Niwot Ridge LTER Program, Annual Report, 1995-1996

1.1. Brief Description of on-going research:

The major thrusts of the Niwot Ridge LTER continue to focus on potential changes in the alpine ecosystem caused by 1) enhanced snowpack and 2) enhanced nitrogen inputs. Monitoring of plant and soil characteristics in response to snowpack augmentation is now in its third year. Measurements include plant species composition, plant phenology and growth responses, soil chemistry and soil processes such as decomposition and mineralization. We note that this year continued the trend of the previous year in terms of high snow pack. Unlike 1995, however, this snow occurred earlier in the season and melted "on schedule" such that the 1996 field season is normal in duration. The unusual weather of 1995 has left some legacies in terms of plant responses in 1996 that are being studied.

In addition to following the recommendations of the 1995 external site review (Groffman et al., unpubl. report to NSF, 1995), especially in regard to more intensive and detailed documentation of the nitrogen budget, the site continues to expand its focus in the areas of regional hydrology and watershed biogeochemistry, as detailed Cline's NASA/DEM story in the 1996 Spring/Summer LTER Network News.

Science issues and concerns for this and the subsequent year (96-97) involve activities essential to integrating specific projects into a unified body of scientific information. Our work continues to span a range of topics from organismic biochemical capabilities and developmental morphology to entire drainage studies and vegetation - atmosphere interactions. Only a Jenny-type model (e.g., Jenny 1980) is capable of synthesizing this work into a unified whole. Our goal is to construct a complex, conceptual model that provides a comprehensive understanding of the biological and physical factors responsible for creating and generating the behaviors exhibited by the alpine ecosystem, both under current conditions as well as those anticipated under modified atmospheric chemical and physical conditions. Finally, our planned expansion of LTER research in the coming years involves a more explicit coupling of the alpine to the larger regional system, and this work will expand research on 1) watershed phenomena at alpine-subalpine, land-water, and aerobic-anaerobic interfaces, and 2) evaluation of anthropogenic intrusions, including biotic (e.g., exotic species), chemical (nitrogen and other chemical enrichment) and physical (energy balance) modifications.

1.2 New LTER research 1995-1996:

The Network News story indicates an area of research that, while not new, has certainly been enhanced in terms of activity. Watershed biogeochemistry efforts, spearheaded by Mark Williams, have also been substantially increased using other funding sources, but much of that work relies heavily on LTER core measurements. An innovative approach using dual isotopic signatures (18O, 15N) is being attempted to evaluate atmospheric versus soil microbial sources of nitrate in ground and surface waters. Our 1996 supplement will use this technique in conjunction with more standard measurements to evaluate changes in soil characteristics associated with tree island movements in the alpine.

Work on an alpine ecology synthesis volume edited by Bowman and Seastedt continues with external reviews of chapters scheduled for fall, 1996. Two BioScience articles are "in press" that use Niwot efforts in a synthetic manner. Ideas for the Asner et al. manuscript was generated from the regionalization effort of the site that considered relative sensitivity among ecosystems to anthropogenic nitrogen inputs. The Ingersoll et al. manuscript was a direct result of the suggestion of the 1995 external site review to advertise data management efforts and procedures.

1.4. Cross-site activities:

The ITEX study by M. Walker et al. (see grants listed below) involves Niwot-Toolik Lake comparisons. A number of projects are also underway that relate Niwot findings to other studies ongoing in the Rockies and elsewhere (see grant list).

1.5 Network-level activities:

Bowman remains active with the collaboration with Central Europe. Seastedt remains active with the LIDET group, and Wessman remains active with the funded, LTER-NASA collaboration. We are participating in a number of workshops at NCEAS that were organized by LTER personnel or organizations (e.g., ITEX, AERC) containing large LTER components or memberships.

1.6 Data set status:

Please see http://culter.colorado.edu:1030/. We believe our system is near state-of-the-art, with all data on-line or readily available with PI consent.

1.7 Grant support associated with the Niwot Ridge LTER:

1. Mellon Foundation Grant. 1995-1998. W.D. Bowman, P.I.

2. NSF Young Investigator Award. 1993-1998. P.K. Diggle, P.I.

3. NSF-Earth Sciences Watershed study. 1995-1998. M. W. Williams, P.I., N. Caine co- P.I.

4. NSF REU project. 1995-97. Deane Bowers P.I. (note: Dr. Bowers does not conduct research on Niwot Ridge, but four of the faculty identified in the REU program (Bowman, Diggle, Schmidt, Seastedt) are LTER P.I.s)

5. EPA. Trace Gas Study. 1995-1998. S. K. Schmidt P.I. E.A. Holland, co-P.I.

6. NSF-RTG Biosphere/Atmosphere Research. 1994-1999. R.K. Monson, P.I. (Several LTER graduate students are participating in this effort.)

7. NSF IBN-9207627 "Resource storage in alpine plants", 10/92-3/97, R. Monson, S. Schmidt, PIs.

8. NSF IBN-9514123 "Soil amino acid uptake by alpine plants and microorganisms", 2/96-1/99, R. Monson, S. Schmidt, PIs.

9. EPA. N Cycling at Conifer Forests and the Impact of Canopy, Uptake Herman Sievering.

10. NSF-EGB Collaborative Research: Biogeochemical and hydrologic controls on solutes and flowpaths in alpine watersheds. M.W. Williams, J. Baron, Steve Schmidt et al. 9/95-8/98.

11. NBS Global Change. Responses of hydrologic and aquatic ecosystem processes to potential climate change on watershed, Drainage Basin, and Regional Scales. PI: Jill Baron, Co-PIs: S.W. Running, L.E. Band, T.G.F. Kittel, and R.A. Pielke.

12. DPP. Responses of tundra to altered snow regimes. 1994-1999, M. Walker, P.I. (this study put up snowfences at Toolik Lake and is conducting a comparative study using similar procedures at Niwot Ridge.)

13. DPP Response of tundra to altered snow regimes (CSU contract to above). J.M. Welker, P.I.

14. NASA. Satellite remote sensing of ecosystem changes. 1995- 1998. C.A. Wessman, P.I.