EGU General Assembly 2023

Session BG9.3 – Remote Sensing of Vegetation Biodiversity

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Combining Remote Sensing Data for Habitat Mapping and Monitoring on a Regional Scale - the SEMONA RELOADED project

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Introduction and Motivation

Natural and cultural conservation habitats as well as green infrastructure in settlement areas play a vital role in protecting and increasing biodiversity and maintaining cultural heritage. The **monitoring and mapping of these areas require significant effort**, which often exceeds the capacities of management authorities. **Earth observation (EO) data** has the potential to **assist in monitoring and mapping** these areas. In view of this, we investigate five different study sites in cooperation with the respective management authorities.

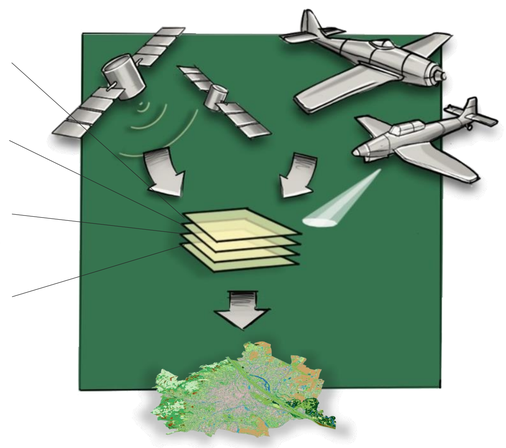
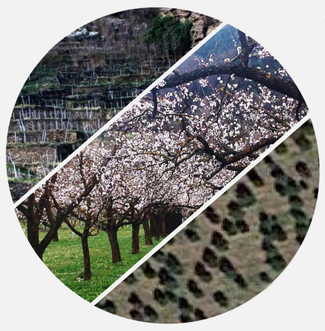


Figure 1: Data scheme

The aims of the presented project are:

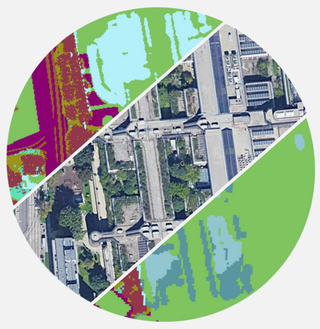
- The identification of practical use cases of EO data for the operational management of natural and cultural conservation areas as well as green infrastructure.
- The evaluation of the potential of EO data to support and complement monitoring and mapping of features of interest for natural and cultural conservation and protection.
- The investigation of combining various EO data sources, such as airborne laser scanning and image-based point clouds, along with temporal data from Sentinel 1 and Sentinel 2, for the identified use cases.
- Facilitating and connecting stakeholder engagement for adaptive management of biodiversity and climate resilience measures.
- Dissemination of the findings amongst relevant stakeholders and the interested public.

Study Sites and Identified Use Cases



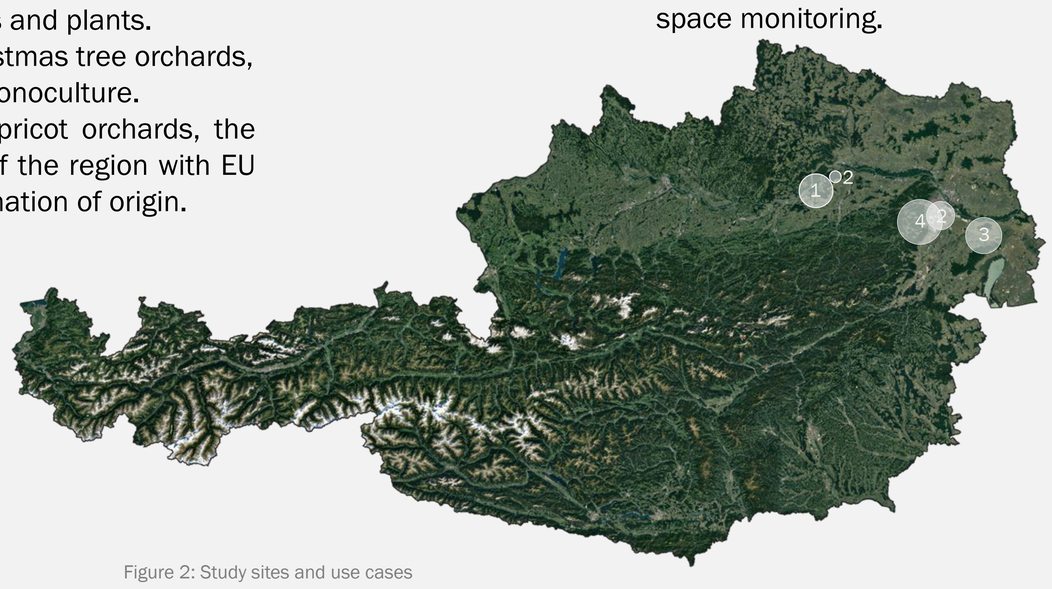
World Heritage Site Wachau (1)

- Monitoring of dry stone walls, which protect vineyards from soil erosion and host insects and plants.
- Mapping of christmas tree orchards, an increasing monoculture.
- Monitoring of apricot orchards, the signature fruit of the region with EU protected designation of origin.



Vienna and Krems: Urban Green (2)

- Possibilities of area-wide monitoring of green infrastructure in cities.
- Detailed description of inaccessible green spaces such as green roofs.
- Operational integration of remote sensing data in the urban green space monitoring.



Donau-Auen National Park (3)

- Identification of invasive species and neophytes like Ailanthus altissima.
- Monitoring of conservation status, occurrence and fallowing of dry grassland.
- Monitoring and mapping of Natura 2000 habitats.

Vienna Woods Biosphere Reserve (4)

- Monitoring the development of forests that have been taken out of use.
- Monitoring the development of surface sealing.
- Implementation of an alarm system for fallow meadow areas.

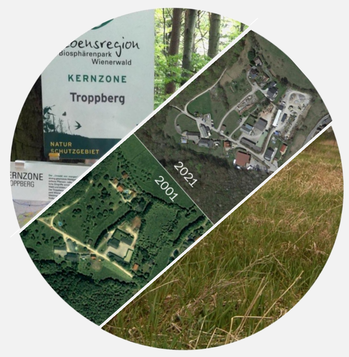


Figure 2: Study sites and use cases

Image and map data credits

Map data: Google, Landsat / Copernicus (2023)

World heritage site Wachau: Christmas tree field: Google, Maxar Technologies (2023), Apricot trees blooming: Helga Iglseder (2023), Dry stone walls: Anna Iglseder (2023)

Vienna Woods Biosphere Reserve: Kernzonen: BPWW/H.Brenner (2023), Fallow meadow: Elke Freese CC BY-SA 3.0 (2005), Surface sealing: Google, Maxar Technologies (2023), edited by Anna Iglseder

Urban Green: Green space monitoring: Stadt Wien (2020), Orthophoto Green space monitoring: Google, Maxar Technologies (2020)

Doanu-Auen National Park: Leaves of Ailanthus altissima: Dietmut Teijgeman-Hansen CC BY-NC-ND 2.0 (2008), Donau-Auen Nationalpark Stopfenreuth: Medbiker 1965 CC BY-DA 3.0 AT (2015), Dry grassland: Nationalpark Donau-Auen (2023)

Preliminary results

Random forest based classification of Natura 2000 Habitat's Directive forest types. For detailed results and a extensive description of the forest habitat types see Iglseder et al. (2023), https://doi.org/10.1016/j.jag.2022.103131

Table 1: Confusion matrix study site A

study site A		Observed habitat types						sum	UA (recall)
		9110	9130	9170	9180	91E0	91G0		
Predicted habitat types	9110	18	1343	1727	83	74	29	3274	0.5%
	9130	1221	44585	30384	782	236	520	77728	57.4%
	9170	520	19961	93951	905	632	2488	118457	79.3%
	9180	131	218	970	7	10	15	1351	0.5%
	91E0	223	1400	5765	111	4584	673	12756	35.9%
	91G0	39	908	3826	33	159	46	5011	0.9%
sum		2152	68415	136623	1921	5695	3771	218577	
PA (prec.)		0.8%	65.2%	68.8%	0.4%	80.5%	1.2%		
F1-score		0.007	0.610	0.737	0.004	0.497	0.010		

overall accuracy: 65.5 %
kappa: 0.37

Table 2: Confusion matrix study site B

study site B		Observed		sum (pred.)	UA (recall)
		91E0	91F0		
Pred.	91E0	6142	12514	18656	32.9%
	91F0	2780	80440	83220	96.7%
sum (obs.)		8922	92954	101876	
PA (prec.)		68.8%	86.5%		
F1-score		0.445	0.913		

overall accuracy: 85.0 %
kappa: 0.37

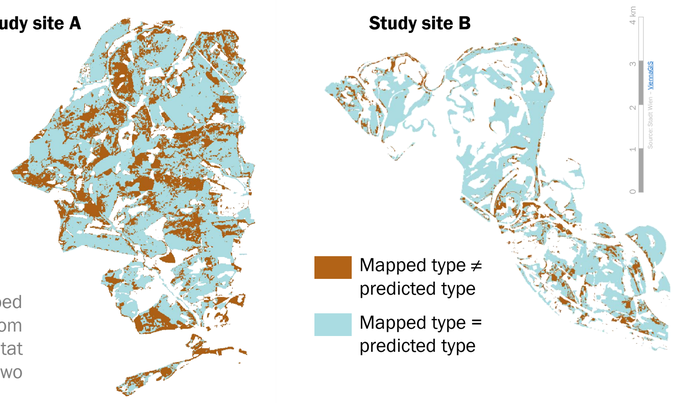


Figure 3: Mapped results of random forest based habitat classification on two study sites (3, 4)

Classification using on a knowledge based decision tree: radiometric and geometric data from IM and ALS in combination with available semantic segments, e.g. building polygons provided by the open data platform of the City of Vienna.

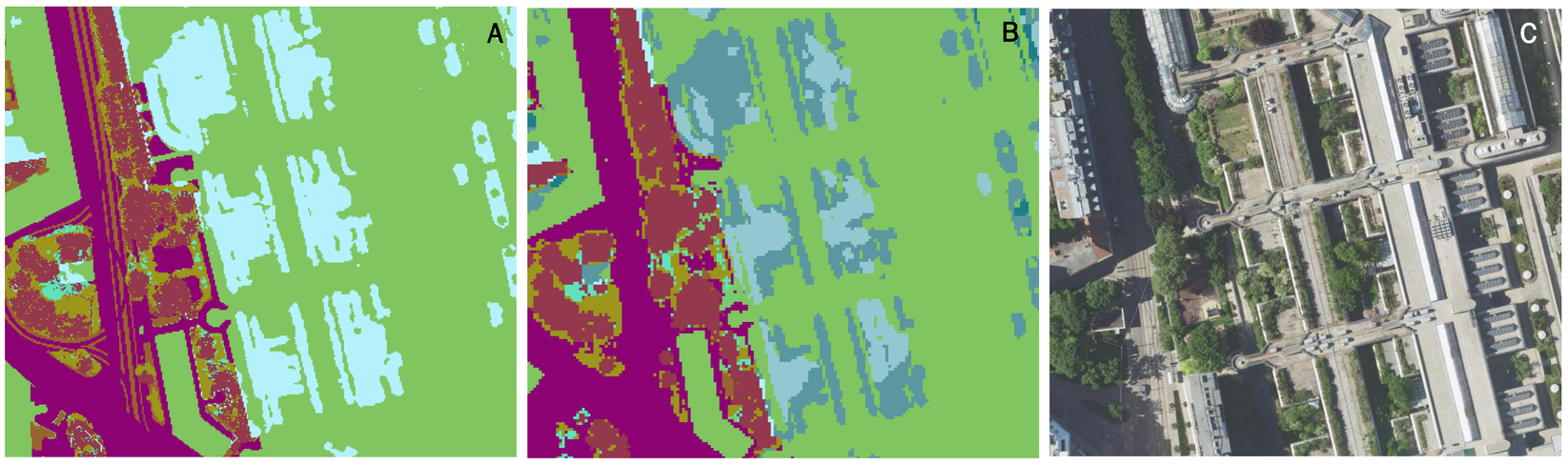


Figure 4: Comparising of the results of the current green space monitoring and the extended approach combining multiple RS data sources on a study site in the city of Vienna. : A: current official green space monitoring map of the City of Vienna (Stadt Wien 2018). B: Enhanced classification using combined remote sesing data, C: Orthophoto (Stadt Wien 2021)

This presentation participates in OSPP
Outstanding Student & PhD candidate Presentation contest

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