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Remote Sensing Assessments of Social Trails Fragmenting Subalpine Paradise Meadows

Documenting damage to subalpine meadows in Mount Rainier National Park because of off-trail hiking is integral to protection and restoration and mapping impacts is time-consuming and expensive. University of Washington researchers (Drs. L. Monika Moskal and Meghan Halabisky) are working with NPS to test use of remote sensing tools to rapidly map impacts and improve proactive management in the park. UW post-bac researcher and Summer 2024 NPS Scientist in Park Intern Lindsey Skidmore has been working to develop spatial models, expand upon past field data, test model accuracy, and, now, report results.

In 2024, Lindsey completed fieldwork to expand impact mapping to higher elevations in Paradise and collected preliminary data on impacts in the Sunrise area to support the development of future models. UW developed a random forest model, a type of analytical method, using high-resolution aerial imagery and field data to predict the probability that any one pixel is a visitor impact (0–100%). Field validation found an accuracy of 53%, likely because of limitations in the detail of the imagery, and snow, rocky areas, and trees obscuring detection. To address these challenges, UW focused analysis on high vegetation cover areas and improved accuracy to 73%. That model shows promise yet demonstrates that remote sensing along cannot capture this resource damage. Modeling could improve with advanced remote sensing information: more detail, vegetation structural data in peak summer. A balance between rapid remote sensing assessments and accurate but slow field data collection will be crucial for conserving Cascades meadows.

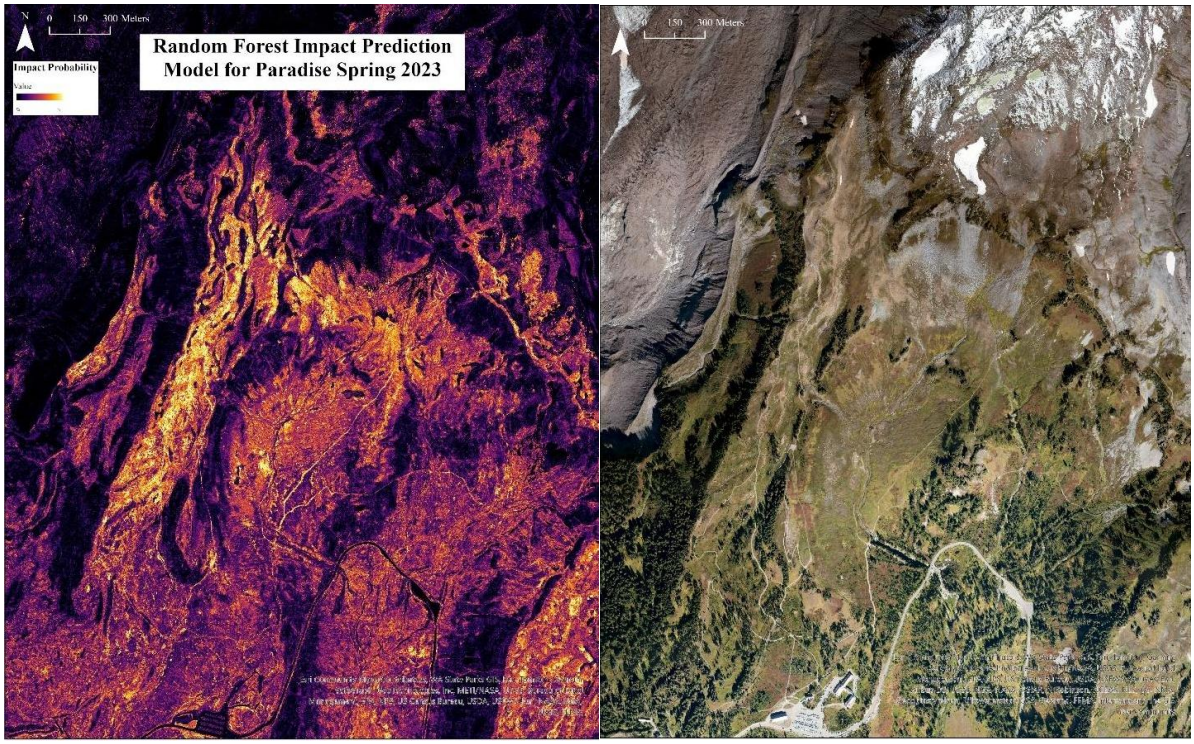

Figure 1 – Random Forest impact probability model for the entirety of Paradise, Mount Rainier compared to 25 cm imagery taken in September 2021. This model had a 53% field-validated accuracy.