GCMRC Stakeholders-Technical Work Group **December 8 1999**

River Health Proposal

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Todays Objectives:

1) Description of Northern Arizona University integrated watershed proposal.

2) Seek comments on the proposal outline as part of the stakeholder requirement for this competition. Are they any research components that we could look into that are not part of the GCMRC AdaptiveManagement Process in a river health context?

3) Determine if the TWG would like to hear from us if we are awarded the grant. This could be an annual presentation. In turn we would make our results avaliable to the TWG/GCMRC as they become available. We plan to have a web site for interested agencies to keep track of our progress which would include focus groups dates and locations that your are invited to attend.

If any TWG memeber would like ro review a draft the proposal please let us know. The proposal is not due until April 2000.

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Draft of EPA/NSF/USDA Water and Watersheds RFA

Title: An ecological indicator of aquatic health in the upper Colorado River basin and Grand Canyon based on a benthic carbon/invertebrate mass index and the regions social value orientations.

Program Description

Objectives:

Create an effective stream health monitoring program for the upper Colorado River basin through the following objectives:

1) Determine a baseline of benthic organic carbon and macroinvertebrate mass throughout the upper Colorado River basin and Grand Canyon.
2) Define basic water quality variability throughout the Colorado River basin.
3) Create a benthic organic carbon mass to invertebrate mass index with water quality as a co-variate for the upper Colorado River basin for use as an ecological indicator of aquatic health. This index would be a useful communication tool for the agencies that are responsible for monitoring the Colorado River as it crosses their jurisdiction.
4) Develop a baseline of how the regions people relate to the upper Colorado River in terms of river health, economics, growth and development. Examine the values of people living within the Colorado River region and track the relationship over time between demographic changes and shifting value orientations. Analyze people's perceptions of science and understand the likelihood of people modifying their behaviors based on information derived from scientific studies.
5) Interact with the Grand Canyon Adaptive Management stakeholders about the development and results of this proposed research. Communicate results through an internet site, workshops and popular press articles.

Approach:

Ecological

The Colorado River Basin is one of the most regulated, through dams and diversions, river basins in the world. Dams disrupt the down stream flow of carbon between reaches and resets characteristics of the river to that of a headwater stream. This serial discontinuity (Ward & Stanford, 1983) and lack of connectiveness between reaches results in many changes in the structure and function of aquatic processes. Therefore, many of the typical monitoring techniques such as aquatic diversity indices are not applicable to the Colorado River basin. For example in the tailwaters of Glen Canyon Dam, Arizona, macroinvertebrate community is comprised primarily of an amphipod Gammarus lacustris and a neartic assemblage of 12 chironomids. If these data were compared to a typical invertebrate health index it would score as an aquatic community in poor health because of low taxa richness. However, invertebrate biomass estimates range between 2.9 and 10.5 g/m^2 AFDM and support a prolific trout fishery along with wintering water fowl (Stevens et al. 1998) which indicate a healthy aquatic habitat. Our data from the main stem Colorado River and major tributaries through Grand Canyon, and above Lake Powell in Canyonlands National Park indicate that estimating carbon mass (algal, aquatic plant and detrital sources) and macroinvertebrate mass are good common denominators for all reaches within the Colorado River basin. We propose to expanded our collections up to the headwaters of the Green, Colorado, San Jaun and Little Colorado Rivers for two years and then validate the index during the third year.

Physical Research

Along with this benthic mass index basic watenr quality variability will also be assessed throughout the upper-Colorado River basin and Grand Cayon. Basic water quality parameters (temperature, pH, conductivity and dissolved oxygen) are important abiotic variables which can influence aquatic community structure. Determining water quality patterns with modern electronic equipment is relatively inexpensive and very reliable. We also plan to use existing water quality data from the United States Geological Survey gaging stations. This information will be used as a co-variate to determine if changes in the carbon mass within a watershed occurred with a corresponding change in water quality.

Social Science Research

Assessing value orientations and resident perceptions of science, using the tools of social science research, is key to the success of a monitoring program. This region is not heavily populated or industrialized as most river basins, however use pressure is high generally outside of the basin. This paradox occurs because of inter-basin transfers of water that start in the headwaters and continues through to California and hydro-power production. Defining a baseline of data that characterises peoples values and perceptions is important for understanding how important the river is to people's daily lives and how their lifestyles affect river health. By linking individual values with people's perceptions of science, an analysis of the range of adjustments people are willing to make to maintain some level of river health is developed. Key to this information is knowingthe level of trust people assign to scientific information. This data set would then be used to access how the values of the region are changing over time with population growth and development.

Venn Diagram Response (as depicted in EPA/NSF/USDA RFA)

1 = Development of a river health index for the upper Colorado River basin.

2 = For example, if it were determined that a land use practice was reducing the health of the river through increasing sediment loads, then to what extent will the regions people support changing the land practice in relation to economic or life style changes? Our overall research design should be adequate enough to answer this question with a defined level of error.

3 = For example, what is the relationship between carbon/macroinvertebrate mass estimates and water quality between and within the major tributaries? Our overall research design should be adequate enough to answer this question with a defined level of error.

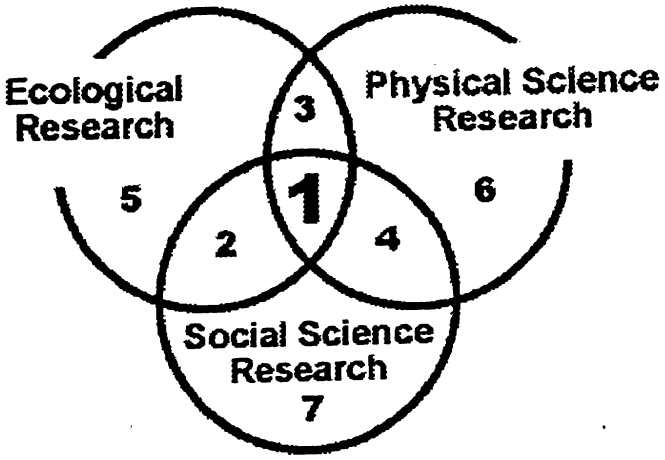
4 = For example, how variable are the peoples' preception's of river health between and within the major tributaries? Our overall research design should be adequate enough to answer this question with a defined level of error.

5 = Ecological research would include expanding carbon and macroinvertebrate mass estimates on cobble bars from the Grand Canyon up to the head water of the Colorado River.

6 = Physical research would include examining the three major tributaries, Green, Colorado and San Jaun River for basic water quality variability. With additional USGS data we will be able to define baseline water quality for a given reach of the river.

7 = Social science research would include developing a baseline defining the relationship of the regions people with the Colorado River and how important river health is to these citizens.

The following Venn diagram illustrates the conceptual approach:



The illustrated multidisciplinary areas may include the following. These are not necessarily exclusive and are not presented in priority order:

- Ecological Research: Ecological research that addresses diversity and vitality of aquatic biota and ecological processes and/or relationships among populations and communities of organisms. Statistical, mathematical, and bio- or environmental-engineering research on these topics is also included.

- Physical Science Research: Hydrologic, biogeochemical, chemical, and engineering research that addresses the processes and mechanisms which govern the interactions of nutrients, organic matter, metals, toxic materials, and organisms within and among surface waters, ground waters, sediments, soils, and the atmosphere. This area includes mathematical and statistical modeling and engineering research on these processes.

- Social Science Research: Social science research that develops a systemic perspective on, and predictive understanding of, the impacts and spatial aspects of human behavior/attitudes/perceptions/cognition, and social, geographic and economic systems on water resources and watersheds. This area also includes statistical research with a social emphasis. Note that simply demonstrating applicability of the research to social, economic or management issues is not adequate for the purposes of this competition.

Some examples of interest include, but are not limited to:

1. Research on total maximum daily loads (TMDLs). Under the Clean Water Act, States have the authority to impose TMDLs on the amounts of point and non-point sources of pollution that impair the quality of rivers, lakes, and estuaries. This announcement of opportunity solicits research proposals that will improve our understanding of watershed

processes relevant to TMDLs and of analytical methods for determining how changes in the management of upland and riparian areas affect the quality of water bodies. Watershed processes of interest include those that affect streamflow, erosion, sediment transport and routing, stream temperature, stream habitat, inputs of nutrients and toxics, and the relation of these processes to aquatic ecosystem health. Analytical methods of interest include distributed process models and process-related indicators of watershed condition that can be derived from remotely sensed imagery. In addition, research is needed to define disturbance thresholds, understand the cumulative effects of multiple stressors at different scales, and quantitatively define the uncertainty associated with interpretation of model simulations or inferences drawn from indicators. Please refer to the TMDL web site at http://www.epa.gov/owow/tmdl/.

2. Research on watersheds that includes agricultural activities. Organic wastes from animal and municipal sources, fertilizers and pesticides from agricultural sources, and sediments from all sources provide a challenge in developing strategies for pollution prevention and/or remediation. Research is needed that addresses the processes and mechanisms that govern the physical and social interactions within these complex ecosystems.

3. Research on the interactions between urbanization and watershed processes. Research is needed on spatial and temporal scaling; contaminant transport, wet weather flows and runoff, including non-agricultural pesticide runoff, and infiltration from urban/suburban areas; and interfaces between terrestrial and aquatic ecosystems.

4. Research on rehabilitation of damaged or degraded watersheds. Examples include the ecosystem and societal processes that must be understood before undertaking rehabilitation efforts; and the objective criteria needed to determine if the rehabilitation effort is effective.

2.3 Review Criteria

In addition to the general review criteria listed in Sections 5.0 and 6.4 of this announcement, Water and Watersheds proposals will also be evaluated on the degree to which the research components are integrated in a systems approach. The likelihood that the proposed research will effectively address questions that are comprehensive in scale and transferable in scope will also be a consideration. Innovative statistical and mathematical approaches are encouraged.

2.4 Additional Considerations

Stakeholder Involvement

The goals of community-based environmental protection are to enhance the community's understanding of environmental issues, build the capacity for communities to address these problems, develop tools, information and data to assist communities in addressing environmental problems, and ensure communities have access to the most credible available scientific information. For this competition, the most competitive proposals will demonstrate involvement

of local governments and/or community groups from inception (developing the research questions and designing the project) to completion of the research project (analyzing and disseminating the results of the research). Please note that stakeholder involvement does not constitute social science research as defined herein.

Integration of Education

It is expected that proposals will include plans for meaningful integration of research with education and outreach. This might include involvement of local school groups in field sampling, lab analyses, or other project activities.

Management Strategy

Each proposal must also provide a separate Management Strategy section of no more than 2 pages. The Management Strategy must include plans for coordinating the activities of the collaborators, and describe the responsibilities of each collaborator, including a designated team leader.

Mission Considerations

EPA's Office of Research and Development's (ORD) Ecological Research Strategy (June 1998) states that the goal of the Ecological Research Program is to 'provide the scientific understanding required to measure, model, maintain, and/or restore, at multiple scales, the integrity and sustainability of ecosystems now and in the future.' Research is organized into four areas: (1) ecosystem monitoring, (2) ecological processes and modeling, (3) ecological risk assessment, and (4) ecological risk management and restoration. This solicitation complements the ongoing research program in EPA Laboratories and contributes to all four research areas. The ORD Ecological Research Strategy is available at http://www.epa.gov/ORD/WebPubs/final.

The NSF's continuing mission is set out explicitly in the preamble to the National Science Foundation Act of 1950 (Public Law 810507):

> To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes.

The Act authorizes and directs NSF to initiate and support:

- basic scientific research and research fundamental to the engineering process,
- programs to strengthen scientific and engineering research potential,
- science and engineering education programs at all levels and in all the various fields of science and engineering, and
- an information base for science and engineering appropriate for development of national and international policy.