Summary

In this report, the members of the NESP Science Panel: (1) review the existing Vision Statement for the NESP and revise it for operational purposes; (2) propose and discuss goals for addressing the ecological component of the UMRS vision; (3) outline examples of potential UMR system- and reach-wide ecosystem objectives and performance criteria to stimulate discussion for further developing objectives through a collaborative process; (4) recommend initial guidelines for addressing system-wide ecosystem objectives, and; (5) identify steps to implement the process.

The NESP vision statement provides the foundation for goals and objectives and sets the broad direction and sideboards for future ecosystem restoration work. The existing vision statement is:

> *"To seek long-term sustainability of the economic uses and ecological integrity of the Upper Mississippi River System"*.

Three concepts underpin this vision: balance, sustainability, and ecological integrity. *Balance* is emphasized by the word *and* linking economic uses *and* ecological integrity. It implies an understanding of a co-dependency between economic and ecosystem conditions and that a successful NESP will result in a future balance between economic prosperity and ecosystem quality. It acknowledges that NESP partners cannot "have it all" and that trade-offs will be necessary to realize the vision.

S*ustainability* is defined for NESP as, "*the balance of economic, environmental, and social conditions so as to meet the current and future needs of the UMRS without compromising the ability of future generations to meet their needs*" (Upper Mississippi River Summit 1996).

A cornerstone of UMRS sustainability is *resilience*: the ability of the system to absorb disturbance and still retain its basic function, structure, and feedbacks. Centuries of urbanization, poor land-use practices, stream channelization projects, and construction and operation of dams have changed the flow and stage relationships, sediment transport, and biotic patterns within the UMRS. The UMRS has shifted to a new ecological regime wherein levels of underlying controlling variables and their feedbacks have changed. Add to this the uncertainty associated with forecasted climate change effects, and it is challenging to predict when the UMRS might again become sustainable. The NESP partnership must determine the degree of sustainability desired and clearly reflect this desired sustainability in the implementation of economic and ecosystem restoration goals and objectives.

Adopting *ecological integrity* as a part of a NESP vision statement means targeting a system that resembles its natural state as much as possible with minimal influence from human actions. This is a goal that a program like NESP cannot realistically achieve. The NESP Science Panel proposes that the existing definition of UMRS sustainability be simplified for operational purposes: *to achieve sustainability of social-ecological systems within the Upper Mississippi River System*. The original statement implies that the vision will be achieved as long we can demonstrate that we are *seeking* sustainability, even if little progress towards *achieving* sustainability is made. Social-ecological systems are defined as linked systems of humans and nature and emphasize the dualism of social/economic prosperity and ecological quality. Sustaining the UMRS social-ecological system encourages balancing its economy and ecology for the System to be resilient to future threats.

A system-wide approach is process based, rather than site based. Restoring ecosystem structure and function will be more effective than restoring locations in order to achieve a sustainable UMRS because process-based restoration will be more resilient to human and natural disturbances. The success of restoration planning depends on identifying key ecological functions and processes within the UMRS and incorporating them into goals and objectives at all levels.

The ecosystem-wide goal proposed by the Science Panel to the NESP for consideration is:

> *…to conserve, restore, and maintain the ecological structure and function of the Upper Mississippi River System to achieve the vision of the Navigation and Ecosystem Sustainability Program.*

This goal implies conserving the UMRS's remaining structure and function while restoring the degraded components to realize a sustainable UMRS. Five system-wide objectives framed within essential ecosystem characteristics (EECs) are identified to manage for:

1. a more natural hydrologic regime (hydrology & hydraulics);
2. processes that shape a diverse and dynamic river channel (geomorphology);
3. processes that input, transport, assimilate, and output materials within UMR basin river-floodplains: water quality, sediments, and nutrients (biogeochemistry);
4. a diverse and dynamic pattern of habitats to support native biota (habitat), and;
5. viable populations of native species and diverse plant and animal communities (biota).

Examples of performance criteria (Section 5) are provided to promote thought and discussion among partners. Whatever performance criteria are ultimately adopted, they should be based on ecologically attainable future conditions defined by river managers and stakeholders aided by reference conditions. The task of refining these draft objectives and performance criteria at system and project levels depends on collaboration between river managers and the NESP partnership.

The NESP Panel recognizes that achieving system-wide objectives will remain largely project based and propose the following 10 guidelines to help facilitate linking project-scale activities and system-wide objectives:

1. describe and quantify ecosystem objectives (desired future conditions and outcomes) anticipated for the project;
2. identify system-wide goal(s) and objective(s) addressed by the project outcomes;
3. specify how the project will contribute to the desired future conditions;
4. evaluate the project in relation to other management and restoration actions;
5. identify and describe data to be collected and used to measure project performance;
6. implement the project (i.e., build, manage);
7. monitor project performance;
8. compare measured performance with anticipated outcomes/desired conditions;
9. if the project produces desired conditions, maintain project as necessary, and;
10. if the project has not produced the desired conditions, either revisit steps 3 through 9 or abandon the project.

The Science Panel proposes to further develop system-wide goals and objectives to implement UMRS adaptive management. It is anticipated these steps will include the following activities:

1. In collaboration with Project Delivery Teams (PDTs), Navigation Environmental Coordination Committee, and others, use this report and additional input to define an acceptable working approach for further developing reach- and system-wide objectives and performance criteria;

2. Integrate the 43 UMRS environmental objectives reported in Barko et al. (2006) into a system-wide perspective by clarifying the functions they address and the scales at which they apply;

3. With the aid of deliverables from activities 1 and 2 above, hold a series of workshops with the river management community to refine and quantify system-wide and reach- scale objectives and establish performance criteria;

4. Use the workshops to identify a target objective (e.g., restore in-channel sediment transport from the UMRS; re-establish migration pathways of native fishes) at each reach scale for testing and adapting goals, objectives, and performance criteria;

5. Translate these objectives into projects that collectively address reach- and system-level functions and processes;

6. Follow the guidelines to implement project(s), and;

7. Use lessons learned to revise ecosystem objective(s), performance criteria, and management actions.