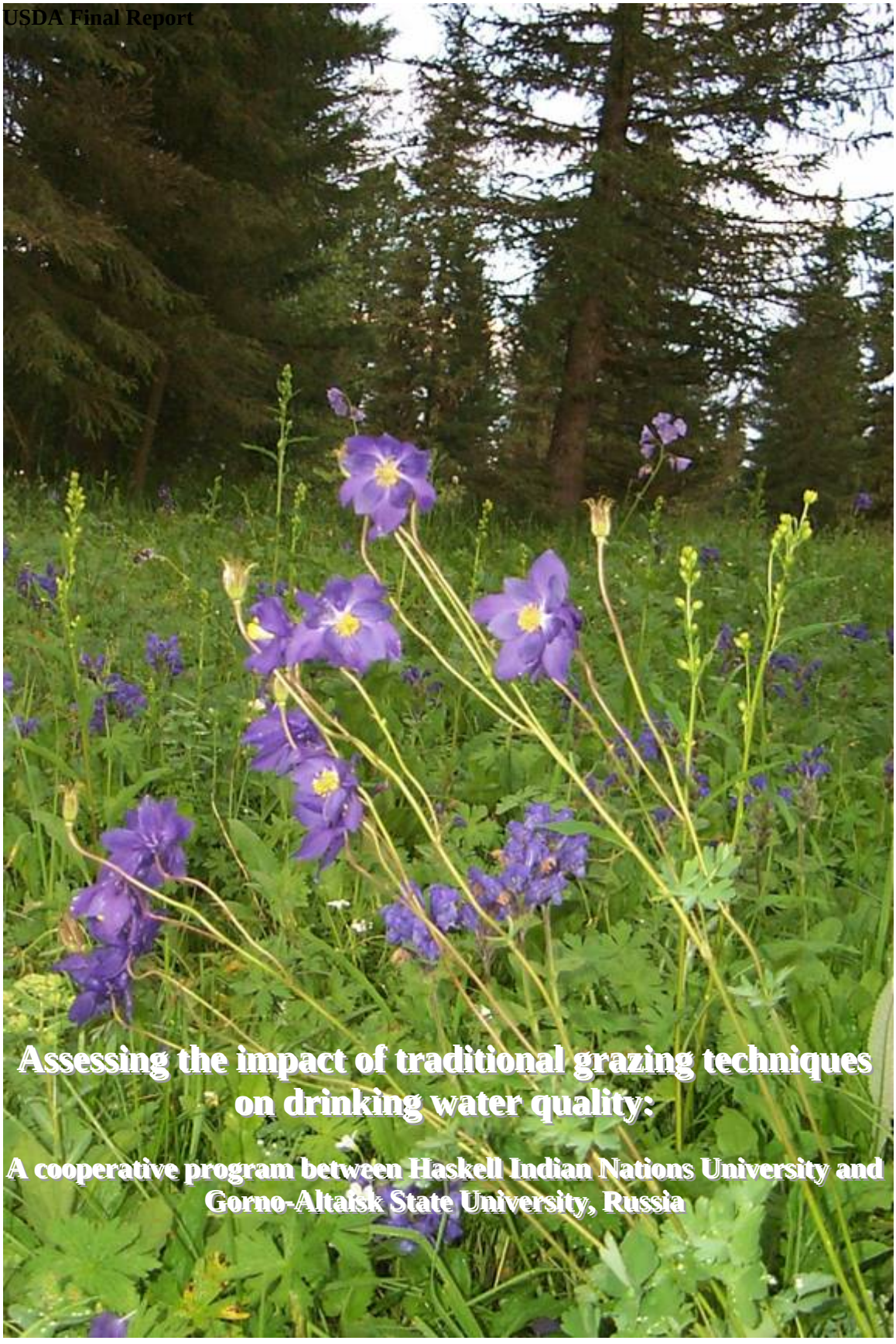
USDA Final Report



Assessing the impact of traditional grazing techniques on drinking water quality:

A cooperative program between Haskell Indian Nations University and Gorno-Altaisk State University, Russia

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Host-Country Partner Institution
Gorno-Altaisk State University
Gorno-Altaisk, Altai Republic, Russia

Lead U.S. Institution
Haskell Indian Nations University
Lawrence, Kansas

Additional Partner Institutions
Kansas State University
Manhattan, Kansas

The University of Kansas
Lawrence, Kansas

The Civil Society Group, LLP
Lawrence, Kansas

Partnership Directors
Nikolai Malkov, GASU
Dan Wildcat, HINU

Editors

Nikolai Malkov
Gorno-Altaisk State University
1 Lenkin Street
Gorno-Altaisk, Altai Republic
Russia 659700

Cynthia Annett
The Civil Society Group, LLP
PO Box 1416
Lawrence, Kansas

USA 66049

Contributing Authors

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Available electronically at <http://www.engg.ksu.edu/HSRC>

Vera Aleinikova
Gorno-Altaisk State University

Cynthia Annett
The Civil Society Group, LLP

Anne Calhoon
The University of New Mexico

Dustina Edmo
Haskell Indian Nations University

Larry Erickson
Kansas State University

Alexander Golubtsov
The Russian Academy of Sciences, Moscow

Wendy Griswold
Kansas State University

David Khaydarov
Gorno-Altaisk State University

Victor Lukyanenko
Gorno-Altaisk State University

Nikolai Malkov
Gorno-Altaisk State University

Victor Mamrashev
Gorno-Altaisk State University

Julia Mekechinova
Gorno-Altaisk State University

Ray Pierotti
The University of Kansas

Sheldon Selwyn
Haskell Indian Nations University

Photo Credits

Mike Cuenca
The Civil Society Group, LLP

Glen Gary
Haskell Indian Nations University

Alexander Golubtsov and Elizabeth Golubstov
The Russian Academy of Sciences, Moscow

DVD/Video Production

Mike Cuenca

Final TECHNICAL REPORT

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Title: Assessing the impact of traditional grazing techniques on drinking water quality: A cooperative program between Haskell Indian Nations University and Gorno-Altaisk State University, Russia

U.S. Cooperating Institution: Haskell Indian Nations University

U.S. Principal Investigator: Dan Wildcat

Collaborating Country: Russian Federation of States

PROJECT SUMMARY

Over the past five years, Haskell Indian Nations University (HINU), an American Indian Tribal College, has developed a collaborative program with faculty at Gorno-Altaisk State University (GASU) in the Russian Federation of States to create a cooperative program in research and teaching focusing on environmental issues of importance to Native Americans and Indigenous Altaians. The partner institutions have worked with funding from the U.S. Agency for International Development Partnership in Higher Education Program (USAID-ALO), supplemented with funds from EPA, the NSF Undergraduate Mentoring in Environmental Biology (NSF-UMEB) Program and the National Security Education Program (NSEP), to develop and implement a program for community-based drinking water quality monitoring. The funded USDA-SCRP project extended this program to include research on the reemergence of traditional practices of herd management among Indigenous Altaians and the impact of domestic animals on drinking water.

Our water quality-monitoring program identified fecal coliform and other non-point source pollutants generated by animal husbandry as the major sources of water pollution in the Altai Republic. As a result of the USDA-SCRP project, we have implemented a program to determine whether there are differences in surface water quality linked to animal husbandry in districts differing in herd management practices.

The partnership provided training to participants from the Russian and U.S. partner institutions in scientifically rigorous water quality assessment methodology and in capturing and interpreting Traditional Ecological Knowledge. It created training modules suitable for use by elementary and secondary schoolteachers and community groups who now form a water quality monitoring network in the Altai Republic. The partnership has also provided state-of-the-art laboratory and field testing equipment for scientists at GASU to investigate surface water chemistry at a more sophisticated level. The sustainability of this program has been assured by the implementation of a new USAID-ALO grant to develop capacity at GASU to disseminate scientific information to the media and an NSF-UMEB grant that will create a stream bioremediation demonstration project in 2004 and an investigation of Traditional Knowledge and the impact of wildlife on herd management in 2005 and 2006.

Background

Our project addressed the SCRP Target Subject Area for 2001 “Integrating environmental concerns into food security to ensure sustainability” by developing an understanding of the impact of grazing practices on drinking water quality. Grazing is the major agricultural activity in the southern part of the Altai Republic in Russia and on

many Tribal lands in the U.S. Restoration of degraded grazing lands and improvement of drinking water quality were identified by a USAID sponsored land-use planning team as top priorities to aid economic development of the Altai Republic (ESD 1998). Poor quality of drinking water is the leading cause of health problems for young children in the Republic. As is typical in Siberia, few settlements in the Altai Republic have facilities for either purification of drinking water or treatment of sewage. Many settlements obtain drinking water from surface water sources (streams, rivers, lakes) that suffer from elevated levels of nitrogen, fecal-coliform bacteria and other non-point source pollutants associated with animal husbandry. Non-point source pollution of a similar nature is the major problem with water quality throughout the Great Plains region of the U.S., causing difficulties for the management of small water systems on Tribal lands and rural municipalities.

Approximately 60% of the Altai Republic is shortgrass steppe, which is the dominant vegetation type in the southern districts where the majority of the indigenous Altaians live. Shortgrass steppe is characterized by low and unpredictable rainfall and well-drained sandy soils, and in the high altitudes of the southern regions the steppe is also underlain by permafrost. These factors, combined with the short growing season, make most forms of agriculture impossible, and indigenous Altaians depend upon horses, cattle, sheep, goats, and yaks (*Bos grunniens*) for their livelihood. The soils of the semi-arid steppe are fragile, requiring that herds be moved over great distances to avoid environmental degradation from overgrazing. Caring for herds means that indigenous Altaian families live a semi-nomadic lifestyle that takes them far from settled villages for part of each year (Annett and Klubnikin 1998, Klubnikin et. al 2000).

The Altai mountains encompass the most complete sequence of vegetation zones in western Siberia and is viewed as a center of origin for montane vegetation of north Asia (Koropachinsky 1996). Montane tundra is found at the highest elevations, followed by steppe, with taiga, wetlands, and meadows at lower elevations. The vegetation of this region exhibits a high degree of endemism (12 %), higher than that found in either the Pyrenees or the Alps. The higher elevations also contain rare animals and are a key area for the conservation of endangered species. For example, the Gobi-Altai population of snow leopard (*Uncia uncia*) serves as a core source for individuals dispersing into southern Siberia, Mongolia and Kazakhstan (IUCN 1998).

Since the collapse of the Soviet government in the early 1990's, agricultural practices in the Altai Republic have changed dramatically. The Republic was a major producer of meat and dairy products for the military during the Soviet period, resulting in large herd sizes and intensive grazing. At the same time, huge flocks were regularly brought over the border from Kazakhstan. After the break-up of the Soviet Union, demand for military supplies fell off and the border regions were closed to herders from Kazakhstan, resulting in a drastic reduction in grazing pressure. In addition, with the decline in the Russian economy, agricultural chemicals such as pesticides that were previously used to reduce parasite infestation on sheep, and both irrigation and fertilizer application to improve production of grasses have all been reduced, prompting herders to return to traditional management techniques to care for their animals.

The idea that traditional practices can result in reduced pasture degradation was indicated in Sneath's study using satellite imagery that shows that grassland regions of Inner Asia (which in addition to the Altai, includes the Russian Republics of Tuva, Chita,

Buryatia, parts of China, and Mongolia) were severely degraded by the imposition of government policies to increase livestock production and destroy indigenous nomadic practices (Sneath 1998). The change to mechanized mixed farming during the Soviet period of collectivization resulted in severe and lasting degradation of dry grasslands. Likewise, significant degradation was caused by the attempt made by the Chinese to plow the virgin steppe. In contrast, retention of the relatively mobile system of traditional pastoral land use in Mongolia and Tuva has had much less of a negative impact on the commonly owned pastures (Sneath 1998).

In this project we investigated whether the Traditional Ecological Knowledge of Indigenous Altaians and Native Americans can provide insights into improving the management of herds, grasslands, and water quality.

Development of joint program in Traditional Ecological Knowledge

The cultural heritage of most indigenous peoples contains a large store of knowledge and experience of ecological phenomena that can provide a strong basis for natural resource management and conservation (Pierotti and Wildcat 1997a, 1999, 2000). Combining traditional knowledge with modern scientific perspectives lends new perspectives and insights that are likely to lead to creation of new solutions to environmental problems. Treating traditional knowledge as empirically derived allows investigators to access a large amount of information and experience that has been previously ignored, or treated as irrelevant “mysticism”. Such knowledge, with its emphasis on observation of natural phenomena and its profound understanding of connections between aspects of nature, treated as parts of separate disciplines by the

Western scientific tradition, can provide us with new and unique, scientifically testable insights into some of the most pressing problems facing humankind today (Johannes 1989, Pierotti and Wildcat 1999, 2000, Sneath 1998).

Despite a long tradition of knowledge about ecological and environmental phenomena, Native Americans are one of the most under-represented groups among undergraduate science majors, graduate students, and science faculty (Pierotti personal communication). In 1999, HINU initiated a four-year Baccalaureate granting degree program in Environmental Science. Around the same time, KU opened a Masters program in Indigenous Nations Studies (CINS), increasing opportunities for advanced students to specialize in work on environmental issues of importance in Indian Country. The relationship between the Hazardous Substance Research Center (HSRC) at KSU, which helped to create the Haskell Environmental Research Studies Center (HERS), and degree granting programs at both KU and HINU has expanded to include opportunities for students to move between institutions to obtain specialized training in chemical engineering and environmental remediation.

Over the same time period, faculty from the collaborating programs at KU, KSU, and HINU, formed a consortium to create the first international program for Native American students at HINU. This program involves exchanges between HINU and GASU, a university serving indigenous peoples in Siberia. Emphasis in this program is on providing opportunities for students to conduct studies on water quality and environmentally related health issues that reflect shared concerns between indigenous peoples in North America and Siberia. Our program focuses on convergences in worldviews and philosophy between indigenous Americans and indigenous Altaians. The

basic theme of this project is how these cultural traditions relate to knowledge and application of existing technologies to environmental problems (Pierotti and Annett *In Press*, Calhoon and Annett 2003, Calhoon et. al 2003, Calhoon et. al 2002, Griswold and Annett 2002).

Despite relocations, both forced and voluntary, American Indian people take their knowledge with them (Owens 1998, Pierotti and Wildcat 2000). This has allowed them to survive decimation, relocation, and urbanization through establishment of new sacred places in the places to which they have been relocated. The basis of American Indian thought includes the following concepts: (a) local places and the natural environment are of utmost importance to cultural identity, (b) respect for non-human entities as fully competent individuals whose lives have meaning on their own terms, (c) the existence of bonds between humans and non-humans, including incorporation of non-humans into ethical codes of behavior, and (d) recognition of humans as part of the ecological system, rather than as separate from and defining that system (Pierotti and Wildcat 1999, 2000).

Worldviews that involve representing sound ecological management in strongly ethical (spiritual) terms, and developing views of the environment that stress specific bonds between nature and the human community are consonant with American Indian philosophy and other Indigenous philosophies (Deloria, 1990; Deloria & Wildcat, 2001; Pierotti & Wildcat, 1997b, 1999, 2000). These constructs represent both scientific and spiritual knowledge, representation of the community as an ecological rather than simply as a social unit, while creating devices for sanctioning moral and ethical codes. “The task of the tribal religion...is to determine the proper relationship that the people must have with other living beings” (Deloria, 1992p. 130). As a result, a large part of Indigenous

knowledge from other tribal communities, like Native American knowledge, is based on and has considerable insight into the workings of nature (Klubnikin et al. 2000).

With the resurgence and return to educational opportunity based on traditional wisdom, knowledge, oratory, science, and art in place at many Tribal Colleges and Universities, many Native American students are engaged in pursuing information that relates to their continuing search for cultural relevance. Our goal has been to create a study abroad program in which Native American students are able to develop cultural and social capital through knowledge obtained through travel that enhances their ability to return to their communities and work for those communities with an enhanced sense of what it means to be indigenous and the value of indigenous rather than Western solutions to environmental problems (Pierotti and Annett *In Press*, Calhoon and Annett 2003, Calhoon et al. 2003, Calhoon et. al 2002, Griswold and Annett 2002).

In our program Siberian students, including those of indigenous Altaian ancestry from partner institutions, were also able to gain insight into some environmental issues shared by indigenous cultures in different parts of the world. For example, Native Americans and indigenous Altaians hold similar beliefs that natural sources of water are sacred because they provide life to the ecological community, including humans. A large component of the traditional knowledge of the Altai people is related to water (Klubnikin et al. 2000). We used this connection to jointly develop a culturally relevant training program to promote assessment by village residents of the impact of economic activities on water quality. This allows an increased capacity to deal with environmental pollution as a threat to public health, particularly to underrepresented indigenous populations, both in Siberia and on Indian reservations in America.

In both the United States and Russia, water sources on homelands were kept pristine and healthy for thousands of years, yet today many have become too polluted to drink from directly. From a Native American perspective, water is considered a sacred element because it is recognized as a source of life and also an element that moves readily between living and non-living, human and nonhuman, establishing connectedness. Thus, testing for pollution in water involves much more than simply a scientific endeavor. Working on water quality issues together helped students identify their shared traditional values, at the same time taking joint steps to educate younger people and to improve their drinking water.

Dan Wildcat of HINU works with the Director of the Altai cultural resources collection in Gorno-Altaisk.

As one of our Native American student participants has written:

> *"The most obvious similarity between the Altai People and Native American People is the interaction between the people and their environments.*

Traditional ceremonies have common interests in a way that enables communities to care for their environments. We also share interests in preserving our land for future generations and deal with environmental problems with limited resources. A great deal of respect is given to the elders of the Tribes in both countries. In return for respecting elders there is an exchange of knowledge that the elders have been given by their ancestors. The Altaian country is not developed land and is kept pure so that the processes of Mother Earth can work naturally, as it is for most places in Indian Country where Native Americans have had the opportunity to keep their sacred sites clean (Sheldon Selwyn, HINU student)."

Dustina Edmo (HINU student) and Dan Wildcat (HINU faculty) preparing for a demonstration of traditional Native American dancing at the Atlaian school in Gorno-Altaisk.

Another student participant has provided the following insight:

"I have been greatly affected with this experience because it has broadened my perspective regarding indigenous cultures and lifestyles. Also it gave me the opportunity to share the dances and culture of Native American Indian people, especially of my own people, the Lemhi Shoshones. My goal is to return to the Altai to further increase my knowledge of the people and land and hopefully be able to share more about the Native people of America with them as well. I have been most blessed with all the individuals I have met— they have affected my life and I have made friends that will forever be a part of my life"(Dustina Edmo, HINU student).

We have developed a video documentary of the historic exchange between the two institutions that serve Indigenous populations (HINU and GASU). This documentary incorporates over 1,000 digital images collected during the 2001 exchange as well as several hours of digital video taken during the 2002 exchange (the video can be viewed online at http://www.engg.ksu.edu/HSRC/international/altai.html and http://www.civilsocietygroup.com). Interactive online materials for the new International Program at HINU and the CINS at KU are also being developed thanks to funding from the National Endowment for the Humanities (see for example http://www.seekpeace.com/hinu/Global.html). This program began with a course on World Geography and a course on the worldviews of Native Americans (American Indian Studies: Native and Western Views of Nature), and has expanded to include international travel for HINU students and faculty (funded by grants from USAID, USDA, and EPA) and graduate level work for Native American students at KU.

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ACCOMPLISHMENTS DURING THE 2001-2002 REPORTING PERIOD

Water Quality Monitoring

In Summer 2001, two HINU faculty (Dr. George Godfrey, Pottawatomie; Dan Wildcat, Euchee) and seven HINU students (Dustina Edmo, Shoshone; Glen Gary, Lakota; Krystale Head, Cherokee; Stefanie Reyna, Taos Pueblo; Tina Scott, Creek; Sheldon Selwyn, Nakota; and Marie Spaola, Lakota) traveled to the Altai Republic. The funds from the USDA-SCRP were used for faculty travel and also allowed us to fully fund participation of two alternates (Dustina Edmo and Stefanie Reyna) in the exchange. In addition, the funds from the USDA grant provided stipends for two student participants (Krystale Head and Tina Scott), increasing our capacity for scientific analysis of the water quality data collected during the course of the project.

The program was enhanced by the participation of a Chickasaw graduate student from KU, Jennifer Ivie. Ms. Ivie was awarded a National Security Education Program Graduate Fellowship (NSEP) to study at GASU. One of the goals of the USDA, USAID-ALO and EPA sponsored program was to develop an understanding of the linkages between water quality degradation and health, which formed the basis for Ms. Ivie's NSEP application. Ms. Ivie, who worked with Dr. Anne Calhoon, compiled and analyzed data collected by Dr. Tatiana Lukyanenko, a faculty member at GASU. Ms. Ivie also worked closely with the HINU undergraduates during their stay in the Altai Republic.

The group was joined in the Altai Republic by Dr. Mikhail Korenman, a professor of chemistry and head of international programs at Bethany College in Lindsborg Kansas who lead the water quality training. Dr. Korenman arranged a donation of computerized instruments and water testing equipment by the American partners to GASU to improve

their capacity for monitoring water quality in the Republic. The scientific capabilities of GASU were significantly impacted by this project. This equipment included three sets of pH meters, oxygen meters, temperature probes, and calculators for use in on-site field sampling of water sources. Use of this equipment and water test kits gives GASU the opportunity to test water quality on a regular basis, which they had not been able to do previously.

Presentation of water chemistry testing equipment by Dan Wildcat of HINU to GASU's Chemistry and Biology Department representatives.

The purpose of the 2001 exchange was to field test appropriate methods of water quality assessment in the area. The partners purchased 27 water quality testing kits for use during fieldwork and for limited distribution and use the Altai Republic. During fieldwork, U.S. and Russian partners collected water samples from Altai National Park water sources over three days in the field, during which they were joined by a group of about fifty high school students from all over the Republic who were attending an environmental camp. Samples of water were collected from the local river, streams and other natural sources of water. The tests were conducted immediately after the samples

Top: HINU student Mari Spaola with water testing kit in Gorno-Altaisk.
Bottom: HINU students Dustina Edmo and Mari Spaloa conduct water tests with the help of Dr. George Godfrey (HINU) and GASU student Maria Usova.

were collected. The results of these tests were provided to representatives of the local

nature reserve, a body of representatives for Altaians similar to a tribal council. Ten

chemistry kits were park staff. We felt that it was very important that local people, especially those representing the nature reserve, participate in testing and discussion of the results in order that they be able to conduct similar tests in the future. It was also very educational for local students to discuss water quality and the way water can be preserved.

Results of the water quality analyses conducted during summer 2001 were presented by Victor Mamrashev, GASU student, in the Ecological-Biosphere Competition among universities of the Siberian Region in Novosibirsk, during spring 2002. Mr. Mamrashev presented an overview of the ALO project and data from fieldwork he conducted with the help of HINU students. The meeting was attended by representatives from 11 universities, and GASU was awarded sixth place in the competition.

Pasture Management and Water Quality

Answering a request from Vera E. Mel'chenko, the scientific deputy director of the Katunsky Reserve, Drs. Malkov (GASU) and Annett (KSU and The Civil Society Group) conducted a survey of the Reserve and provided training to her staff. The Katunsky Biosphere Reserve is part of the new World Heritage Site in the Altai Republic established by IUCN/UNESCO under the World Heritage Convention for both cultural and natural resource values. One of the most important goals of our overall program was to find ways to implement results of our work in a consistent and sustainable fashion that will have direct, quantifiable impacts on the health of the people of the Republic, the conservation of natural resources, and the economic development of the region. Meetings with community leaders, conservation officials, politicians, and the business community

in the region allowed us to explain our program, obtain input on ways to implement our water quality assessment network, and learn about how different stakeholders view our work.

The Bioshpere Reserves are an essential part of the conservation of the major watersheds in the Altai Republic. Dr. Nikolai Malkov was instrumental in the development of the Katunsky Reserve, and organized our visit to facilitate efforts to educate the staff of the new reserve so they might be able to assess and improve water quality in the regions they manage. Since the Katunsky Reserve is in the headwaters of the Katun River, it is an especially important location for conservation.

The Katunsky Reserve is only five years old, and has been developed on lands that were heavily grazed during the Soviet period. The rugged geography of this region assures that the mountainous lands of the reserve are only accessible to herders from the southern borders, which are adjacent to Kazakhstan. Since the separation of Kazakhstan from the Russian Federation of States, this border region has been closed to the movement of herders, completely eliminating grazing from the lands of the reserve. Thus, working in the reserve was particularly appropriate to further our understanding of the impact of grazing on water quality.

The Katunsky Reserve is located in the southern part of the Republic, which is where the highest proportion of indigenous Altaians live. It is also the poorest region of the Republic. The Reserve faces the challenge of developing an ecologically sustainable economic base to replace revenues lost by the cessation of grazing activities. The town of Ust-Koksa was heavily dependent upon economic activities related to grazing (meat processing, dairy processing, etc.) and is the regional center. While grazing has

traditionally been the economic base of the region, such activities have severe impacts on water quality. In addition, siltation from grazing activities was identified by the Reserve staff as the major reason for declines in salmonid populations (including several endangered and threatened species) in the upper Katun River in the region of Ust-Koksa/Katunsky Bioshpere Reserve. Extensive discussions were conducted with officials about how to develop community support for conservation initiatives and alternative economic development plans that would be less harmful to water quality.

Drs. Malkov and Annett with Liza Golubtsov on the trial to Lake Taimen'e in the Katunsky Reserve.

Dr. Alexander Golubtsov of the Russian Academy of Sciences Severtsov Institute in Moscow, joined Drs. Malkov and Annett to assess the health of the fisheries and discuss water quality and fisheries management issues with reserve staff. We traveled by boat and horseback to Lake Taimen'e, the largest body of water in the Katunsky Reserve.

Drs. Golubtsov and Annett survey the fisheries of Lake Taimen’e in the Katunsky Reserve.

Our surveys helped the staff document how aquatic resources have responded to the release from intensive livestock grazing to a Biosphere Reserve. This work resulted in a report written for Reserve staff (in Russian) with recommendations about fisheries and water quality management in the Reserve.

ACCOMPLISHMENTS DURING THE 2002-2003 REPORTING PERIOD

During May 2002, four faculty and administrators and four students from GASU visited their Kansas partners at four educational institutions (HINU, KU, Bethany College, and KSU). Participants in the exchange were Yuri Tabakaev, rector; Victor Lukyanenko, dean of foreign languages and director of international programs; Nikolai Malkov, biology professor; Vera Aleinikova, dean, chemistry and biology department; and students Oxana Kolbeshkina, biology; Victor Mamrashev, chemistry; Maria Usova, languages; and Julia Mekechinova, languages.

The group spent several days at Bethany College hosted by Dr. Mikhail Korenman who demonstrated advanced water chemistry techniques, including an analysis of water samples from the Altai Republic and samples collected from rivers in Kansas. GASU and HINU faculty and students received training in laboratory analyses, including use of a spectrophotometer; in using a portable water chemistry lab; and in software to collect and record data. In addition to being trained in water chemistry analysis, the group worked with Mike Cuenca of the Civil Society Group (CSG) to film a training video in Russian on how to use a spectrophotometer and water quality test kits. Dr. Korenman also provided Dr. Aleinikova with teaching materials used in his chemistry classes.

The group spent several days at KSU, during which GASU faculty met with the dean of agriculture and representatives from the Agricultural Extension Program. Their discussions focused on potential collaboration regarding the impact of grazing on water quality, grazing land management, and resource management. Drs. Vera Aleinikova and Larry Erickson discussed the next steps for addressing water quality issues in the Altai Republic and developing educational programs in order to continue water quality work

beyond the end of the current project. Dr. Malkov and Dan Wildcat met with researchers at the Konza Prairie Long-term Ecological Research site to discuss the relationship between grazing practices and water quality, a major component of research at Konza Prairie and KSU. Dr. Malkov met with Dr. Marc Johnson, Dean of the College of Agriculture and representatives from the Agricultural Extension Program. Their discussions focused on potential collaboration regarding the impacts of grazing on water quality, grazing land management, and resource management.

During the visit to HINU, the delegation from the Altai Republic participated in activities that allowed them to explore the connections between the traditional belief systems of North American Native Peoples and Indigenous Siberians and consider how Traditional Knowledge can be used to inform scientific studies of environmental problems. Dan Wildcat (HINU) led the group in an exploration of environmental issues relevant to many North American Indian Nations. This exploration included a tour of the Haskell wetlands and the Haskell medicine wheel. The wetlands are an important HINU resource that is also used as an outdoor lab for science courses. The area has spiritual significance for the Haskell community because it represents a place for spiritual retreat, celebration, and gathering. The Medicine Wheel is recognized nationally as a site of cultural significance to Native Americans. The indigenous Altai also have symbols whose function is similar to the idea of Medicine Wheels. The students worked with Dr. Ray Pierotti and Dan Wildcat to produce a series of essays on Altaian Traditional Knowledge that were published in the Center for Indigenous Nations Studies Journal, the scholarly journal published by CINS at the University of Kansas.

The U.S. and Russian partners visited the Prairie Band Potawatomi Nation. They toured a riverbank filtration project and discussed how this could be used as one possible solution to water quality issues in the Altai Republic.

During their visit to KU, the director of the Center for Indigenous Nations Studies (CINS), Dr. Don Fixico, met with the group to explore future cooperation and cultural exchanges and discuss mutual interests in Traditional Knowledge and indigenous worldviews.

GASU and U.S. faculty toured the Kansas River and met with Non-Governmental Organization (NGOs) representatives to discuss techniques and strategies for preserving rivers and protecting water quality. The American partners were subsequently asked to provide training in water quality monitoring and education to members of one of the NGOs, The Friends of the Kaw, who are interested in conserving rivers in Kansas.

The GASU chemistry and biology department was provided with several publications focused on informing citizens about water quality. These publications included EPA documents from the Office of Water Quality, such as “Private Drinking Water Wells,” “Total Maximum Daily Load Program,” “Water on Tap: A Consumer’s Guide to the Nation’s Drinking Water,” and “Drinking Water and Health: What You Need to Know.”

One hundred water quality test kits were purchased with EPA grant funds and supplied to GASU for distribution to schools in the Altai Republic. The instructions for the test kits were translated into Russian by the GASU language students who were members of the exchange group. The instructions have been supplemented by introductory material tailored to the GASU water quality-monitoring program, including

traditional Altaian stories about the sacredness of water. The introduction is in both the Russian and Altaian languages.

The water chemistry test kits provided by EPA funds have subsequently been distributed among schools in several districts of the Altai Republic including Kosh Agach, Ulagan, Ongudai, Turachak, Maima, and Chemal. These districts were chosen because of the strength of their science education programs, their locations around the Republic, and their degree of concern about water quality degradation. An effort was made to include school districts with large Altaian populations (Kosh Agach, Ulagan, and Ongudai). Four secondary schools in Gorno-Altaisk (National Lyceum, Gymnasia #3, City Lyceum, and Republican Lyceum) also received kits. In addition, seven districts in the neighboring Altai Krai have received test kits. Teachers and students in the participating districts have received training in use of the test kits, and are currently monitoring water in their districts. Data is being provided each semester to Dr. Aleinikova at GASU for archiving and analysis; we are now in our second year of monitoring.

A spectrophotometer was purchased for GASU using funds provided by the EPA. The spectrophotometer was needed to allow GASU to do more scientific and more accurate tests at the university lab. Because of restrictions in transporting this equipment by plane, which prevented our shipping an instrument from the U.S. or Europe, we were forced to spend a prolonged period of time locating a distributor in Moscow and having it shipped via rail to Gorno-Altaisk. The spectrophotometer was installed at GASU and became fully functional in April of 2004.

Drs. Aleinikova (GASU) and Annett (CSG) with graduate students installing the new spectrophotometer at GASU.

ACCOMPLISHMENTS DURING THE 2003-2004 REPORTING PERIOD

A delegation from GASU visited Kansas in May/June 2003 to complete work on the USDA-SCRP project. This group was partly funded by our NSF-UMEB program.

During this trip, the partners worked with a local NGO, The Friends of the Kaw. This organization sponsored a canoe trip to share information with the GASU delegation on the status of the Kansas River, one of the most polluted rivers in the U.S., and their grassroots efforts to preserve it. Local journalists reported on the trip, which allowed a local community organization to draw attention to an important local environmental issue. The newspaper reporter who wrote the story, Abby Mills, has subsequently received an NSEP fellowship to work with the KSU faculty when they travel to the Altai in Summer 2004 and to attend courses at GASU during the fall semester.

Dave Murphy, the Kansas Riverkeeper, speaks to the GASU and KSU faculty and students participating in the exchange, in addition to members of The Friends of the Kaw and community members about conserving the Kansas River during a canoe trip.

Dr. Aleinikova and her student, Victor Mamreshev, traveled with funds from our NSF-UMEB grant. Drs. Larry Erickson, Larry Davis and Mikhail Korenman worked with them to create a database for the water quality data. They also made plans for a visit by Drs. Jim Steichen and Larry Davis (KSU) and Heidi Mehl (KU), a Cherokee undergraduate student, during summer 2004 to continue the USDA-SCRP project using NSF-UMEB funding. The 2004 exchange will focus on stream and lake shore remediation and will create a demonstration project at the GASU field station on Lake Teletskoye.

During her trip, Dr. Aleinikova presented the scientific results of the water quality-monitoring program at the International Forum of Analytics and Analysts in Voronezh, Russia, (June 2-6, 2003: http://www.vgta.vrn.ru/forum/inf-engl.htm).

With funding from USDA-SCRP and NSF-UMEB, a team from GASU joined Dr. Raymond Pierotti, a Comanche Ecologist at KU (CINS and Department of Ecology and Evolutionary Biology), on a trip to the Navajo and Hopi Reservations in New Mexico and Arizona so they could learn about environmental issues facing the Navajo people. Issues of common concern were addressed, including problems with overgrazing by traditional herders that reduce water quality in streams and springs. The Siberian scholars were introduced not only to cultural traditions and the Traditional Ecological Knowledge of Native Americans, but also to practices put into place by the Navajo Environmental Protection Agency and other tribal entities that were established to set environmental and cultural standards on reservation land. They also participated in traditional Navajo and Hopi ceremonies, including sweat lodge, and the butchering of a sheep for a group feast, an activity with great resonance for both Southwestern tribes and Altaian herding peoples.

The GASU group traveling with Dr. Pierotti and his students included Yuri Tabakaev, rector; Victor Lukyanenko, dean of foreign languages and director of international programs; Nikolai Malkov, biology professor; Julia Mekechinova, student in the languages program; and David Khydarov, biology student.

Native American students participating in the program included Myron Dewey (Agui Diccutta Band of the Walker River Paiute) and Dustina Edmo (Shoshone-Bannock), both of whom recently graduated from HINU. Dustina is a champion women's

traditional dancer who traveled to the Altai with the HINU exchange in 2001 and participated in the 2002 exchange as part of this program. A primary organizer of this exchange was Allen Long (Navajo), a senior majoring in Applied Indigenous Studies at Northern Arizona University (NAU). The expert on traditional knowledge, particularly of sacred sites including springs and petroglyphs was Benny Lebeau (Wind River Shoshone), a senior at NAU majoring in Applied Indigenous Studies. Benny also works to preserve sacred springs of tribes in the American West, and taught our Altaian visitors about the significance of springs to Native Americans.

We departed Lawrence and traveled through central and western Kansas. In western Kansas we were able to see feedlots around Dodge City and discuss the social and environmental consequences of feedlots. We also discussed the concept of the Buffalo Commons and it's implications for development in Siberia.

We then drove through the Oklahoma Panhandle and across New Mexico to Window Rock. Along the way we were shown Tribal Casinos and discussed the role of Casinos and ecotourism in economic development. In Window Rock we had a full day meeting and workshop at the Navajo EPA. During these meetings they discussed how indigenous peoples can control their own water and air quality. The GASU faculty and students introduced themselves and spoke on the environmental issues they are facing in the Altai. Issues of shared concern included grazing and water quality. There were also presentations on the use of GIS techniques in assessing concerns.

We also attended a presentation on historical preservation and wildlife management on reservation land. We then traveled to Wheatfield Lake where we camped. The Siberians fished in the lake and were shown the environmental aspects and

issues linked to sheepherding. That evening around the fire we exchanged traditional stories and music. The Siberians received instruction in traditional cedar flute playing and the importance of music and song in traditional knowledge and ceremonies was discussed.

We then traveled to Dine Community College (DCC) where we met with faculty and administrators who told us of the Navajo creation story and its relevance to environmental concerns. There was extensive discussion and exchange of ideas about effective means of educating students who are strongly linked to indigenous cultures and allowing them to develop intellectual traditions within an indigenous context.

Faculty and students from NAU, HINU, and GASU at Canyon de Chelly.

We were then taken to Canyon de Chelly by DCC faculty through the back routes to the head of the canyon and were there shown traditional agricultural practices and were able to observe indigenous conservation practices.

After leaving the Navajo Reservation we traveled to Moenave and the Hopi Village of Moenkopi. In Moenkopi the Siberians were able to observe traditional Hopi ceremonies and dances and were provided a feast as guests of honor by one the Hopi families. In the evening we visited the petroglyphs at Newspaper Rock, an area where many petroglyphs are well preserved. There was a presentation on petroglyphs by Benny Lebeau, a Shoshone elder who is an expert on petroglyphs and is active in the preservation of petroglyph sites throughout the western U.S. Nikolai Malkov compared many of the petroglyphs with similar sorts of carvings found in the Altai and extensive discussion ensued.

HINU and GASU partners at petroglyph site in the Altai Republic during the 2001 exchange.

We camped on the Navajo family rancheria controlled by Allen Long's family in Moenave. During this period we were able to participate in a traditional sweatlodge

ceremony run by the head of the family at the rancheria where we were camped. This visit also allowed observation of traditional methods of irrigation and crop management and how indigenous wildlife was incorporated into management practices. During the men's sweat the female members of our group traveled to Second Mesa to visit Hopi families (males sweat separately from females in traditional Dine practice). The following day there was a sweat for female members of the family and our group.

Then we participated in a traditional sheep butchering ceremony that was of great interest because sheep butchering is also an Altaian tradition. Dr. Malkov participated and exchanged ideas on the most efficient forms of butchering.

U.S. and Russian partners participate in a sheep butchering ceremony on the Navajo Reservation.

Both Dr. Malkov and the head of the family were each responsible for dealing with his own half of the sheep. They did the work practically simultaneously, losing no blood,

because in both Altaian and Native American tradition nothing of the food should be wasted.

When the traditional dishes were cooked, Dr. Malkov was able to give Altaian names for each. Visitors from GASU also made bread in the traditional Navajo way and later all of the people shared the food cooked together.

We then traveled to Monument Valley where we were shown how tribes manage historical and cultural sites. Several participants in the exchange were interviewed by Mike Cuenca (CSG) about the exchange program for a documentary film he is making. In the afternoon we moved on to Page Arizona, where we were shown Glen Canyon Dam. This was particularly pertinent because the Alataians are also faced with a major dam project on their sacred river and were able to observe firsthand the social and environmental consequences of a major dam project.

Rector Tabakaev at the Grand Canyon.

We then camped in Lee's Ferry on the Colorado River below the dam, where the Siberians were able to bathe and fish in the river. The next day we drove through Grand Canyon National Park from the east entrance.

After touring the park we went to Flagstaff, where we met with faculty of Applied Indigenous Studies Program at Northern Arizona University. At NAU we were shown a traditional hogan built for ceremonies, which the Altaians compared to one type of traditional hut used by some of the groups of Indigenous Siberians. Individuals from NAU included Aregai Tecle, professor of hydrology and decision Systems Analysis, School of Forestry; Octaviana Trujillo, professor and chair, college of ecosystem science and management, Applied Indigenous Studies Department; Ronald Trosper, Director, Native American Forestry Program, college of ecosystem science and management.

The GASU delegation also met with staff from the Institute for Tribal Environmental Professionals (ITEP), Todd Barnell, Research Specialist, Frederick Sherman, David Delmar, and Matt Andrews. Discussions focused on training programs for tribal professionals in wildlife and environment. Partners had discussions with students and faculty who work to improve environmental management (forestry and water resources) on tribal lands. Topics discussed included how the university uses the media to promote their work with the environment to local communities.

We next visited a sacred spring known only to local indigenous peoples located on the eastern slope of Dook'o'slid (San Francisco Peaks). There we participated in a water blessing ceremony and compared the ceremonial treatment of scared springs in Altai with similar situations in the southwestern U.S. Afterwards we visited the Museum

of Northern Arizona where the Siberians were able to observe both the natural and cultural history of the area.

The final stop was at the University of New Mexico, where we met with Anne Calhoon from the College of Education. Dr. Calhoon teaches writing and literacy to indigenous communities and has participated in previous exchanges. We also met with Gregory Cajete, Director of Native American Studies and an Associate Professor in the College of education. Information Drs. Calhoon and Cajete shared will benefit the project by providing GASU faculty with techniques for educating and communicating about environmental issues with the indigenous population in the Altai Republic.

Results of Collaborative Research Program

I. Historical overview of livestock management practices in the Altai Republic

By Dr. Nikolai Malkov

From the beginning there was a division between Altai people; the ancient economy of different groups of Altaians varied due to differences in the landscape and ecology of the regions in which they lived. The livelihood of people in the Taiga in the northern part of Republic was based on hunting and gathering from the forest, while herding livestock was typical of the central and southern regions in areas with natural steppes.

Traditional Altaian meal served inside a yurt belonging to a herding family from the southern grasslands.

The old division, which was independent of the political situation, divided Altaian groups between northern (Taiga; forest based economy) and southern (steppe and alpine meadows; livestock based economy). These groups were brought together under the Soviet government into a single governmental unit with an economy based upon herding. But now because of the recent changes in the political and economic situation there are groups arguing that they are not part of the larger Altai nation but rather should be considered separate nations with different means of economic support; that is, they are not livestock herders and should be allowed to have a different economic base.

Groups currently seeking recognition in the northern region are the Tubalars, Kumandihs, and Teles people. Groups distributed mostly in the Taiga in the region of lake Teletskoye are the Kumandihs who were the only people engaged in horticulture in

ancient times. Altais, who in the southern part of Republic call themselves Altai kuzhi which means “Altai man” and the Telengits, who are herdsmen of southern Altai are the nucleus of the proper Altai nation.

The traditional grazing practices were based on dozens of tribal units, each of which controlled their own land area. Each family had their own lands within tribal lands. There was a seasonal migration between regions, with separate summer and winter pastures. Some groups used Yurts while those in the central Altai constructed temporary houses using bark.

Traditional bark hut in the forested northern regions of the Altai Republic.

The Altai Kuzh used mainly horses as draft animals while Telengits used both horses and camels. One camel can carry an entire yurt.

Winter pastures are in regions of low snow cover, either in the mountains or valleys. The summer pastures were chosen to be close to watering places; in winter livestock consume snow for their water supply but in the summer they require water. Usually the areas with deep snow in winter were used for summer pasture. They traditionally used sheep for the main part of livestock, with some smaller amount of goats, horses, and yaks (sarlyk is the Altaian name for yak).

The number of livestock was limited by the quality of pasture but the family economy determined whether pastures were taken out of rotation. Periodic epidemics freed land from exploitation, whereas when the population grew in size grazing activities were extended into areas previously unexploited. The allocation of grazing lands to families was firmly established. It is important to emphasize that at that stage families did not produce products for markets. The basic economic structure was subsistence in that they produced goods almost exclusively for their own consumption. Livestock products, e.g. meat, leather, felt, were not traded because everyone around had the same products available—they traded hunting products, metals, etc. but not livestock products. This situation lasted until after the Russian Revolution (1920s).

Collective farms were created in the 1930s, with the immediate consequence of destroying the family and tribal structures Land was divided between collective farms, with cattle and other livestock becoming the property of the collective farm. This situation continued until the 1980s when the collective farms began to be dismantled.

The chaban (Russian word for shepherd) was responsible for the herds. Each collective farm had to produce and present to governmental authorities some particular quota of meat, fur, etc. Over time the quotas were consistently raised with general negative impacts on grazing lands resulting from overuse of land resources. Substantial increases in livestock increased these impacts as the government demanded more and more products.

The chaban was the person who dealt with a particular stock, with his family being responsible for production. This period was the beginning of the construction of permanent huts in the winter pastures. It was typical to have a permanent settlement for each collective farm, a legacy of the ethnic Russian population, which began building them in the central Altai before the revolution. However in the south this tradition did not begin until the period of collectivization. Altaians did not construct and were not accustomed to permanent residences on the steppe. This management regime was disastrous for the environment, especially because plans to increase meat production required increases in the number of animals that needed to be grazed to levels that led to destruction of grazing areas, a situation also seen in parts of the American West.

Heads of collective farms were expected to know the number of animals on the farm and report this information to the authorities. The number of animals allowed as personal family property was severely restricted during the Soviet period. For example, in Kosh Agash a family could own five sheep, one cow, one horse and no more. This was typical in the 1950s and the beginning of the 1960s. All other animals were the property of the collective (that is they were government property).

By the 1950s the number of livestock was close to or exceeded the carrying capacity of the pastures. With up to 1200 sheep per chaban, (for breeding this number was lower with one herdsman responsible for up to 700 sheep because it is more time consuming to care for sheep while they are giving birth). Since traditional lands were already being grazed to capacity by the 1950s, further increases were achieved by expanding into new mountain regions, thus damaging or destroying new, previously undisturbed habitat. Russian ministries provided herders with jeeps and all terrain vehicles. As a result, they were able to expand grazing to less accessible areas, thus displacing wildlife. By the mid-1980s all available pastureland in the mountains was exploited for grazing.

While all lands used for grazing practice were supposed to be reported to the government administration, in reality, there was an even higher intensity of grazing because of the need for animals for subsistence consumption by the herding families. These additional animals were concealed by herders because government practice was that if extra animals were discovered the responsible person (head of collective farm) was punished by imprisonment.

Even during that period the economic situation in southern Altai was more or less good because the ecosystem conditions were good for a livestock based economy. During the Soviet period people of the southern Altai were fairly prosperous. Unfortunately the regional planning considered the whole Altai region as appropriate for grazing, not just the southern pasturelands. As a consequence, they forced people in the north to produce the same quotas as in the south. The excessively high quotas caused people in the north a great deal of suffering because they were not able to raise the same amount as in the

south. Livestock in the northern part of Republic requires haying because of heavier snow than in the southern winter pastures. Getting grass from under the snow is called tebnevka. This practice is feasible in the southern region because snow cover is small, but in the north snow cover is much deeper, rendering this practice infeasible.

In the forested regions of the northern Altai there were special enterprises for timber harvesting. Altai people also engaged in this business. In fact it was like a coop of tribes in the northern part of the Republic that were forced to deal with the forest economy differently than in their traditional ways, cutting forest timber rather than sustainable uses. Taiga was not converted to grazing land, because after timbering they typically left stumps and slashpiles, which left the land unusable for grazing. Around a settlement it was traditional to clear nearby land for livestock grazing but no there was no largescale conversion of forest to grazing land in the Republic.

Northern herds were mainly cattle, while in the southern areas it was more diverse, with yaks, sheep, some cows, goats, and camels. During the Soviet period there were dairy farms throughout the Republic to produce cheese and butter. They were forced to rear some cows in the south for dairy production, but the productivity was very low. New kinds of cattle were bred to increase productivity. The same was true of other livestock; Dr. Malkov was engaged in selection of new kinds of sheep and goats for three years (1957-1960) in the Kosh Agash region. He worked in one of the largest collective farms; each field station had 800-900 sheep, and he was in charge of 72 field camps. The collective he worked on owned a total of 70,000 sheep and goats, as well as some yaks and camels.

During the collective farm period in the Soviet era livestock from different owners were combined into large herds, increasing both the concentration in a given area and overall density. This increased the danger from disease transmission both among animals and from livestock to humans. For example there were epidemics of sheep ticks. To control this they used annual sheep dips employing pesticide. Special baths made of concrete were filled with water and the chemical pesticide was added, then they bathed all of the sheep and goats in the summer. The water from these baths washed into the river, becoming a source of pollution that damaged fish stocks and created human health problems. In fact, the pesticide eliminated fish populations in small streams near baths.

Local human populations traditionally knew which watercourses were clean and where they could drink without boiling. Each village has wells or clean mountain creeks to get their water, and they usually use springs for drinking. During the winter they use snow or ice to produce drinking water. Among educated people there is more of a tendency to boil drinking water but the main part of the population cannot usually boil it. Probably the major criterion for location of villages was access to a river; although where possible they use springs for drinking water.

The ability of local populations to identify clean sources of drinking water is sometimes limited by undetected contaminants. For example, people living in Chibit settlement, which is on the highway going to Kosh Agash, drank what they considered clean water from the river; however, when an analysis was done it was found to have high levels of mercury. Thus, there are problems with finding a clean water supply in many settlements.

The problems that occurred after the transition from collective farms to private ownership can be illustrated by an example. By the end of the 1980s they successfully bred a kind of long-haired goat and were awarded a state prize. The breeding program produced more than 100,000 of the new kind of goat, which were reared all over the Republic. After the fall of the USSR, when the collective farms were destroyed the livestock was divided between workers. Demand for livestock products substantially decreased, the most profitable being meat production. As a result most of the animals were killed and the meat was sold. This provided a short-term windfall, but lost them their breeding stocks and most of the new breed of goat. As a result part of the population has fallen into poverty.

The density of livestock has been reduced by an order of magnitude over the past decade in the Republic. There is no longer any centralized funding to supply remote stations with food and fuel, therefore, remote herdsmen camps are disappearing, which is allowing many pastures to rehabilitate after the period of severe pressure during the Soviet period.

Dismantling collective farms also improved conditions for wildlife. For example, populations of mountain sheep (*Ovis ammon*) suffered severely from high densities of livestock because their pastures overlap more than that of Ibex, which aren't suitable for livestock grazing. As a result of the recent improvement in pastures the number of mountain sheep have doubled in size. The main threat to populations of mountain sheep now is poaching. By the middle of the 1990s Dr. Malkov estimates that there were only 200 mountain sheep in the Republic. There were only about five locations where stocks existed in his conservative estimation (they are difficult to count because they migrate to

Tuva, Mongolia, and surrounding regions). Now there are probably more than 500 animals in the Republic. However, the increased number of mountain sheep could be an artifact, if for example pressure from increased livestock grazing in Mongolia was driving animals into Altai. For this reason there are now discussions of creating a trans-boundary conservation area for animals migrating in the region.

Dr. Malkov raised the idea of establishing a trans-boundary conservation region in the 1980's but it was not acted on at the time. There have been efforts to revive the idea and the Mongolian scientific community supports it. The World Wildlife Fund is continuing activities in this region, receiving funds from Global Ecological Fund and the UN for this program.

There are significant changes occurring in the population densities of most species of large native grazing mammals because of the reduction in grazing pressure and the withdrawal of herders from distant pastures. There are also ongoing changes in management of predators such as wolves and large raptors. This will be the focus of the 2005 exchange, led by Drs. Malkov and Pierotti and funded by the NSF-UMEB grant.

Collection of skulls and hides at the Natural History Museum of GASU that form part of the current study of grazing animals and wildlife being conducted by Drs. Malkov (GASU) and Pierotti (KU).

II. Summary of Russian Language Reports on Grazing and Pasture Conservation

N.P. Malkov, A.S. Surazalkov, A.M. Paltyn, The World Natural Heritage in Altaii. Center of Science and Technology of the Altai Republic, Gorno-Altaisk, 2002. 100 pages.

> This is a photo album in three languages which deals with five World Heritage Sites; Belukha Mountain, Katun State Natural Biosphere Reserve, Altai State Natural Reserve, Lake Teletskoe, The Ukok Quiet Zone. Published with support of United Nations Development Program (UNDP) and UNESCO.

The ethnic-cultural and biological diversity conservation of the mountain territories through the sustainable development strategies. Proceedings of the International scientific and practical conference devoted to the International Year of Mountains 2002. Gorno-Altaisk September 24-27, 2002. Volume I. Gorno-Altaisk 2003. Paper: Tabekaev Yu. V. and Malkov, N.P. Problems of economic development and establishment of framework of specially protected natural territories in the Altai Republic. Pages 28-30.

This paper discusses the special role of local experts in the development of any projects because the local experts know the local conditions and usually have more information at their disposal. Local experts are interested in the results while experts from other regions may not be interested in the final results of the work. Argues against the idea that the Altai Republic is pristine and should be preserved without change, instead argues that the region should be developed in social and economic terms rather than keeping it as a preserve supported by the federal government. Argues that roads and agriculture, energy (including experimental forms), and mining are necessities, and considers that it is necessary to develop and regulate tourism. At the same time it must be remembered that mountain ecosystems are fragile. Authorities are against the establishment of newly organized protected areas because the authorities believe that it will be against their best interests and point out that 22% of Republic is already covered. The authors do not suggest that there should be any prohibition of economic activities in protected areas, but rather that the money earned from an area should be used for further preservation. Conservation does not mean prohibition but rather regulation and rational use of natural resources. The new national parks are being established in two new units, one is in Uch Enmek and the other is Argut (Katun River valley). Absence of properly elaborated program of economic development in the former government resulted in the uncontrolled taking of lands which can be used for recreational purposes and uncontrolled flood of tourists into accessible and inaccessible sites (including World Heritage sites). It is necessary to organize the tourist business and offer to establish a special directory/ministry for the government of the Altai Republic to organize tourism. There is some desertification of some lands and some abandonment of settlements. Many agricultural lands were abandoned a decade ago. In some regions the number of livestock is an order of magnitude decreased. There is a migration from country to cities. They express the hope that the new government of the Republic will take these criticisms into account to transform the economic life of the Republic.

The Project “Ensuring long-term conservation of the Altai-Sayan ecoregion” WWF Russia. Protected areas of the Altai-Sayan Ecoregion. Scientific Editor Prof. A.N. Kupriyanov, Leader of the Altai-Sayan Project A.I. Bondarev. Publishing House ASIA, Kemerovo. 2001. Part 2. Existing specially protected natural territories.

Pages 45-54. Malkov, N.P. and Maneev, A.G., Yakolev, V.A., and Artemov, I. A. Altai Republic. The first section of this paper describes two reserves, Altaisky and Katunsky Reserves. The next part describes the Zakaznik—no hunting or timber harvest in reserves, but not full protection—there are three Zakaznik at Republic scale and one regional for protection of reintroduced beaver. There is also a section describing other forms of protected territories, sites of UNESCO world heritage (lists 3 sites). Part 3 discusses planned specially protected areas.

Pages 99-104. Malkov, N.P. and Maneev, A.G., Yakolev, V.A., and Artemov, I. A. This paper proposes that reserves should be enlarged for Katunsky and

Altaisky reserves; establishment of two national parks, Sailyugem and Teletskoe Lake; additional Zakaznik are also proposed. Also suggest other specially protected territories called “natural parks” central Altai (both ethnic and natural); Sailyugemsky, Bya-Teletskoye, Telengitsky, Tubalars (these are the names of the small ethnic groups in the forested region of Altai), North Katun, and one that is only natural and not cultural (Seminskii).

The Project “Ensuring long-term conservation of the Altai-Sayan ecoregion” WWF Russia. Biological diversity of the Altai-Sayan Ecoregion. Scientific Editor Prof. A.N. Kupriyanov, Leader of the Altai-Sayan Project A.I. Bondarev. 1. Pages 127-136. Form and populations of vertebrate animals. Malkov, N.P. and Savchenko, A.P. 2. pages 137-155 Malkov, N.P. and Savchenko, A.P. List of vertebrate animals of the Altai-Sayan Ecoregion.

Text supplementing the WWF reports total area of pastures in the 1632.7 thousands of hectares, 18% of total area of republic in the areas that are critically important for nature conservation. Pastures occupy 10% of this area (conservation of biodiversity). This 10% is equal to 350 thousand hectares. This area is distributed as 10% meadows, 35% steppe, 55% forest used for pastures. The mountain steppe pastures of southern Altai are most degraded (3.17-3.20 map reference). At present because of the reduction of livestock the gradual rehabilitation of pastures is observed (especially in map areas 3.17-3.19). Pronounced rehabilitation of mountain meadows and pastures is also observed in map region 3.7 because of the establishment of Katun biosphere reserve. Before the establishment of reserve alpine and subalpine of southern macroslope of Katun mountain chain were suffering complete destruction because of overgrazing of livestock. Their rehabilitation will take a long period. Within the limits of specially protected territories habitats are in good conditions in general. The exception is pastures in map regions 3.3-3.5. In this area all landscapes are under severe anthropogenic pressure because of the high use of these territories in summer by visiting tourists from other regions. Total area of forest in republic is 47.2%, an area is equivalent to 4386.7 thousands of hectares. This area is the Altaian part of the forest fund (lands of special legal status. This is a federal designation). There is a classification of federal lands into agricultural use in ownership of still existing collective farms still existing. Forest fund lands are given special legal status for use. The lands critically important for biodiversity conservation that are covered by forest make up 43%. That is 1500 thousands of hectares.

Conceptual Program of Ecologically Sustainable Development of Altai Republic. N. Malkov and V. Sedelnekov, general editors. Report to USAID 75 pages. Pages 40-41 from chapter “Resource potential and possibilities for their use”.

Haying area total 121.9 thousand hectares including 13.5 thousand hectares of improved hay fields. Only 60 thousand hectares are suitable for mechanical haying with agricultural machinery, the rest can only be hayed by hand. The productivity of haying areas is very low because they have been used for a long time. Pastures cover 85% of total area of agricultural lands. 67% of total livestock feeding ration was from hayfields, 33% supplied with grain or other crops. Increase of livestock in the 1960's and 1980's resulted in degraded pastures. Process of degradation was enforced by year-round grazing, especially grazing in early spring. There were botanical studies in 1952-1960 and assessments of pastures conducted in 1982 and 1989; comparison of data for these two periods showed that during the 30 year period there was a 15-25% decrease in pasture productivity in low mountain zone, for mountain steppe zone 20-30%, for high mountain zone 25-35%. Of total area of pastures 33% covered with sparse forest, 40% are rocky to varying extent, more than 10% has harmful and poison plants. Productivity of pastures measured with dry mass is 4.4-4.5 (in 100's of kilograms) per hectare ranging from 0.3-12.0. Especially low productivity is characteristic of the high mountain zone where it is 2.9 (range from 0.3-4.9). Even taking in account that pastures were used more than once per year and there was year-round grazing the supply of pasture feeding production before 1994 could not cover the needs of the existing livestock and this led to degradation. Recommended that pastures should be used carefully to avoid overexploitation and it is necessary to create maps containing the estimates of pasturelands to assess the capacity of different pasturelands and to elaborate a sustainable plan for livestock grazing. It is necessary to introduce a system of regulated use of pastures (spring, summer, fall, and winter pastures) taking into account the resources of production that can be consumed by livestock. Regulation of grazing should not allow the grazing of livestock on fields of agricultural crops, along riverbanks or lakeshores except in special places for watering. There should also be no grazing (except introduced deer, large deer, maral deer) on slopes with an incline greater than 17 degrees. Grazing of livestock should be conducted in stocks, not solitary animals. Pastures should be fenced in order to decrease erosion and rehabilitate degraded areas and increase the productivity and economic benefits by changing usage pattern and allowing rotation of pastures. It is necessary to use pastures in such a way as to provide protection of valuable forage plant productivity in regions where the livestock are reared for meat and dairy production and for this it is necessary to introduce a system of fenced pastures. In high mountain regions in the zone of alpine and subalpine meadow vegetation, which are areas characterized with higher levels of moisture, if these areas are used as remote pastures it is necessary to introduce a special rotation of pastures for cattle (not sheep or goats). At the same time it is necessary to exclude areas with *Veratum lobelianum*, as it is an indicator of degradation. By excluding these areas from grazing (wet alpine and subalpine meadows that contain this plant) will promote conservation. It is necessary to reduce goat and sheep livestock in mountain steppe zone (high mountain zone) and river valley zone. This should result in the rehabilitation of pastures for both domestic animals and wildlife, including mountain sheep.

III. English Language Publications

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Calhoon, J. A., Wildcat, D. R., Annett, C., Pierotti, R., & Griswold, W. 2003. Creating Meaningful Study Abroad Programs for American Indian Post-Secondary Students. Journal of American Indian Education 42(1), 46-57. http://jaie.asu.edu/abstracts/abs2003.htm

Calhoon, A., W. Griswold, J. Ivie, and C. Annett. 2002. Water monitoring project links Indigenous students from Kansas and Altai. Give and Take: The Journal of the Initiative for Social Action and Renewal in Eurasia. Spring 2002, Volume 5, Issue 1, pages 28-29. http://www.isar.org/isar/archive/GT/GT14griswold.html#top

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Griswold, W.M. and C.A. Annett. 2002. Kansas-Siberia partnership addresses drinking water quality issues in rural and indigenous communities. International Ecological Congress Journal, Spring 2002, volume 5, number 2, pages 39-41.

Malkov, N.P., 2001. Altai Republic Album, Ak Chechek, Translation by V.N. Lukyanenko.

Mikkelson, J., and M.Winchell. 2001. Contributed material from their English language translation of Valentin Rasputin's book Siberia, Siberia to the publication Altai Republic Album, Ak Chechek.

Published Abstracts

Mamreshev, V., and A. Tlisova. The monitoring of drinking water quality in the Altai Republic (abstract). Journal of Ecology and the Problems of Environmental Protection, Krasnoyarsk. In press.

IV. Media Coverage

English Language Press

The Lawrence-Journal World, Volume 141, Number 310, November 6, 1999, "Water expertise flows to Siberia," by Dave Ranney.
http://www.webarchives.net/november_1999/group_hopes_for_russian_exchange.htm

Earth Medicine, Volume 6, Number 2, Fall 1999, "HINU and Siberian university partner to assess water quality."

The Indian Leader, Volume 104, Issue 6, November 13, 2000, "Altai exchange program," by Glen Gary, student participant in the ALO exchange program.

The Lawrence-Journal World, April 23, 2001, "Haskell delegation building warm relationship with Siberians, by Dave Ranney.
http://www.ljworld.com/section/citynews/story/50279

The Lawrence Journal-World, May 14, 2002, "Russian visitors tour wetlands," by Dave Ranney http://www.ljworld.com/section/citynews/story/92855

Lindsborg News Record, May 23, 2002, "Siberians bring water from home for tests at BC."

Lawrence Journal World. June 2, 2003. "Russian visitors study Kaw for answers to take home." By Abby Mills.
http://www.ljworld.com/section/citynews/story/133947

Lawrence Journal World June 1, 2003. "State: Siberian visitors to join float trip on Kansas River".
http://www.ljworld.com/section/archive/story/133815

Lawrence Journal World November 28, 2003. Friends and neighbors.
http://www.ljworld.com/section/bigger_photo/96230

The Manhattan Mercury June 3, 2003. "Russians study Kansas River during visit".
By Associated Press
http://www.themercury.com/stories/article.12424.aspx

Russian and Altaian Language Press

The Altaidyn Cholmony (Altaian language newspaper) and the TV news in Gorno-Altaisk reported on the March 2001 visit by U.S. partners.

1999 – Zvezda Altaya (The Altai Star). "Joint project of the universities." Victor Lukyanenko and Nikolai Malkov were featured. The article contained a description of the project and the prospects of its development. Also included was information on the purpose of the project, universities, USAID, and U.S. partners.

March 2001—Zvezda Altaya (The Altai Star). "The festival in the city." The article was about the Nauryz (Moslem) festivities in the city of Gorno-Altaisk. The author noted, "That was a very nice surprise to be greeted by a representative of the Euchee Tribe who wished warm sun and clear water to the Altaian people."

Summer 2001—Zvezda Altaya (The Altai Star). An article about the Haskell students. The article presented information about the project, English language classes, and the chance for GASU students to go to the U.S.

Summer 2001 – Ulala (The Altaian language newspaper). An interview with Dustina Edmo, HINU student from the Shoshone-Bannock Nation.

2002—Post Scriptum. The article reported on a press conference held at the university after the GASU delegation's May visit to the U.S. where results of the trip and its benefits to the university, faculty, students, and water quality was discussed.

2002—Zvezda Altaya (The Altai Star). "The grant of the future." Nikolai Malkov and Victor Lukyanenko were interviewed about their recent trip to the U.S. The article focused on how we live on a very small planet, which needs the concern of ecologically minded people.

2002—Zvezda Altaya (The Altai Star). An article about GASU biology students. Of specific interest is the mention of Lena Vysotskaya, who received a monetary award from the Altai Republic government and the World Wildlife Federation for her work based on fieldwork accomplished with Nikolai Malkov and Cynthia Annett, and related to the USAID/ALO project.

2002—Zvezda Altaya (The Altai Star). "To the ecological well being." Interview with Cynthia Annett and Wendy Griswold on the conclusion of the initial project and future collaborations.

Newsletters

Connections between indigenous peoples in Siberia and America. (2003). Biohawk, the University of Kansas Biology Division newsletter.

TV/Video Broadcasts

March 2001 – Nauryz interview, GTRK (State Television/Radio Company)

Summer 2001 – Republic's anniversary interview, GTRK (State Television/Radio Company)

Summer 2001 – Interview of Dustina Edmo, GTRK (State Television/Radio Company)

Summer 2001 – Dance performance (at gymnasium and celebration), GTRK (State Television/Radio Company) and Planet Services Company

June 2002 – Press conference held by university – attended by over 80 people, including some from different parts of the republic, GTRK (State Television/Radio Company)

2002 – Community meeting at the gymnasium to discuss the recent visit of GASU representatives to Kansas (was video taped).

2002 – Lena Vysotskaya on television about her participation in the field trip, GTRK (State Television/Radio Company)

V. Online Resources

Streaming Video: Community-Based Drinking Water Quality Analysis: A partnership between Gorno-Altaisk State University and Haskell Indian Nations University
http://www.seekpeace.com/civil/hinugasu.mov

http://www.engg.ksu.edu/HSRC/international/altai.html

http://www.engg.ksu.edu/HSRC/UMEB/

http://www.ksu.edu/grow/ExpeditiontoAltai.html

VI. Grants Supporting Water Quality and Grazing Research Program

U.S. Department of Agriculture Scientific Cooperative Exchange Program. "Assessing the impact of traditional grazing techniques on drinking water quality: A cooperative program between Haskell Indian Nations University and Gorno-Altaisk State University, Russia." 2000-2003. Dan Wildcat (HINU) and Nikolai Malkov (GASU). $44,987.

U.S. Agency for International Development/ALO "Community based drinking water assessment- a cooperation between Gorno-Altaisk State University and Haskell Indian Nations University." 1999-2002. Dan Wildcat (HINU), Larry Erickson (KSU), Maria Carlson (KU) and Nikolai Malkov (GASU). $181,932.

U.S. Environmental Protection Agency. "Science and traditional knowledge: International exchange of indigenous peoples in water quality monitoring and river management between Russia and the United States." Larry Erickson (KSU). $66,775.

U.S. Agency for International Development/ALO "Media relations for science reporting and environmental advocacy: facilitating higher education leadership and administration at Gorno-Altaisk State University." Larry Erickson and Jackie Spears (KSU), Mike Cuenca (CSG) and Victor Lukyanenko (GASU). $ 125,000

National Science Foundation, Undergraduate Minorities in Environmental Biology Program. "Recruiting Native Americans into the environmental sciences." Ray Pierotti (KU) and Larry Erickson (KSU). $443,000. NSF Proposal Number 0203404.

World Wildlife Fund, Russian Office. Individual grant under the Altai Sayan

Programme on Biodiversity. Lena Vysotskaya (GASU). $250.

National Security Education Program Graduate Fellowship. "The association of quality of drinking water with academic, social, and cognitive functioning of children in the Altai Republic." 2001-2002. Jennifer Ivie, (KU) and Tatianna Lukyanenkova (GASU). $21,000.

National Endowment for the Humanities Extending the Reach: Institutional Grant to HBC, HIS, and TCUs. "Technical support for international coursework development for tribal colleges." Mike Cuenca, (HINU). $24,826.

Postscript

On September 27, and October 1 2003 earthquakes struck the Altai Republic. They ranged between 7 and 9 on the Richter scale, and have been followed by a large number of aftershocks that are still ongoing. This has significantly impacted our project, since the earthquakes struck in the southern region of the republic, the area that is the focus of the grazing and water quality research program. This region is the most impoverished and has the highest population of indigenous Altaians. In many areas, discharges released by the quakes have contaminated the drinking water. Schools and other public facilities were either destroyed or damaged severely. Families have been separated as children were moved northward to safer communities with undamaged schools. The rebuilding effort is ongoing as of the writing of this report (March/April 2004) and involves drastic changes to communities in that region. We will continue to maintain the water quality monitoring program, although the results of sampling will be significantly impacted by the release of highly saline water and the need to move villages to sites further from the epicenter of the quakes.

Program Sustainability: Summer 2004

The data from the USDA/SCRP project on pasture management will be used as a case study for our new USAID/ALO grant ("Media relations for science reporting and environmental advocacy: facilitating higher education leadership and administrative transformation at GASU" Larry Erickson, Victor Lukyanenko, and Mike Cuenca co-PIs. Partnering with Higher Education for International Development 2002 Special Request for Applications.) A student participant on the UMEB grant will help to film and edit the video documentary of the work. We plan to use the activities funded by the new ALO

media grant to facilitate dissemination of information about water quality and rangeland management in the Altai.

Research plan for NSF-UMEB project led by Dr. James Steichen of KSU

The objective is to plan a research activity focusing on improving water quality of runoff water entering Lake Teletskoye in the Altai Republic of Russia. The research anticipated may include some or all of the following:

- Modeling the potential benefit of using riparian buffer strips to improve water quality before runoff enters stream
- Monitoring of surface and underground waters, soils and plants where their chemical and microelement composition is studied
- At present the number of tourists visiting Lake Teletskoe has grown greatly and with the developing construction on the shores of the lake the pollution of it by oil and phenol products has also grown. The methods to determine oil products with the low content of hydrocarbons are based on IR spectroscopy.
- Study the feasibility of other stormwater management strategies to protect water quality.

This research must be conducted on site at Lake Teletskoye in the Altai Republic of Russia. The topography, climate, and other local conditions are essential to the relevance of the research.

Lake Teletskoye, as described in greater detail under Research Venue, is a unique and pristine body of water and the target of developing interest as an eco-tourism site. It is essential that development occur in a way that doesn't detract from the essential quality of Lake Teletskoye itself.

Research Venue

Lake Teletskoye is the largest body of fresh water in south-western Siberia and is Siberia's largest lake after Lake Baikal. The lake is about 78 km long and has a surface area of 233 sq. km. Lake Teletskoye is exceptionally deep with a maximum depth of 325 m. Lake Teletskoye is also called Altyn Kyol (Golden Lake). It is the pride of the Altai Republic. Lake Teletskoye is protected as a natural monument and was designated as a World Heritage Site in 1998. Though smaller than Lake Baikal, Lake Teletskoye has many similarities; including great depth and exceptionally clear water (up to 15.5 m visibility). Lake Teletskoye is more remote and is still in nearly pristine condition.

The Altai Republic of the Russian Federation is located in southern Siberia, just north of where Mongolia, China, and Kazakhstan join. The population is only about 200,000. As Lake Teletskoye becomes better known, there is a desire to develop the Lake as an eco-tourism site. Few facilities exist for tourists. Tourism is increasingly seen as an important aspect of future development in the region. Economic development is needed, but there is concern about rapid development damaging the unique character of Lake Teletskoye, especially its visual clarity and pristine purity.

Figure 1 is a map showing the location of three natural monuments in the Altai Republic. Lake Teletskoye is located in the north-central part of the map. The area enclosed by the red line is the watershed. Mongolia, China, and Kazakhstan are on the

south edge of the map. The other two areas in red are mountainous natural monuments, including Mt. Belukha (elevation: 4506 m).

Figure 1. A map showing the three natural monuments of the Altai Republic of Russia. Lake Teletskoye and its watershed are located within the area in the north-east part of the map.

Figure 2. Lake Teletskoye.

In June 2003 a group of Russian visitors from GASU came to the KSU campus, I met several including the Rector, Yu.V.Tabakayev. Rector Tabakayev invited us to conduct research together. He reminded us that GASU has a research station (Figure 3) located near the shore of Lake Teletskoye and that we could work together at that facility. Other faculty members included Victor Lukyanenko the Dean of Languages, Vera Aleinikova, the chair of chemistry, and Victor Mamrashev, a new faculty member in chemistry. The chemists are active participants in the Drinking Water Quality Monitoring project. Both Dr. Aleinikova and Dr. Mamrashev will be active members of my research team. The Siberian Branch of Russian Academy of Sciences also has research facilities at Lake Teletskoye.

Figure 3. The Gorno-Altaisk State University Research Station located at Lake Teletskoye.

Research Methodology

Riparian buffer strips are areas of grass and woody vegetation along streams that are protected and managed to improve runoff water quality and protect the stream and therefore Lake Teletskoye. Figure 4 shows algae growth, an indication of excess nutrients. A small stream draining a populated area enters Lake Teletskoye here.

Riparian buffers can slow runoff water allowing sediment to settle out and also remove some nitrogen, phosphorus, and fecal coliform bacteria. I believe that it would be possible to study some of the small watersheds that drain developing areas adjacent to Lake Teletskoye. I understand that a geographic information system (GIS) database exists for the Lake Teletskoye watershed. A GIS could be used to model the effectiveness of riparian buffer strips for protecting streams. The GIS could also be used to identify areas that offer the best potential for improving and protecting streams.

I plan to visit GASU and the Lake Teletskoye research station in July 2004. Working with GASU faculty, we will determine what data (including GIS coverages) exist or will need to be collected in order to do some preliminary modeling.

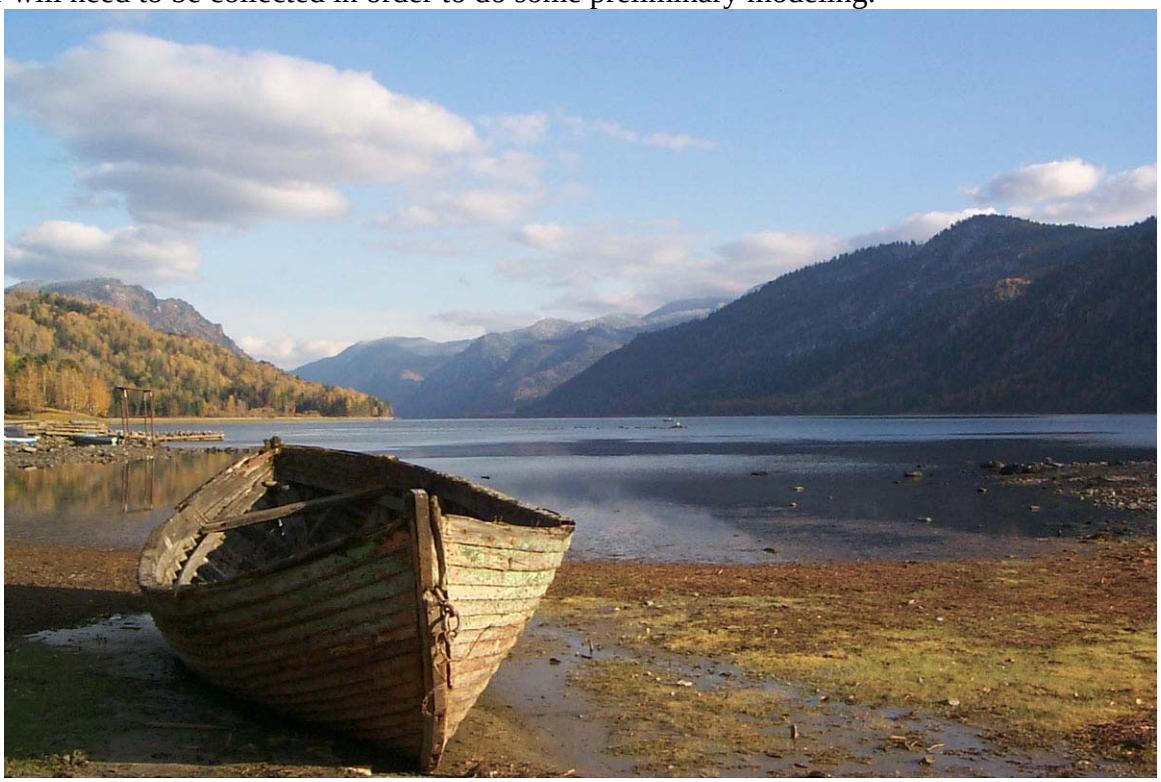

Figure 4. Note the algae growth where a small stream drains into Lake Teletskoye. This stream drains from a populated and developing area.

The Riparian Ecosystem Management Model (REMM) will be considered for use in this research. A major benefit of the REMM model is that it incorporates vegetative growth and nutrient dynamics. Some riparian models only use the sedimentation and trapping characteristics of the riparian buffer. In an attempt to provide a riparian buffer assessment tool, the Riparian Ecosystem Management Model (REMM) (Figure 5) (Lowrance *et al.*, 2000; Inamdar et al, 1999a; Inamdar et al, 1999b) was developed. Currently, the REMM model is state of the art for assessing riparian zone function for control of sediment and nutrient NPS pollution.

The site visit to Lake Teletskoye may find that steep topography may limit the feasibility of using riparian buffer strips. Alternative research strategies may include more analysis of a target sub-watershed to assess the feasibility of storm water management using sediment basins or related strategies. Using the GIS for the local area may help us focus on target areas.

Forestry operations in the Lake Teletskoye watershed have also been identified as contributing to pollution of Lake Teletskoye. Collecting data about the location and extent of forestry operations will also be necessary.

I see this as a preliminary research planning trip. Working with GASU faculty we intend to assess our alternatives and choose a research project that is important for the region and fits the capabilities of the team members. The research planning trip will occur during July 2004. Our plan is to decide upon a project and strive to complete a draft publication within a year.

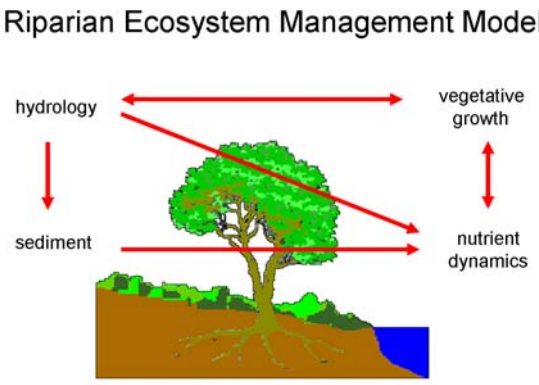

Figure 5. The Riparian Ecosystem Management Model (REMM) is a comprehensive ecosystem model that integrates hydrology, sediment transport, vegetative growth, and nutrient dynamics.

Impact of Research

We anticipate that this research will include the involvement of one or more of the tourist resort enterprises. Positive outcome from the research can be discussed in connection with benefits for increasing the opportunity for tourism and resulting economic benefits for local residents. The GASU-KSU Environmental Journalism project can publicize these benefits.

Successful completion of the anticipated research will add to the experience and capabilities of the faculty at GASU and could lead to further cooperative projects.

Support for Transitions

The outcome from research supported by this grant is directly tied to economic development of the eco-tourism potential of the Lake Teletskoye region of the Altai Republic. The Altai Republic is located in southwestern Siberia. It is relatively isolated and needs economic development. The environmental assets of the lakes and mountains of the Altai Republic are exceptional. Currently there are few tourist facilities available. A few travel companies have brought tour groups to the Altai Republic. Most tourists are from Russia, but foreign travelers are also coming. There is a strong demand for high quality, pristine environmental enjoyment and recreational activity.

A major concern is that this development occurs in a responsible manner that protects the environmental resources that attract tourists. My proposed research focuses on adapting management practices that improve the quality of runoff water from developed areas before it reaches the streams and Lake Teletskoye. Tourist resorts can publicize these water management practices as a measure of their environmental stewardship.

A related program will support these relationships. In 2003, the institutional partnership between Gorno-Altaisk State University (GASU) in the Russian Federation of States, Kansas State University, and The Civil Society Group LLP, received funding from USAID/ALO to improve higher education leadership and facilitate administrative transformation at GASU, the only higher education institution in the Altai Republic. This program focuses on environmental journalism. They can help tell the story of a successful strategy to combine environmental stewardship and economic development.

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