M U N I

COMMENTARY TO HABILITATION THESIS

Name of the habilitation thesis: **Advancing Ecosystem Study with Remote Sensing – from Describing the Patterns to Understanding the Processes**

Name and surname of the applicant: Jana Müllerová

I hereby present my research in the field of ecology, specifically the use of remote sensing to characterize and understand ecosystem state and functioning. As a plant ecologist, throughout my career, I have focused on the application of remote sensing, GIS and modelling in plant ecology and landscape studies. I analyse and interpret remote sensing (RS) data (including satellite, airborne and from unoccupied aerial systems) not only to monitor vegetation state and spatio-temporal changes at both community and landscape levels but also to understand the underlying processes. In my work, I explore human disturbances, plant-environment and plant-human interactions, current and historical disturbances, ecosystem functioning, and ecosystem threats such as invasive species and climate change at both local and regional scales.

The main aims of presented research can be summarized as follows:

- Define concepts and a framework for using a RS approach to study ecosystem complexity and variability across spatial and temporal scales.
- Discuss both the advantages and pitfalls of RS technology in contributing to ecosystem studies.
- Introduce various approaches to mapping and monitoring biodiversity patterns across space and time using RS, either directly, or indirectly via mapping habitats, functional diversity, or spectral diversity.
- Provide examples of how RS can enhance our understanding of ecological processes at local to regional scales, serving as a basis for management and nature conservation in a rapidly changing world.

In presented research, I touch various topics, including plant invasions, ecosystem services and role of human disturbances and climate change on high mountain ecosystems and forest ecosystem health. I hope my research adds bits and pieces to the puzzle of how to conserve the beauty of nature for future generations.

Below are selected peer-reviewed papers included in the Thesis. These are seven original research articles (Paper 6, 8-13), three reviews (Papers 1, 2, 4), one opinion paper (Paper 5), and two book chapters (Paper 3, 7). I served as the first and/or corresponding author on eight

of those (Paper 1 – 4, 6 – 7, 9 and 13), with the majority published in Q1 journals. See my contribution to each paper in below. The papers are attached as correspondingly numbered Appendices and are marked in the main text.

[1] Müllerová, J., Gago, X., Bučas, M., Company, J., Estrany, J., Fortesa, J., Manfreda, S., Michez, A., Mokroš, M., Paulus, G., Tiškus, E., Tsiafouli, M., Kent, R. (2021). Characterizing vegetation complexity with unmanned aerial systems (UAS) – A framework and synthesis. Ecological Indicators 131, 108156. https://doi.org/10.1016/j.ecolind.2021.108156
(JIF 2024: 7.4, ENVIRONMENTAL SCIENCES - Q1)

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
0	90	50	70

[2] Müllerová, J., Brundu, G., Große-Stoltenberg, A., Kattenborn T., Richardson, D.M. (2023a). Pattern to process, research to practice: Remote sensing of plant invasions. Biological Invasions 25, 3651–3676. https://doi.org/10.1007/s10530-023-03150-z
(JIF 2024 - 2.6, ECOLOGY - Q2)

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
0	80	60	60

[3] Müllerová, J., Bartaloš, T., Gago, X., Kent, R., Michez, A., Mücher, S., Paulus, G., Mokroš, M. (2023b). Vegetation mapping and monitoring by unmanned aerial systems (UAS)—current state and perspectives. In Manfreda & Ben Dor, Unmanned Aerial Systems for Monitoring Soil, Vegetation, and Riverine Environments, p. 93-124, Elsevier. ISBN 9780323852838. https://doi.org/10.1016/B978-0-323-85283-8.00008-4

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
10	80	60	60

[4] Müllerová, J., Kent, R., Brůna, J., Bučas, M., Estrany, J., Gago, X., Michez, A., Mokroš, M., Tsiafouli, M., Manfreda, S. (2025). Understanding spatio-temporal complexity of vegetation using drones, what could we improve? Journal of Environmental Management 373, 123656. https://doi.org/10.1016/j.jenvman.2024.123656
(JIF 2024: 8.4, ENVIRONMENTAL SCIENCES - Q1)

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
0	70	70	60

[5] Fassnacht, F. E, **Müllerová, J.,** Conti, L., Malavasi, M. & Schmidtlein, S. (2022) About the link between biodiversity and spectral variation. Applied Vegetation Science 25, e12643. https://doi.org/10.1111/avsc.12643
(JIF 2024: 2.6, ECOLOGY – Q2)

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
0	20	25	20

[6] Müllerová J., Pergl J. & Pyšek P. (2013). Remote sensing as a tool for monitoring plant invasions: testing the effects of data resolution and image classification approach on the detection of a model plant species Heracleum mantegazzianum (giant hogweed). International Journal of Applied Earth Observation and Geoinformation 25, 55–65. https://doi.org/10.1016/j.jag.2013.03.004
(JIF 2024: 8.6, REMOTE SENSING - Q1)

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
100	40	90	60

[7] Müllerová, J. (2019). UAS for Nature Conservation–Monitoring Invasive Species. In: J. B. Sharma (ed), Applications of Small Unmanned Aircraft Systems: Best Practices and Case Studies, CRC Press, pp. 157-178, ISBN 9780367199241. https://doi.org/10.1201/9780429244117

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
100	100	100	100

[8] Kupková, L., Červená, L., Potůčková, M., Lysák, J., Roubalová, M., Hrázský, Z., Březina, S. & **Müllerová, J.** (2023). Towards reliable monitoring of grass species in nature conservation practice: evaluation of the potential of UAV and PlanetScope multi-temporal data in the Central European tundra. Remote Sensing of Environment 294, 113645. https://doi.org/10.1016/j.rse.2023.113645
(JIF 2024: 11.4, ENVIRONMENTAL SCIENCES - Q1)

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
30	40	40	50

[9] Müllerová J., Vítková, M., Vítek, O. (2011). The impacts of road and walking trails upon adjacent vegetation: Effects of road building materials on species composition in a nutrient poor environment. Science of the Total Environment 19, 3839-3849. https://doi.org/10.1016/j.scitotenv.2011.06.056
(JIF 2024: 8, ENVIRONMENTAL SCIENCES - Q1)

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
40	40	50	50

[10] Potůčková, M., Kupková, L., Červená, L., Lysák, J., Krause, D., Hrázský, Z., Březina, S. & **Müllerová, J.** (2021). Towards resolving conservation issues through historical aerial imagery: vegetation cover changes in the Central European tundra. Biodiversity and Conservation 30(12), 3433-3455. https://doi.org/10.1007/s10531-021-02255-y
(JIF 2024: 3.1, BIODIVERSITY CONSERVATION - Q1)

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
30	50	25	40

[11] Pergl P., **Müllerová J.,** Perglová I., Herben T. & Pyšek P. (2011). The role of long-distance seed dispersal in the local population dynamics of an invasive plant species. Diversity and Distributions 17, 725-738. https://doi.org/10.1111/j.1472-4642.2011.00771.x
(JIF 2024: 4.2, ECOLOGY - Q1)

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
20	0	20	20

[12] Dostál P., **Müllerová J.,** Pyšek P., Pergl J., Klinerová T. (2013). The impact of an invasive plant changes over time. Ecology Letters 16, 1277–1284. https://doi.org/10.1111/ele.12166
(JIF 2024: 7.9, ECOLOGY - Q1)

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
20	20	20	20

[13] Müllerová, J., Šiffel, E. (2025). Cooling the Land Surface: Ecosystem Health and Water Availability Drive the Landscape Capacity to Mitigate Climate Change. Ecological Indicators 172, 113265. https://doi.org/10.1016/j.ecolind.2025.113265
(JIF 2024: 7.4, ENVIRONMENTAL SCIENCES - Q1)

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
20	100	80	100