Technical Report 0706

Technical Design for a Status & Trends Monitoring Program to Evaluate Extent and Distribution of Aquatic Resources in California

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EXECUTIVE SUMMARY

The 2010 State of the State's Wetlands report(CRNA 2010), issued by the California Natural Resources Agency, found that, while California is a leader in investment in wetland monitoring, protection, and restoration, the state lacks a coordinated statewide system to accurately determine wetland extent and distribution. Consequently, it is not possible to accurately report on the effect of these investments. The principal challenge to accurate assessment and effective monitoring over time is the expense of comprehensive mapping; conservative estimates predict comprehensive mapping of California's wetland resources would cost at least $8.4 million. As a result, the State cannot yet answer the fundamental question "What is the extent of California's wetland, and how is it changing with time?"

Probabilistic mapping can provide a cost-effective alternative for monitoring aquatic resource extent and distribution. Currently, the National Wetland Inventory Status and Trends program (NWI-S&T) and the Minnesota Status and Trends program (MN-S&T) utilize this approach to assess wetland extent and distribution. Elements of these two programs provide a foundation for the development of a status and trends (S&T) program for California. However, given California's geographic and climatic diversity, the design of the national program is not adequate to independently meet the state's information needs.

A probabilistic approach includes three basic elements: i) random placement of sample points across the entire state; ii) wetland map production for small (ideally, 1-16 km^2) plots placed at each point; iii) extrapolation from the random sample plot maps to a statewide estimate of wetland extent. This report provides recommendations for a probabilistic monitoring design for California's aquatic resource S&T. The design was developed to meet the following objectives:

- Report extent (status) and changes in extent (trends) at regular intervals.
- Include estimates for all surface aquatic resources including wetlands, streams, and deepwater habitat.
- Support regional intensification through design flexibility.

Design recommendations for the California S&T program were developed with input from the project's technical advisory committee (TAC) and based on a review of existing S&T programs. A series of design alternatives were identified for various program elements. Each design alternative was tested through repetitive simulation and modeling using the most comprehensive wetland and stream maps currently available. Simulation results allowed statistical comparison of each alternative and resulted in optimized technical design parameters with respect to California's S&T program objectives. Modeling results were discussed with the TAC, who produced the following design recommendations:

1. Use probability-based sample selection and analysis, as opposed to comprehensive mapping or non-probabilistic sample selection methods. Probabilistic sampling is a consistent design parameter in all of the reviewed S&T programs.

2. Select samples by generalized random tessellation stratified (GRTS) sampling without geographic pre-stratification. This will increase precision of estimates and provide a simple mechanism for regional intensification.

3. Use the entire State as a sample frame, rather than relying solely on areas with previously mapped aquatic resources. This will ensure that estimates reflect comprehensive extent and distribution of wetlands and aquatic resources.

4. Map and classify all elements within sample plots, including aquatic resources and upland land use. This will provide information about proximal anthropogenic influences and impacts on wetlands and aquatic resources.

5. Balance plot size with total sample size and the number of aquatic resources and wetlands covered by each sample plot. Small plots are more variable, and therefore require a larger total sample size, but may be more cost-effective at the program level. In contrast, large plots provide more information within each individual plot. We recommend a 4 km^2 plot size as the best balance of these factors for California.

6. Revisit and remap sample plots at regular intervals. This will help identify and track changes in extent and distribution, in addition to distributing mapping costs over multiple years.

7. Maintain static sampling plot locations over time, as opposed to monitoring new locations, or a mix of new and previously observed locations, at each time point. This will increase the accuracy and precision of estimates for both extent (wetland status) and changes in extent (trends).

The recommended program design was validated through a pilot-scale application at 60 plots in the Salinas River Valley and Southern California regions. This validation quantified expected random and systematic errors between map producers and between probabilistic estimates and comprehensive values. These error rates can be used to develop data quality objectives for use during program implementation.

The proposed S&T design will allow the State of California to reliably estimate the extent and distribution of wetlands, streams, and deepwater habitat, and changes over time in a cost effective manner. However, a probabilistic program, such as the proposed S&T program does not result in a "wetland map" for California. The S&T program, combined with other elements such as regional intensive maps, project-based accounting, and analysis of drivers of wetland loss will allow California to meet the needs for a comprehensive strategy to assess wetland gains and losses, and will support condition assessment, and will ultimately facilitate evaluation of the effectiveness of the state's wetland protection and restoration programs.

Full Text

ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/706_StatusTrendsMonitorAqResources.pdf