KÄRNTEN University of Applied Sciences

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„New ways of monitoring: New techniques for scientists and visitors"

Vanessa Berger & Melanie Erlacher

EUROPARC Conference, Mind Factory, 03.05.2022

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of Conservation Areas
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of Applied Sciences, Austria

Agenda

- 14:00 – 14:30 Welcome & Introduction
- 14:30 – 15:00 New Technologies
- 15:00 – 15:15 Case Study: Digitize the Planet
- 15:15 – 15:30 Coffee Break
- 15:30 – 16:30 Round Table
- 16:30 – 17:00 Into to Wild

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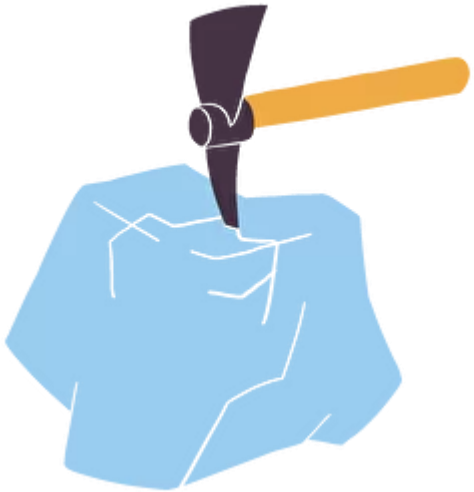
Who are you und which mishap happened to you while using a monitoring technology?



E-DNA

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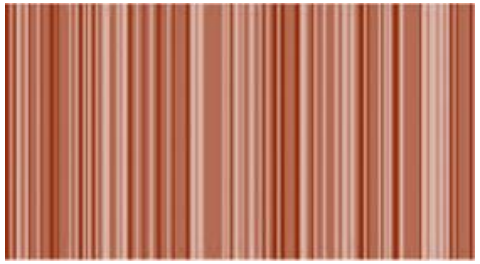
- Environmental – DNA
  - Water sample
    - Lakes
    - Streams
    - Watering
  - Soil samples



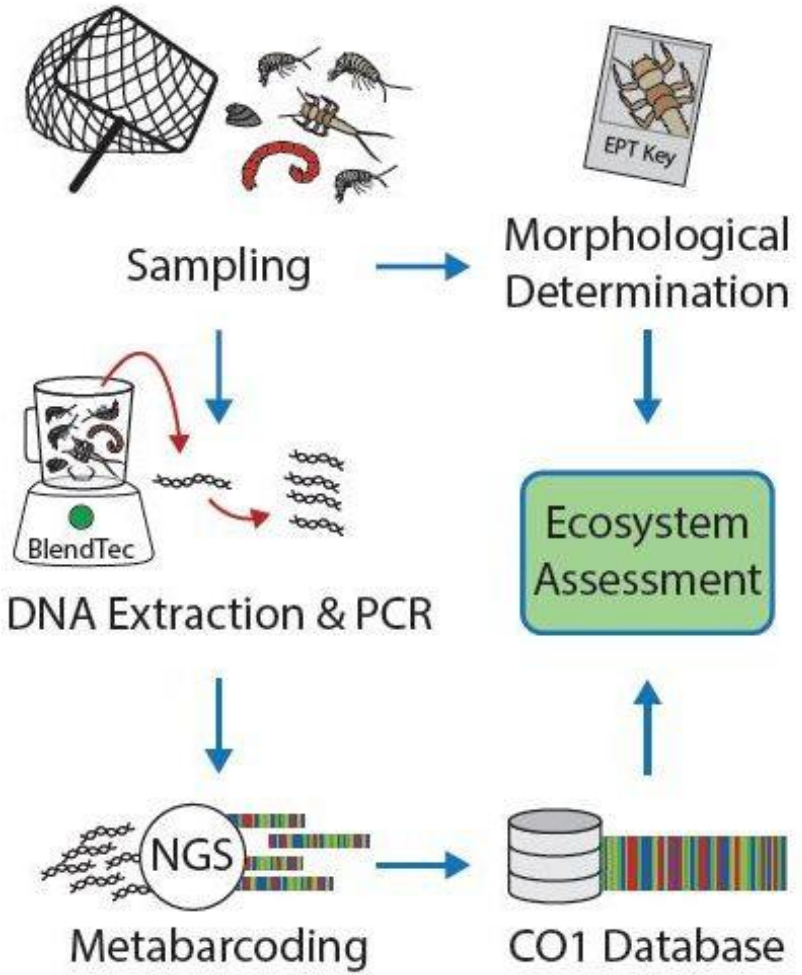
Samples

- Bulk samples
  - Pit trap
  - Malaise trap
- Parts of organisms
  - Hair
  - Skin
  - Stomach content
  - Faeces

Barcoding

- Detection of complex relationships
- Detection of species without direct sighting
- Sampling also possible by laymen

- A specific question is needed
- A lot of know-how needed
- Laboratory experience
- Bioinformatics experience



http://www.master-ecotoxicology.de/ecotox-blog/wp-c4nt2nts/uploads/2018/01/Bti1-e1516919272541.jpg

Wildlife Camera Trap

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- Identification Species
  - Insects
  - Birds
  - Mammals
- Documentation of wildlife movements
  - Game trails
  - Watering
- Check legal regulation
- Mark camera/SD card

https://www.doerr-outdoor.de/de-de/204440?gclid=CjOKCQiA-qGNBhD3ARIsAO_o7ykGJSZRwhVbrdHn9Vbn7Tt2HHwOMsv6y1R5T4Kpu1Nrx2-LD7FR-WoaApBDEALw_wcB

Dalton e ta l. 2021

Do you recognize this building?

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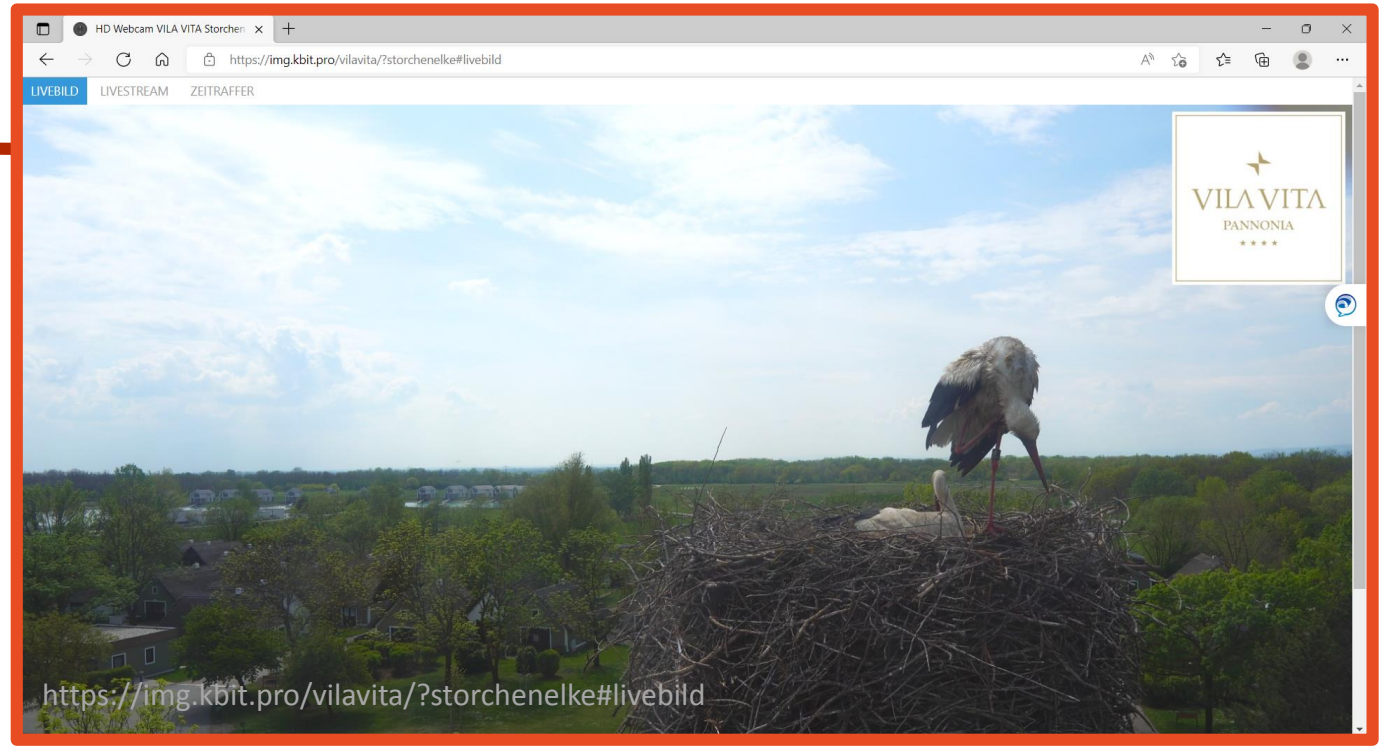

Frequencies & Workflow

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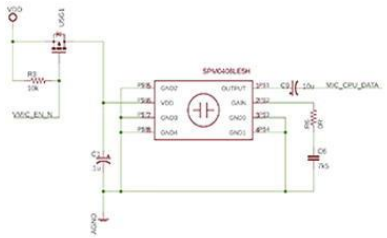
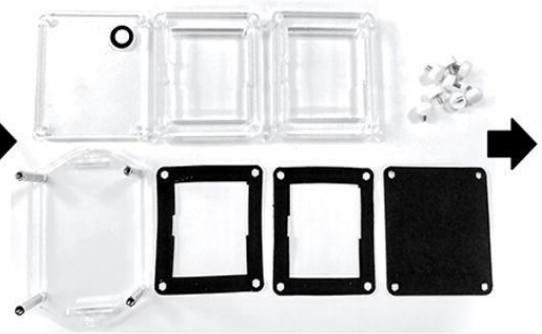
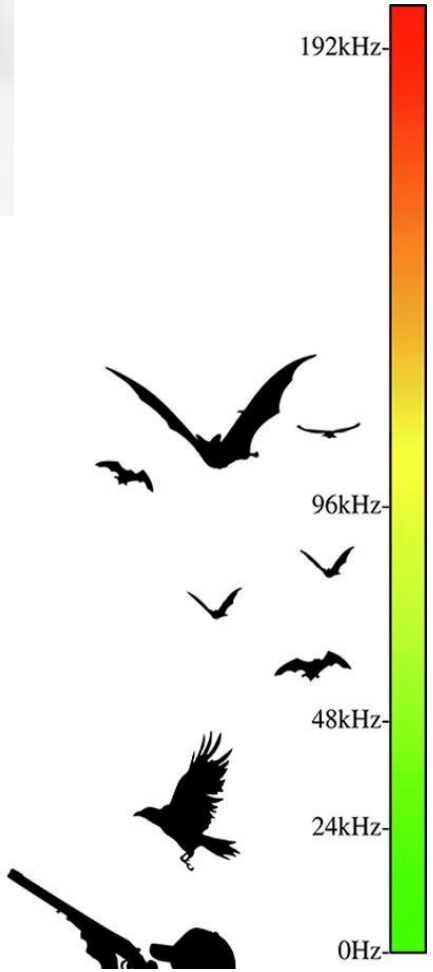
Hardware description → **Hardware build instructions** → **Validation tests** → **Enclosure build instructions** → **Low-cost acoustic monitoring**







Hill et al. (2019): AudioMoth: A low-cost acoustic device for monitoring biodiversity and the environment, HardwareX 6 (2019) e00073, https://doi.org/10.1016/j.ohx.2019.e00073

Audio - Batdetector

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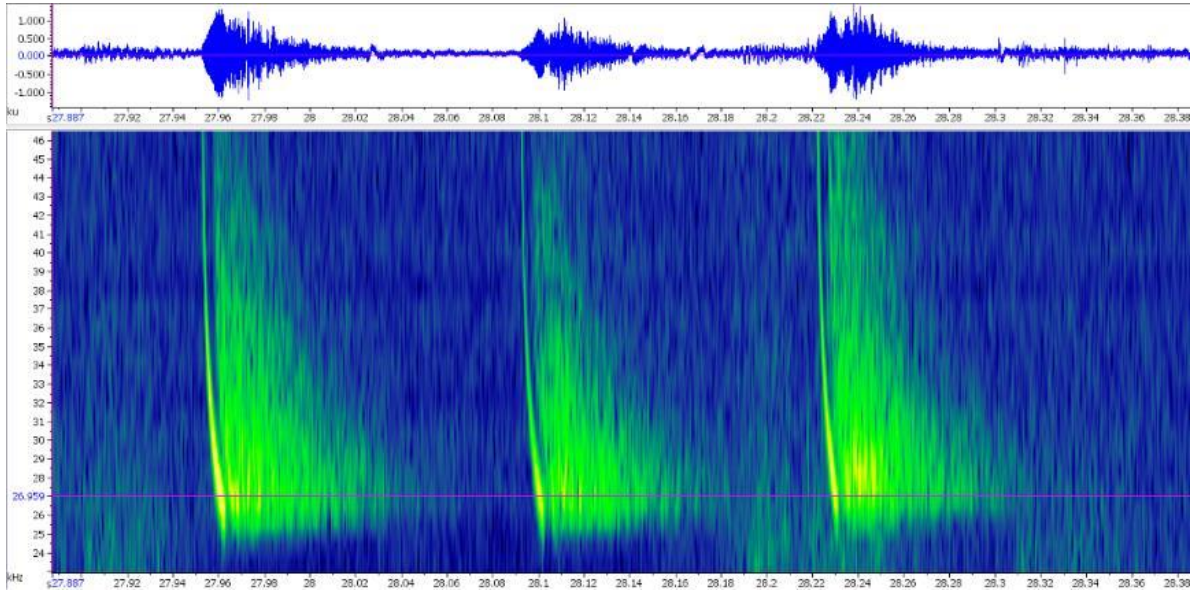
- Bat detector for mobile devices
  - Evaluation directly on the mobile devices via app
  - Recordings can also be evaluated with external software
  - Low costs 430 €



Passive Acoustic Monitoring

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Advantages

- Non-invasive method
- Allows monitoring of distribution and behaviour of animals
- Estimation of environmental, seasonal and climatic effects on species
- Automated – semi-automated species identification
- Cost-effective method for remote areas

Sourxe:https://cieem.net/wp-content/uploads/2020/04/WA-Mini-Configurator.png

©Elisabeth Wiegele

Source: https://cdn.webshopapp.com/shops/39297/files/311369190/wildlife-acoustics-song-meter-mini.jpg

SMART Spatial Monitoring And Reporting Tool

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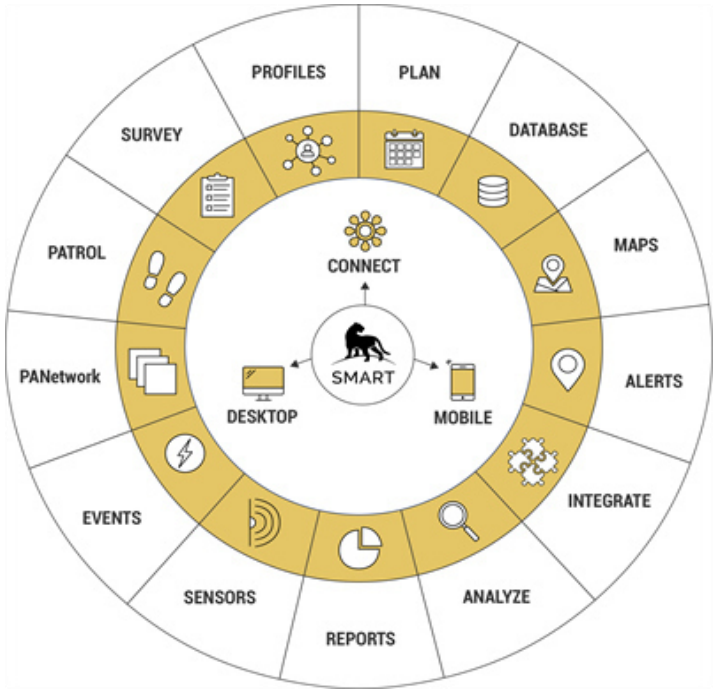
- SMART Connect
  - Quick exchange of data between management and rangers
  - digitale data collection (Cybertracker & SMART Mobile)
  - Integration of different sensors (e.g. camera traps)
  - Query & reporting tool

https://www.doerr-outdoor.de/de-de/204440?gclid=Cj0KCQjA-qGNBhD3ARIsAO_o7ykGJSZRwhVbrdHn9Vbn7Tt2HHwOMsv6y1R5T4Kpu1Nrx2-LD7FR-WoaApBDEALw_wcB



https://smartconservationtools.org/

WWW.CUAS.AT/UNESCO-CHAIR

Earth Ranger

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- https://www.earthranger.com/technology

QField

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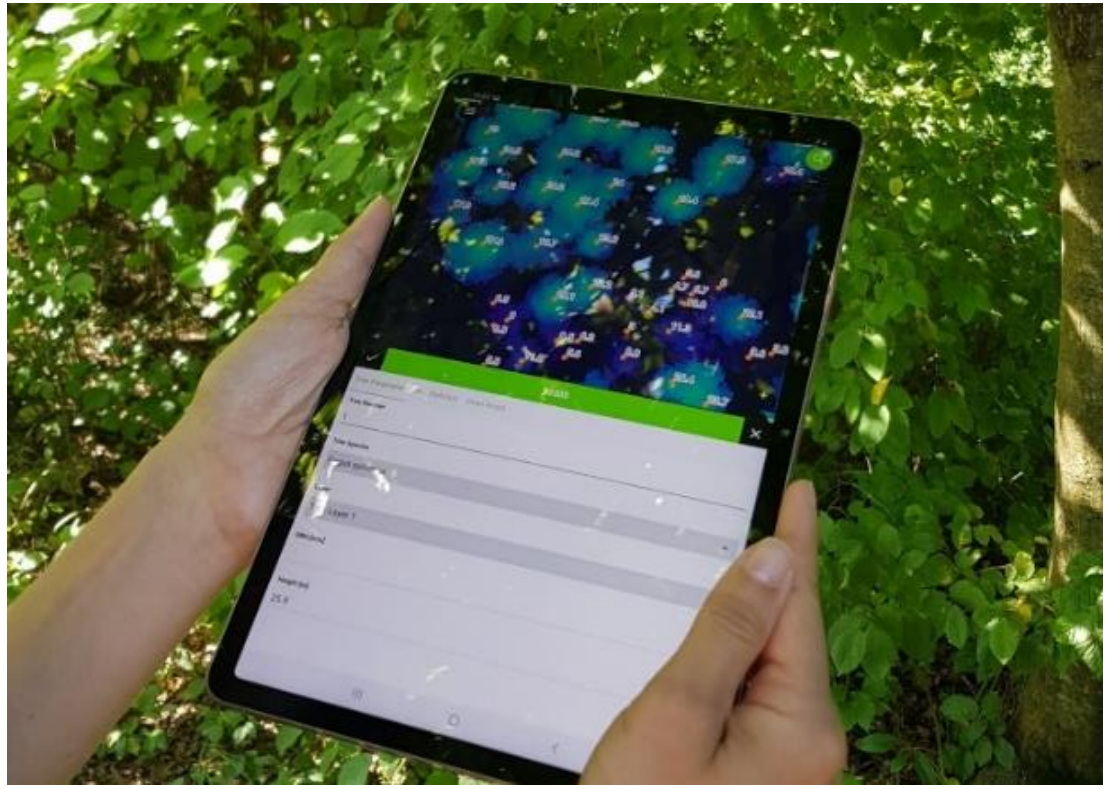
- Mobile [Q]GIS Application
- Cloud Service
- Open Source



- GPS, raster & vector data
- photo + descriptive indicators

Remote Sensing Platforms

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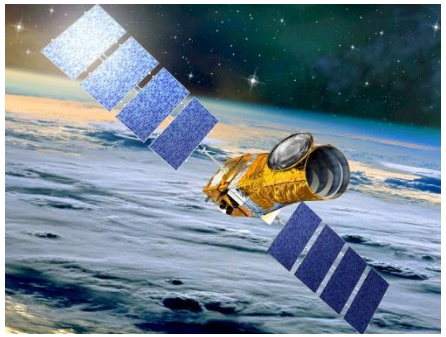
Satellites



e.g. Sentinel, Landsat,
Quickbird, RapidEye, ...

UAVs (drones: copters, fixed-wing, VTOL)

Balloon, Kite

Aircrafts

Remote Sensing

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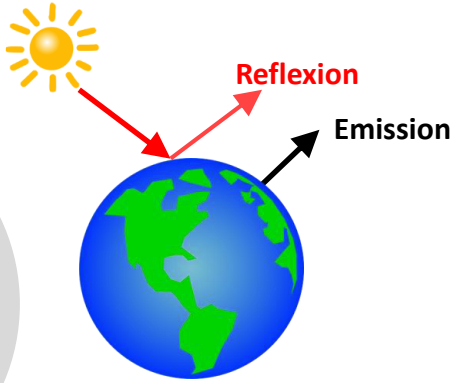
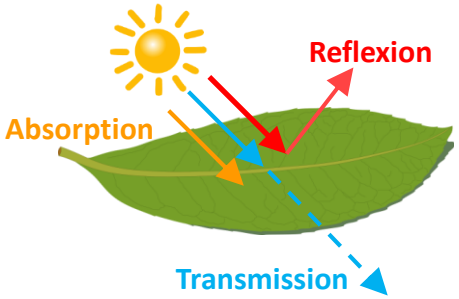
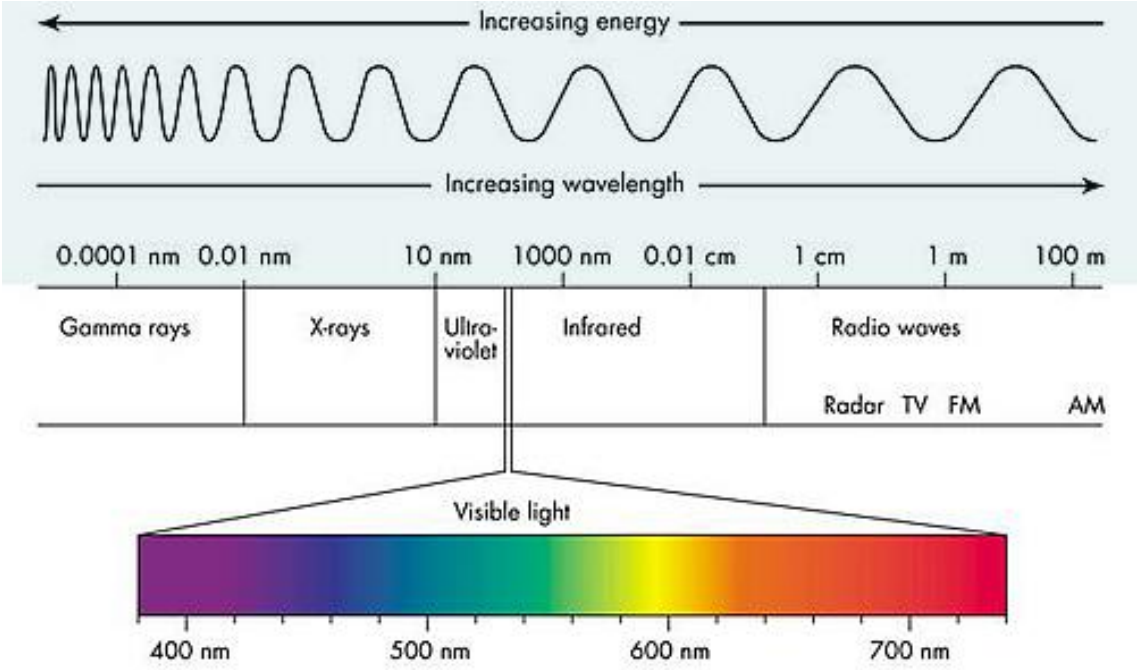
Remote sensing refers to the activities of recording / observing / perceiving (**sensing**) objects or events in distant (**remote**) places.

- **Varying Distances**
- **Electromagnetic Radiation (EMR)**
- **Spectral Signature**







Sensors detect and measure specific parts of the electromagnetic radiation

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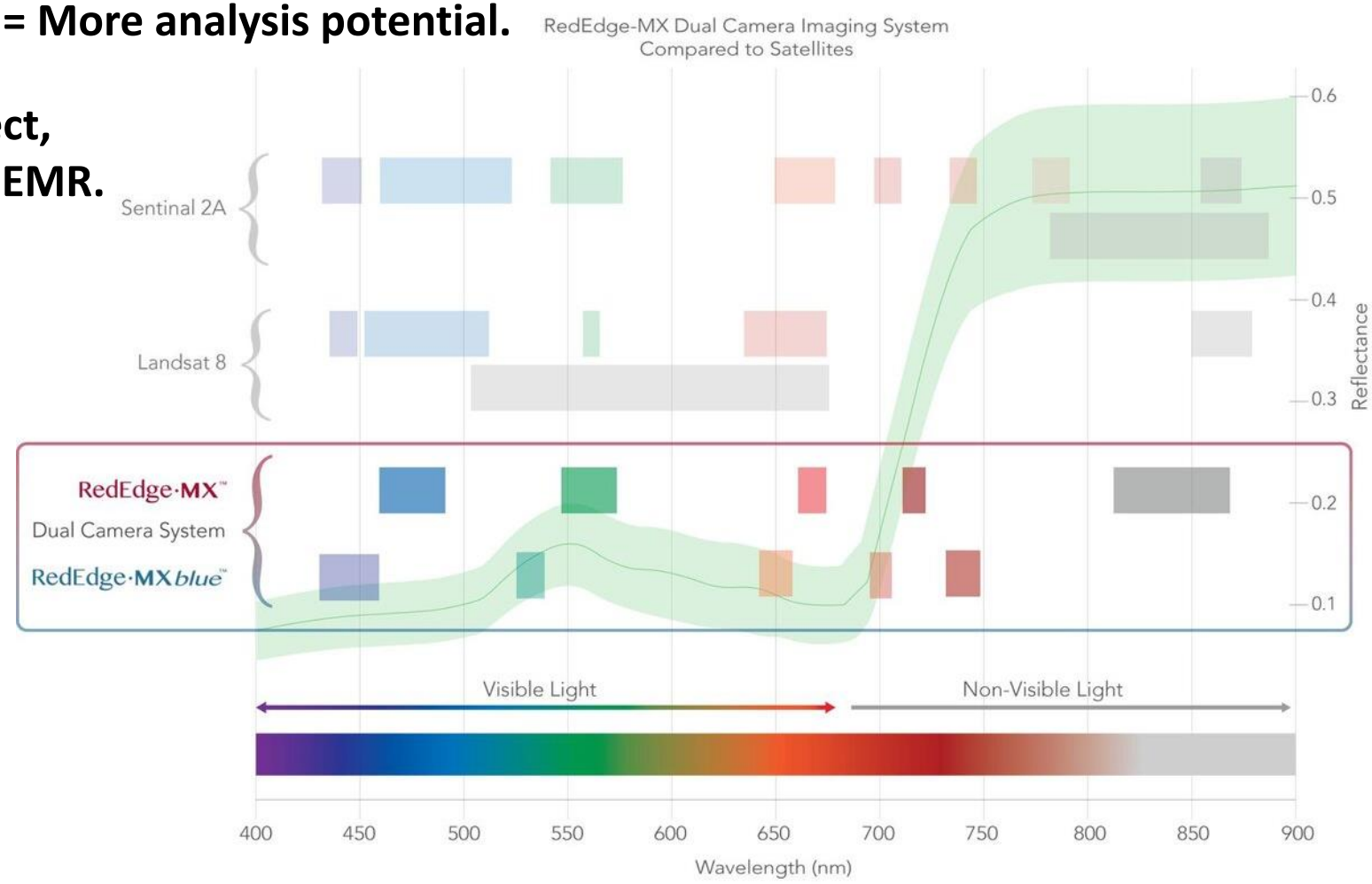
More wavebands = More information = More analysis potential.

Depending on what you want to inspect, you need to use different parts of the EMR.



Source: https://micasense.com/dual-camera-system/

Remote Sensing with UAVs

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Airborne **monitoring and inspections** of places and animals

- using **video** (livestream)
- using **images** that can be post-processed to orthomosaics and 3D surface models

➔ achieved by Photogrammetry

Photogrammetically generated Point Cloud

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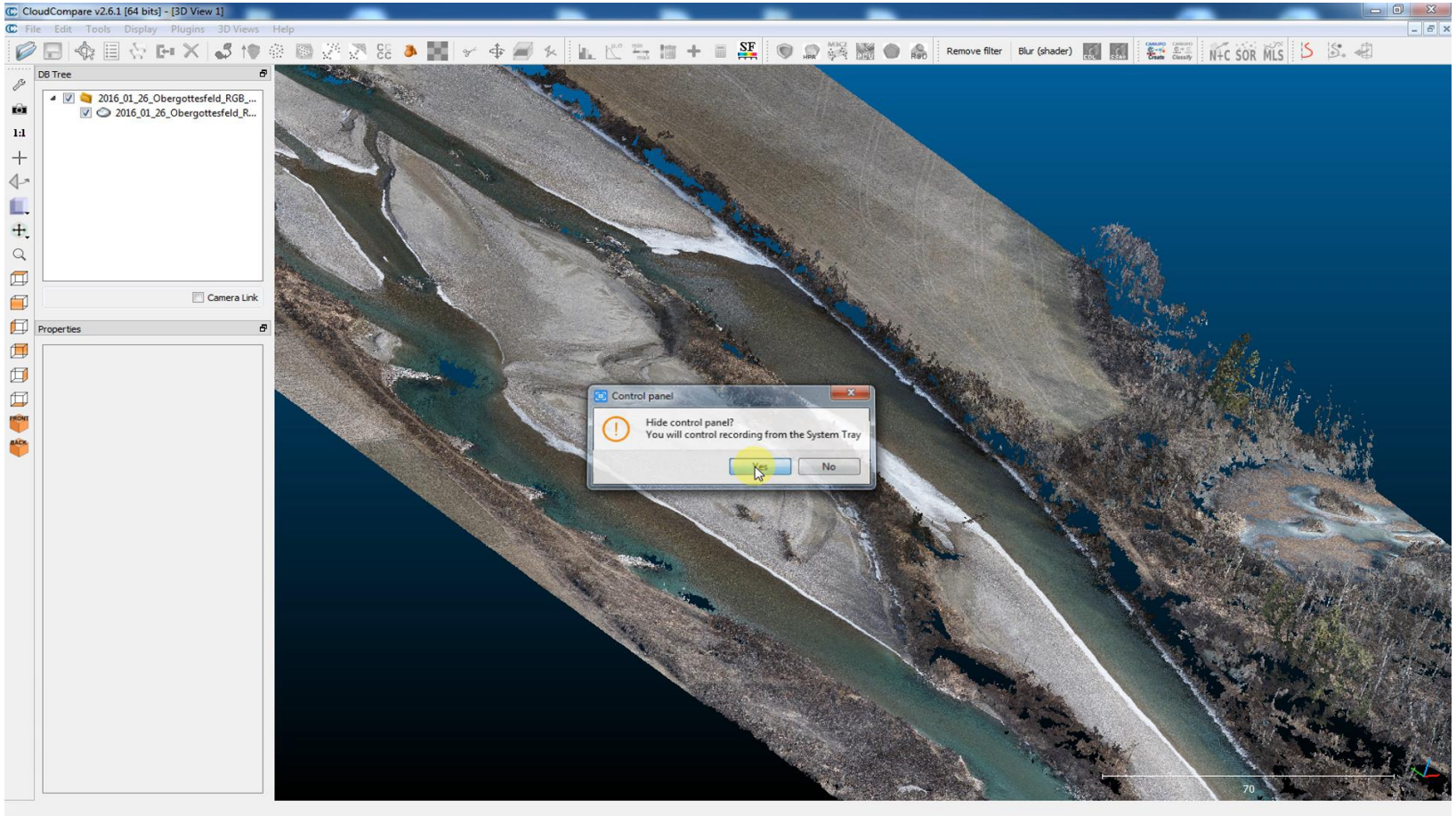

Monitoring of changes along rivers after renaturation measures

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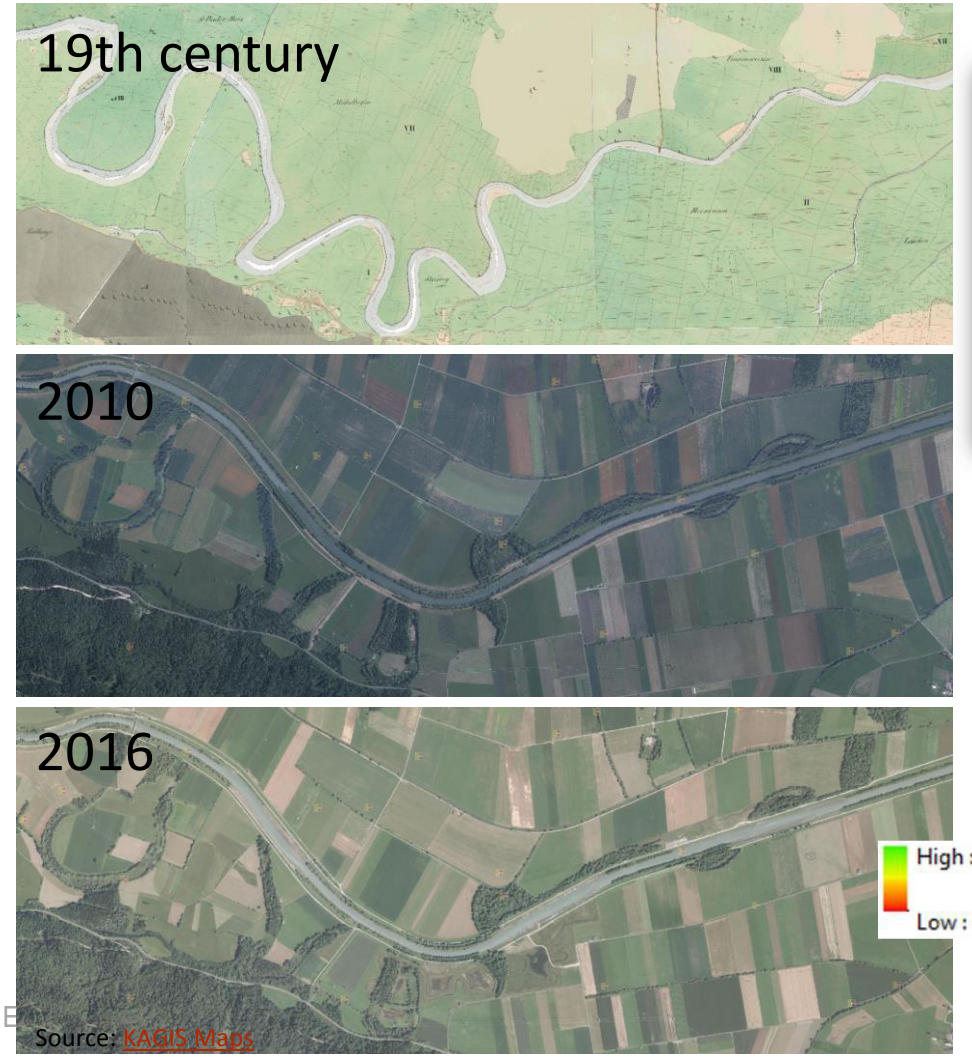
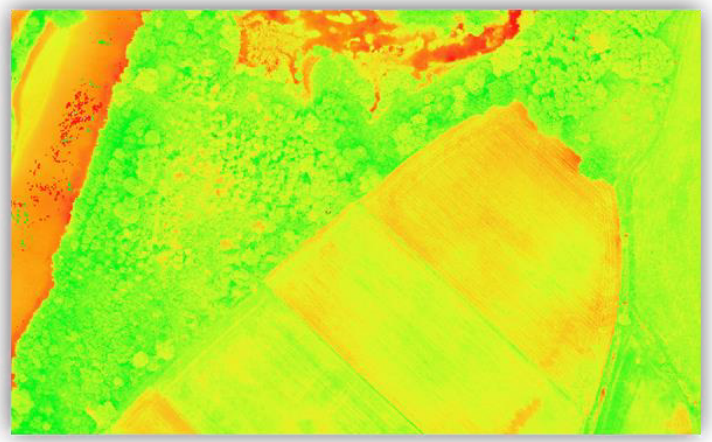
River Gail in Carinthia, Austria
Natura 2000 European Protected Area



Source: KAGIS Maps

Land Use Classification (Source: Lina Zander)

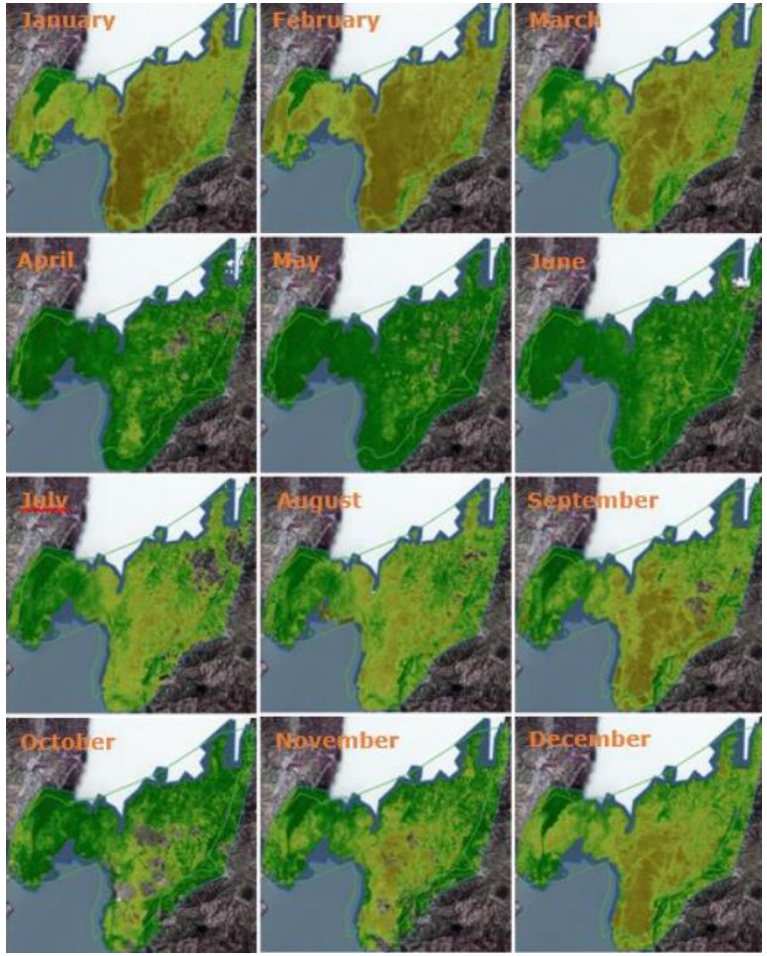


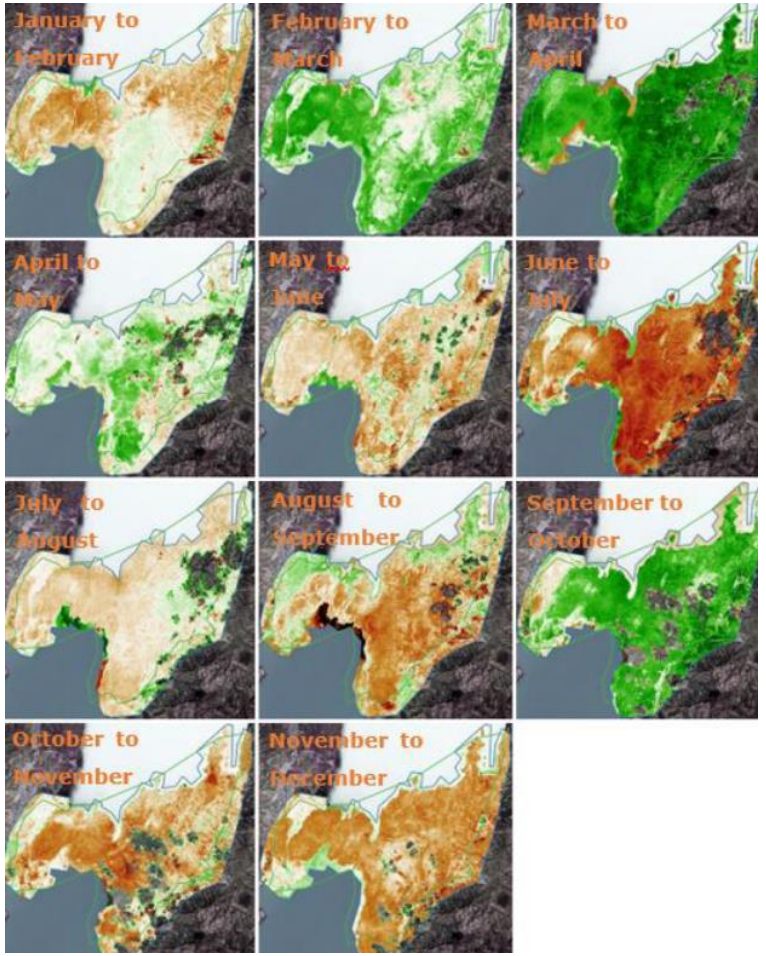
Change Detection – Vegetation & Morphology

Source: RPAMSS

Vegetation Indices to determine the vitality Source: RPAMSS

Change Detection - Indices





Quelle: Thamer Alexander

Normalized Difference Vegetation Index (NDVI)

state of plant health

Normalized Difference Moisture Index

indicator of water stress for plants

List of further spectral indices: https://www.l3harrisgeospatial.com/docs/alphabeticallistspectralindices.html

Monitoring of Species

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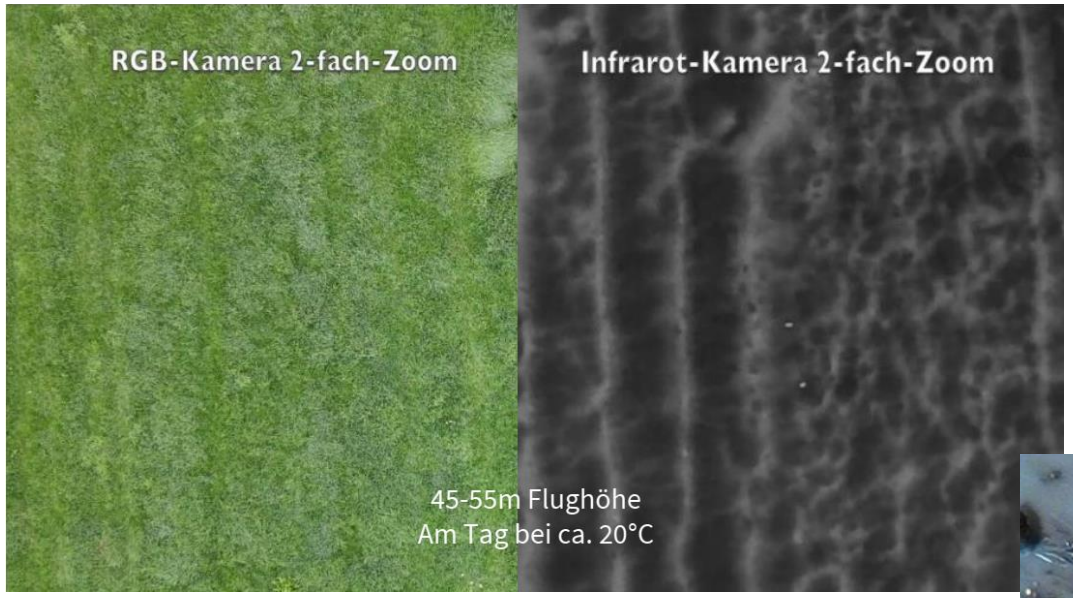
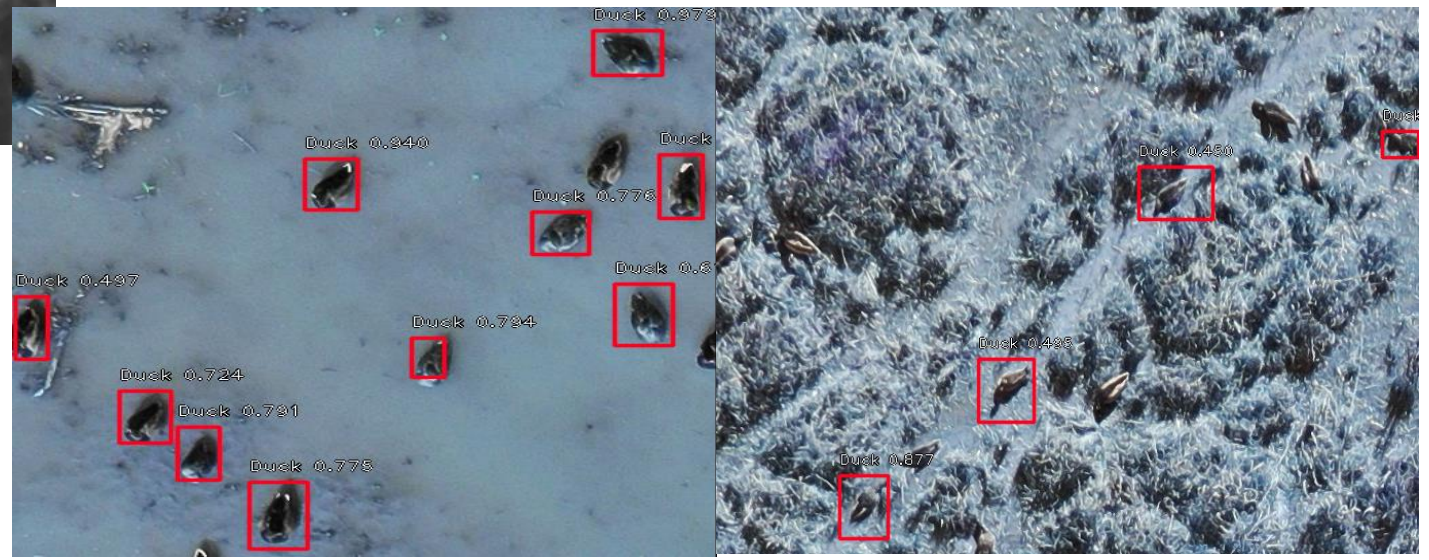


Quelle: Ökologische NABU-Station Ostfriesland (ÖNSOF), Rewen Tölge

Protection of nests *(left image)*

AI-based detection of birds *(bottom image)*



Quelle: Mohammad Sadoun

Habitat Heterogeneity

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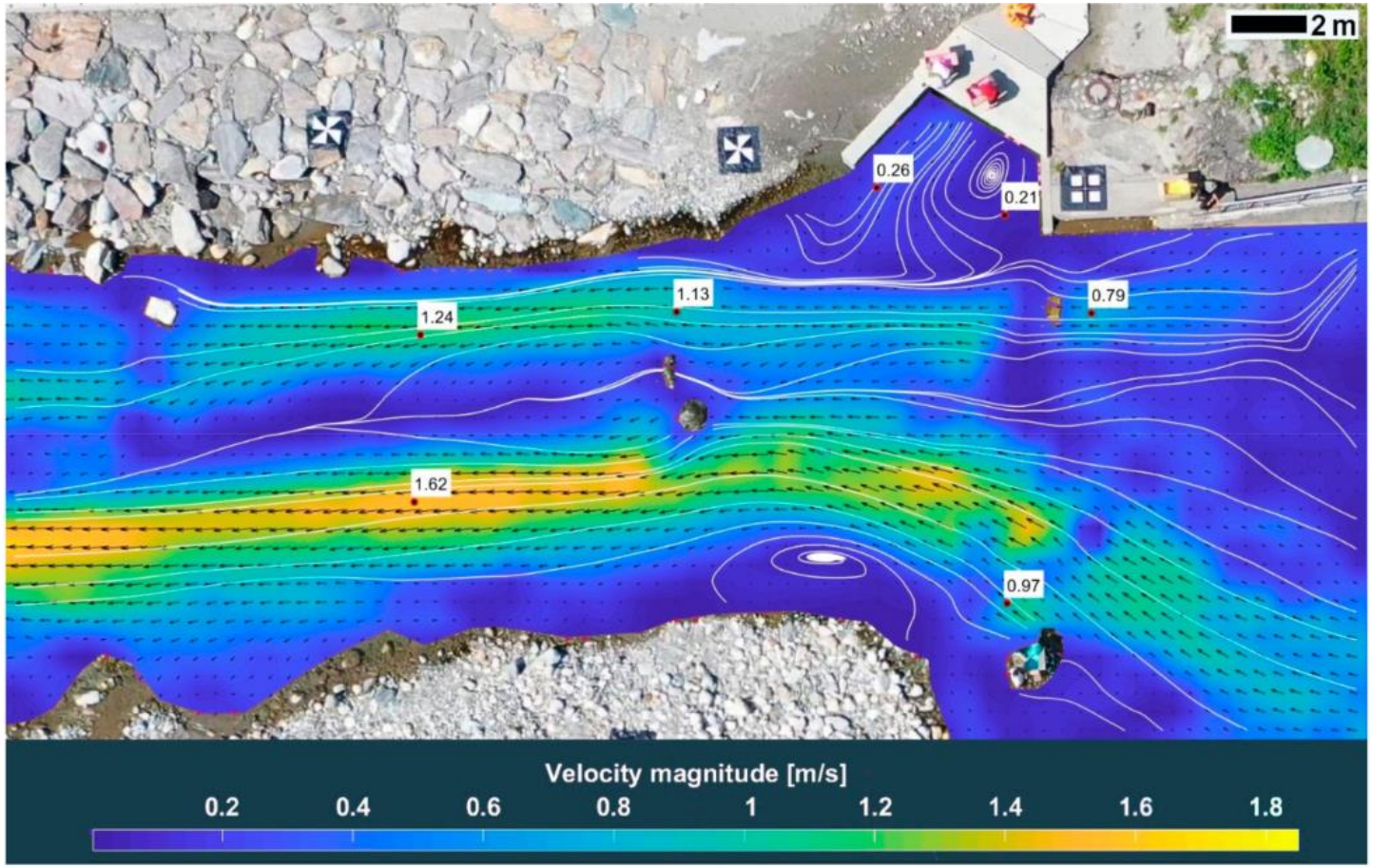

Drone-based non-intrusive optical measurement and calculation of flow patterns near fish passages at hydropower plants

Strelnikova, D; Paulus, G; Kafer, S; Anders, KH; Mayr, P; Mader, H; Scherling, U; Schneeberger, R.
(2020): Drone-Based Optical Measurements of Heterogeneous Surface Velocity Fields around Fish Passages at Hydropower Dams
REMOTE SENS-BASEL. 2020; 12(3), 384

Habitat Heterogeneity

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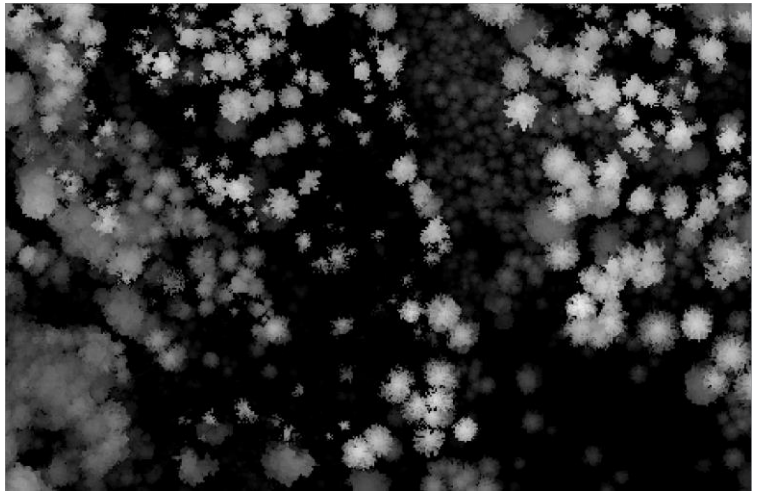
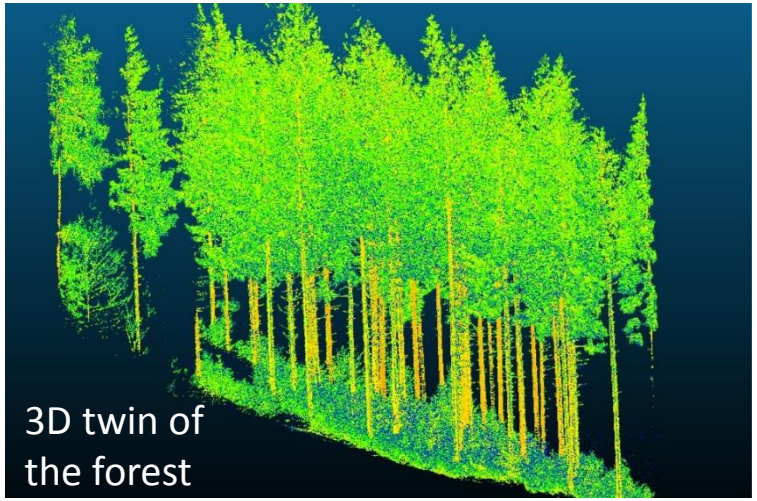
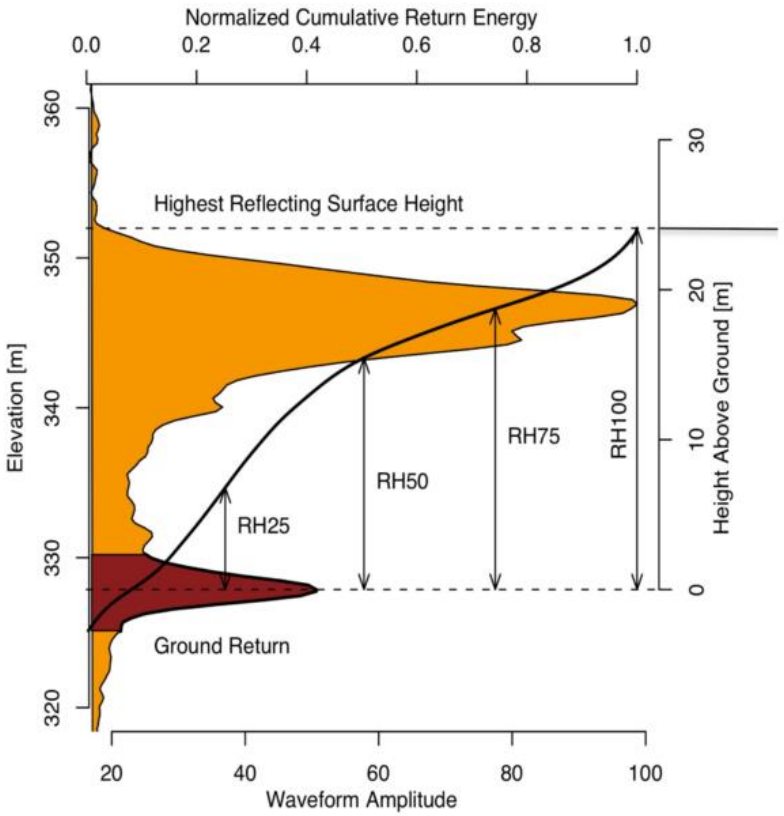
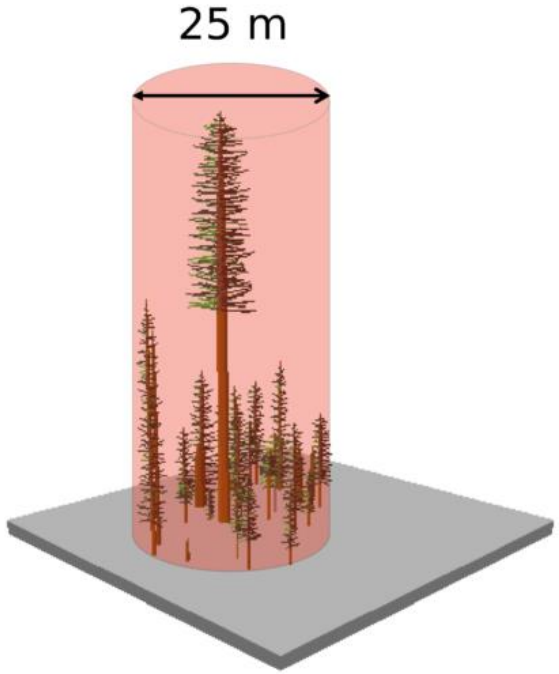


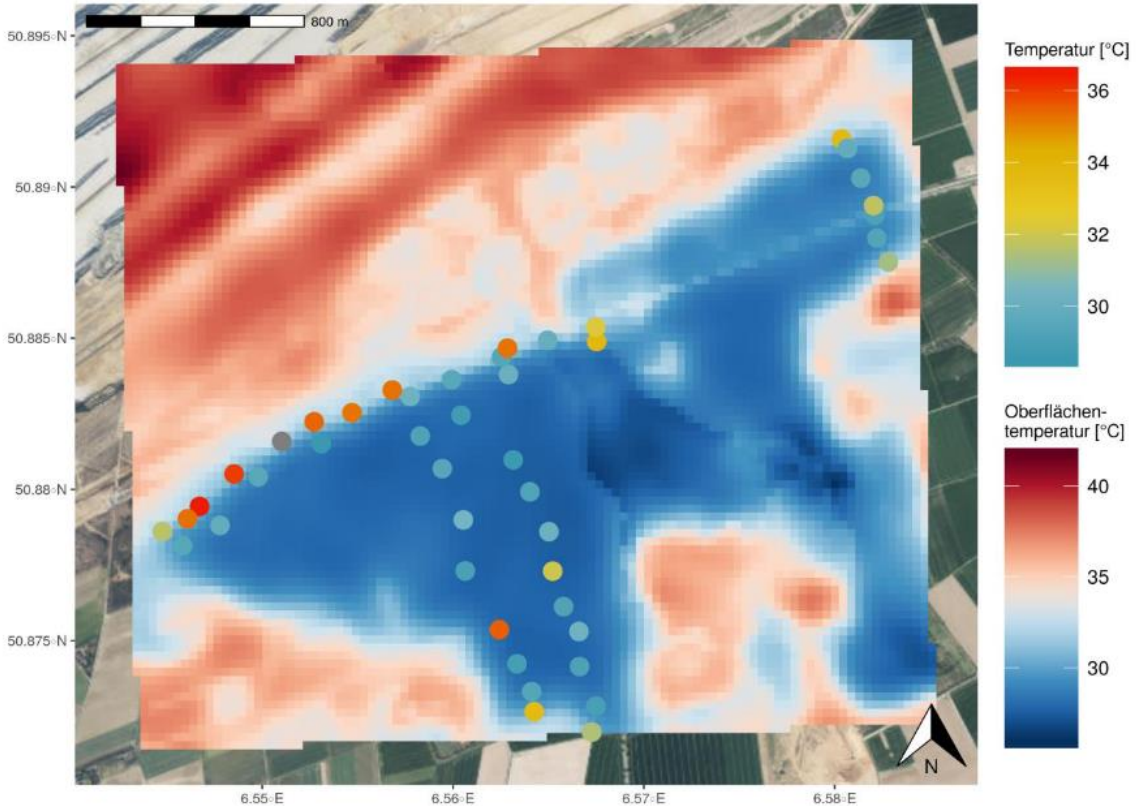




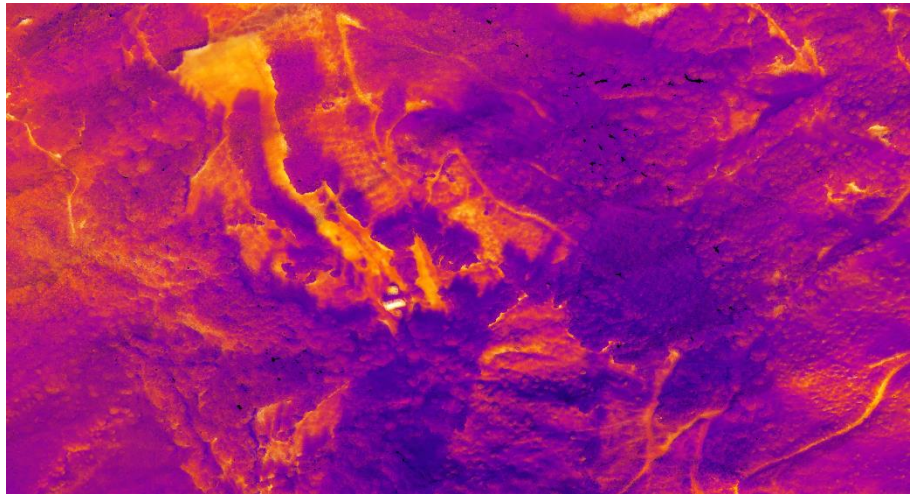


https://gedi.umd.edu/data/products/

Habitat Conditions



Average maximum temperature (shown as coloured dots) from this data logger-based analysis and results of the satellite-based analysis using Landsat-8 data.



UAV-based thermal image of a managed forest

Ibisch, P.L., Kriewald, S., Blumröder, J.S., 2019. Hambacher Forst in der Krise: Studie zur Beurteilung der mikro- sowie Randeffekten. Greenpeace e.V., Hamburg. (https://www.greenpeace.de/sites/www.greenpeace.de/files/publications/hambacher_forst.pdf)

Change Detection - Biomass

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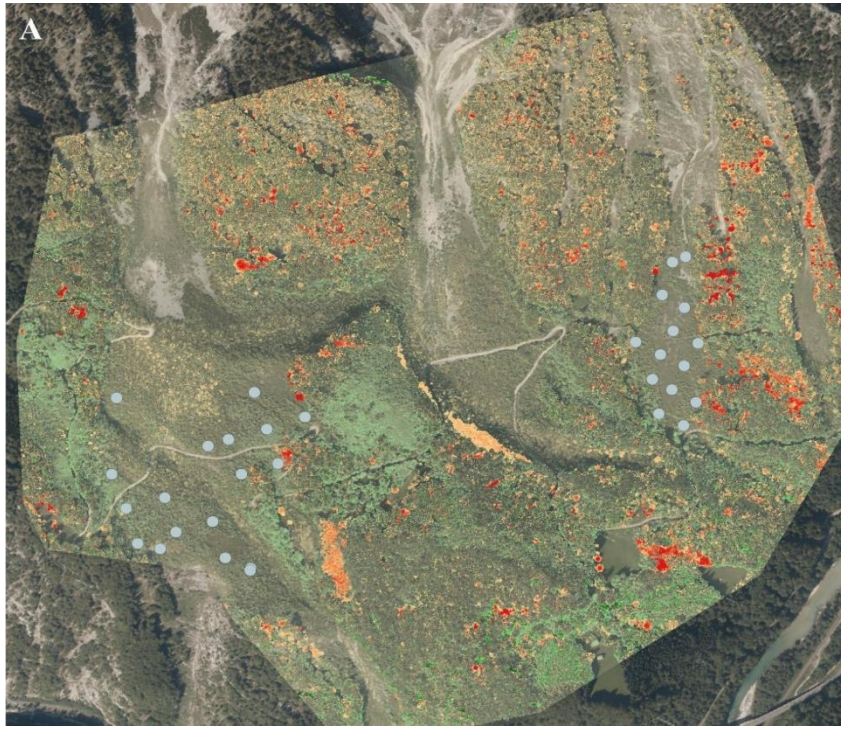

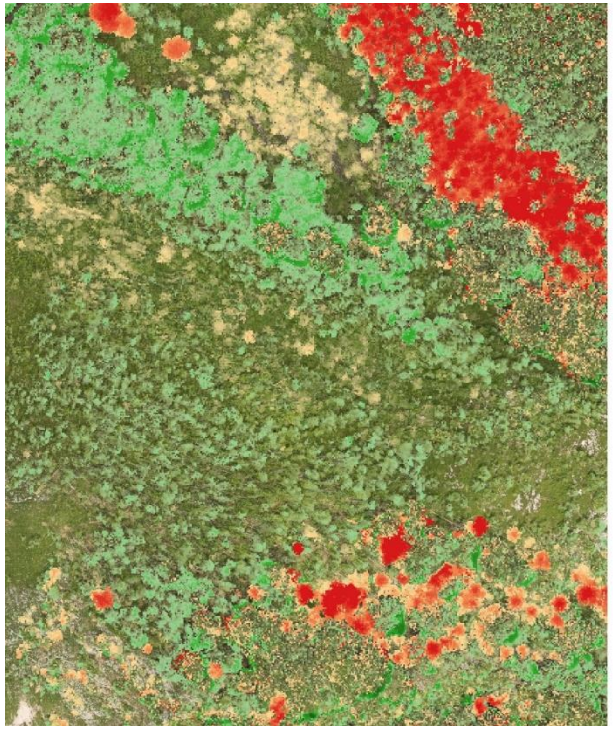

Berger, V., Kirchmeir, H., & Hirschmugl, M. (2021). Application-oriented approach to monitoring the dynamics of avalanche tracks using conventional forest inventory parameters and Lidar-based change detection. In Proceedings of the SilviLaser Conference 2021 (pp. 353–355). https://doi.org/10.34726/wim.2034

umwelt data

aero map JOANNEUM RESEARCH

E. C. O.

Data Analysis – Citizen Science

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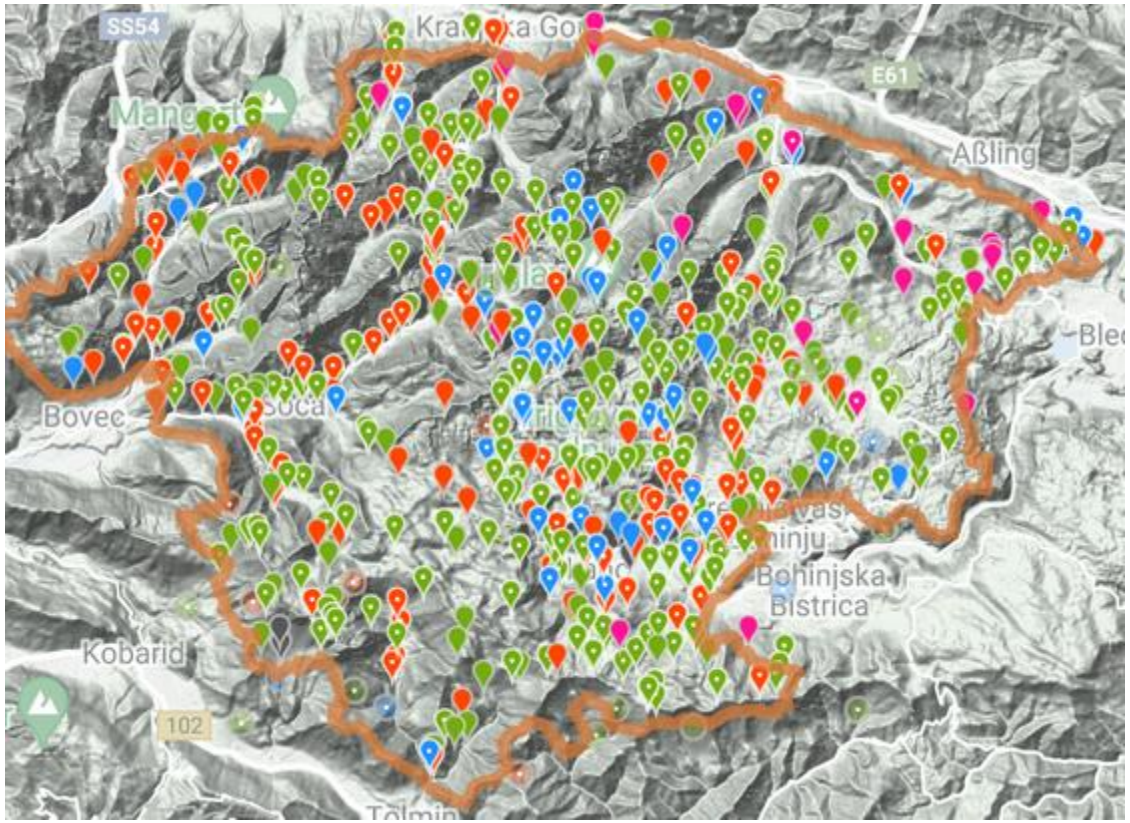
iNaturalist – NP Triglav

- 6457 observations confirmed
- 1514 species
- 488 observers



- https://www.inaturalist.org/home

Reporting – Maps
Storytelling with Maps

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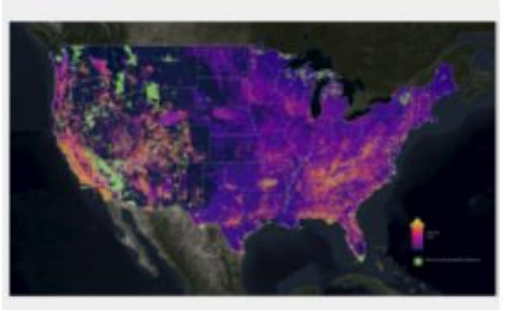
e.g. **ArcGIS Story Maps**

- Combination of text, interactive maps, and other multimedia content to tell stories
- **Communicate issues** (successes, problems, activities, history) about your conservation area
- Example Gallery of ArcGIS Story Maps

Open Source Story Map Tool „StoryMap JS“

Alaska Landbird Monitoring Survey

Great Wetlands of the World



The Map of Biodiversity Importance: An Overview

Story Map “Discovering Patterns in Global Wildfires”

3-Dimensional - Laserscanning

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Airborne Laser scanning - Airplane

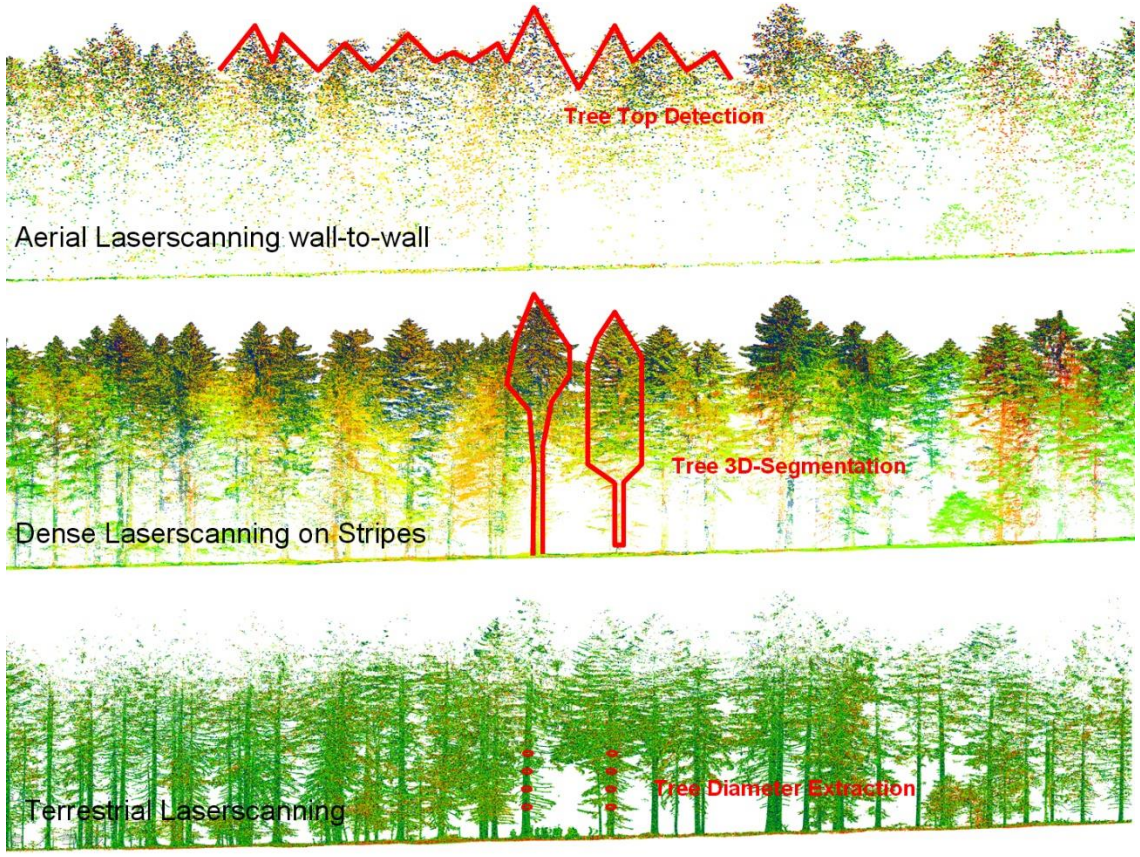
Airborne Laser scanning - UAV

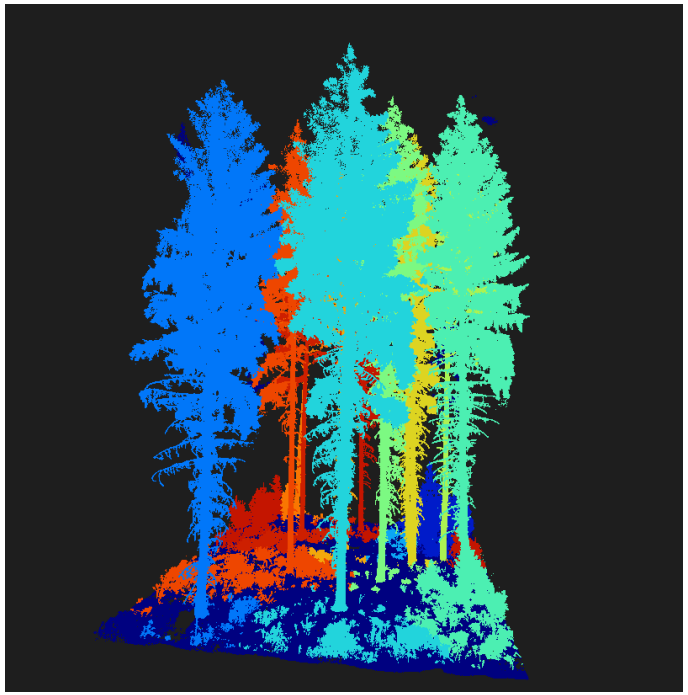
Terrestrial Laser scanning

Mobile Laser scanning

3-Dimensional – Laserscanning

umwelt data





3-Dimensional - Photogrammetry

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Photogrammetry - Structure from Motion

DGPS – Differential GPS

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Differential Corrections can be accomplished:

- while the GPS receiver is in use (**real-time**)
  live broadcast of corrections (e.g. via radio signal)
  GBAS- or SBAS-capable GPS receiver required

Source: Leica & DJI

- at a later time (**postprocessing**)
  by using postprocessing software (e.g. gLAB, RTKLIB)
  needed:
  - Rinex log from GPS receiver
  - Rinex log from a base station

Common Usage of DGPS

Capturing **ground control points (GCPs)** for drone missions

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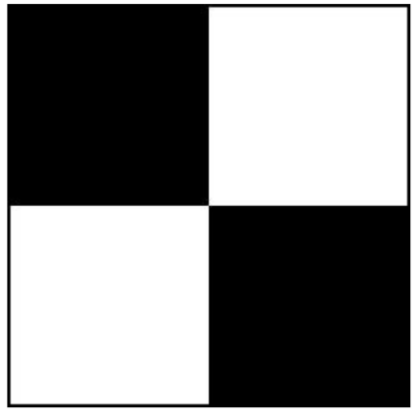
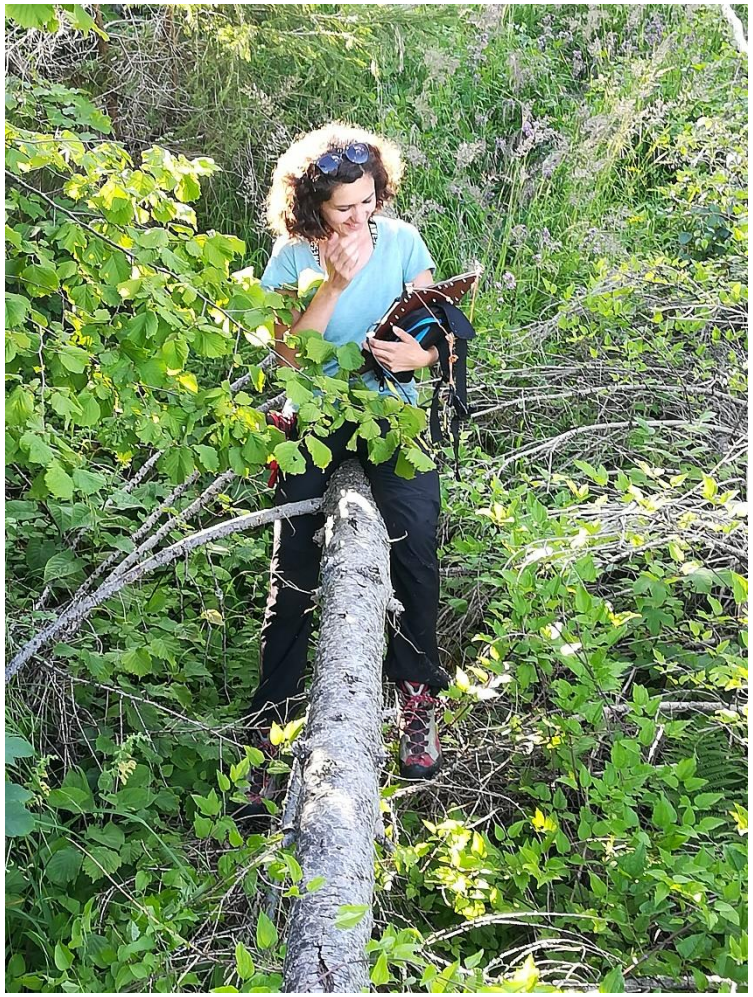
- Points with **known coordinates**
- good visibility, good contrast, dull surface, (water proof)
- at least 5 up to 10 recommended (read more)
- on the ground (in uneven terrain place GCPs in locations of different heights
- “natural” GCPs can be used too
- spray-painting possible; “L” recommended



Source: Pix4D

Are you early bird or late adopter?



Round Table

United Nations Educational, Scientific and Cultural Organization

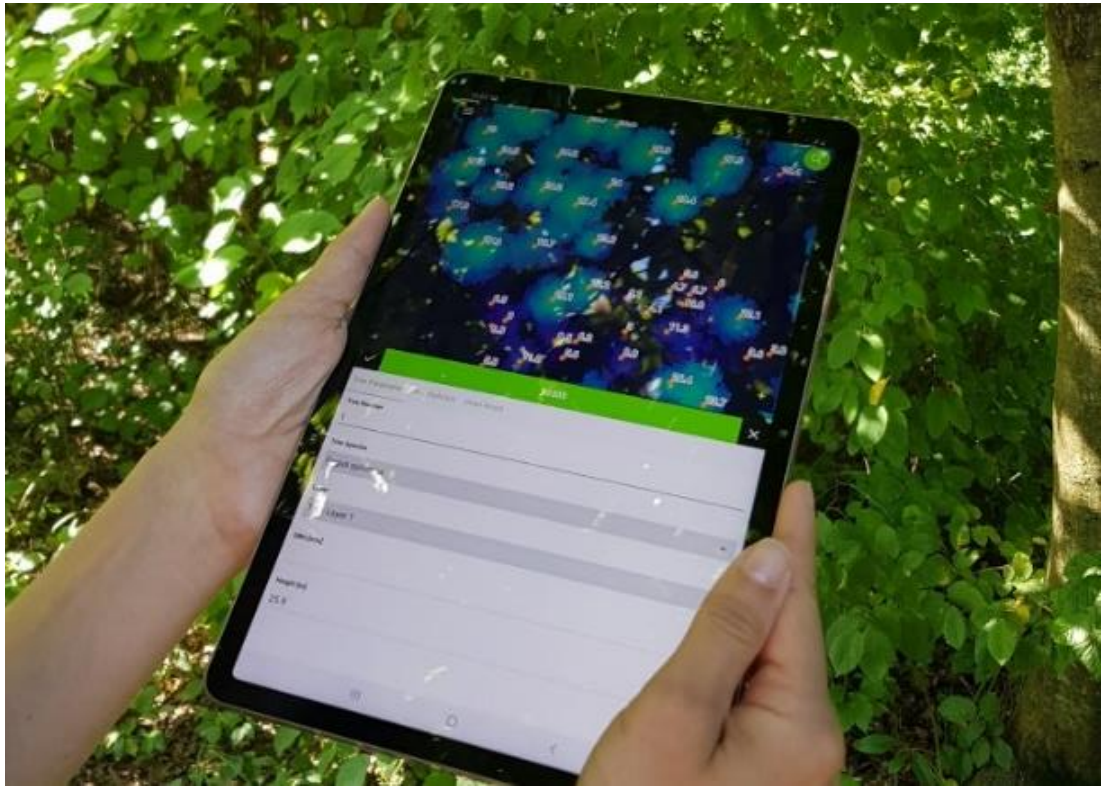
UNESCO Chair on Sustainable Management of Conservation Areas Carinthia University of Applied Sciences, Austria

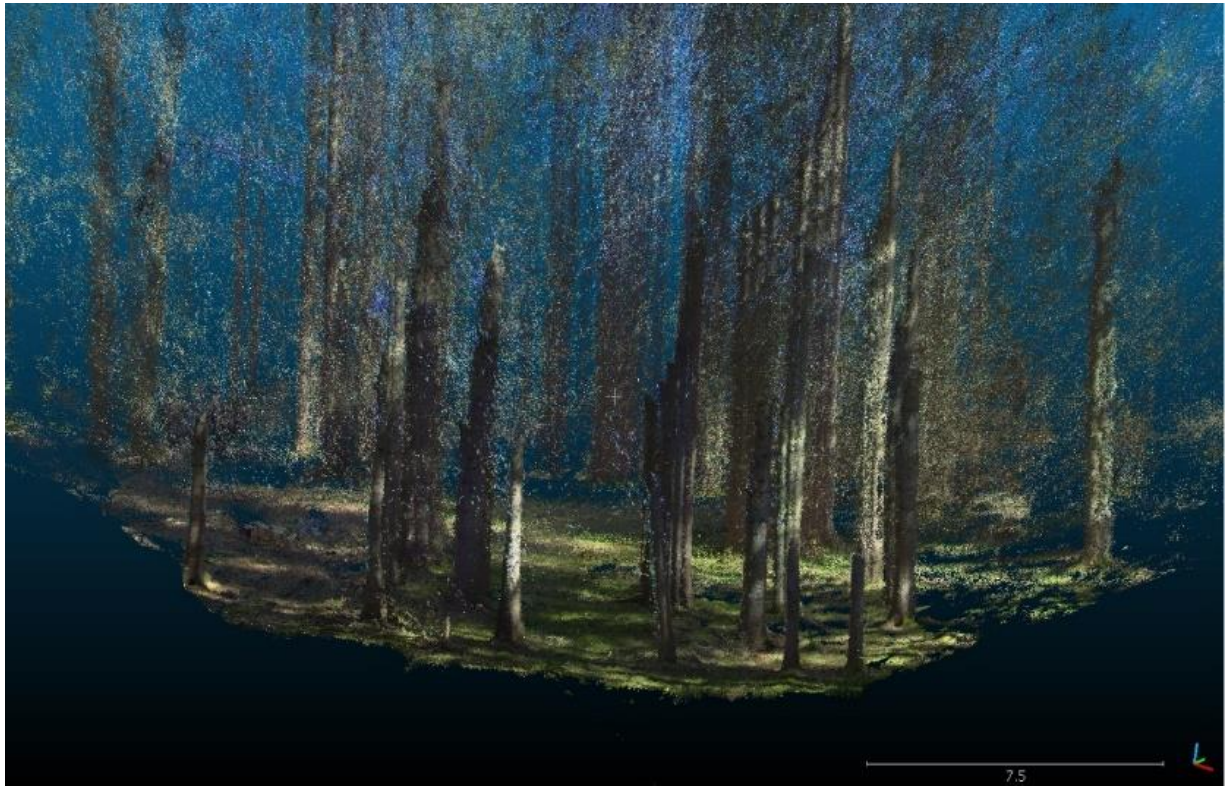
- How can we use new technologies appropriate in monitoring?
- How much technology is really needed?
- What are the challenges in the application of new technologies?
- What do you need to tackle this challenge?
- How can synergies be used optimally?

Into the Wild

United Nations Educational, Scientific and Cultural Organization

UNESCO Chair on Sustainable Management of Conservation Areas Carinthia University of Applied Sciences, Austria





Case Study

DIGITIZE
THE PLANET

We support visitors in experiencing nature according to the rules, without harming it.
In this way, we enable visitors to have satisfactory and appropriate experiences.

We reach this goal by digitizing all relevant rules, including laws and local agreements for use in nature.

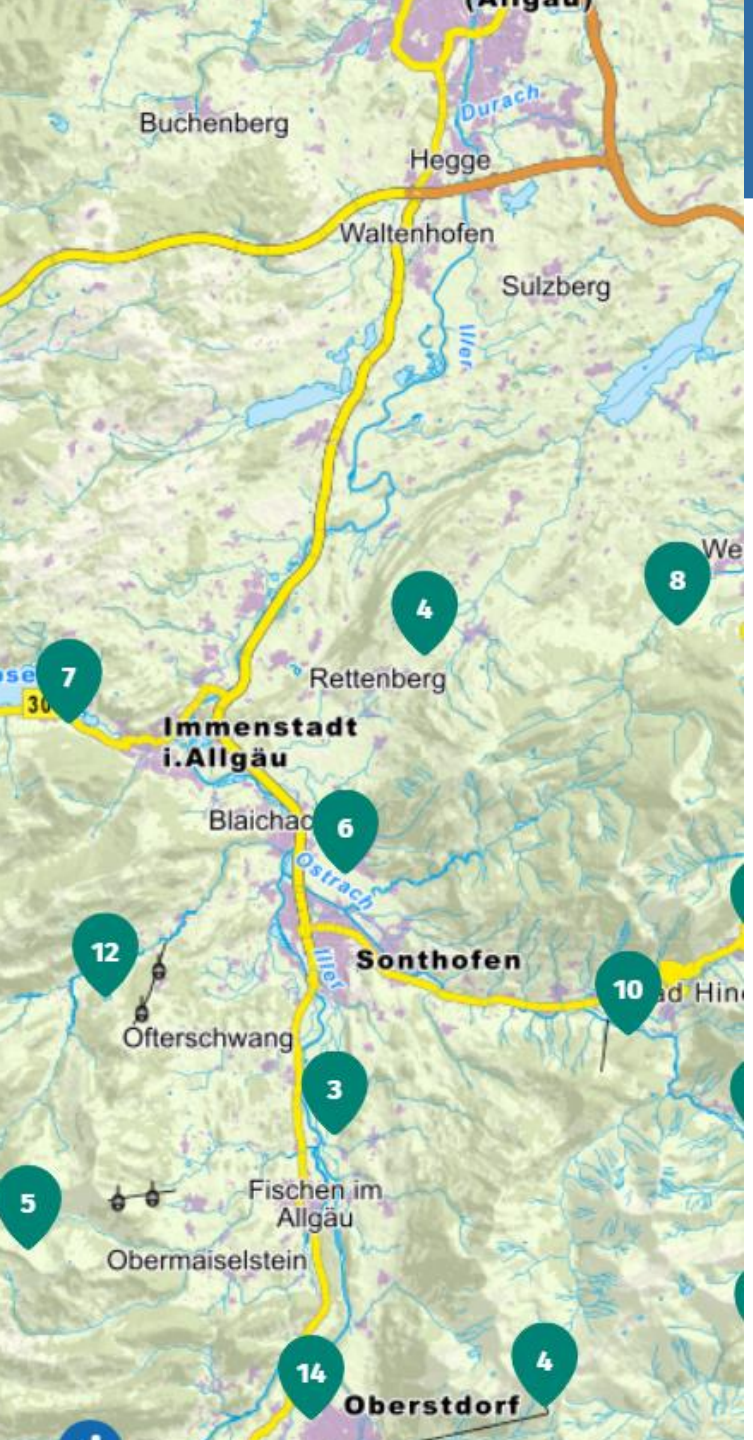
DIGITIZE THE PLANET

More and more people are enjoying nature. But often they don't know the rules.

Digital services with user-generated content intensify the situation.

As a result

- Pressure on nature increases even where strict protection rules are already in place.
- Sensitive spaces are put under excessive strain.
- Conflicts between users increase.
- Property owners become more restrictive.
- Guests are dissatisfied.



Digital all-in-one solution

DIGITIZE THE PLANET

According to the behaviour and needs of the users

Digital solutions are created

Traffic
Parking
Public Transport
Last mile

Hiking routes
Routes
POIs
Experiences

Time of day
Opening hours
Requirements
Prices
Equipment

Lack of digitization

Protected areas
Rules
Behaviour
Agreements
Nature conservation

Bundle - simplify - provide information

Information should easily be integrated into any system to ensure that it can reach all visitors at the appropriate time.

Format Properties:

- Structured
- Open data
- International
- Standardized
- Machine readable

Data is a relevant planning tool

Platforms and map services can provide and filter compliant content:

- Rule-compliant trail network
- Selected tours & experiences

Information on compliant behavior can be easily displayed according to the activity:

- Visual representation on the map
- Clear wording

Roadmap

DIGITIZE THE PLANET

Nationale Naturlandschaften

MOUNTAINBIKE TOURISMUSFORUM DEUTSCHLAND

outdooractive

BTE

Founding of the association

March 2020

May 2020

Start of work

Development of 5 core tasks:

1. Examine Regulatory Frameworks
2. Define a Data Format
3. Producing Data
4. Data Distribution
5. CcE ducate the Public

Proof of Concept:

5 core tasks tested
Study of different regions
Structured presentation of the rules
First data created

First pilot phase

August 2020

April 2021

Evaluation phase

Optimization for technical processing

- Ease of use and effectiveness
- International application

Prototype Data Platform

October 2021

Roadmap Digitize the Planet

DIGITIZE THE PLANET

- Further development of the data model with findings from the evaluation phase
- Exchange with platforms for interfaces and data formats

operative Data platform

Opening of the platform

October 2021

Prototype Data platform

December 2021

March 2022

Testing phase

Initial data entry with first-time users via a web-based interface

Summer 2022

Members

DIGITIZE THE PLANET

MOUNTAINBIKE TOURISMUSFORUM DEUTSCHLAND

outdooractive

BTE

Nationale Naturlandschaften

alpenverein österreich

TRIGLAVSKI NARODNI PARK 40 YEARS LET

TN-Deutschland
TourismusNewsDeutschland

Respektiere deine Grenzen

neusta destination solutions

Bad Urach

adidas

LOWA simply more...

Naturpark Karwendel

Landkreis Ostallgäu

ALPENREGION TEGERNSEE SCHLIERSEE

SCHWARZWALD Black.Forest.

Pfaffenwinkel Natürlich Oberbayern!

hubermedia

Südliche Weinstrasse
Zum Wohl. Die Pfalz.

BERGWELT TIROL MITEINANDER ERLEBEN

SÖLKTÄLER NATURPARK

Zum Wohl. Die Pfalz.

Lebensraum Lechtal

Sauerland in Südwestfalen

green-solutions

bergfex.at

Zugspitz Region

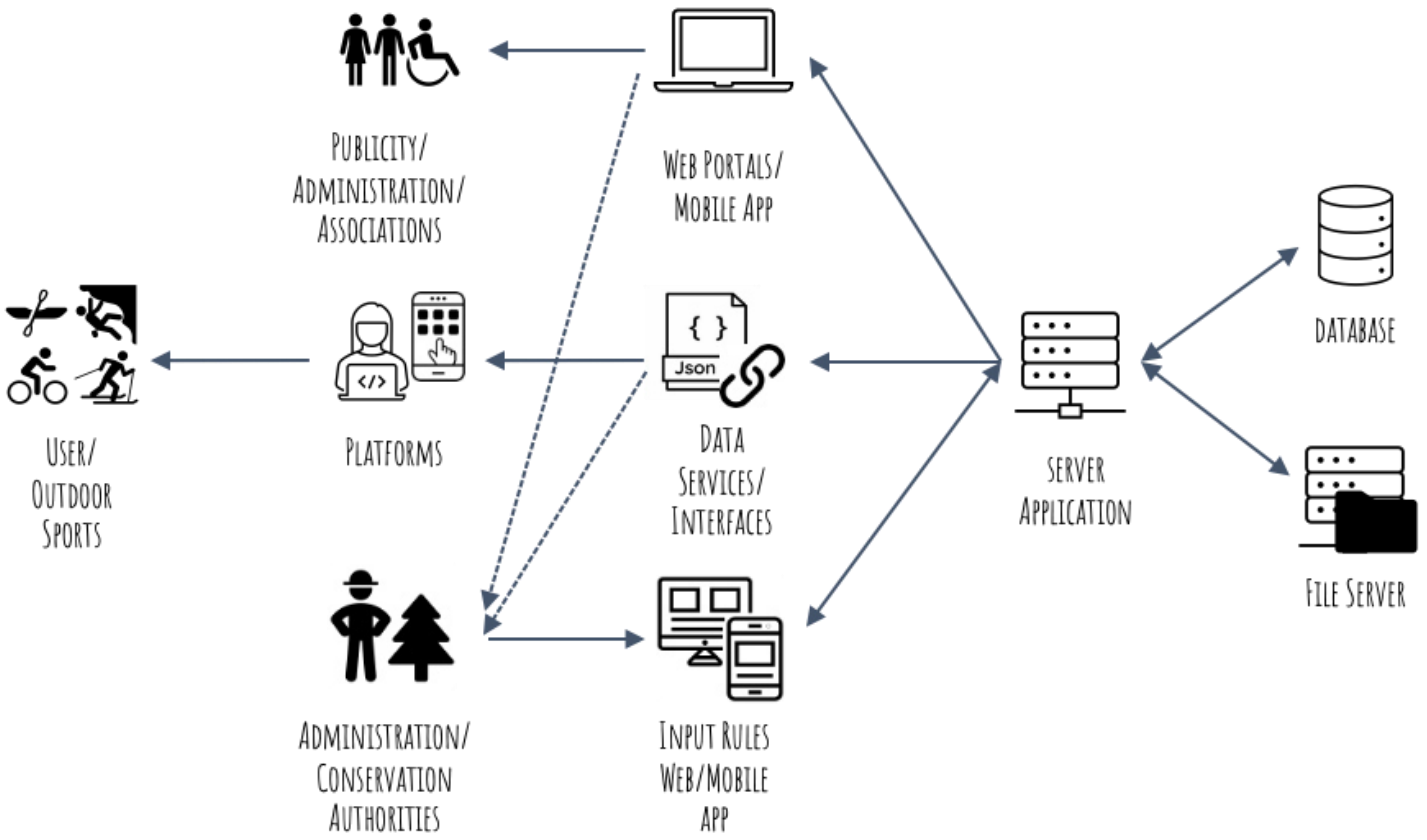
NATURPARK BERGISCHES LAND

KOMPASS

David Wewetzer

Prof. Dr. Alexander Dingeldey

Service architecture



Challenges

DIGITIZE THE PLANET

Together we can manage

- Membership
- Project partnership
- Donation
- Data entry
- Data use
- Participation Dialogues
- Visit website and contact us

Goodbye and see you

at every suitable opportunity

or at the 4th Digitize Dialogue

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