WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: AK3521

Title: Hydrological and geomorphological Controls on Sediment Transport Processes

Focus Categories: Hydrology, Models

Keywords: channel networks, Arctic, permafrost, erosion, sedimentation

Start Date: 03/01/2001

End Date: 04/28/2002

Federal Funds: $16,995

Non-Federal Matching Funds: $16,150

Congressional District: AK

Principal Investigator:
Larry D. Hinzman
Associate Professor, University of Alaska-Fairbanks

Abstract

It has been acknowledged that arctic regions of the world are critical components of earth's climate and that hydrology plays a very important role in the transfer of energy. From the discovery of oil in the late 1960s until the recent past, hydrologic studies in the Alaskan Arctic were primarily dictated by resource development, rather than scientific interest. A nested watershed study in the Kuparuk River basin was the first truly scientific study conducted in the United States Arctic at a large scale where all the major hydrologic elements were examined. Our previous research has been directed at characterizing hydrologic and thermal processes occurring in North Slope watersheds and developing the tools to accurately simulate these processes and their interactions with other components of the ecosystem. In this phase of the research program we intend to focus upon the hydrologic controls on the riparian system (including channel network) and how this system will respond to changing climate. Most research tasks in this project will be associated with determining how the drainage network will evolve with a changing climate or with determining how the hydrologic regime will respond with a different channel network. Understanding how these riparian areas, specifically channel networks evolve is a critical component of understanding the arctic system.

The central theme of this proposal is that climatic warming is occurring in the Alaskan Arctic, that this will result in a thicker active layer (the layer of soil near the surface which proceeds through freeze and thaw each year) with more shrubs and that the present hydrology will undergo changes in the future. These changes may be most pronounced in riparian zones, which are dominant regions of physical and biological activity in watersheds. We hypothesize that the present drainage network of water tracks and incised channels represents an immature system restricted from further development by the shallow active layer over permafrost; as the thickness of the active layer changes in response to climate change, the drainage patterns will also change. Further, we hypothesize that:

1) The hydrologic drainage patterns have major influence on the spatial distribution of soil moisture and that an increase in the number of incised channels will result in a reduction in surface area of poorly drained or wet soils.

2) Present areas contributing flow to the incised streams include those areas of enhanced soil moisture adjacent to the water tracks; changes in the contributing area of flow will alter the characteristics of the flow regime, water chemistry and sediment transport.

3) On the low gradient Alaskan Coastal Plain, changes in drainage pattern will both arise from and cause drainage of shallow thaw lakes. Summer stream flows will increase along with areas of improved drainage (reduction in wetlands).

Complementary funding has been secured under an existing grant from the National Science Foundation to cover PI salary and equipment. This proposal requests support to cover salary and tuition for one M.S. graduate student to assist in the research activities.