

Adam Mickiewicz University
c/o Marek Ewertowski
Poznan
Poland

Höfn, föstudagur, 9. maí 2025
202505-0036/C.E.J.B.
10.01.01

Subject: Adam Mickiewicz University, Marek Ewertowski – research permit 2025

The Nature Conservation Agency of Iceland has received an application from Marek Ewertowski, dated 16.04.2025, to conduct research within Vatnajökull National Park. The applicant has already researched the area twice, with case numbers 2107081 and 2207049.

Description of the project, according to the application:

Project name:

Mapping and quantifying short-term evolution of proglacial areas (continuation of permits 2207049 and 2107081)

Date, timeline and duration of the project:

Project duration: July 2021 – July 2025, Fieldworks:

2021 fieldwork (4 people): 2021-08-29 – 2021-09-11

2022 fieldwork (4 people): 2022-08-19 – 2022-09-04

2024 fieldwork (2 people): 2024-09-13 – 2024-09-24

2025 fieldwork (4 people): 2025-05-05 – 2025-05-31

Location inside Vatnajökull National Park:

Proglacial and ice-marginal areas of: Skeiðarárjökull, Skaftafell, Svínafell, Fjallsjökull/Hrútárjökull, Kvíárjökull, Breiðamerkurjökull, Heinabergsjökull, Skálafellsjökull, Fláajökull, Virkisjökull

Description of the project, purpose and execution:

Description: The main aim of the project is to understand and quantify feedbacks between deglaciation and paraglacial activity on the foreland of receding temperate glaciers in SE Iceland over annual and intra-annual temporal scales. Geomorphic dynamics in proglacial landscapes is controlled by the time passed since deglaciation, with modification by the local conditions. Existing theoretical models of paraglacial activity take the form of a simplified curve, indicating when the landscape may become unstable. The key issue is that they have not been

tested and compared over detailed spatial and temporal scales. Moreover, the quantitative aspect of recent paraglacial activities related to deglaciation and climate changes remains largely unknown despite being of critical importance due to their potentially substantial impact on landscape dynamics and further implications for the interpretation of geological records. To understand how rapidly the debris can be re-distributed, the theoretical paraglacial model needs to be constrained, while more specific models for different settings need to be developed. Herein lies the motivation for this study. This project will employ field-based and remote sensing observations to quantify and compare the sensitivity of paraglacial activity to climate change and the character of the ice masses on a range of mountain outlet glaciers as the landscape becomes exposed from beneath the ice. The project will: (1) map recent (last ~ 15 years) changes in the landscape based on semi-annual high-resolution satellite images; (2) quantify the annual and intra-annual rates and volume of relief changes based on time-series of UAV surveys. The impact of this work will be to quantify the rates and magnitudes of geomorphic processes modifying proglacial areas such as drainage transformation, dead-ice melting, debris flow activities and to assess the preservation potential of landform assemblages important for the interpretation of specific glacial processes-form relationships. As such, the realisation of this project will lead to a quantified understanding of the short-term evolution of proglacial areas, which will allow researchers to compile modern analogues for contextualising palaeoglaciological reconstructions and provide a basis for the prediction of future changes in the polar regions. The project will produce a database of landscape dynamics related to the transition from glacial to non-glacial conditions. Therefore, on a broader scale, this work will add to a more extensive study of landscape dynamics which is conducted by Professor David Evans (Durham University), Dr Aleksandra Tomczyk (Adam Mickiewicz University) and Professor Marek Ewertowski (Adam Mickiewicz University) based on field-sites in Svalbard, Greenland and Iceland (projects funded by Polish National Science Centre and INTER-ACT).

Purpose Ongoing glacier retreat has resulted in the continuous exposure of proglacial areas. Such areas contain essential information about glacial process-form relationships that manifest themselves in specific landform assemblages (glacial landsystems). However, the preservation potential of freshly exposed glacial landforms can be very low, as proglacial terrains are one of the most dynamic parts of glaciated landscapes (cf. Benn and Evans, 2010; Ewertowski and Tomczyk, 2015; Carrivick and Heckmann, 2017; Ewertowski et al., 2019b). Therefore, rapid mapping and geomorphological characterisation of such areas are important from a glaciological and geomorphological standpoint for a proper understanding and reconstruction of glacier-landform dynamics. The main research problem which we are trying to solve is the preservation potential of freshly exposed proglacial areas based on systematic multi-scale investigation and quantification of recent landscape changes on the forelands of receding temperate glaciers in SE Iceland. Planned research focuses on the short-term evolution of proglacial areas, addressing the following objectives: Objective 1 (O1) to map landform changes

in the proglacial areas over the last 15 years based on time-series of high-resolution satellite imagery; Objective 2 (O2) to quantify annual and intra-annual volumetric changes in detailed spatial scale based on surveys with unmanned aerial vehicles (UAV); Objective 3 (O3) to recognise the main mechanisms responsible for the transformation of proglacial areas and predict their future changes; Execution We would like to ask for permission to access several key locations in proglacial/ice-marginal areas and use UAV (drones) to produce a database of landscape dynamics related to the transition from glacial to non-glacial conditions. We will use drones to create very high-resolution (cm-scale) digital elevation models (DEMs) and orthomosaics to study morphometry, geomorphology and surface deposits of proglacial areas. Time-series of UAV-generated data will allow to quantify landscape changes in response to deglaciation.

Description of methods for sample taking, if part of the research:

We are planning to use topographic surveys and unmanned aerial vehicles to map geomorphology and quantify landscape changes in the spatial scale of landforms and landform assemblages. Small quadcopters (Phantom 4 and MavicPro) will be used to collect low-altitude aerial images. The accuracy of the final products (DEMs and orthoimages) will be further improved using Ground Control Points (GCP) collected with dGPS. We will follow the operational framework for using low-cost UAV and structure-from-motion photogrammetry for rapid mapping and monitoring of glacial geomorphology, which was developed based on our previous research on Greenland, Iceland and Svalbard (e.g., Evans et al., 2016; Ewertowski et al., 2016; Ewertowski et al., 2019a; Tomczyk et al., 2019; Tomczyk et al., 2020). As a result, very detailed orthomosaics (~0.02 m GSD) and digital elevation models (~0.05 m) will be produced, allowing for comparing landscape dynamics in a detailed spatial scale. UAV flights will be performed with the use of small and light quadcopters: 1) The flights will be restricted up to 100 m in altitude above the ground level. 2) The flights will be restricted to visual line of sight, i.e. up to 400 m in a range from the operator 3) Two people will always be operating the flying missions. Operators are familiar with local and international regulations 4) The craft has built-in safe-fail mechanisms – after the loss of GPS signal or loss of radio link, it will automatically land. 5) We have the appropriate insurance cover. 6) Flights will be conducted far from any human infrastructure or human beings. 7) We will fly in the valley (up to 100 m above the valley floor). As it is far below the level of standard manned craft operations, there is no danger to the other aircrafts. 9) Duration of each flight takes up to 25 min. We are planning to perform up to 12 flights per day. Flight locations are specified in the separate file attached to the application

Impact assessment:

The Nature Conservation Agency of Iceland considers the project *Mapping and quantifying short-term evolution of proglacial areas* to be minimal and not likely to have negative impact on the conservation value, biodiversity or geological heritage of the area.

Conclusions and conditions:

Vatnajökull National Park hereby grants Marek Ewertowski permission on behalf of Adam Mickiewicz University to conduct research at the locations specified and described above on the following conditions:

- This permit is valid for on-site fieldwork from May 5th to May 31st 2025.
- Keep this letter with you on site during the project, either printed or an electronic copy. The permit conditions should be introduced to the staff of the project before work begins.
- The permit holder shall inform Vatnajökull National Park before arriving in the area. The best way to do that is to “reply all” to the e-mail the permit was sent with.
- If the project dates or description changes, Vatnajökull National Park shall be notified as soon as possible. However, the permit holder may use the permit for up to two days before or after the date given, should weather or other conditions require, without notifying the park.
- When it is necessary to go off-path, extra care must be taken not to cause damage to terrain, including vegetation, soil, and geological formation. All traces of activity must be removed afterwards.
- The permit holder must follow rules of conduct that apply to the area.
- If the material is published anywhere, it must be noted that a permission from Vatnajökull National Park was obtained for the research.

About research

- This permit is only valid for research purposes.
- Every measure should be taken to avoid damage to the sites and unnecessary disturbance while doing the research.
- Vehicles used during field exploration must be labelled with the identity of the researcher's institute. During field work, all participants in the project must wear clothing labelled with the identity of the researcher or the research institute. High-visibility clothing is preferred.

About drones

- Drone flight locations are listed in an attached document. Vatnajökull National Park approves of all locations but wishes to add some comments about some of the locations

- Red lines around locations; 2, 4, 5, 8, 9 and 10 partly cover areas outside of the park boundary, or privately owned. The permit holder might need a permit from landowners as well.
- An unmanned aircraft should never be flown near people. Please take precaution not to disturb people's experience, their safety or personal privacy nor the general peace of the protected areas being filmed.
- Flight time should be kept to a minimum and flight should be avoided during the area's busiest times of the day.
- According to Icelandic law it is forbidden to fly close to cliffs where birds nest. An unmanned aircraft should never be flown near animals or birds, neither in nesting areas nor during nesting season or any other seasonal time when animals or bird habitats are considered vulnerable.
- All disturbance to animals and wildlife is strictly prohibited. If the use of unmanned aircraft causes disturbance to wildlife in the area, its use should be ceased at once.
- The conductor of the unmanned aircraft is responsible for the aircraft within the protected area. This includes taking responsibility of any possible risk of harm to people, fauna and nature and leaving no permanent marks on the site in question. Should the aircraft crash, all components from it must be collected and removed from the area. This does not necessarily apply if retrieving the aircraft is dangerous.
- Unmanned aircraft should take off and land in a safe distance from other visitors according to regulation [1360/2024](#) on unmanned aircrafts.
- The usage of a drone shall be according to regulation no. [1360/2024](#) on the operation of remotely piloted aircraft (www.icetra.is/aviation/drones/).
- Please note that according to the regulation all drones that are used commercially need to be registered at the Icelandic Transport Authority.
- If any complications occur during the project, please contact the ranger at Skaftafell, tel. +354 470 8309 or at Jökulsárlón, tel. +354 842 4355.

Other conditions

- Off-road driving in Iceland is strictly prohibited.
- The permit holder is required to prevent all disturbance to the environment and make sure that all litter is removed from the sites.
- A permission from landowners outside the park boundary might be needed for the project.

Vatnajökull National Park wishes to receive, free of charge, a copy of all reports and scientific articles that result from the research project.

Vatnajökull National Park can withdraw the permit if conditions of the permit are not complied to.

Best regards,



Charli E. J. Brzeski
Assistant Park Manager
Vatnajökull National Park

