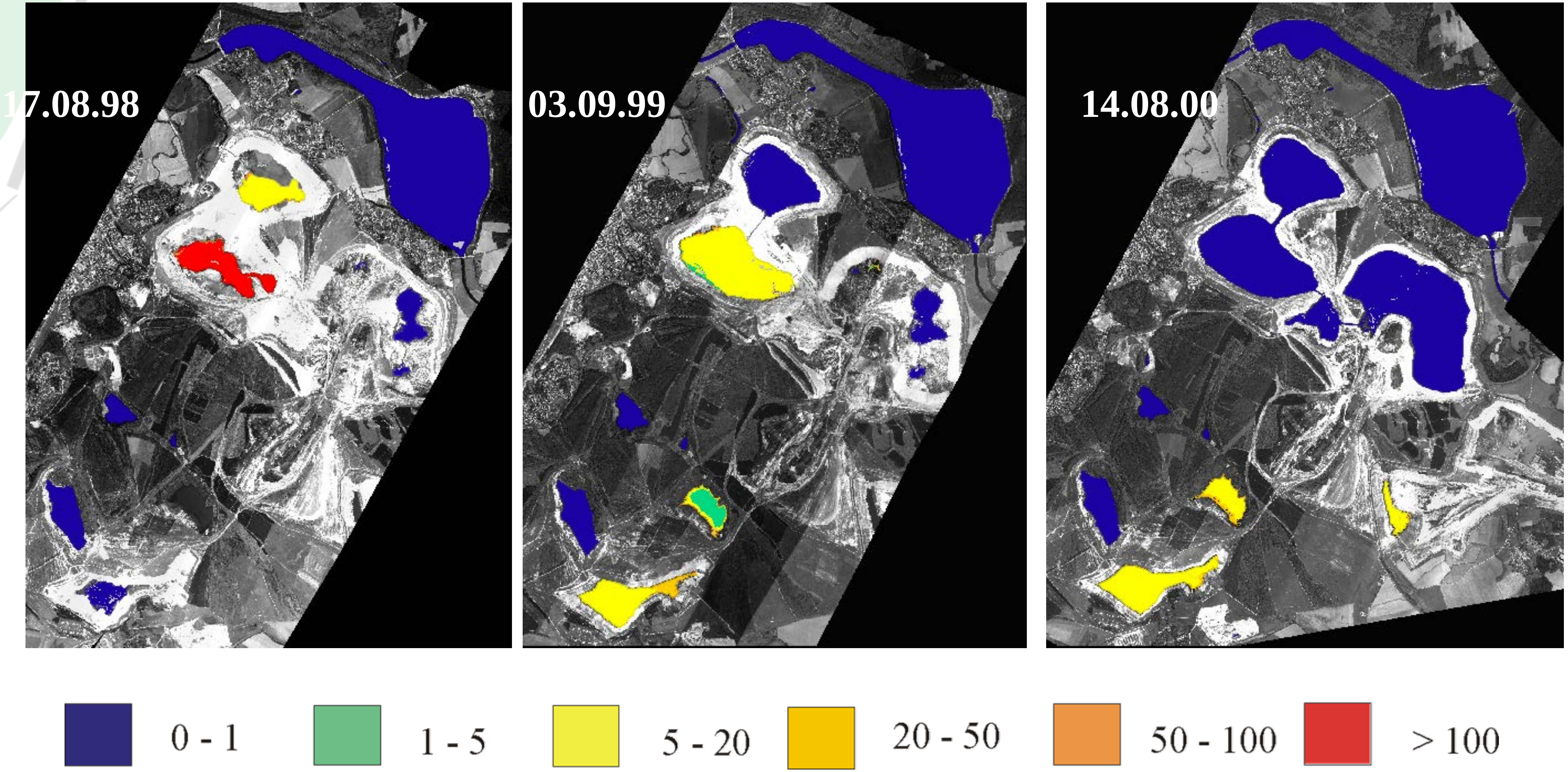
Time series of Landsat TM data



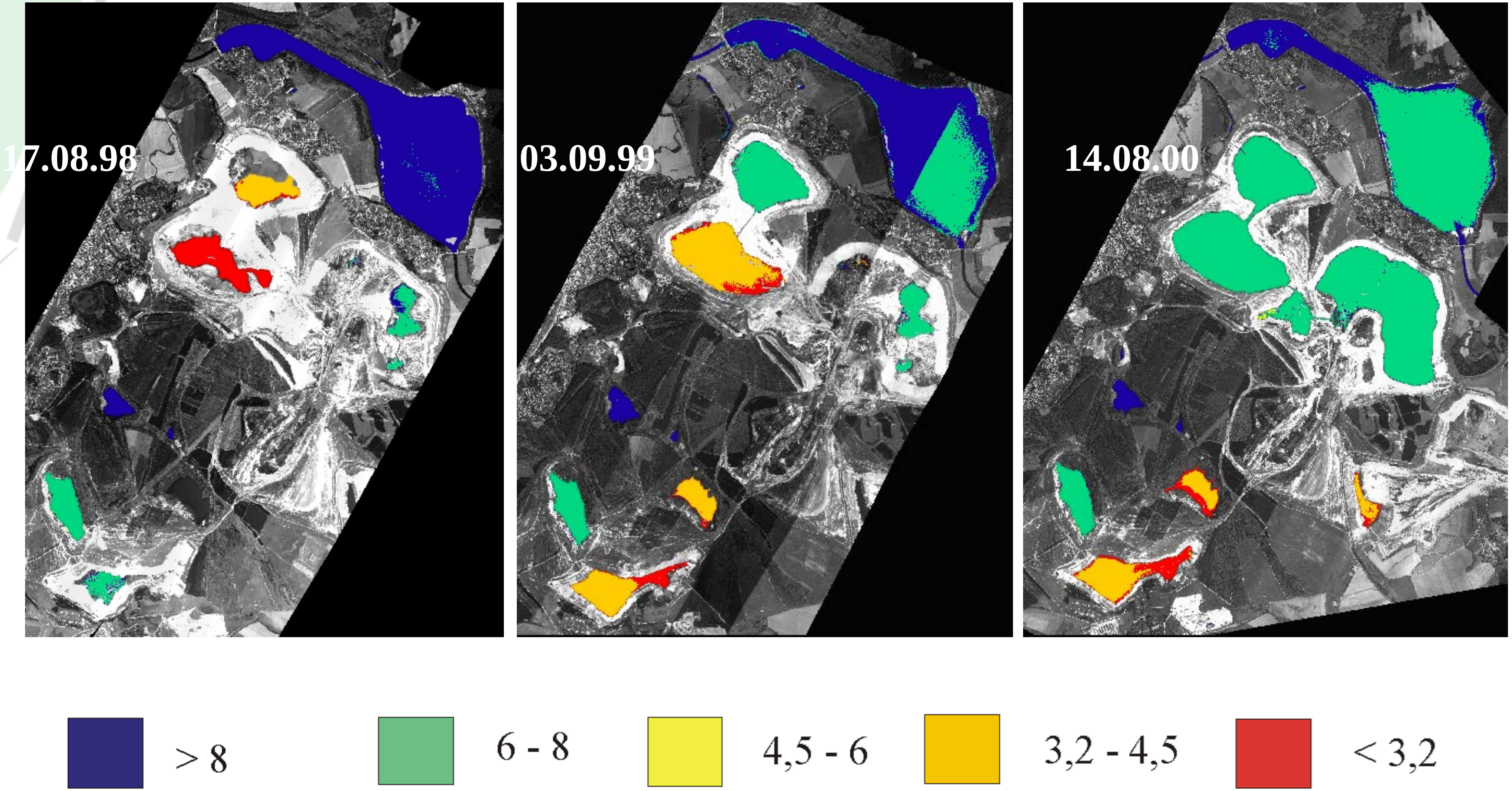


Development of stages of the lakes

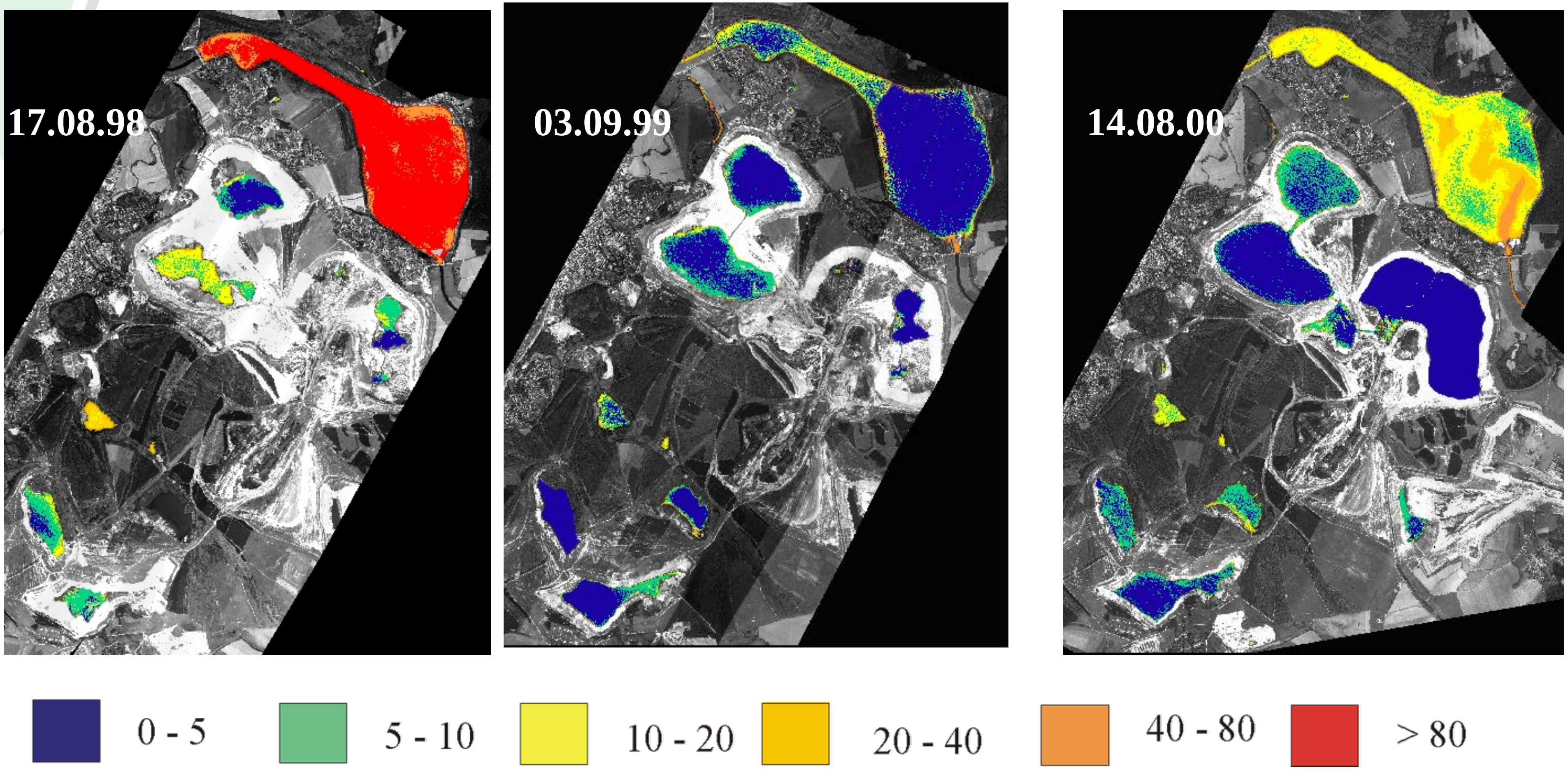
Iron concentration [mg l^{-1}]



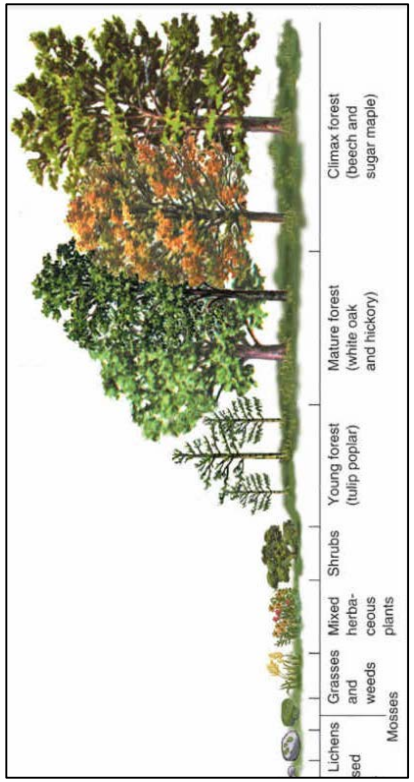
pH value

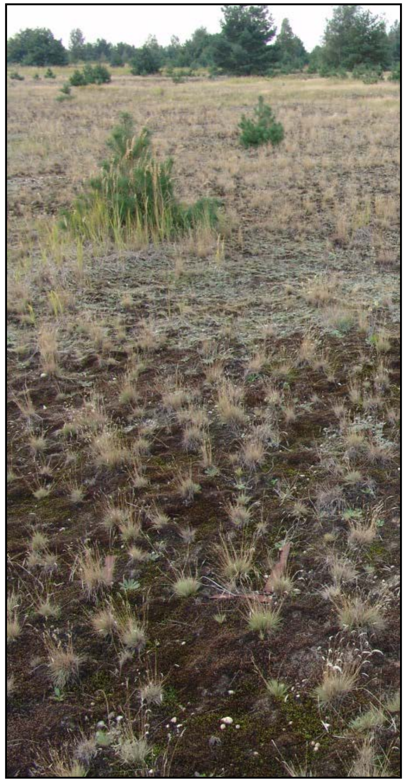


Chla-concentration [µg l^{-1}]



Vegetation is coming back!





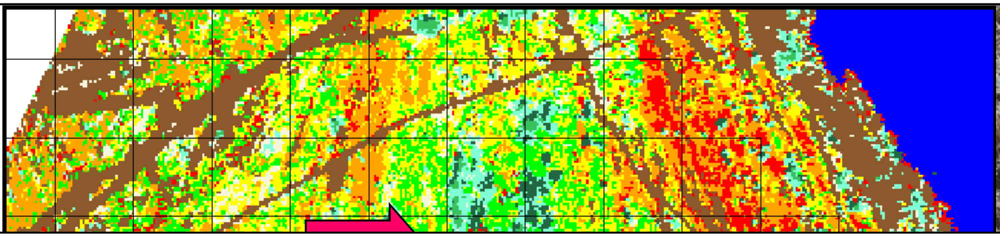
Vegetation structures in the post mining landscape

- Areas of spontaneous succession in the open mines

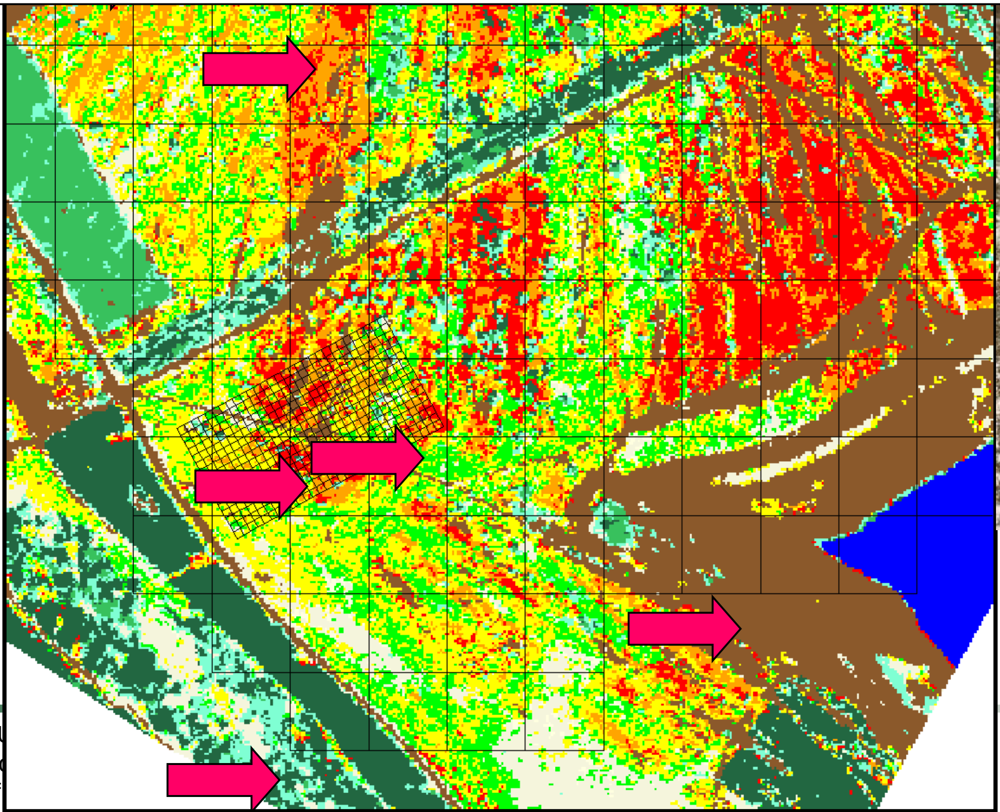

- Longtime areas of succession

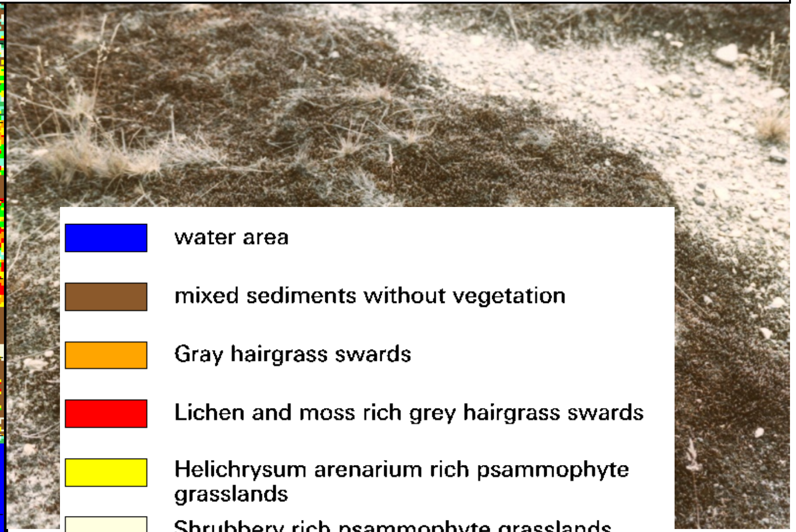

Classification of CASI data
Sand dry lown areas, Combined Parallelepiped - Maximum-Likelihood-Algorithm

Gray hairgrass swards



Lichen and moss rich grey hairgrass swards

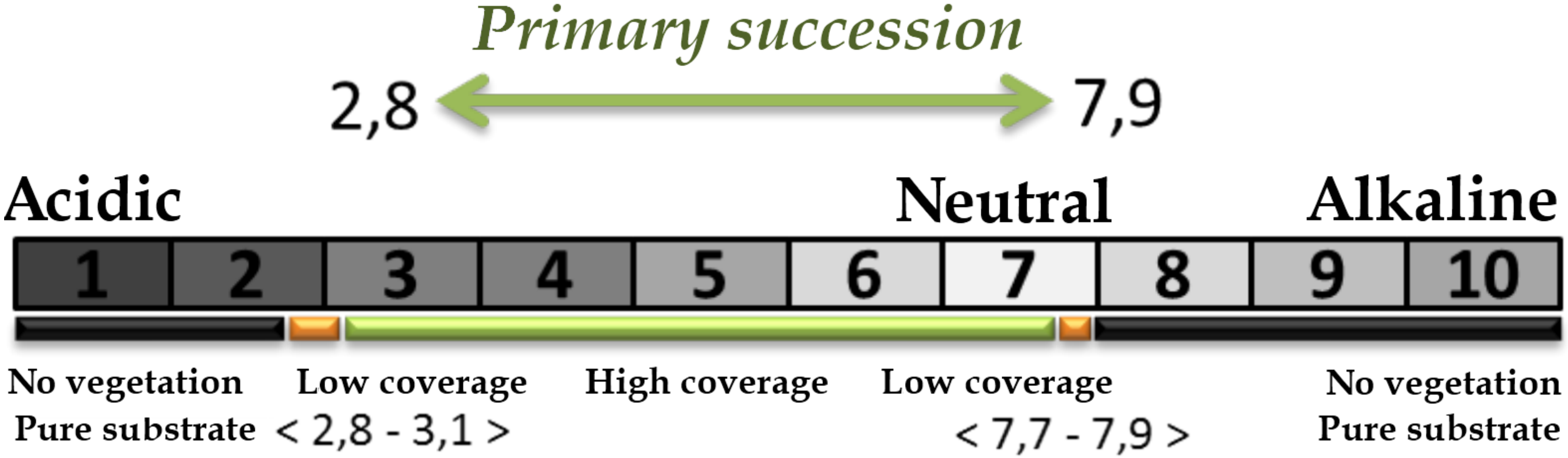




One plant type- *calamgrostis epigejos* as indicator for ph-values – test site Bohemia

Bare sediment Sparse vegetation Dense vegetation

photos: Beyer, Schwefel 2011



Salbach et al. 2011

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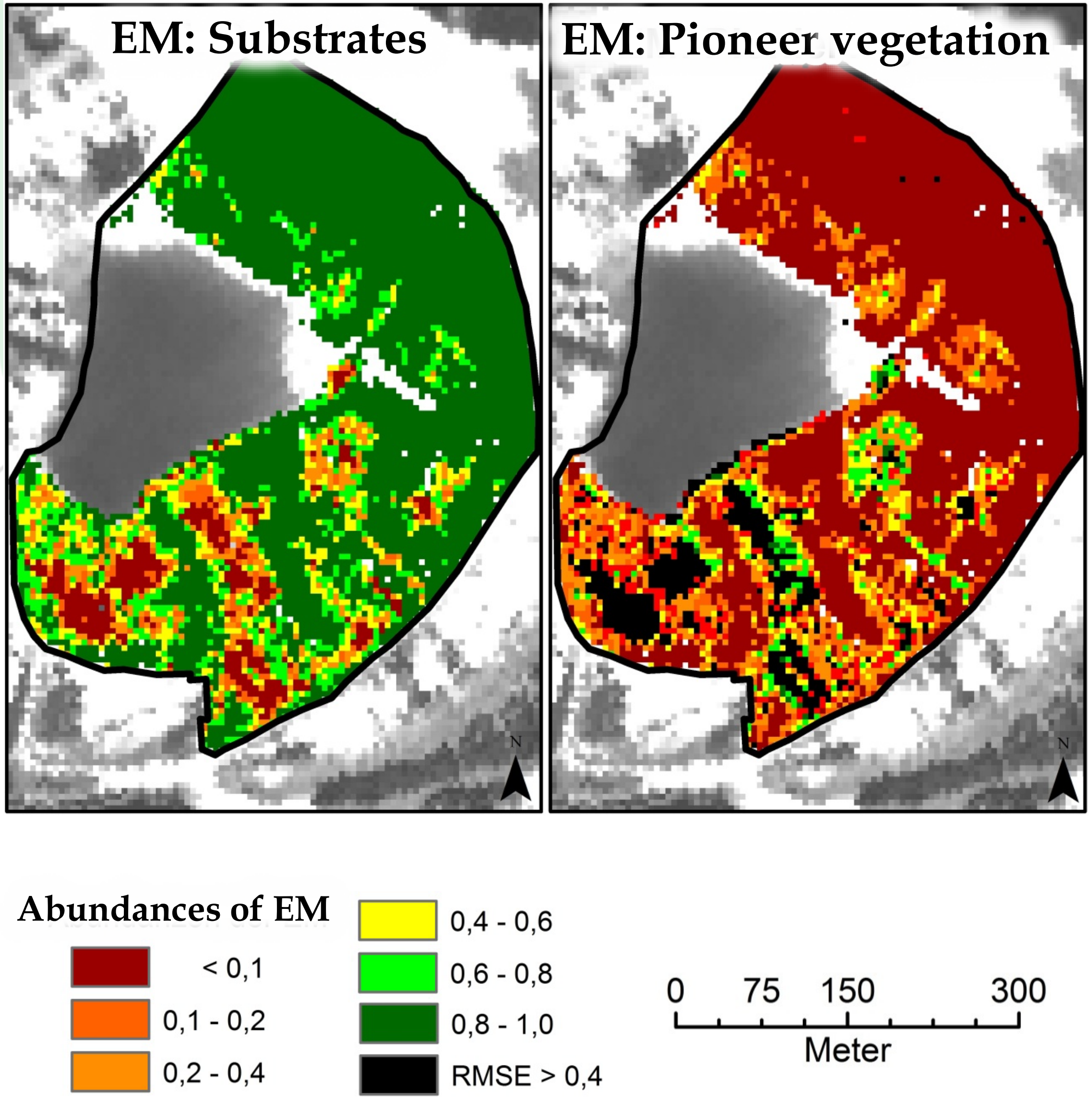
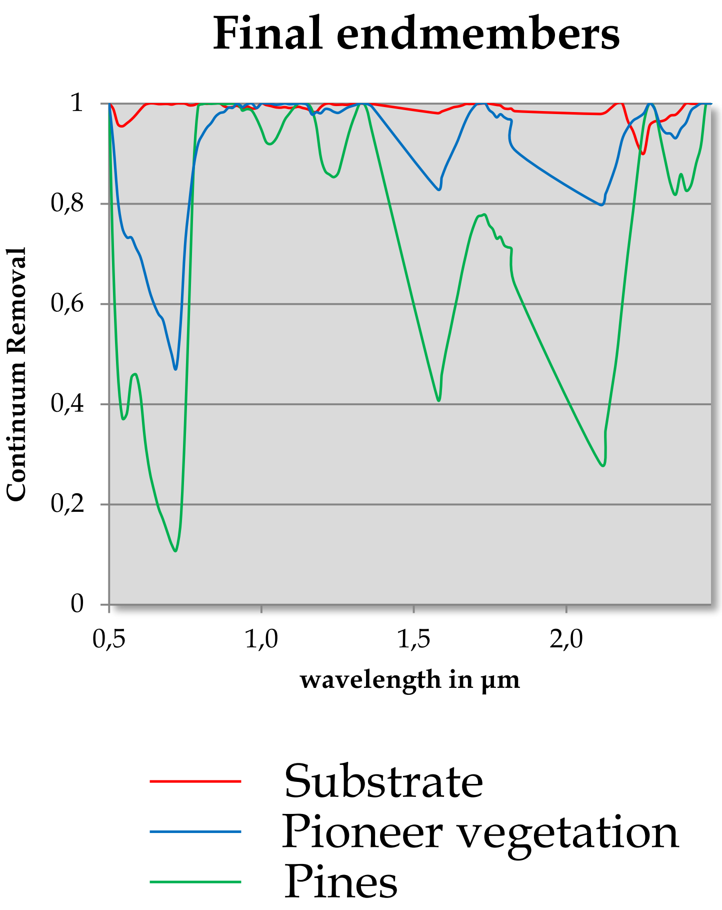
Cornelia.Glaesser@*geo.uni-halle.de*

Unmixing results





Beyer et al. 2012

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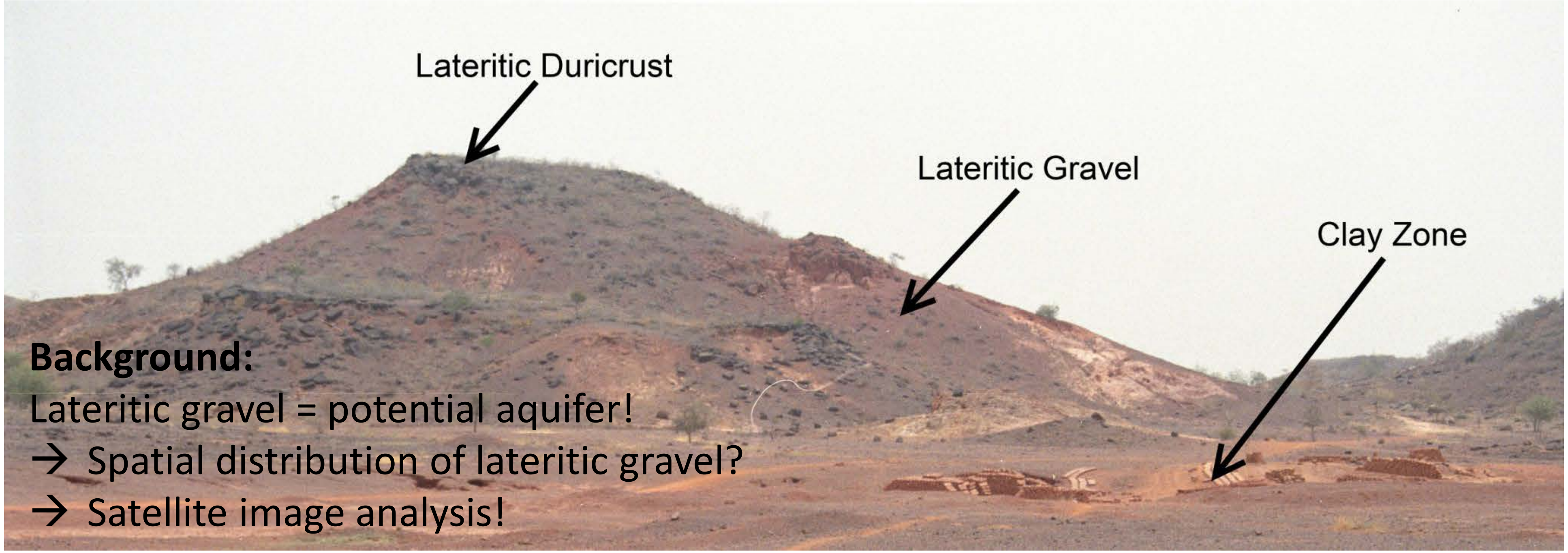
Cornelia.Glaesser@*geo.uni-halle.de*

Example: Advanced geological RS for laterite mapping

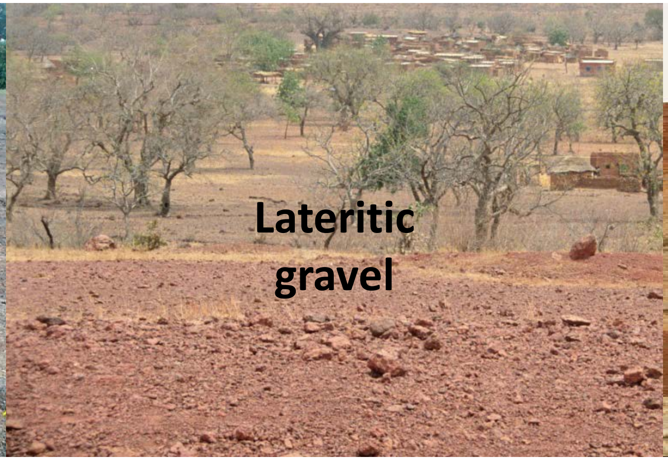


Background:

Lateritic gravel = potential aquifer!

→ Spatial distribution of lateritic gravel?

→ Satellite image analysis!



Example: Advanced geological RS for laterite mapping

ENVI PRO

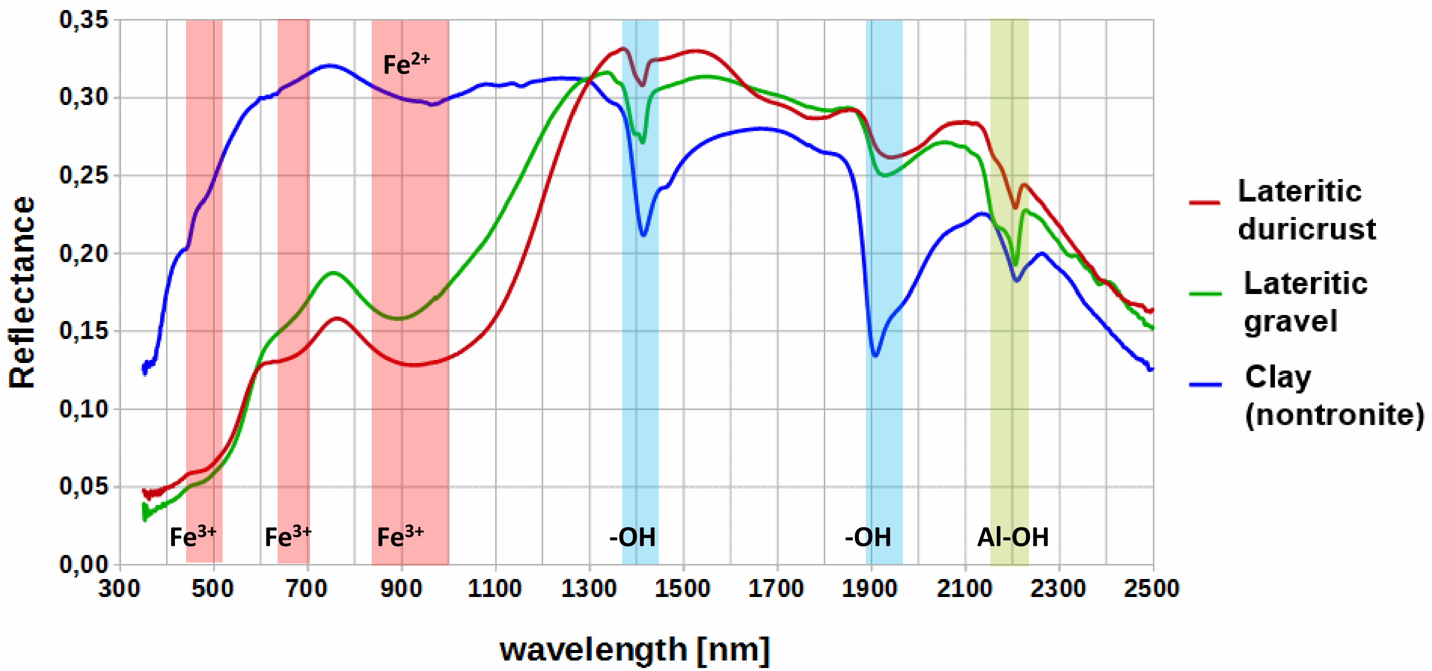
Measuring rock samples in the lab for assessing their spectral properties

Target Class	Mineral Composition
Lateritic duricrust	Hematite, Quartz, Kaolinite, Boehmite, Gibbsite
Lateritic gravel	Hematite, Quartz, Kaolinite, Maghemite, Lepidocrocite
Clay zone	Quartz, Nontronite, Antigorite, Epidote, Muscovite, Diopside, Albite

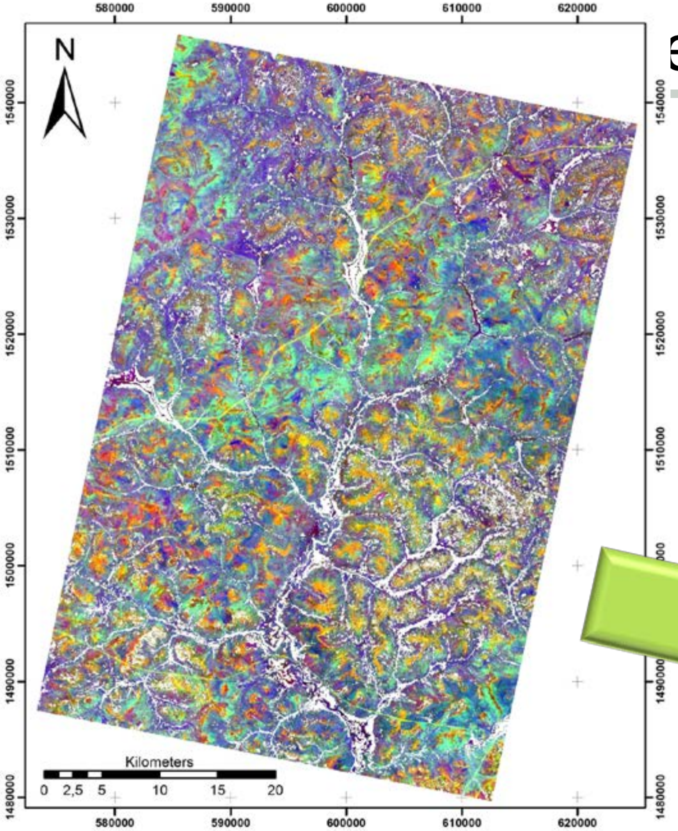
Lateritic duricrust

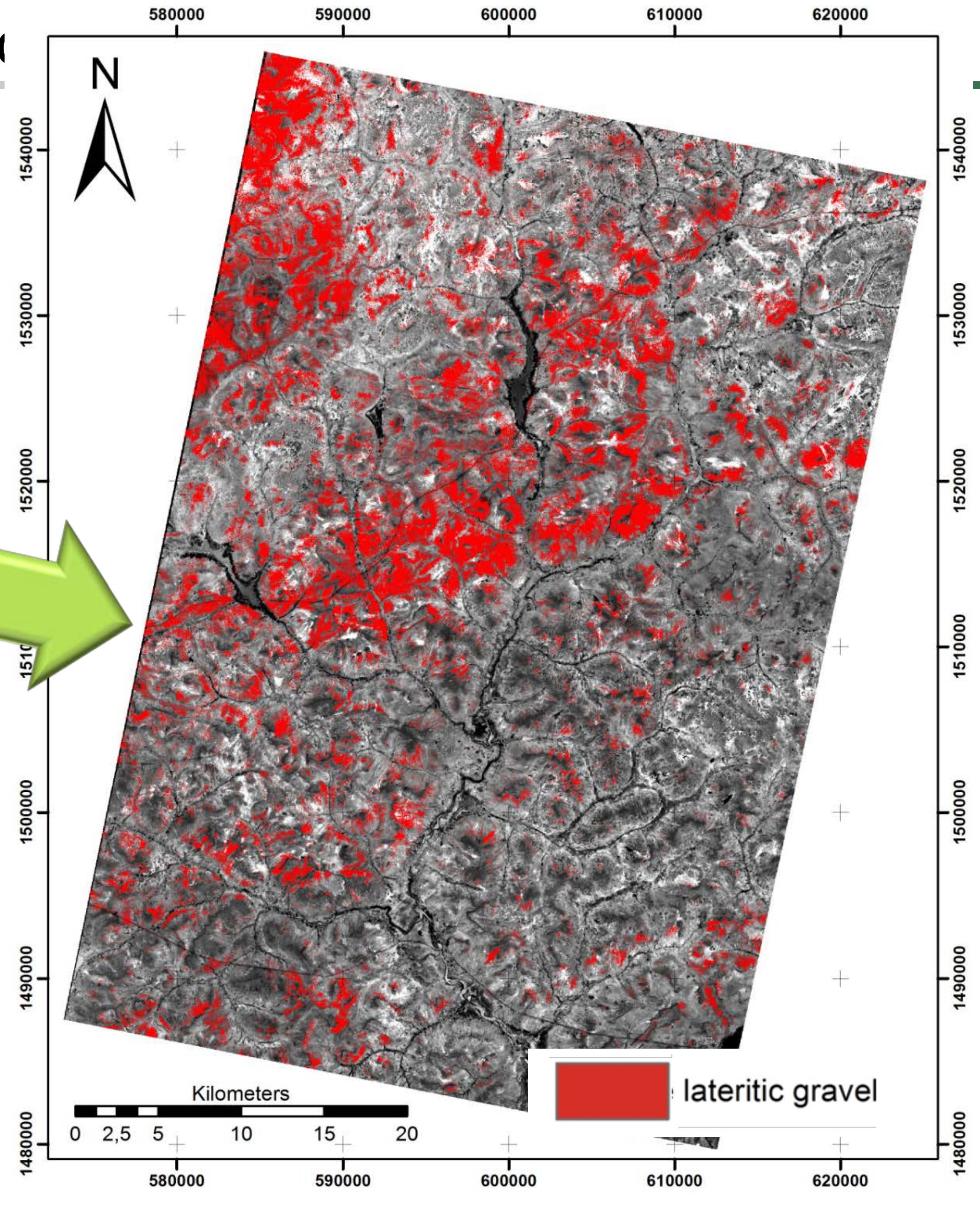
Lateritic gravel

Clay zone sample



eologi





- **Classification** of colour composites

➢ Extraction of lateritic gravel and valley fillings

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Land Use in Arid Environment

Exampe:
Negev Desert in Israel

Phenology

Example: Assessing vegetation phenology in Israel

(RapidEye image, Resa project no. 597)

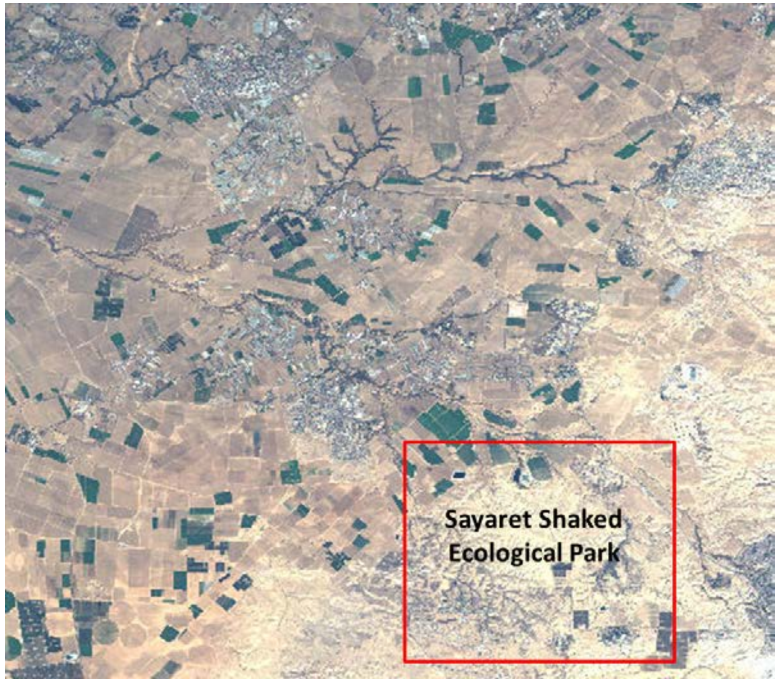
- Heterogenous landscape
- Long Term Ecological Research Site
- ExpEER Ecosystem Research
- Different vegetation types with differing phenology

Example: Assessing vegetation phenology in Israel

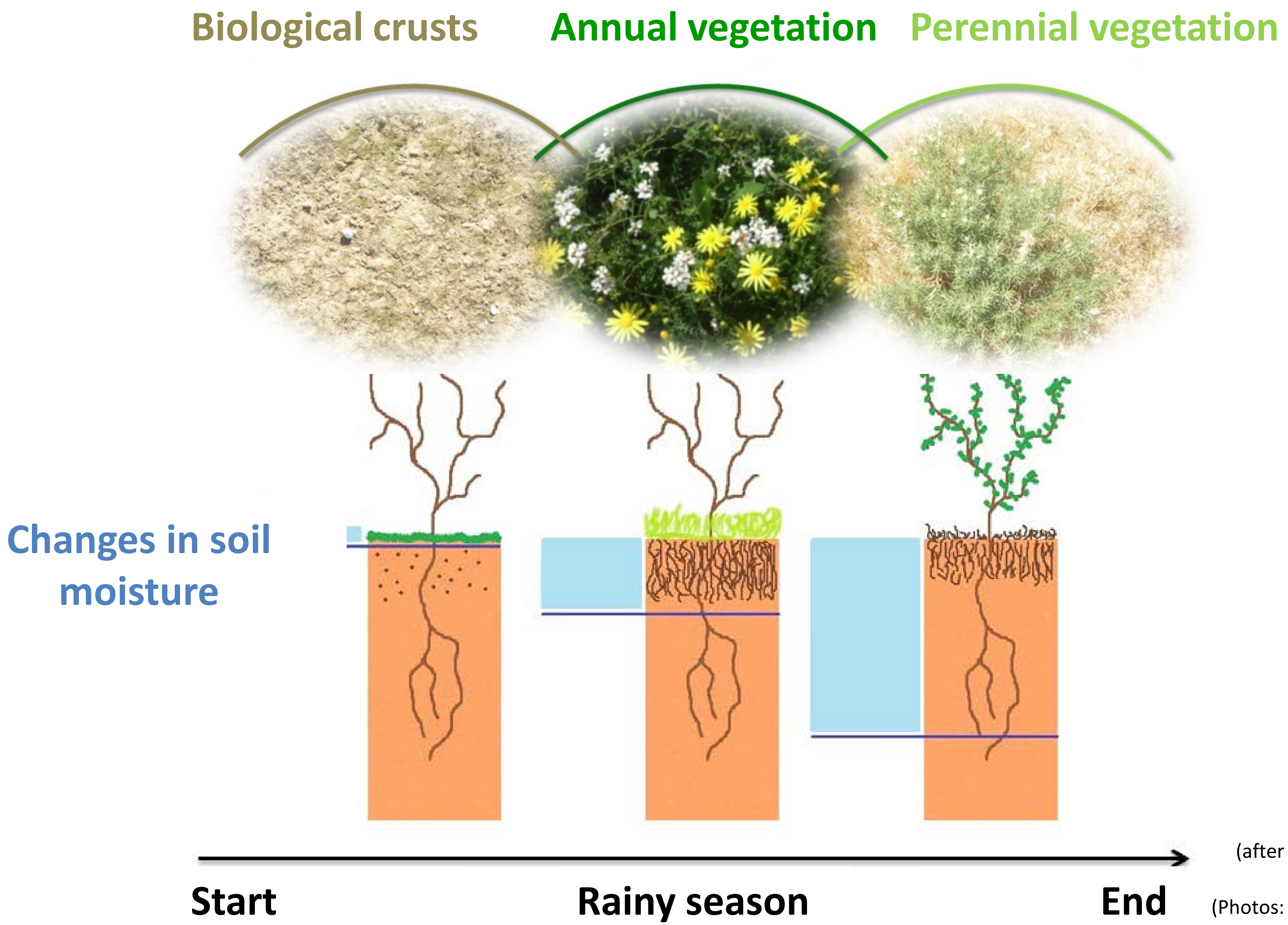
- Annual & perennial vegetation, biolog. crusts
- Large variety and heterogenity in spatial distribution and cover density
- Sensitive response to precipitation

Aim:

Remote assessment of the phenology of the different vegetation units within the LTER site



Example: Assessing vegetation phenology in Israel



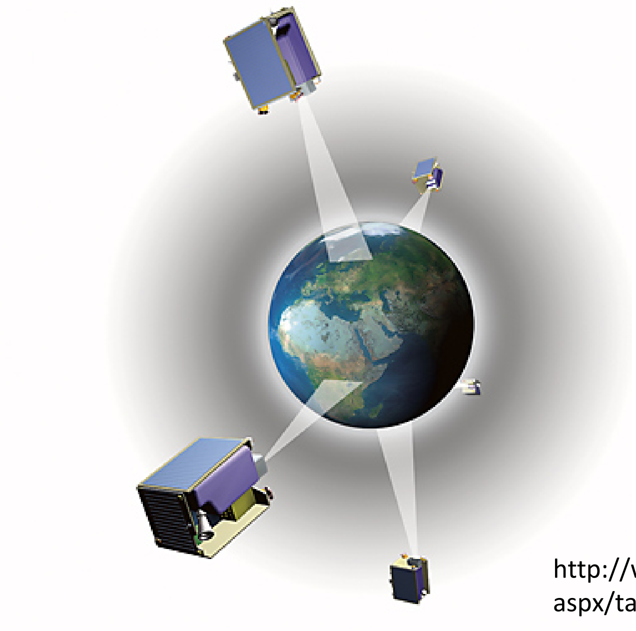
(after Karnieli, 2003)

(Photos: Elste, 20.02/03.2013)

Used remote sensing data

Rapid Eye data (spectral bands):

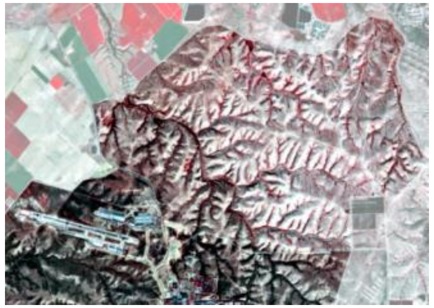
Blue	440-510 nm
Green	520-590 nm
Red	630-685 nm
Red Edge	690-730 nm
NIR	760-850 nm



http://www.dlr.de/rd/desktopdefault.aspx/tabid-2440/3586_read-5336/

RapidEye time-series in CIR (5/3/2), spatial resolution: 5 m

(01-Dec-2012)

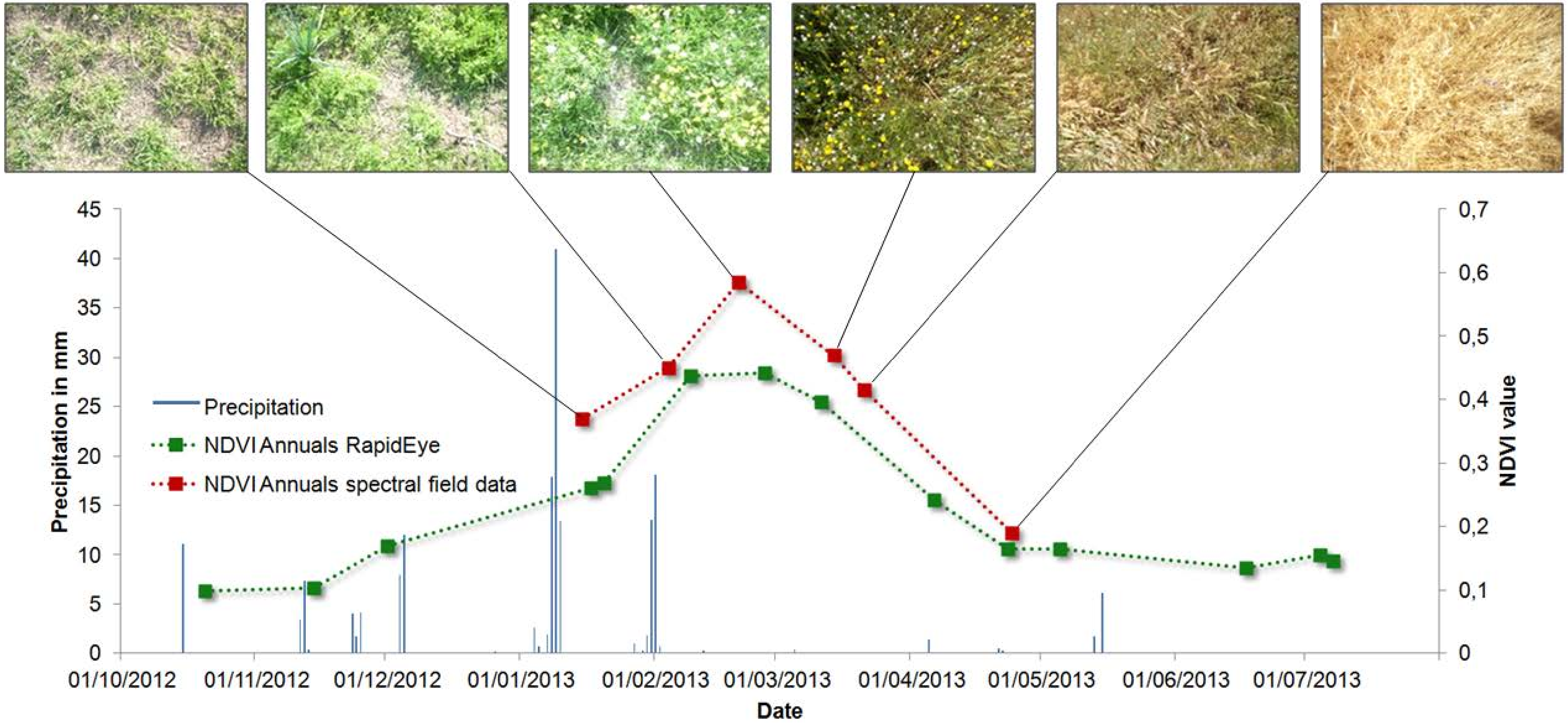


(17-Jan-2013)

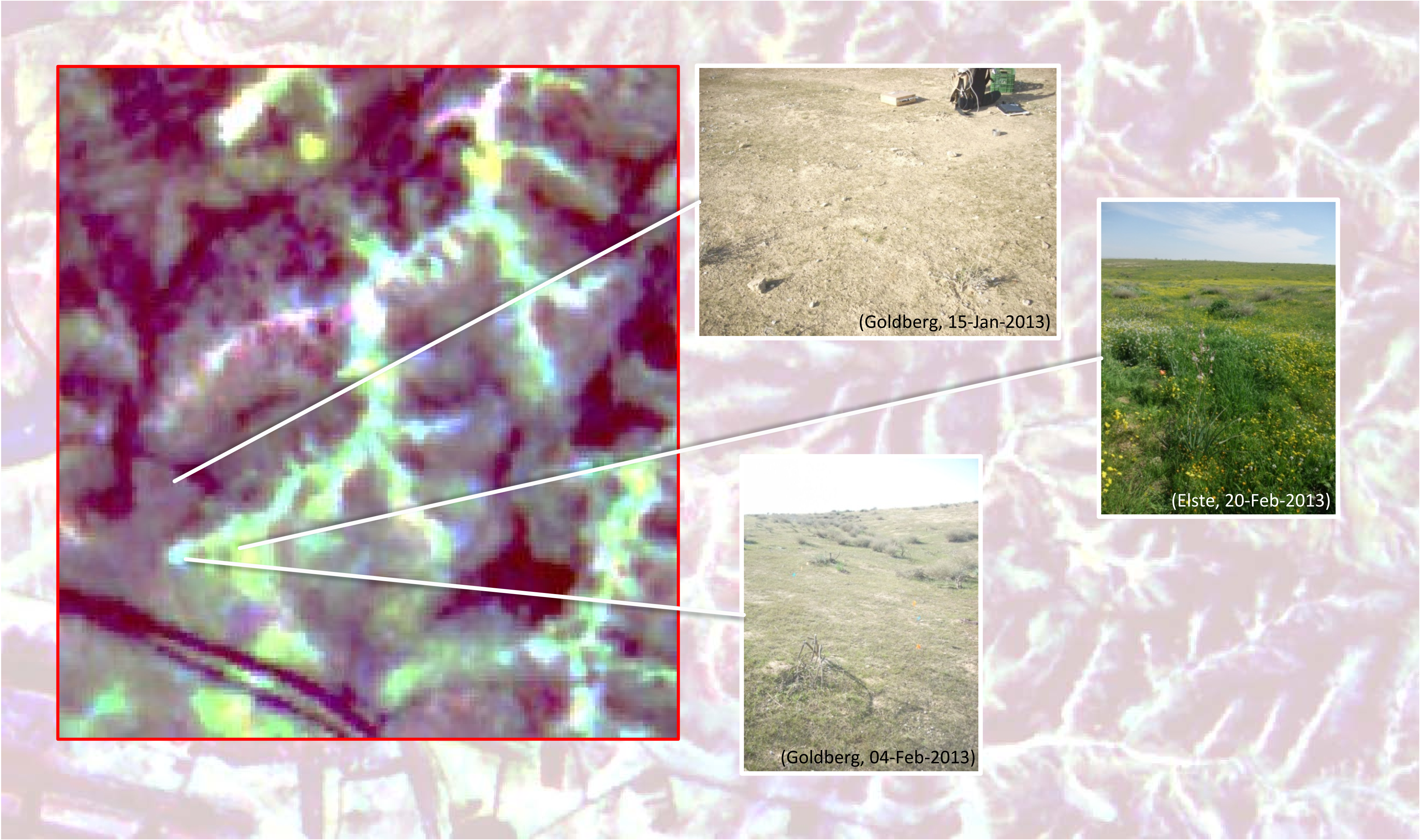
(26-Feb-2013)

(23-Apr-2013)

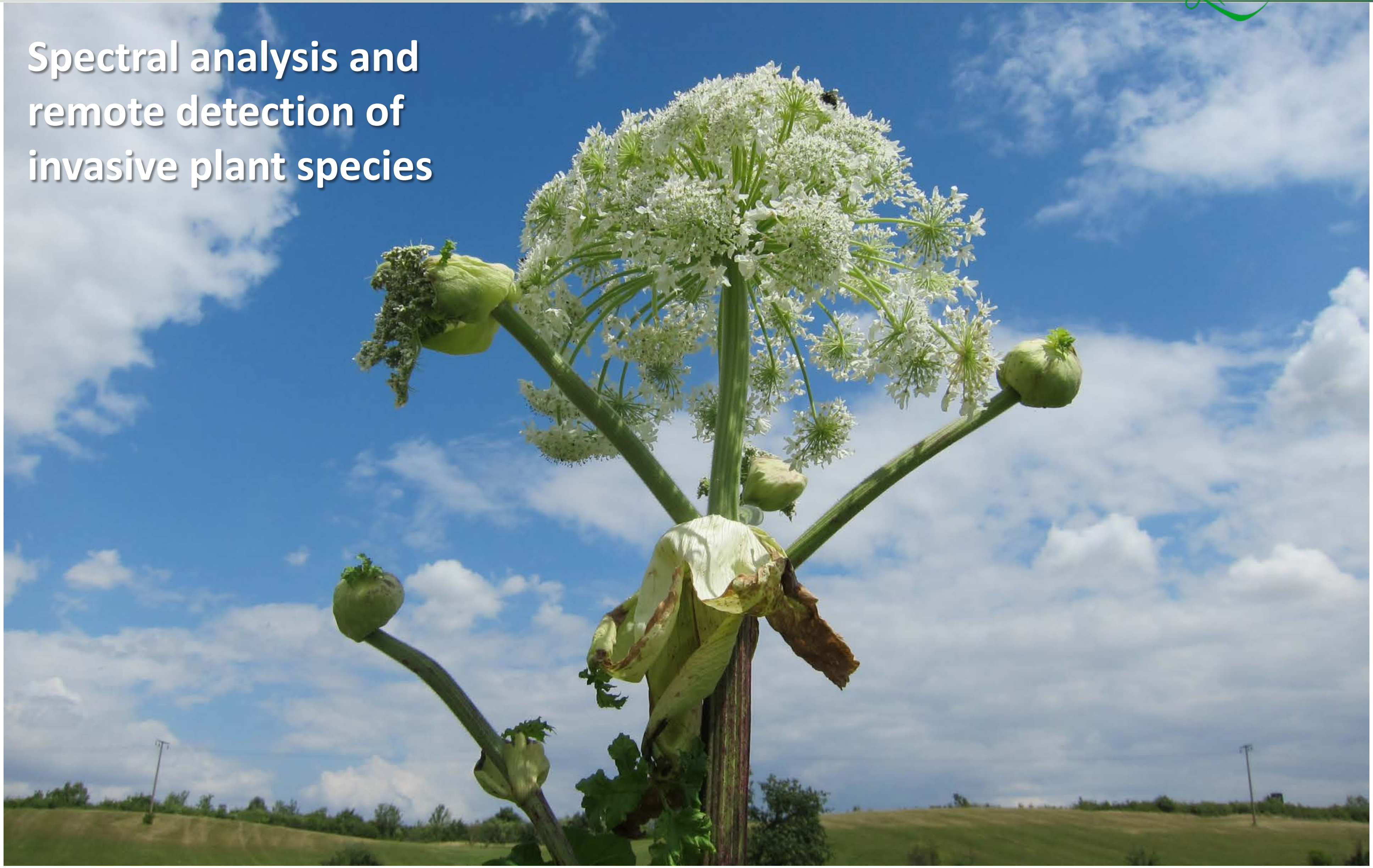
Results – Validation with spectral field data and photos



Results – Spatial distribution of natural vegetation



Example: Spectral analysis of invasive plant species



Example: Spectral analysis of invasive plant species



Photos: Meißner 2014/2015, Götze 2014

***Heracleum mantegazzianum* (giant hogweed):**

- Short-lived shrub, height of growth: 2 - 5 m
- Photodermatitis on contact and sunlight
- Displacement of other species
- Increased risk of erosion at water margins
- Treatment is time-consuming and costly and requires detailed knowledge of occurrences

RS methods offer great potential for detecting giant hogweed!

- Only few studies available
- Basic knowledge about spectral properties is required
- Knowledge of mixed spectral signatures is crucial

Example: Spectral analysis of invasive plant species

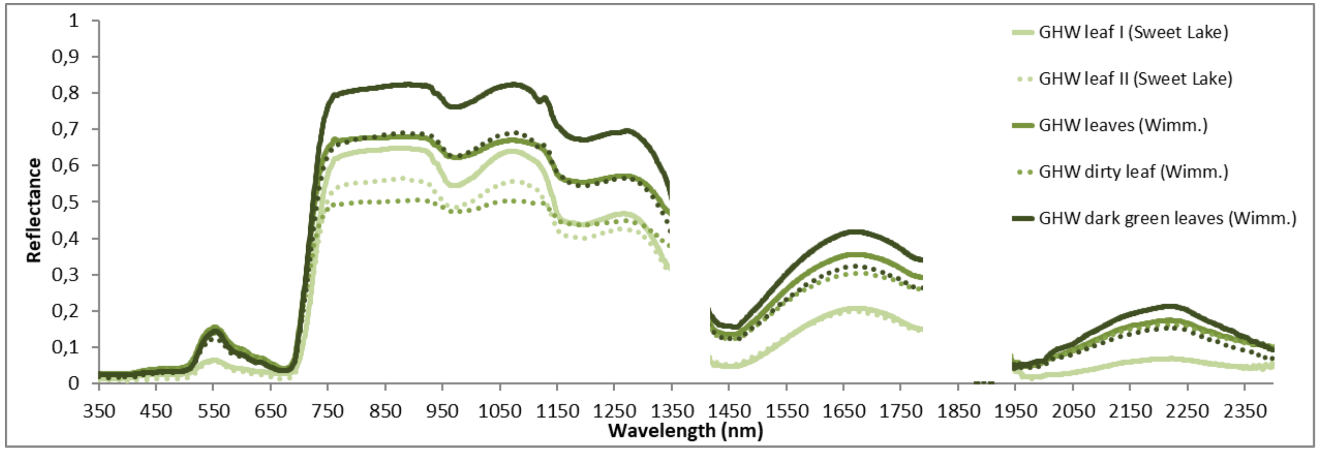
Utilised data:

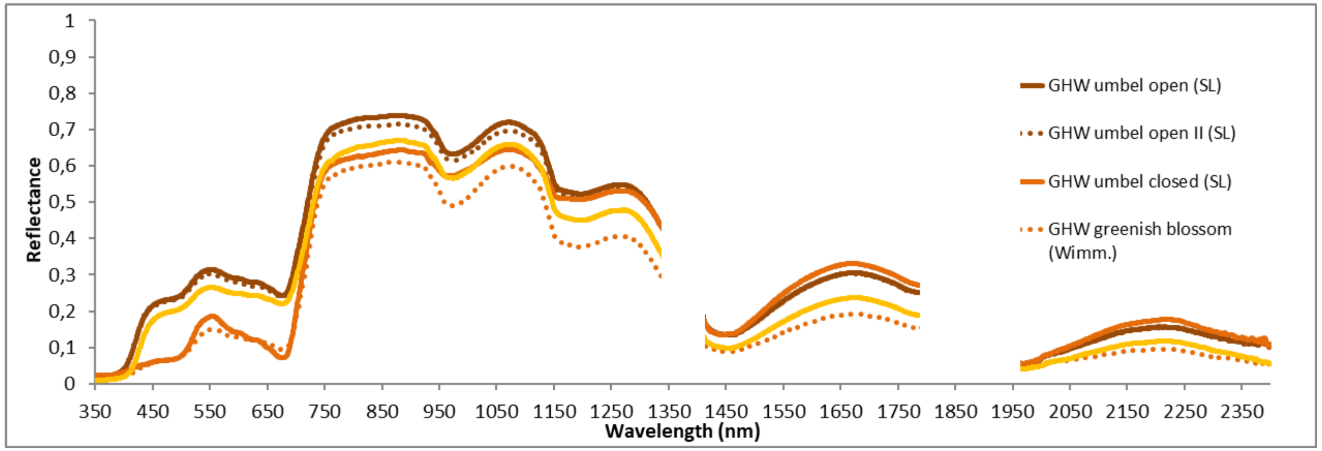
- Field spectra
- Field photos
- Field mapping data
- GPS coordinates

- Several RapidEye images, March – September 2014

http://www.dlr.de/rd/desktopdefault.aspx/tabid-2440/3586_read-5336/

Example: Spectral analysis of invasive plant species

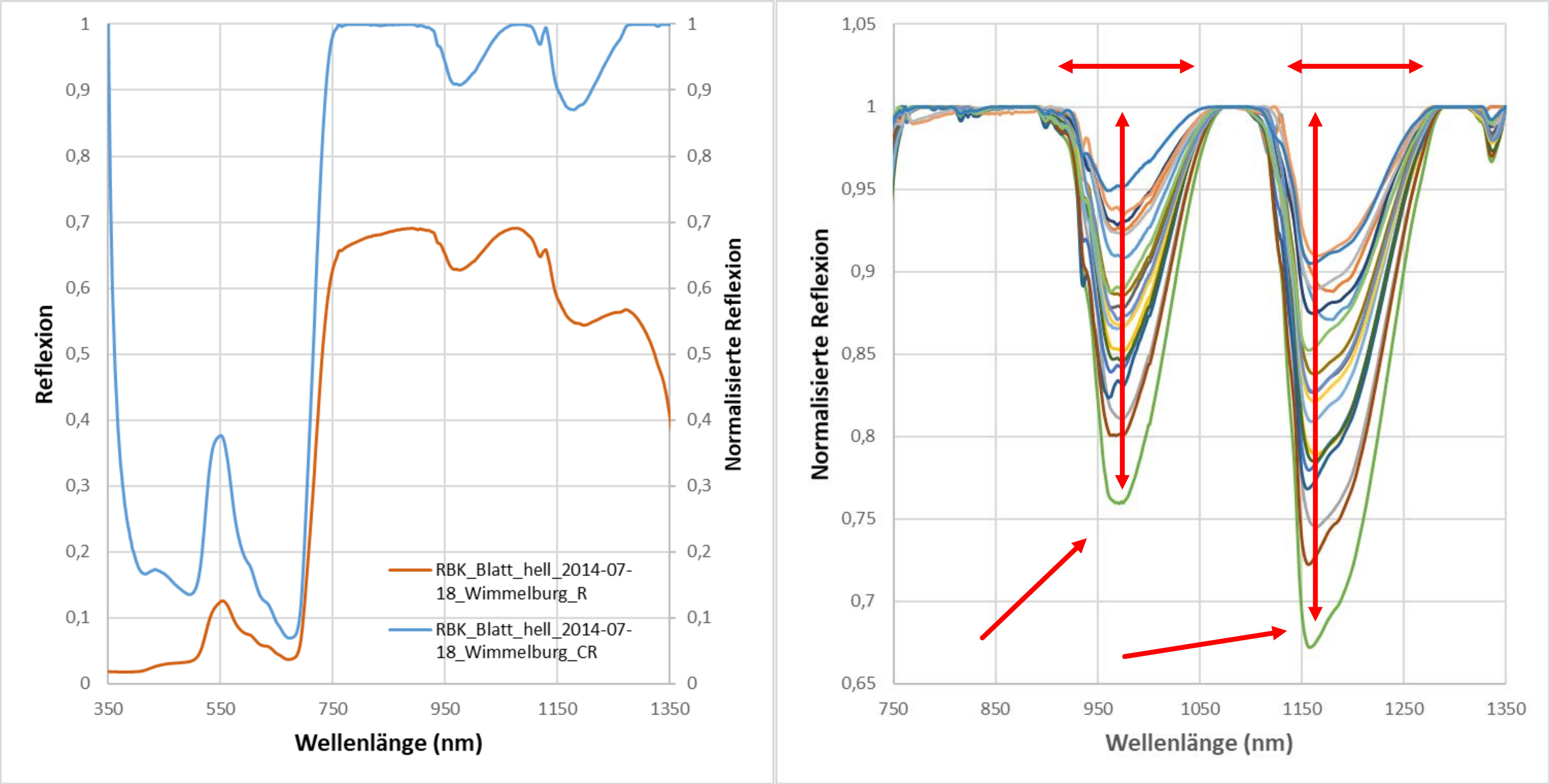




Visual inspection and assessment of the spectra

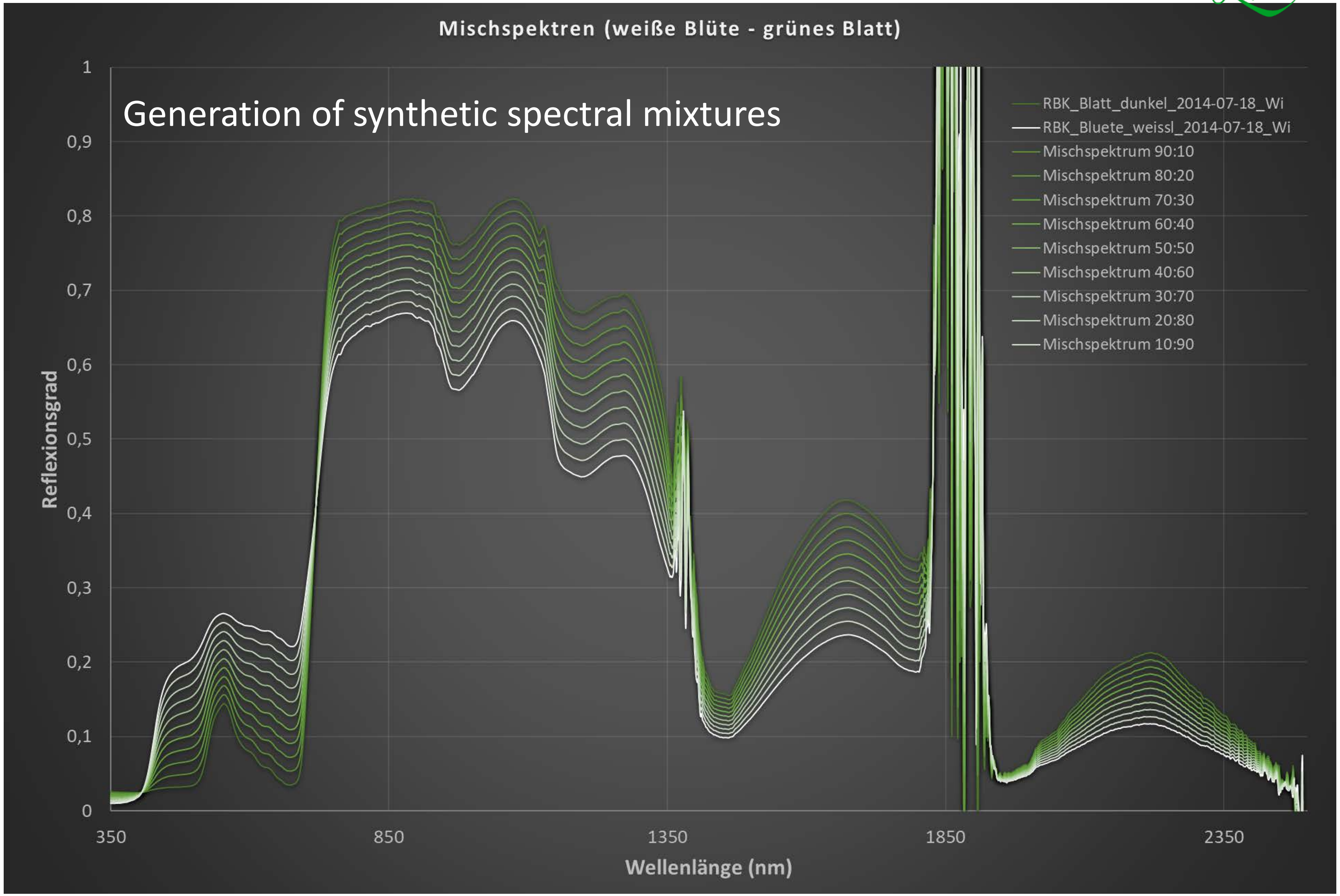
Integration of phenpological changes!

Example: Spectral analysis of invasive plant species



Advanced data analysis: Quantification and parameterisation of spectral features (e.g. positions and depths of absorptions) followed by statistical analyses

Example: Spectral analysis of invasive plant species



Example: Spectral analysis of invasive plant species

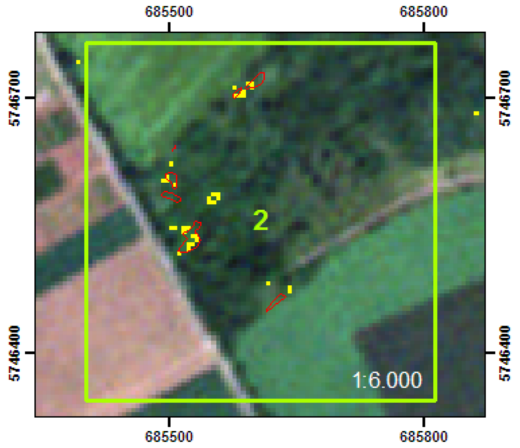
Analysis of RapidEye data for spatio-temporal mapping GH occurences

Dates of RapidEye imagery and applicability of different detection methods

	10.03.	27.03.	16.04.	04.06.	04.07.	17.07.	06.09.
Multiband Thresholding	-	-	x	x	x	(x)	-
VIO (Permutation)	-	-	-	x	-	-	-
Matched Filtering	-	-	-	x	-	-	-

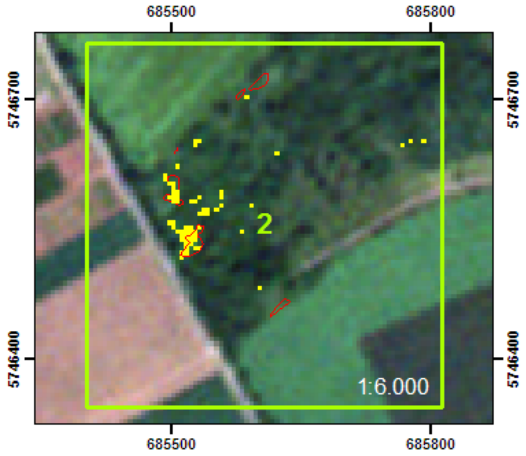
Multiband thresholding

EM_{100} 04.06.



Vegetation index optimising

EM_{NIR} 04.06.



Matched filtering

EM_{100} 04.06.

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Department of Remote Sensing and Cartography

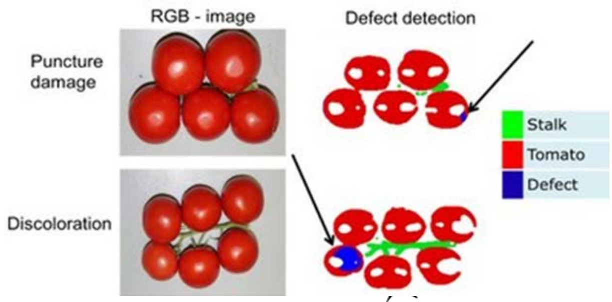
How to select remote sensing data für a special topics and objectives?

- Is the topic relevant to information in remote sensing data?
- Which scale is relevant?
- Which spectral infromation I need?
- Which spatial infromation I need?
- Which actuality is necessary?
- Which temporal resulution) need?
- Budget!!!

- Huge data sets of free available remote sensing data and software
- Goodle Earth Engine, European Open Science Cloud, Zoom Ertrh and others.

Conclusion

- Short overview about applied remote sensing
- Selected exampes related to scales, topics and remote sensing data
- Remote Sensing data today basic geodata
- Geodata as „ Ressources of the 21 century“
- Free data and software available
- Extremly crowing market



Next lectures on Saturday
GIS and Geodata Management
Practical Remote Sensing and GIS

YOU ARE WELCOME!