Synthesis of the Outside Scientist Panel's Comments on Wetland/Stream Environment Zone (*SEZ*) Monitoring

A Symposium on SEZ Restoration Monitoring in the Tahoe Basin: Are we getting the information we need? February 9 and 10, 2010

Introduction

The stated purpose of this symposium was to explore the approaches and techniques used to assess the effectiveness of stream channel and flood plain restoration projects in the Tahoe Basin, with the aim of assessing the efficacy of monitoring protocols used in the Basin. The specific objectives identified for this symposium were to

- Consider past and current Tahoe Basin SEZ restoration programs and examine the approaches developed to assess the effectiveness of stream channel and flood plain restoration projects.
- Learn about monitoring and assessment techniques from outside the Tahoe Basin, to understand their strengths and possible weaknesses.
- Consider proposed frameworks for planning and monitoring the effectiveness of stream and flood plain restoration projects.
- Consider tools to quantify stream and flood plain project-level water quality benefits and inform basin-wide progress in meeting Lake Tahoe TMDL targets.

The symposium organizers convened a panel of six scientists with relevant expertise in stream hydrology and geomorphology, wetlands ecology, and aquatic species ecology. The panel of outside scientists was asked to listen to all the presentations and then provide a critique of the information presented, including recommendations for improvement. The Outside Scientist Panel consisted of Robert Al-Chokhachy (USDA Forest Service Rocky Mountain Research Station), Jeanne Chambers (USDA Forest Service Mountain Research Station), Josh Collins (San Francisco Estuary Institute and Aquatic Science Center), Amy Lind, (USDA Forest Service Pacific Southwest Research Station), Tom Lisle (USDA Forest Service Pacific Southwest Research Station), and Mitch Swanson (Swanson Hydrology and Geomorphology). The members were invited by symposium organizers, Jonathan Long and Zach Hymanson, to comment on the current Wetland/Stream Environmental Zone Program in Lake Tahoe Basin. There is no expectation at this time that this panel will be reconvened. The following comments are the panel's final input to the symposium.

During the two-day symposium, the panel members listened to a series of informative presentations regarding a variety of stream restoration projects, monitoring efforts for those projects, and related regulatory and management concerns. The presenters were very knowledgeable and able to answer all of the panel's follow-up questions. Following these presentations, the panel met in private to construct its comments. Each comment should be considered as a product of the panel as a whole. In the few days following the symposium, the panel revised some of its comments to improve their clarity.

The panel wishes to acknowledge Jeanne Chambers, for both participating in the discussion and serving as scribe. The panel thanks the symposium sponsors and organizers for the chance to provide these comments.

Comments

Kudos!

- We recognize that we are outsiders – our goal is to encourage the ongoing work and we appreciate that you may already be undertaking much of what we are suggesting in our comments.
- Lots of good work is happening. We think all of the work conducted to date has or will have net positive consequences.
- The framework for identifying objectives is good overall. We agree that monitoring must be guided by clear objectives that define project or management success.
    - The framework has been applied well to some SEZ projects and might be retrofitted to others to asses the relationship between their objectives and their monitoring efforts.
    - The framework could be strengthened by a greater focus on defining success in terms of ecosystem potential instead of ecosystem impairments.
    - Given the importance of hydrology to project success, more objectives relating specifically to hydrology are probably warranted.
- The modeling of sediment depositional processes and stream bank stability is strong; models of movement of bed sediment would be a valuable addition.
- The linkage between project objectives and monitoring data is especially close and therefore good for some projects.
- Considerable information about projects and their encompassing watersheds is currently available that could be analyzed at a variety of scales and synthesized.

Philosophy

- Project objectives need to be expanded beyond sediment issues to include broader functions and services of the "SEZ ecosystem."
- Major emphasis needs to be on ecosystem resilience – how climate change, fire, invasive species, and land use will affect SEZ ecological potential over time at a variety of scales, such as reach, watershed, landscape, and the Tahoe Basin.
- The focus on physical process is correct; but additional predictability is needed to establish the linkages between habitat and focal fish and wildlife.

Scales

- The framework and examples presented are focused at the project (reach or multiple reach) scale. The general approach of establishing objectives needs to be applied to larger and longer scales, such as watershed, landscape, and the Tahoe Basin.
- The cumulative effects of projects need to be assessed at the watershed scale. Some watershed assessments have been conducted and these might be redone to determine cumulative effects of projects and effects of large-scale events and processes including wildfire, biological invasion, and climate change.
- Effects of projects and larger-scale events and processes should be assessed in the context of what key functions or services a watershed can or should provide and this can vary among watersheds. The focus on regulatory compliance and on projects in isolation of their watershed and landscape contexts can increase the risk of not identifying larger controls on project success and not achieving success at the scale of watersheds, landscapes, and the Tahoe Basin as a whole.
- The success of a project and its influence at larger scales depend on the position of the project within its watershed and on the landform in which the project is situated. These considerations should influence project objectives.
- The functions of a watershed depend on the continuum of linked process zones (e.g., sediment transport, sediment storage, groundwater recharge, water conveyance) and it should be recognized that restoration projects are embedded in one or more of these zones. These considerations should influence project objectives.

Conceptual Models and Predictive Tools

- Conceptual models are needed as tools to explicitly identify what is known from scientific fact, what can be inferred from fact, and what is assumed or speculated – the latter can be translated into needed research. Conceptual models can be used to facilitate adaptive management and should be periodically revised based on current scientific understanding.
- "How did it get this way?" A synthesis of the geomorphic and anthropogenic history is needed to understand the underlying SEZ ecosystem trajectories (Holocene – last 10,000 years, mid-late Holocene – last 5,000 years; anglo-american settlement since 1840; recent decades). An authoritative reconstruction of the SEZ ecosystem, could aid restoration of all SEZ environments.
- "Where is it going?" Before-and-after monitoring is most appropriate for projects. At larger scales, models will be needed to forecast SEZ ecosystem response to a variety of alternative scenarios for climate change, disturbance, and land use. At the scales of watersheds, landscapes, and the Basin, monitoring should focus on the status and trends of SEZ ecosystem condition as indicated by selected processes or services. Monitoring data at these larger scales can be used to increase model accuracy.
- Concerns about water quality, biological invasion, and fire drive many actions and policies in the Basin. However, climate change likely will be the biggest driver in coming decades. Conceptual models and predictive models are needed to explore

linkages between climate change and SEZ distribution and condition. For example, a drop in lake level due to increased aridity could lower base elevations for local streams and initiate chronic incision.

- One form of risk is that incorrect knowledge of the SEZ ecosystem leads to inappropriate project designs that have undesirable outcomes. Monitoring is needed to reduce this risk by testing the effectiveness of project designs and evaluating the accuracy of the predictions. Monitoring provides the basis for adaptive management, meaning ongoing revision of conceptual and predictive models, adjustments in project management practices, and review of management and project objectives.
- Another form of risk is significant disturbances (e.g., landslides, floods, wildfire) or rapid climate change that leads to project failure. Data that exist to describe the likelihood of such disturbances should be incorporated into the predictive models.
- More models need to be developed to better link habitat with fish and wildlife populations (i.e., ecological functions, ecological services, and beneficial uses). If objectives include wildlife and fish, then monitoring should be conducted to determine restoration success and to further develop the ecological models.

Monitoring Approaches

- We recognize that key processes and functions operate at these scales: reach of stream or lakeshore, landform (e.g., channel, terrace, floodplain, and hillslope), watershed, landscape (i.e., multiple watersheds) and the Lake Tahoe Basin.
- To achieve larger-scale goals, effective monitoring will feed into analyses of SEZ ecosystem form and function at each of the above scales.
- A basin-wide monitoring program is needed that explicitly tracks progress toward goals at all scales. The program should focus on consistent ambient watershed and basin-scale monitoring, project monitoring, and supportive research. Many details will need to be worked out, including funding and institutional relationships. The EPA 1-2-3 framework is reasonable for guiding the planning of the needed program.
- Watersheds that contain stormdrains have unique management objectives and should receive special designation. The approach to SEZ project design and monitoring is the same for watersheds containing stormdrains as it is for other watersheds, although stormdrain projects are likely to have a somewhat restricted set of objectives that focus on sediment filtering and retention. The ecological and hydrological linkages between stormdrains and SEZs need to be understood at the watershed scale.
- "Observational watersheds" or "focal watersheds" should be designated to develop and test conceptual models, predictive models, and monitoring tools. The regional SEZ monitoring program mentioned above might be initiated in these selected watersheds. A set of criteria are needed to guide watershed selection. Representation of the range of climatic regimes and geomorphic characteristics within the Basin should be criteria.

- Distributed, stochastic models (i.e., “desktop watersheds”) could be developed that permit landscape scenario planning to explore possible effects of climate change, major disturbance, and land use on key watershed-scale processes and services of the SEZ ecosystem.
- The assessment of ambient SEZ condition at any scale should be based on a probabilistic sampling design that accounts for the inclusion probability of any candidate SEZ sample site. USEPA can provide guidance on probabilistic sampling.
- The following comments are organized according to the USEPA 1-2-3 Framework for comprehensive environmental monitoring. While the panel recognizes that other frameworks might be as useful, it also recognizes that this framework is being considered by the regulatory community for coordination of monitoring efforts across projects and agencies.

  Level 1

  – Develop a comprehensive base map of all SEZs for all channels, wetlands, and lakeshores in the Basin. The map of SEZs should ignore political and real estate boundaries. This map should be used as the common base map for all aspects of monitoring and reporting. For example, all SEZ projects should be mapped onto the base map.

  Level 2

  – Further develop a primary rapid assessment method with guidelines for its suitable use, application, and interpretation, recognizing the limitations of rapid assessment. It may be most useful for large-scale assessment of status and trends in general SEZ condition, including the cumulative effects of projects on general condition at the watershed, landscape, and basin scales. Level 2 tools are not likely to help assess progress toward objectives and goals for specific SEZ functions or services.

  Level 3

  – Level 3 data are essential to minimize risks and to track progress toward objectives and goals for specific ecosystem functions and services at all scales.

  – Level 3 data are relatively expensive. All Level 3 data should follow directly from the conceptual models and objectives for projects, watersheds, and the Basin.

  – Level 3 data should be used to validate conceptual models and the Level 2 monitoring tools.

  – The hydrograph and sediment regime of a reach integrate across all upstream events and processes that affect water supply and sediment supply. The hydrograph and sediment regime of a reach might therefore be regarded as “performance curves” for all upstream watershed management, in the context of watershed objectives. Consider developing water budgets, sediment budgets, and adding gauging stations in selected watersheds (i.e.,

the "observation watersheds" mentioned above) to better understand and model the relative effects of disturbance, climate change, and land use on SEZ ecosystem condition and watershed functions and services.

  - USGS gauging stations and other long-term hydrological and climatological datasets should be strongly supported. Although stations might be relocated to fill data gaps, any reduction in the number of stations is likely to be regretted.

Standardized Protocols

- All monitoring methods used to assess changes over time or through space must be standardized. Standardized monitoring protocols are needed to assess how projects change over time, to compare different projects to each other, to assess changes in ambient conditions and to evaluate project performance relative to ambient conditions.

- Protocols currently in use for National or State efforts should be evaluated in terms of their suitability for assessing progress toward goals and objectives. Adopt or adapt those with greatest applicability. Develop a "menu" or "decision tree" for matching protocols to objectives and budgets.
- The needed accuracy and precision of monitoring data are determined by how the data are going to be used. Land managers and scientists should work together to decide on the levels of accuracy and precision needed to assess whether or not objectives are being met.

Databases

- A central repository and clearing house is needed for all SEZ data and related data collected in the Basin. The repository should provide public access to data and related reports and other documents. All SEZs and SEZ projects should be uniquely identifiable using the Level 1 base map mentioned above. The repository should enable users to view all past, present, and proposed SEZ projects in the watershed and landscape context. The applicability of existing database systems should be investigated, such as the USGS Digital Land Treatment Database, USGS NBII GBII Science Locator, and California Wetland Portal, to meet these needs.
- Any data archive should have adequate metadata describing the purpose, sponsors, methods of collection, vintage, QAQC processes, location, and any limitations of the archived data.

Common Sense and Collaboration

- Successful implementation of multi-scale effectiveness monitoring of SEZ projects and the SEZ ecosystem requires leadership and cooperation among multiple agencies and jurisdictions. Key considerations for success include the following:
  - Ability to share existing database resources;

  - Assurances that new data will be included into and accessible from the shared databases;
  - Consistent use of comprehensive mapping tools;
  - Assignment of key tasks to capable leader.

- Consider developing restoration and monitoring "cadres" composed of interagency and interdisciplinary resource managers and scientists. These "cadres" can be used to create and maintain necessary expertise within the agencies. This is essential for mentoring new generations of professionals and maintaining the "institutional memory" of large-scale monitoring and assessment efforts.
- Consider the benefits of a periodic, well-publicized public report on the important functions and services of the SEZ ecosystem, the performance of SEZ restoration efforts, and on the status and trends in SEZ ecosystem health.
- Consider avenues of funding for project-scale and ambient monitoring that tap into the prevalent regional environmental ethic and aesthetic.