Steps to Develop a Module for the California Rapid Assessment Method for Wetlands (CRAM)

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LEVEL 2 COMMITTEE

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The Level-2 Committee of the CWMW maintains and coordinates CRAM and other condition assessment methods, including updates, training, QA/QC, and reference networks. It also provides a forum for agencies to discuss and review policy issues regarding CRAM. The members of this committee and principal contributors to this document are listed below:

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Purpose of this Document

The purpose of this document is to provide guidance for CRAM module development. It is an attempt to assure that all new CRAM modules are developed using an approach and procedure that has been approved by the California Water Quality Monitoring Council and subject to the peer review process of the California State Water Resources Control Board and of the California Environmental Protection Agency. Because new modules may be developed by different teams through different funding sources, it is important that each new module of CRAM be developed with oversight and guidance provided by the statewide Level 2 Committee of the California Wetland Monitoring Workgroup (CWMW) of the California Water Quality Monitoring Council, which is charged with the oversight of Level 2 methodologies including CRAM.

Conceptual Approach to Module Development

The overall process for CRAM module development includes six phases: 1) definition phase; 2) basic design phase; 3) verification phase; 4) validation phase; 5) module production; and 6) ambient survey. As part of the routine quarterly reporting of L2 activities, results for each of these steps shall be reported to the CWMW for comment and approval.

The purpose of the Definition Phase is to finalize a definition for the wetland type for which a new CRAM module is proposed (either a new type of wetland or a subtype of an existing wetland type). This definition must be integrated into the statewide wetland classification system. Once defined, the Design Phase is used to develop a conceptual model of the natural processes and anthropogenic stressors that control the form, structure, and function of the proposed wetland class or sub/class.

The purpose of the Verification Phase is to optimize the correspondence between CRAM results and quantitative data for the new wetland type or sub-type across a gradient of condition within a reference network or to generate numerical scaling of CRAM metrics. Through verification, adjustments (where needed) are made to improve the method's ability to discern differences in wetland condition. Verification could result in providing better support documentation, guidance, and instructions; revising narratives for metric scoring; rescaling metrics; re-scoring or re-binning of metrics; eliminating or combining metrics; and creating new submetrics.

In contrast, the Validation Phase is the process of documenting relationships between CRAM results and independent measures of condition (Level 3 data) in

order to establish CRAM's defensibility as a meaningful and repeatable measure of wetland condition. However, available Level-3 data sets are themselves indices of wetland condition based on floral and faunal community composition. Rapid Assessment Methods (like CRAM) can only be evaluated in relative terms, based on a heuristic approach emphasizing the weight of evidence from multiple independent measures of condition. Once validated, a finalized module is produced.

Steps to Develop a Statewide CRAM module

Any persons, agencies or enterprises may initiate and conduct this process under the oversight of the L2 Committee. Note that identification of a new wetland type or sub-type that might require a separate CRAM module would not automatically lead to new module development via the subsequent steps listed below. An identified need for a new module might not be met due to staff or budget constraints, especially if no significant regulatory or scientific problems are addressed by creation of the new module.

Phase 1: Definition

1. Provide evidence to L2 Committee of the need for a new module. This evidence must include CRAM data indicating systematic bias of one or more metrics for a particular type of wetland that is well recognized by a statewide or regional consortium of wetland managers. The L2 Committee will decide on the need for a new module based on the evidence that is presented.

2. Assuming that a new module is needed, form a statewide development team with link to the L2 Committee. Select a team leader as liaison to the L2 Committee.

3. The new module team provides the L2 Committee with a definition of wetland type that is the focus of the effort. The L2 Committee works with the team to finalize the definition, and integrate it into the statewide wetland classification system. The definition might be a new class of wetland or a subclass of an existing wetland class.

Phase 2: Basic Design

4. Develop a conceptual model of the natural processes and anthropogenic stressors that control the form, structure, and function of the proposed wetland class or sub/class. This model should be designed to guide the development of metrics of condition and stressor checklist. The model must be vetted through the L2 Committee.

5. Based on the conceptual model, develop the "Verification[1] version" of the module. This version reflects the Best Professional Judgment (BPJ) of the development team. Vet the verification version of the module with the L2 Committee.

6. Identify the physical "Test Gradient" along which the efficacy of the verification version of the module will be tested. The Test Gradient should encompass the range of field conditions that is likely to be encountered in California. It can consist of sites from different regions of the State. The Test Gradient must be vetted through the L2 Committee.

7. Develop a checklist of field-based and/or GIS-based indicators used to identify position of test sites along the Test Gradient. Vet these indicators with the L2 Committee.

Phase 3: Test of Verification Version

8. Test the efficacy of the verification version of the module.
    A. Use team BPJ to select 30+ Test Sites along Test Gradient. These "verification sites" should collectively represent the statewide range of condition of the targeted wetland class, including least-impacted reference sites for multiple eco-regions that together represent range of least-impacted conditions statewide.

    B. Run the verification version of the module consistently at each selected verification site. If multiple teams are used, then conduct inter-team calibration exercise to assure adequate QAQC. Confer with the L2 Committee about the target QAQC thresholds.

    C. Analyze the test results by determining if any of the metrics of the verification version of the module exhibit strongly biased scores (always low, always high, or otherwise skewed distribution of scores across the condition gradient). A metric is biased if it fails to generate different scores across the full range of the conditions it is intended to assess. Report results to the L2 Committee, which will help determine next steps.

    D. Use team BPJ to revise any metrics that exhibit bias, based on step C above. Revisions might involve removing, adding, or changing metrics to improve their sensitivity to the range of conditions along the Test Gradient.

[1] The term *verification* is used in lieu of calibration here in order to distinguish "calibration" of the model/method (an aspect of CRAM module development) from inter-calibration of practitioners conducting field exercises (an aspect of CRAM QA/QC).

E. The team and the L2 Committee must work together to decide if more verification is needed, or if the development process can proceed to the Validation Phase.

F. Once the Verification Phase is completed, the results are presented to the CWMW by the L2 Committee for review and approval. This step yields the Validation Version of the module.

Phase 4: Validation

9. Validate the completed verification version of the module.
   A. ID existing and/or preferred Level 3 data for validation. Confer with the L2 Committee about the criteria for selecting L3 validation data. One criterion will be that the data represent a broad range of condition as assessed using one or more CRAM metrics of condition.

   B. Develop conceptual models of the expected correlations between CRAM metrics of condition and the selected L3 validation data. These models should predict the shape of the verification curves (linear or other) and their direction (positive or negative correlation).

   C. ID validation sites that together represent a very broad range of condition for L3 validation data. Validation sites should include the least-impacted reference sites and can include sites used for the verification phase. Validation sites might be sites where the L3 data were previously collected, CRAM sites selected for validation at which new L3 data will be collected, or a combination of these choices.

   D. Collect the validation data at the validation sites.

   E. Analyze the validation data by comparing the actual results of the correlation between L2 and L3 data to expected results based on the conceptual models from step 11B above.

   F. Based on the validation results, identify the limitations of module and make any metric changes deemed appropriate to improve the overall performance of the module. In this regard, be aware that the conceptual models might not be correct, and that altering metrics to maximize any one particular correlation is likely to affect (usually reduce) other correlations. Furthermore, no single set of L3 data are likely to represent all of the likely processes or stressors assessed using CRAM, which means that altering the metrics with

regard to the available L3 data might reduce the performance of CRAM with regard to processes and stressors not represented by the available L3 data. Finally, there is no gold standard for the validation; BPJ will be needed to decide whether or not the module is performing adequately, based on the weight of evidence provided by the validation effort.

G. Submit the validation results for review by the L2 Committee. The L2 Committee will work with the team to decide if additional validation is required before the module development can be implemented, and what limitations should be imposed on its implementation. This step yields implementation version 1 of the module.

Phase 5: Module Production

10. The module is finalized when it is converted to a field book with an online version for data management. The module development team does not usually conduct these steps. These steps are coordinated by the L2 Committee to assure integration with other monitoring efforts.
    A. Develop all necessary illustrations and tables to guide module use in the field and incorporate them into a field book.
    B. Develop the online version of the field book for data exchange and management.

Phase 6: Ambient Survey (as resources become available)

11. Conduct a statewide ambient survey using the final version of the module. The module development team does not usually conduct these steps. These steps are coordinated by the L2 Committee to assure integration with other monitoring efforts.
    A. Develop the Sample Frame
    B. Develop the Sample Draw
    C. Conduct the Ambient L2 Survey
    D. Create Statewide Cumulative Frequency Distribution to which local and regional assessments can be compared.