

The Glacier National Park GLORIA Project: A new US Target Region for Alpine Plant Monitoring Installed in the Northern Rocky Mountains, Montana

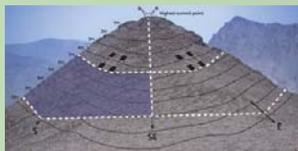


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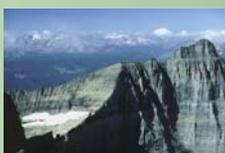
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The Global Observation Research Initiative in Alpine Environments (GLORIA) is an international research network whose purpose is to assess climate change impacts on vegetation in alpine environments worldwide. A standard protocol was developed by the international office in Vienna, Austria, and has specific site requirements and techniques that allow sites to be compared worldwide. This protocol requires four summits to be selected within a target region, covering zonal differences of subalpine to nival, and on each of these summits intensive vegetation plots are set up and monitored on a five year interval.



Only three target regions in North America have been completed to date, one in Glacier National Park, Montana, and the other two in the Sierra Nevada and White Mountains, California.

During the summers of 2003 and 2004 we completed 4 GLORIA summit area plots in our target region of Glacier National Park. The Continental Divide bisects Glacier National Park and we decided to choose summits only East of the divide to stay within a similar climatic pattern. Our sites run North to South on the East side of the divide with our highest summit (Seward Mtn.) as the northernmost and our lowest summit (Dancing Lady) southernmost.



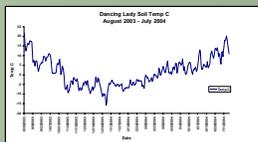
Dancing Lady Mtn. (elevation 2245m)

Observations:

- 51 species of vascular plants were identified on Dancing Lady Mountain, and include a mixture of grassland and alpine species.
- Dominant species on Dancing Lady were *Eriogonum androsaceum*, *Agoseris glauca*, *Senecio canus*, *Potentilla fruticosa* L., *Oxytropis sericea* Nutt., *Eriogonum ovalifolium* Nutt., *Minuartia nuttallii* (Pax), and *Minuartia rubella* (Wahl.).

Summary:

The highest diversity and ground cover occurred within the east summit area sections and most of these species occur in mats of *Potentilla fruticosa* L which has the highest vegetation cover within this area.



Temperature Data from first year:



Bison Mtn. (elevation 2387m)

Observations:

- 82 species of vascular plants were identified on Bison Mountain and include a mixture of grassland and alpine species. Typical grassland species such as *Festuca idahoensis*, *Geum triflorum* and *Heterotheca villosa* were found growing intermixed with common alpine species such as *Poa glauca*, *Dryas octopetala*, *Silene acaulis* and *Minuartia obtusiloba*.
- Northern Rocky Mountain endemic species found on Bison include: *Arnica alpina v. tomentosa*, *Douglasia montana*, *Eriogonum androsaceum*, *Hedysarum sulphurescens*, *Stellaria americana*, and *Townsendia parryi*.

Summary:

Although overall vegetation cover was low in all areas surveyed, some small patches of turf development dominated by alpine sedges and grasses (*Carex atrosquama*, *Carex nardina*, *Festuca brachyphylla*, and *Poa glauca*) were seen especially on the north and west slopes of the mountain. Most notable was the frequency of dead and dying alpine cushion species of *Silene acaulis* and *Minuartia obtusiloba* on the south and west slopes at both the 5 and 10 meter sections. Dead plants of both species were also found on the east and north sections, but less frequently.



Pitamakan (elevation 2493m)

Observations:

- 59 species were recorded on Pitamakan which include a combination of alpine and sub-alpine species, with lower elevation species seeming to predominate on the East side of the peak and higher elevation species on the West side.
- Dominant species on Pitamakan were *Achillea millefolium*, *Arnica latifolia*, *Astragalus bourgovii*, *Erigeron compositus* var. *glabratus*, *Penstemon ellipticus*, *Polemonium pulcherrimum* var. *pulcherrimum* *Senecio cymbalaria*, *Senecio cymbalarioides*, *Solidago multiradiata* var. *scopulorum*, and *Stellaria Americana*.



Summary:

In general the vegetative communities on Pitamakan are a mix of alpine and sub-alpine species, with lower elevation species seeming to predominate on the East side of the peak and higher elevation species on the West side. On the ridge to the West of the HSP, which runs into Pitamakan Pass, there is a rich community of alpine vegetation which could serve as a source for upslope migration. On the East side, the drop into krumholz and sub-alpine meadows is steep and rapid, and the vegetation is dominated by species characteristic of these slightly wetter, more sheltered environments.

Seward Mtn. (elevation 2717m)

Observations:

- 39 species were recorded on Seward and were predominantly alpine.
- Species that exhibited dominance over the whole summit area were *Smelowskia calycina* var. *americana*, *Polemonium viscosum*, *Potentilla diversifolia* var. *diversifolia*, *Erigeron compositus* var. *glabratus*, *Carex albionigra*, and *Saxifraga bronchialis* ssp. *austromontana*.

Summary:

The areas of highest species diversity and overall vegetative density were on the North and East sides of the summit, increasing towards the convergence of these two sides along the NE break in slope, and decreasing in both density and diversity towards the South and West sides. All four sides of the peak exhibit distinct vegetative composition and variable densities, with the greatest degree of overlap in micro-community composition at the NE corner, and the lowest amounts of both vegetative cover and species richness on the West and South sides.



Conclusion:

Treeline in the target region is strongly influenced by terrain and significantly more variable than in the central Rocky Mountains. This also was true of zonal differences of alpine vegetation. Subalpine and even grassland species were found on the same summits as upper alpine species. While different zonal areas often occurred on one summit, they were highly influenced by the aspect and slope of that summit area. Between 51 and 82 vascular plants were documented on each summit. There was a high degree of variability in species diversity and percent cover on each summit that was correlated to directional exposure. Strong prevailing winds contribute to the variability with aspect; these winds scour snow from windward slopes, thereby reducing insulation and soil moisture. The summit morphology caused loose vegetative associations, or micro-communities, that varied with exposure, slope angle, and substrate character. Species that exhibited dominance within the target region were *Smelowskia calycina* var. *americana*, *Polemonium viscosum*, *Achillea millefolium*, *Erigeron compositus* var. *glabratus*, and *Potentilla fruticosa* L. These species reflected the same variability in percent cover on the four sides of the summit areas as did the vegetation as a whole, but were present on all sides.

- We had some difficulty finding sites due to:
- the steep and rocky glaciated terrain within Glacier National Park
 - the fact that it is hard to determine elevational treeline in this area as it is influenced more by terrain and climatic factors than elevation
 - multi day approaches to sites