

2001

Mini-Proposal for (MORRES) to USDA

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Lehrer, H., & Bowen, B. D. (2001). Mini-Proposal for (MORRES) to USDA. , (). Retrieved from <https://commons.erau.edu/ni-s1eb-usda/1>

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Proposal to the US Department of Agriculture

May 8, 2001

1. **Project Title: Missouri River Remote Sensing (MORRES): A Partnership Between the NE NASA Space Grant and Selected Great Plains Tribal Governments**
2. **Principal Investigator**
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3. **The Application**

The Missouri River Basin (Mni Sose in Lakota) is home for the major portion of the Northern Great Plains Indian Nations. The extent of tribal land in this area is estimated at well over 15 million acres and the Missouri River drains that land and flows toward the Gulf of Mexico via the Mississippi River. However, the Missouri River is considered by many to be one of the most endangered tributaries in this country. Specifically, there are many indigenous species of fish and wildlife (pallid sturgeon, interior least tern, and piping plover) that are considered endangered or are rapidly approaching that status. In addition, Indian Nations in the region are faced with increases of population, changes in land use, issues related to urban industrial growth, and a reduction in general water quality.

In many areas of the country, community awareness and action to mitigate the effects of similar economic, environmental, social, and political issues outlined above are progressing well. However, American Indians in general and the tribal nations of the Upper Missouri River Valley specifically have not been as fortunate in meeting and solving these challenges. In many cases, tribes have not possessed or had access to the technical expertise, environmental technology, or appropriate information to begin to address and solve these major issues.

The project outlined in this brief proposal intends to attempt to rectify some of the inequities outlined above. In addition, the project is envisioned to have a more regionally focused approach rather than just encompass the Native American tribes of Nebraska. This unique conceptual framework has been selected because the problems and the solutions for these problems will have a much greater impact than on just one state. Additionally, future expansion of this research will naturally include several other neighboring states so it seems most expedient to build a multi-tribe and multi-state infrastructure from the onset. The charter tribes for this project will include from 4 to 6 of those currently located in Nebraska (Ponca, Omaha, Santee Sioux, and Winnebago) and South Dakota (Cheyenne River Sioux, Crow Creek Sioux, Ogallala Sioux, Rosebud Sioux, and Yankton Sioux). However, by maturity, MORRES could include as many as twenty-seven tribes in the Upper Missouri River Valley.

4. Information Products from the Application

The use of remote sensing technology and remote sensing based products have not been heavily used by tribal governments in the past. This proposal represents an effort to incorporate readily available remote sensing based datasets with other geospatial products to produce an operational system to enable tribal leaders to assessing on a current basis the status of their environmental infrastructure. This will involve not only assessing the status of their environmental assets but evaluating problem areas and using geospatial techniques in coming up with workable solutions and maintaining continuous assessment of the status of corrective actions. The primary emphasis for this project will be resource management but depending upon tribal needs may also provide the basis for limited environmental assessment and disaster management.

While each of the tribal governments targeted by this proposal will have different specific concerns in terms of resource management all of them are dependent directly on accurately assessing and maintaining their environmental resources. These resources not only have meaning in a spiritual sense to the tribes but also from the standpoint of providing a major asset for tribal economic development.

Themes:

1. Range ecosystem--simple forage production model based on water balance and monitored by AVHRR;
2. Climate probabilities in terms of continuous monitoring for potential crop success based on soil type and crop--i.e. drought;
3. Tying together range composition and plant communities from SSURGO data with Landsat Land Cover data (used as mask);
4. Identification of soils which are highly erodible or subject to saline development with Landsat.

Operational Concept

A vast portion of tribal reservations in the Upper Missouri River Valley consist of farming and grazing lands. In many cases, a good portion of this land is not as productive in number of bushels of grain/product harvested or head of cattle/buffalo sustained. While there are a variety of reasons for this deficiency, it seems very logical that the regular and routine use of geospatial information by this project can greatly enhance these yields. In the past though, such data were not available to tribal governments for their use.

It is also envisioned that both satellite and aerial remote sensing information can be used to develop better range management, water quality, and land management as well. Specifically, areas of assistance to tribes will be in the form of dissemination of data on soil interpretation, root/zone available water holding capacity, potential corn and soybean yields, and hydrological soil group specifics.

The mechanism for the utilization of these data will involve specialists at both the universities involved and on each participating reservation. The geospatial specialist hired for this project will be housed at the University of Nebraska at Omaha (UNO). This person will possibly be a graduate biology or remote sensing student pursuing an advanced degree; the specialist will work closely with remote geospatial decision support experts already in place at both UNO and at the University of Nebraska at Lincoln (UNL). A key responsibility for this person will be to travel to participating tribal locations and train and assist local environmental team members.

A tribal geospatial specialist is also an integral part of the project and there must be one such individual on each participating reservation. This individual may already be in place on several reservations and already acting as an environmental specialist. However, it is believed that this person may need to be trained in the use of remote sensing data and such training is a key component of the initiative. The tribal geospatial specialist will work directly with the tribal government on utilization and dissemination of the remote sensing data.

5. Co-operating Agencies

- a. Mni Sose Intertribal Water Rights Coalition, INC. Rapid City, SD: This Coalition assist Tribes in the protection of their rights to use Missouri River water, its tributaries, and groundwater located on or near their respective reservations.
- b. The Earth Resources Observation System (EROS) Data Center (EDC), Sioux Falls, SD: EROS is a data management, systems development, and research field center for the US Geological Survey=s National Mapping Center. The EDC is designated as a World Data Center for Remotely Sensed Land Data.
- c. Center for Advanced Land Management Information Tec (CALMIT), University of Nebraska at Lincoln, Lincoln, NE: CALMIT has significant expertise in advanced land management, remote sensing, and automated cartography. The Center regularly distributes remote sensing imagery and geographic information to users.
- d. Remote Sensing Laboratory, University of Nebraska at Omaha, Omaha, NE: Remote sensing experts at UNO. The training of the geospatial specialist will be the responsibility of these experts.
- e. South Dakota Space Grant (SDSG), Rapid City, SD. A Memorandum of Understanding has been signed to work with Nebraska on Tribal educational matters and it is foreseen that understanding will be expanded to include this initiative.

6. Co-Investigator and Staff

- a. Brent D. Bowen, Ed.D., Professor, University of Nebraska at Omaha
- b. Henry R. Lehrer, Ph.D., Professor, University of Nebraska at Omaha
- c. Jeffrey S. Peake, Ph.D., Professor, University of Nebraska at Omaha
- d. Jim Merchant, Ph.D. Center for Advanced Land Management Information Technology (CALMIT), University of Nebraska-Lincoln

- e. Edward Zendajas (Omaha), J.D., Assistant Professor, University of Nebraska at Omaha
- f. Mary Fink, NE NASA Space Grant, University of Nebraska at Omaha

7. **Contributions from non-NASA Sources**

Substantial non-NASA contributions are anticipated through this multi-faceted collaborative research project. Each of the participating organizations has indicated a provision of co-funding support. University partners are anticipated to provide the majority of matching funds. The government partners will provide contributions ranging from data supply to personnel involvement. Realizing the substantial fiscal constraints of the Tribal community, co-funding from these partners will likely be in the form of project personnel co-funding.

Additional value-added support will be provided by the Nebraska Airborne Remote Sensing Facility. This facility was funded by an equipment grant from the National Science Foundation to purchase an aircraft and equipment for applied research and technology data acquisition. Now operational, this facility is co-funded by the State of Nebraska and will provide enhanced data support to the project. Provision for immediate data augmentation and emergency response data needs will be maintained in support of this proposed project.

While not a non-NASA contribution, strong encouragement has been provided by Dr. Julius Dasch, Program Manager, NASA Space Grant and EPSCoR Programs, to direct state-based NASA program funding toward this Broad Agency Announcement. Nebraska and South Dakota have answered this call through the provision of this proposal and will provide direct/indirect funding support to the Tribal partners.

8. **NASA Contribution**

The proposed project will take advantage of and benefit from NASA resources, such as data sets, science results, technology innovations, and scientific personnel participation. Although which NASA center(s) will be utilized for this study is(are) still in the conceptualization stage, it would appear that likely participants could be from the Earth Resources Observation System (EROS) Data Center (EDC), Sioux Falls, SD and possibly the NASA Goddard Space Flight Center (GSFC) Biospheric Sciences Branch (Code 923) and Hydrological Sciences Branch (Code 974).

At EROS, the NASA Earth Observing System Data and Information System has one of the world's largest collections of remotely sensed data for land masses. Such data that might be useful for this study includes Landsat 7, archival data sets from ASTER, MODIS, and Terra. At NASA GSFC Biospheric Sciences Branch, various aspects related to terrestrial ecosystems and their interaction with the atmosphere using remote sensing technology are available.

Key dataset information needed should support the study of plant growth, soil processes, and canopy energetics to understand how changes in rangeland ecosystems can be characterized. In addition, the use of remote sensing measurements from ground-based, airborne, and satellite-based platforms will be explored as to how these relate to ecosystem models with specific application to tribal land management and water quality issues.

Other interesting and useful remote sensing products that are relevant to tribal government application include: (a) integration of remote sensing technology with crop growth models; (b) detection and site-specific weed control; (c) soil characterization and soil pedology using remote sensing; (d) detection of stressed crops and defoliation using remote sensing; and (e) application of remote sensing for monitoring transportation infrastructure, such as highways, railroads, etc.

There is reluctance at this stage of the proposal to be too prescriptive as to the specific techniques, application implementation, and data utilization for this study at this purely conceptual stage. This reluctance is due primarily to the fact that one cannot be too certain that the end users, the tribal governments, will be initially able to use the NASA datasets in a raw form. It is anticipated that a certain amount of infrastructure building and technology training will be a necessary preamble to full realization of NASA data selection and utilization. Another reason for a somewhat guarded response to this portion of the abstract is that the tribal government must not be made to feel that it has no choice in the selection of the problems to be studied and the manner in which the data are utilized; however, most of these questions will be answered before the full proposal is submitted since preliminary discussions have begun with several Nebraska tribes (see Letters of Support) .

9. Anticipated Funding Request By Year

It is anticipated that the full funding request of \$400,000 will be made in each of the years of the grant. However, in Year 2, it is anticipated that an approximate 10% match, or \$40,000, will be generated from the tribal governments. In the third year, a 20% match, or \$80,000, is anticipated.

10. Letters of Support

Discussion of the project has begun with tribal officials of the Omaha Nation, the Ponca Tribe of Nebraska, and the Winnebago Tribe as well. Letters of support will be available from these three tribes for the full proposal submission. In addition, it is anticipated that the Santee Sioux and the Yankton Sioux will provide letters of support as well. It is important to note that a central theme that has run through these preliminary contacts is to determine the specific problems that each tribe feels it must tackle first should NASA remote sensing data become available.