

**North American GLORIA Project**  
**(Global Observation Research Initiative in Alpine Environments)**  
GLORIA International: [http://www.gloria.ac.at/res/gloria\\_home/](http://www.gloria.ac.at/res/gloria_home/)

**Point of Departure for Working Group Discussion**  
**MTNCLIM 2005**

High mountain ecosystems are sensitive to climate variability and prone to be early indicators of effects that will ripple through distant ecosystems. The *Global Observation Research Initiative in Alpine Environments* (GLORIA) is an international research project, headquartered in Vienna, whose goal is to assess long-term impacts of climate change on vegetation in alpine environments worldwide. Standardized protocols direct selection of each node in the network, called a target region, which consists of a set of four geographically proximal mountain summits at elevations extending from treeline up to the nival zone. GLORIA's multi-summit approach capitalizes on the comparability afforded by highly standardized monitoring protocols and the fact that alpine environments are similar and widely distributed worldwide. GLORIA specifies a rigorous mapping and sampling design for data collection, site documentation, and data archiving, with re-measurement intervals of five years.

Whereas over 30 target regions have been installed in six continents through the international program, prior to 2004 none was completed in North America. In cooperation with the Consortium for Integrated Climate Research in Western Mountains (CIRMOUNT), three GLORIA target regions were completed by September 2004, one in the Sierra Nevada, California, one in the White Mountains, California, and one in Glacier National Park, Montana. As the goals of GLORIA and CIRMOUNT overlap, CIRMOUNT is making a primary effort to motivate installation of new target regions and development of a dense network of GLORIA sites in western North America.

CIRMOUNT will move toward this goal by identifying high-priority areas in western North America to fill the network; contacting and assisting potential leaders of new target regions; assisting in site selection; botanical expertise, equipment sharing; protocol clarification; budget estimation; archiving; data analysis; and coordinating integrated analysis among regions. A set of webpages on the forthcoming CIRMOUNT website will provide useful information for those anticipating and completing GLORIA installations. Fundraising may be leveraged with CIRMOUNT's collaboration. As more sites are installed and early baseline data compiled, CIRMOUNT would sponsor focal workshops for comparing and integrating results and conclusions about effects of elevation and climate on alpine flora. CIRMOUNT will also encourage extended research opportunities at each region under the GLORIA "Master Station" approach.

With the MTNCLIM working group, we hope to spread the word about the North American GLORIA project, provide information on how to get started, identify new collaborators, and promote new installations in summer 2005. We anticipate participation at MTNCLIM 2005 by several scientists who have proposed new target regions this year.

*For information on CIRMOUNT's North American GLORIA project, contact: Connie Millar (USFS), [cmillar@fs.fed.us](mailto:cmillar@fs.fed.us) or Dan Fagre (USGS), [dan\\_fagre@usgs.gov](mailto:dan_fagre@usgs.gov)*

1/25/05

## Summary Notes from GLORIA First Working Group Discussion

### North American Chapter: Global Observation Research Initiative in Alpine Environments

millar, 051505

Convened at MTNCLIM 2005 Conference, Chico Hot Springs Resort, Pray, MT

GLORIA Work Group (CIRMOUNT) webpages: <http://www.fs.fed.us/psw/cirmount/wkgrps/gloria/>

#### Working Group Leaders

Connie Millar

USDA Forest Service

Sierra Nevada Research Center

800 Buchanan St.

Albany, CA 94706

ph: 510-559-6435

email: [cmillar@fs.fed.us](mailto:cmillar@fs.fed.us)

Dan Fagre

USGS Biological Resources Division

USGS Science Center

Glacier National Park

W. Glacier, MT 59936

ph: 406-888-7922

email: [dan\\_fagre@usgs.gov](mailto:dan_fagre@usgs.gov)

#### Participants (including those who participated at Chico and others who have expressed interest)

Ababneh, Linah, University of Arizona

[linah@lrr.arizona.edu](mailto:linah@lrr.arizona.edu)

Bowman, Bill, Univ of Colorado

[bowman@spot.colorado.edu](mailto:bowman@spot.colorado.edu)

Callaway, Ray, Univ Montana

[callaway@selway.umt.edu](mailto:callaway@selway.umt.edu)

Crawford, Grand Canyon National Park

[columbine\\_julie@yahoo.com](mailto:columbine_julie@yahoo.com)

Dahms, Dennis, Univ of N Iowa

[dennis.dahms@uni.edu](mailto:dennis.dahms@uni.edu)

Dennis, Ann, CalFlora

[dennis@calflora.org](mailto:dennis@calflora.org)

Jamison, Glen, Fisheries & Oceans Canada

[JamiesonG@pac.dfo-mpo.gc.ca](mailto:JamiesonG@pac.dfo-mpo.gc.ca)

Hik, David, Univ Alberta

[dhik@ualberta.ca](mailto:dhik@ualberta.ca)

Jorgenson, Janet, Arctic Nat'l Wildlife Refuge

[janet\\_jorgenson@fws.gov](mailto:janet_jorgenson@fws.gov)

Schrag, Ann, Montana State Univ

[aschrag@montana.edu](mailto:aschrag@montana.edu)

Landry, Chris, Ctr Snow & Avalanche Studies

[clandry@snowstudies.org](mailto:clandry@snowstudies.org)

Millar, Bruce, Yoho National Park, BC

[millar@monarch.net](mailto:millar@monarch.net)

Mitchell, Steve, Oregon State Univ

[Stephen.Mitchell@oregonstate.edu](mailto:Stephen.Mitchell@oregonstate.edu)

Moore, Peggy, Yosemite National Park

[peggymoore@usgs.gov](mailto:peggymoore@usgs.gov)

Nydick, Koren, Mountain Studies Institute

[koren@mountainstudies.org](mailto:koren@mountainstudies.org)

Peterson, Dave, USFS, PNW Research Stn

[wild@u.washington.edu](mailto:wild@u.washington.edu)

Pritchett, Daniel, Univ California

[skypilots@wmrs.edu](mailto:skypilots@wmrs.edu)

Rocheffort, Regina, National Park Service

[regina\\_rocheffort@nps.gov](mailto:regina_rocheffort@nps.gov)

Safford, Hugh, US Forest Service

[hughsafford@fs.fed.us](mailto:hughsafford@fs.fed.us)

Smiley, John, Univ California

[jsmiley@wmrs.edu](mailto:jsmiley@wmrs.edu)

Smith, Dan, Univ Victoria

[smith@uvic.ca](mailto:smith@uvic.ca)

Swerhun, Kristina, Arrowsmith Bio Reserve

[kswerhun@hotmail.com](mailto:kswerhun@hotmail.com)

Welker, Jeff, Univ Wyoming

[jeff@uwyo.edu](mailto:jeff@uwyo.edu)

#### GLORIA-International Program Office

Grabherr, Georg, Univ Vienna, Austria

[georg.grabherr@univie.ac.at](mailto:georg.grabherr@univie.ac.at)

Pauli, Hari, Univ Vienna, Austria

[pauli@pflaphy.pph.univie.ac.at](mailto:pauli@pflaphy.pph.univie.ac.at)

International GLORIA Website: [http://www.gloria.ac.at/res/gloria\\_home/](http://www.gloria.ac.at/res/gloria_home/)

The Global Observation Initiative in Alpine Environments (GLORIA) is an international science program based in Vienna, Austria that promotes monitoring the responses of high-elevation plants to longterm climate change. GLORIA capitalizes on standardized protocols developed by a wide collaboration of scientists, and exploits the relative comparability of alpine summit environments worldwide. The basic

GLORIA approach depends on “Multi-Summit Target Regions”, for which inventory and monitoring are prescribed on four mountain summits per target region. The summits are selected to be within a single bioclimatic region and to extend from treeline elevation to the nival zone. Sites are instrumented with temperature dataloggers, and are extensively photo-documented. All data are archived at the international headquarters and data are available to all interested scientists. To date, over 30 multi-summit target regions have been installed in Europe and elsewhere. With the completion of the first target regions in the United States (Glacier National Park, MT; Sierra Nevada, CA; and White Mountains, CA), CIRMOUNT proposes a North American GLORIA Chapter.

### Working Group Goals

Establish a North American GLORIA Chapter to:

1. Promote coordinated and integrated monitoring of alpine floral response to climate change in western North American mountains using the GLORIA multi-summit Target Region approach.
2. Promote research on other aspects of alpine ecology beyond those in the standard GLORIA approach, including additional floral diversity assessments, animal ecology, carbon issues, substrate relationships, etc.

### Working Group Actions – 2-Year-Horizon

By 2007, the Working Group seeks to:

1. Install 2-3 new GLORIA Target Regions strategically located in western North American mountains.
2. Develop a research approach for extending Target Regions to investigate other aspects of alpine ecology, provide examples.
3. Coordinate fund-raising to support installation and analysis of existing and new GLORIA sites in North America.

Sites (and Coordinators) with Interest to Install New GLORIA Multi-Summit Target Regions (\*\* = installation planned for summer 2005; \* = installation potentially 2005 or later)

1. \*\*North Cascades, WA: Steve Mitchell and Regina Rochefort (1 or 2 new Target Regions)
2. \* (2006) Vancouver Island and Mainland, BC: Kristina Swerhun with Glen Jamison & Dan Smith (1 or 2 new Target Regions)
3. Wind River Mtns, WY: Dennis Dahms (1 or 2 new Target Regions)
4. \* (2006) San Juan Mtns, CO: Koren Nydick & Chris Landry (1 or 2 new Target Regions)
5. \*Niwot LTER, Rocky Mtns, CO: Bill Bowman
6. Greater Yellowstone National Park: Anne Kunzig
7. \*\*White Mountains, CA: John Smiley, Ann Dennis, Daniel Pritchett
8. \* (2006) Carson Range, Tahoe Basin area, Hugh Safford

### Coordination Needed

The CIRMOUNT GLORIA Working Group will benefit by coordinating with other CIRMOUNT Working Groups:

Mountain Monitoring Network (Redmond)  
Hydrologic Observatories (Bales, Dettinger)  
International Collaborations (Greenwood)  
Ecosystem Responses (Littell, Hicke)

and with the International GLORIA Program Office (Grabherr and Pauli)