

The project 'Biogeomorphic dynamics on lateral moraines in the Turtmann glacier forefield, Switzerland' investigates feedbacks between vegetation succession and geomorphic dynamics on Little Ice Age lateral moraines in the Turtmann glacier forefield (Switzerland).

Project information:

BIMODAL is a research project in the field of biogeomorphology, funded by the German Research Foundation (DFG).

Our project aims at understanding coupled geomorphic and ecologic dynamics on lateral moraines in space and time. These biogeomorphic feedbacks are an important control for sediment dynamics in glacier forefields and other alpine environments. Therefore, they represent a major interdisciplinary research challenge.

Our conceptual 'biogeomorphic umbrella' combines ecologic and geomorphic research and integrates several spatiotemporal scales (plot scale to lateral moraine subsystem scale, months to successional/ paraglacial timescale).

Aims:

Ecosystem engineer species: To identify ecosystem engineers with their relevant traits and to quantify their impact on geomorphic sediment transport processes on lateral moraines.

Conditions for feedbacks ('biogeomorphic window'): To determine the geomorphic and vegetation properties relevant for biogeomorphic interactions on lateral moraines, as well as boundary conditions and thresholds.

Patterns and dynamics: To understand the decadal, scale-dependent development of biogeomorphic lateral moraine systems.

Study Site:

The Turtmann glacier forefield is located at the southern end of the Turtmann valley in the Swiss Alps. The Turtmann glacier has been retreating since the end of the Little Ice Age in 1850, interrupted by advances in the 1980s/ 90s and accelerating since the beginning of the twenty-first century.

Its glacier forefield represents a perfect research area for the investigation of coupled vegetation and geomorphic dynamics due to proceeding vegetation succession and highly active geomorphic processes. These especially act on the 1850 lateral moraines, which are the main research focus.

Methods:

- Permanent plot surveys (50 plots) on lateral moraine slopes
- Geomorphic and vegetation mapping (lateral moraine slopes, turf-banked solifluction lobes)
- Investigation of plant traits (*Dryas octopetala* L.)
- UAV missions (in cooperation with the Institute of Geodesy and Geoinformation, University of Bonn)
- Geoelectrics (Electrical Resistivity Tomography; in cooperation with D. Draebing, Bonn)

- Soil sampling and analysis (in cooperation with N. Meyer, Institute of Crop Science and Resource Conservation, University of Bonn)

Publications:

Peer-reviewed:

- EICHEL, J. (accepted): Chapter 7.2: Vegetation succession and biogeomorphic interactions in glacier forelands. In: HECKMANN, T. & D. MORCHE (eds): Geomorphology of proglacial systems – Landform and sediment dynamics in recently deglaciated alpine landscapes.
- EICHEL, J., DRAEBING, D., KLINGBEIL, L., WIELAND, M., ELING, C., SCHMIDTLEIN, S., KUHLMANN, H. & R. DIKAU (2017): Solifluction meets vegetation: the role of biogeomorphic feedbacks for turf-banked solifluction lobe development. *Earth Surface Processes and Landforms*. doi: 10.1002/esp.4102.
- DRAEBING, D. & J. EICHEL (2017): Spatial controls on turf-banked solifluction lobes and their role for paraglacial adjustment in glacier forelands. *Permafrost and Periglacial Processes*, 28, 2, p. 446-459. doi: 10.1002/ppp.1930.
- EICHEL, J., CORENBLIT, D. U. R. DIKAU (2016): Conditions for feedbacks between geomorphic and vegetation dynamics on lateral moraine slopes: a biogeomorphic feedback window. In: *Earth Surface Processes and Landforms* 41, p. 406 - 419. doi: 10.1002/esp.3859.
- EICHEL, J., KRAUTBLATTER, M., SCHMIDTLEIN, S. & R. DIKAU (2013): Biogeomorphic interactions in the Turtmann glacier forefield, Switzerland. In: *Geomorphology* 201, p. 98-110. doi:10.1016/j.geomorph.2013.06.012.

International conference abstracts:

- EICHEL, J., DRAEBING, D., WIELAND, M., ELING, C., KLINGBEIL, L., SCHMIDTLEIN, S., KUHLMANN, H. & R. DIKAU (2016): Bridging periglacial geomorphology and ecology: a conceptual model of turf-banked solifluction lobe development; talk at the International Conference on Permafrost 2016, Potsdam, Germany.
- EICHEL, J., MEYER, N., DRAEBING, D., SCHMIDTLEIN, S. & R. DIKAU (2016): Controls on small-scale biogeomorphic interactions on lateral moraine slopes and their linkage to large-scale geomorphic and vegetation patterns. In: *Geophysical Research Abstracts*, 18, EGU2016-1860.
- DRAEBING, D. & J. EICHEL (2016): Controlling factors of turf-banked solifluction lobe evolution in the Turtmann glacier forefield, Switzerland. In: *Geophysical Research Abstracts*, 18, EGU2016-479.
- EICHEL, J., CORENBLIT, D., SCHMIDTLEIN, S. & R. DIKAU (2015): Linking plant traits to a geomorphic disturbance gradient: the biogeomorphic window concept for lateral moraines; talk at the 58th Annual Symposium of the International Association for Vegetation Science: Understanding broad-scale vegetation patterns; July 2015, Brno, Czech Republic.
- EICHEL, J., DRAEBING, D., WIELAND, M., ELING, C., KLINGBEIL, L. & R. DIKAU (2015): Feedbacks between vegetation and solifluction processes on hillslopes: case study of an alpine turf-banked solifluction lobe In: *Geophysical Research Abstracts* Vol. 17, EGU2015-1738.

- EICHEL, J., CORENBLIT, D. & R. DIKAU (2015): The role of feedbacks between geomorphic and vegetation dynamics for lateral moraine slope configuration and development In: Geophysical Research Abstracts, 17, EGU2015-1970.
- EIBISCH, K., EICHEL, J. U. R. DIKAU (2015): Root tensile strength assessment of *Dryas octopetala* L. and Implications for its engineering mechanism on lateral moraine slopes (Turtmann Valley, Switzerland) In: Geophysical Research Abstracts, 17, EGU2015.
- EICHEL, J., SCHMIDTLEIN, S. & R. DIKAU (2014): Interactions between solifluction processes and vegetation on lateral moraines in the Turtmann glacier forefield (Switzerland). 4th European Conference on Permafrost, June 2014, Évora, Portugal. (Winner of the PYRN-IPA Poster Award).
- EICHEL, J., SCHMIDTLEIN, S. & R. DIKAU (2014): Biogeomorphic interactions and patterns on Little Ice Age lateral moraines. In: Geophysical Research Abstracts, 16, EGU2014-826, 2014. (Winner of the EGU Geomorphology Division Outstanding student poster (OSP) award).
- EICHEL, J., SCHMIDTLEIN, S. & R. DIKAU (2013): Paraglacial adjustment and vegetation succession in the forefield of an actively retreating glacier - a biogeomorphological perspective. 8th IAG International Conference on Geomorphology, August 2013, Paris.
- EICHEL, J., SCHMIDTLEIN, S. & R. DIKAU (2013): Investigating biogeomorphic dynamics in the forefield of an actively retreating alpine glacier In: Geophysical Research Abstracts, 15, EGU2013-6036, 2013; EGU General Assembly 2013.

Cooperations:

- Dr. Dov Corenblit (Équipe 'Dynamiques géoenvironnementales actuelles', Université Blaise Pascal, Clermont-Ferrand, France)
- Dr. Daniel Draebing (Bonn)
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- Prof. Dr. Michael Krautblatter (Monitoring, Analysis and Early Warning of Landslides, Technical University Munich, Germany)
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