



## What is GLORIA?

The **Global Observation Research Initiative in Alpine Environments** is an international research network whose purpose is to assess climate change impacts on vegetation in alpine environments worldwide.

Protocol was developed by a network of international scientists based in Vienna, Austria.

Eventual implementation calls for 66 target regions globally

Currently 38 active target regions, but only 4 in North America.



## GLORIA in North America:

4 target regions comprise the North American Chapter to date and are located in the Northern Rocky Mountains, MT, and the Eastern Sierra Nevada and White Mountains, CA.

7 additional target regions are anticipated to be installed by the end of the 2006 summer season.

## North American Chapter Goals:

Promote establishment of baseline GLORIA sites which are well-distributed throughout western North American mountain regions.

To encourage additional alpine plant monitoring through extended research projects related to the baseline GLORIA areas

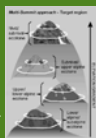
Coordinate large-scale analyses once sites are established



## Protocol:

Selection of 4 similar summits covering zonal differences of subalpine to nival that are likely to be sensitive to climatic change.

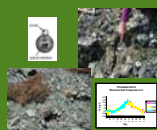
Intensive vegetation plots are set up and monitored every five years.  
Species composition and percent cover are recorded.



Temperature loggers buried to assess long term change

Intense photo documentation procedures followed.

Data entered into international database, available to other researchers



## Plans for the future of North American GLORIA:

Continue a working relationship with CIRMOUNT (Consortium for Integrated Climate Research in Western Mountains) and the International GLORIA Program  
Install new Target Regions in western North American mountains

- 7 additional Target Regions are anticipated to be installed in 2006
  - Coastal Mountains, British Columbia, Canada
  - North Cascades, Washington, USA
  - Coast Mountains, Alaska, USA
  - San Juan Mountains, Colorado, USA
  - Central Rocky Mountains (Niwot LTER), Colorado, USA
  - South Cascades, California, USA
  - Lake Tahoe Basin, Sierra Nevada, California, USA

Develop a research approach for extending Target Regions to investigate other aspects of alpine ecology

- Documentation of species composition and vegetation structure downslope in each cardinal direction from GLORIA sites (esp lowest summit)
- 100 m transect across slope and parallel to slope with point counts, belt transects for species lists

Coordinate fund-raising to support installation and analysis of existing and new GLORIA sites in North America

## Established North American Sites:

### Glacier National Park Northern Rocky Mountains, MT



### Sierra Nevada, CA



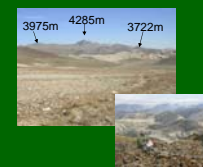
### Northern Rocky Mountains

- High species diversity
- Slope and aspect are important diversity factors
- Scouring winds are particularly associated with aspect
- 5 species were common throughout
  - Smelowskia calycina* var *americana*
  - Polemonium viscosum*
  - Erigeron compositus* var *glabratus*
  - Potentilla fruticosa*

### White Mountains, CA Dolomite



### White Mountains, CA Granitic/ Volc



## Initial Results:

	Number of Species:					
	Summit				Region	
	Low	Mid 1	Mid 2	High	Exotic	Total
Rocky Mtns	51	82	59	39	1	136
Sierra Nevada	38	36	13	22	0	65
White Mtns.	25	26	21	7	1	54

### Sierra Nevada (SN) vs. White Mountains (WM)

- 65 taxa SN, 54 WM, 25 in common
- Only one non native species, found in SN
- Greater species diversity found in lower than higher summits
- Aspect not a strong determinant
- 2 major structural elements: widespread, cosmopolitan montane group (Sierran/Great Basin) + alpine flora (ground hugging/cushion plants)

### White Mountains Granitic (WIM) vs. Dolomite (WDS)

- 19 new species on WDS not found on WIM summits
- Abundant species were common between WIM & WDS
  - Elymus elymoides* was ubiquitous
  - Erigeron gracilipes*, *Phlox condensata*, and *Erigeron pygmaeus* were dominant members of the alpine mat-forming community
- Shrub/subshrub community abundant on WIM, missing on WDS
- No exotic species found within plots