Scientific Evaluation Worksheet

Scientific Evaluation Process Overview

List of materials needed for Scientific Evaluation:

1) Suite of DRERIP conceptual models
2) Comprehensive, standardized list of outcomes (*note: current version 6/8/07 incomplete until conceptual models updated*)
3) Comprehensive, standardized list of stressors (*Note: Daniel Kratville supplementing BDCP list with stressors from species model and pending BDCP stressors workshops; 7/13/07*)

Companion documents:

1) Guidelines for Writing and Parsing Actions (*current version dated 7/16/07*)

Evaluation Team:

Date:

Action:

Step 1: Determine if Action is Ready for Scientific Evaluation

Actions should be clearly written and contain basic components (action, approach, and outcome) as outlined in the Guidelines for Writing and Parsing Actions (*7/16/07*). An action can include multiple outcomes, but should list only one approach.

Is the action written in such a way that it can be evaluated?

Select Yes or No

If yes, list the action, approach, and outcome below and continue.

If no, reject the action as written and move on to another action. Do not attempt to rewrite the action.

Action:

Approach:

Outcome(s):

Step 2: Identify Scale of Action

Identify the scale of the Action 'scope' based on the following criteria. Consider all three components of the action [action, approach(es), outcome(s)]. The purpose of establishing Action scale is to assist with determining the magnitude of effect on the outcomes (see Steps 5 and 6). Scale addresses temporal and spatial considerations, quantity and/or degree of change contained within the Action.

☐ ***Large*** = Broad spatial extent, significant duration and/or annually, and/or major reversal compared to existing conditions. Landscape scale.

☐ ***Medium*** = Moderate spatial extent, moderate duration and/or near to annually, and/or moderate change compared to existing conditions. Regional scale.

☐ ***Small*** = Small acreage, short duration or only on occasional years, and/or small change compared to existing conditions. Local scale.

Rationale

Step 3: Review Models and Other Relevant Information

This step involves reviewing the models to determine if they contain information regarding the suggested cause and effect relationship. This step should not involve any assessment of the nature or significance of the relationship, but only if such a relationship has been documented.

Is the cause and effect relationship between the action, approach, and outcome supported by the conceptual models, or other source material?

Select Yes or No

If yes, document the specific model sections and/or page numbers, or other source materials that support this conclusion and continue.

If no, document the rationale for the finding and stop.

Models used:

Other sources:

Rationale:

Step 4: Identify Positive and Negative Outcome(s)

Using the standardized lists of outcomes and stressors, identify as many positive and negative outcomes as possible (including the intended outcome). Outcomes should not be evaluated at this step, just simply listed. Outcomes not captured in models but identified based on other available information should be included, with notes describing the information from which the outcomes were identified.

Positive Outcomes to Evaluate

Outcome	Source (name of Conceptual Model or external reference)
Outcome P1 (intended):	
Outcome P2:	
Outcome P"X":	

Negative Outcomes to Evaluate

Outcome	Source (name of Conceptual Model or external reference)
Outcome N1:	
Outcome N2:	
Outcome N"X":	

Step 5: Rank Magnitude and Certainty of Potential Positive Ecological Outcome(s)

Using the conceptual models and other relevant source materials, rank the expected magnitude and certainty of the positive ecological outcomes listed in Step 4 above. Record the magnitude and certainty for each positive outcome in the tables below. Add additional tables as needed to reflect additional outcomes. ***Use one table per positive outcome.***

Use the definition, criteria, and conversion tables in Appendix A to guide the ranking determination and to select an estimate of "Worth". Document how rankings for magnitude and certainty were arrived at, including citation of specific model sections and page numbers in the rationale section.

Outcome P1

	Criteria Ranking[1]	Rationale for Ranking, Document DLO paths
Magnitude[2]	☐ 1 ☐ 2 ☐ 3 ☐ 4	
Certainty[3]	☐ 1 ☐ 2 ☐ 3 ☐ 4	
Worth	☐ low ☐ med ☐ high	**NA**

Outcomes P2

	Criteria Ranking	Rationale for Ranking, Document DLO path
Magnitude	☐ 1 ☐ 2 ☐ 3 ☐ 4	
Certainty	☐ 1 ☐ 2 ☐ 3 ☐ 4	
Worth	☐ low ☐ med ☐ high	**NA**

Document comments and/or assumptions:

Step 6: Rank Magnitude and Certainty of Potential Negative Ecological Outcome(s)

Using the conceptual models and other relevant source materials rank the expected magnitude and certainty of each negative ecological outcome listed in Step 4 above. Record the magnitude and certainty in the tables below. Add additional tables as needed to reflect additional outcomes. *Use one table per outcome.*

Use the criteria and conversion tables in Appendix A to guide the ranking determination and to select an estimate of "Risk". Document how rankings for magnitude and certainty were arrived at, including citation of specific model sections and page numbers in the rationale section.

Outcome N1

	Criteria Ranking	Rationale for Ranking
Magnitude	☐ 1 ☐ 2 ☐ 3 ☐ 4	
Certainty	☐ 1 ☐ 2 ☐ 3 ☐ 4	
Risk	☐ low ☐ med ☐ high	

Outcome N2

	Criteria Ranking	Rationale for Ranking
Magnitude	☐ 1 ☐ 2 ☐ 3 ☐ 4	
Certainty	☐ 1 ☐ 2 ☐ 3 ☐ 4	
Risk	☐ low ☐ med ☐ high	

[1] See Appendix A

Document comments and/or assumptions:

Step 7: Identify any Important Gaps in Information and/or Understanding

Using the levels of understanding assigned to the DLO relationships used in the evaluation thus far, and/or any additional information from other sources, identify important data or research needs, that could enhance future evaluation of this or similar actions.

Data Needs (indicate specific models, DLO relationships, or other information indicating the need)

Research Needs (describe specific research activities that could be employed to meet data needs)

Step 8: Estimate Overall Degree of Worth and Risk

Enter ranking scores for Worth and Risk from Steps 5 and 6 above into the table below and estimate the overall Worth and Risk scores for the Action as a whole. Add additional rows to the table as needed to reflect additional positive or negative outcomes.

Overall Worth score should be determined based on consideration of the cumulative positive outcomes (several medium outcomes could justify an overall ranking of "High" worth).

Overall Risk should be based on the highest single risk score (i.e. if any one of the outcomes has a high risk, then the overall Risk should be "high").

Combined Worth and Risk Rankings

Outcome	Worth Ranking	Risk Ranking
P1	☐ low ☐ med ☐ high	
P2	☐ low ☐ med ☐ high	
N1		☐ low ☐ med ☐ high
N2		☐ low ☐ med ☐ high
Cumulative Ranking	☐ *low* ☐ *med* ☐ *high*	☐ *low* ☐ *med* ☐ *high*

Provide rationale for the overall rankings:

Step 9: Assess Reversibility and Opportunity for Learning

Reversibility – The ease and predictability with which an outcome or a group of outcomes could be undone and/or reversed (e.g., if the action changes the ecosystem structure can the original form be re-established? Have such outcomes been un-done in the past?). A change to a flow regime is relatively easy to reverse; the successful introduction of a new species is relatively difficult to reverse.

Criteria to be used for assessing reversibility are:

☐ **Yes/Easy** - Outcome could likely be reversed as, or more quickly and cheaply than implementing the action.

☐ **No/Hard** - Reversing outcomes would require more time or more money than implementing the action; outcomes may not be completely reversible.

Comments:

Opportunity for Learning – The likelihood that an action or a group of actions will address key scientific uncertainties and increase the level of understanding with regard to the species, process, condition, region or system that is in question or of concern, assuming that appropriate monitoring and evaluation is conducted. Use assessment of Data and Research Needs from Step 6 and/or any additional previous documented assessment of need.

Criteria to be used in assessing the opportunity to learn are:

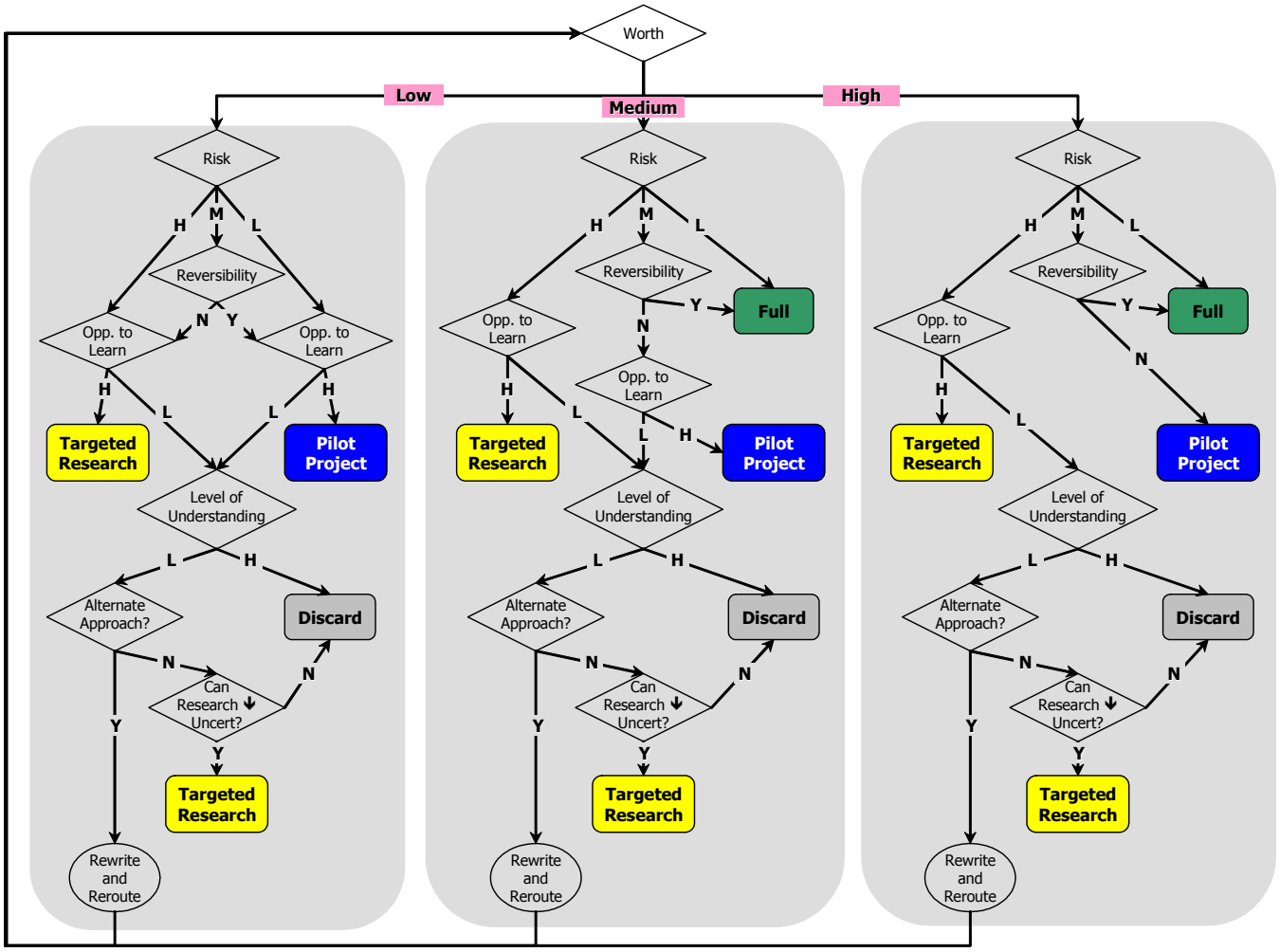
☐ **High** - Expect to advance our understanding of critical uncertainties as identified in Conceptual Models in a quantifiable manner

☐ **Low** - Impractical or excessive time or resources likely required to achieve such understanding.

Comments (refer to specific sources of information identified in Step 6 that support the above determination :

Step 10: Assign the Adaptive Management Category Using the Decision Tree

DRERIP Decision Tree for Routing Actions



ADAPTIVE MANAGEMENT CATEGORY:

- ☐ **Full**
- ☐ **Pilot Project**
- ☐ **Targeted Research**
- ☐ **Discard**

Comments:

Appendix A:

Definitions, Criteria and Conversion Matrices

The following definitions, criteria, and conversion matrices, are provided to aid the Scientific Evaluation process. Some of the definitions pertain to terms used in the conceptual models, such as understanding and predictability. Other definitions relate directly to completion of the Scientific Evaluation worksheet.

Scientific Evaluation Terms

The terms ***scale, magnitude, and certainty*** are Scientific Evaluation terms used to characterize the cumulate "path" or "chain" found between a Restoration Action being evaluated and each Outcome being considered within Scientific Evaluation. Such a path or chain is not the same as the linkage attributes in the conceptual models that describe the cause-effect relationships between a single driver and a single outcome (see conceptual model terms below).

The terms ***worth, risk, reversibility, and opportunity for learning*** are Scientific Evaluation terms which combine considerations of magnitude and certainty to assess the cumulative consequences of an action and recommend whether the action should be considered as targeted research, a pilot study, a full-scale implementation project, or discarded using the Scientific Evaluation decision tree.

> ***Scale*** - Scale addresses temporal and spatial considerations, quantity and/or degree of change contained within the Action.
>
> ***Magnitude*** – Magnitude assesses the size or level of the outcome, either positive or negative, as opposed to the scale of the Action. It can be assigned using consideration of population or habitat effects, and higher rankings require consideration of the scale of the Action shown to result in the outcome. Magnitude ranking is assigned by expert assessment, documented in the Scientific Evaluation worksheet, for all the DLO linkages between the action and the outcome, and/or any additional information available to the Scientific Evaluation team, the use of which must be documented in the Scientific Evaluation worksheet.
>
> ***Certainty*** - Certainty describes the likelihood that a given Restoration Action will achieve a certain Outcome. Certainty thus combines the predictability and understanding of each DLO linkage in the conceptual models through the entire DLO chain from the Action to the Outcome. Generally, the lowest-predictability linkage is used; however, all linkages must be assessed to ensure that certainty is not unduly weighted by a comparatively low-importance linkage.
>
> ***Worth*** - Combines the ***magnitude*** and ***certainty*** of positive outcomes to convey the cumulative "value" of a Restoration Action toward achieving an Outcome.

Risk - Combines the ***magnitude*** and ***certainty*** of negative outcomes to convey the cumulative "potential" for a Restoration Action to result in an adverse, or negative Outcome.

Reversibility - The ease and predictability with which the outcome(s) of a Restoration Action or a group of Restoration Actions can be undone and/or reversed. For example, if the Action changes the ecosystem structure, can the original form be re-established? Have such outcomes been un-done in the past? A change to a flow regime is relatively easy to reverse; successful introduction of a new species is relatively difficult to reverse.

Opportunity for learning - Opportunity for learning is the likelihood that a Restoration Action or a group of Restoration Actions will increase the level of understanding with regard to the species, process, condition, region or system that is in question or of concern, assuming that appropriate monitoring and evaluation is conducted.

Conceptual Model Terms

The terms ***importance, predictability, and understanding*** are used in the conceptual models to characterize individual linkages (depicted as arrows in the models) between a driver and an outcome. The terms pertain to specific processes or mechanisms within a given model (e.g. how important is the supply of organic matter to mercury methylation?). The graphical forms of the conceptual models apply line color, thickness, and style to represent these three terms.

Importance - The degree to which a linkage controls the outcome *relative to* other drivers and linkages affecting that same outcome. Models are designed to encompass all identifiable drivers, linkages and outcomes but this concept recognizes that some are more important than others in determining how the system works. If a driver is potentially more important under particular environmental conditions, the graphic should display the maximum level of importance of this driver with the narrative describing the range of spatial and temporal conditions associated with this driver.

Predictability - The degree to which the performance or the nature of the outcome can be predicted from the driver. Predictability seeks to capture the variability in the driver-outcome relationship. Predictability can encompass temporal or spatial variability in conditions of a driver (e.g., suspended sediment concentration or grain size), variability in the processes that link the driver to the outcome (e.g., sediment deposition or erosion rate as influenced by flow velocity), or our level of understanding about the cause-effect relationship (e.g., magnitude of sediment accretion inside vs. outside beds of submerged aquatic vegetation). Any of these forms of variability can lead to difficulty in properly measuring and statistically characterizing inputs to the model.

Understanding – A description of the known, established, and/or generally agreed upon scientific understanding of the cause-effect relationship between a single driver and a single outcome. Understanding may be limited due to lack of knowledge and information or due to disagreements in the interpretation of existing data and information; or because the basis for assessing the understanding of a linkage or outcome is based on studies done

elsewhere and/or on different organisms, or conflicting results have been reported. Understanding should reflect the degree to which the model that is used to represent the system does, in fact, represent the system.

Criteria

The following tables should be used to inform ***magnitude and certainty*** rankings for Scientific Evaluation. Two tables are presented for magnitude (Tables 1a and 1b) and two for certainty (Tables 2a and 2b). These tables should be used collectively to stimulate thinking and guide decision making. They are not intended to make the decisions for the team.

Tables 1a and 2a entail looking holistically at the cumulative value (positive or negative) of an action. Tables 1b and 2b provide additional guidance based on linkage characteristics from the conceptual models. In using the second table, the scale of the Action should be combined with the lowest-importance individual DLO linkage found within the full 'Restoration Action to Outcome' chain. By selecting the 'weakest link in the chain', magnitude reflects limiting factors.

Results using both tables should be compared and a consensus decision reached by the evaluation team. If a consensus can not be reached, dissenting opinions should be documented.

Table 1a. Criteria for Ranking Magnitude of Ecological Outcomes (positive or negative)

4 - High magnitude: expected sustained major population level effect, e.g., the outcome addresses a key limiting factor, or contributes substantially to a species population's natural productivity, abundance, spatial distribution and/or diversity (both genetic and life history diversity) or has a landscape scale habitat effect, including habitat quality, spatial configuration and/or dynamics. Requires a large-scale Action.
3 - Medium magnitude: expected sustained minor population effect or effect on large area (regional) or multiple patches of habitat. Requires at least a medium-scale Action.
2 - Low magnitude: expected sustained effect limited to small fraction of population, addresses productivity and diversity in a minor way, or limited spatial (local) or temporal habitat effects.
1 - Minimal or zero magnitude: Conceptual model indicates little or no effect.

Table 1b. Additional Guidance for Determining Magnitude Ranking Based on Combined Importance and Scale

Scale	**Importance** (from conceptual models)			
	1 (none/ minimal)	**2 (low)**	**3 (medium)**	**4 (high)**
Small	1	1	2	2
Medium	1	2	3	3
Large	1	2	3	4

Table 2a. Criteria for Ranking Certainty of Ecological Outcomes (positive or negative)

4 - High certainty: Understanding is high (based on peer-reviewed studies from within system and scientific reasoning supported by most experts within system) and nature of outcome is largely unconstrained by variability (i.e., predictable) in ecosystem dynamics, other external factors, or is expected to confer benefits under conditions or times when model indicates greatest importance.
3 - Medium certainty: Understanding is high but nature of outcome is dependent on other highly variable ecosystem processes or uncertain external factors. OR Understanding is medium (based on peer-reviewed studies from outside the system and corroborated by non peer-reviewed studies within the system) and nature of outcome is largely unconstrained by variability in ecosystem dynamics or other external factors
2 - Low certainty: Understanding is medium and nature of outcome is greatly dependent on highly variable ecosystem processes or other external factors OR Understanding is low (based on non peer-reviewed research within system or elsewhere) and nature of outcome is largely unconstrained by variability in ecosystem dynamics or other external factors
1 - Little or no certainty: Understanding is lacking (scientific basis unknown or not widely accepted) OR Understanding is low and nature of outcome is greatly dependent on highly variable ecosystem processes or other external factors

Table 2b. Additional Guidance for Determining Certainty Ranking Based on Combined Predictability and Understanding

Understanding	**Predictability**			
	1 (none/ minimal)	**2 (low)**	**3 (medium)**	**4 (high)**
1 (none/ minimal	1	1	1	1
2 (low)	1	2	2	2
3 (medium)	1	2	3	3
4 (high)	1	2	3	4

Conversion Matrices

The following two matrices are designed to combine rankings for magnitude and certainty to develop overall values for Worth and Risk.

Table 3. Conversion Matrix for Determining Worth from the Criteria Rankings for Positive Outcomes.

Is It Worthwhile? (rev 6-28-07)

Combining Magnitude and Certainty

		Certainty (understanding + predictability)			
		1	2	3	4
Magnitude	1	***Low***	***Low***	***Med***	***Med***
	2	***Low***	***Med***	***Med***	***High***
	3	***Med***	***Med***	***High***	***High***
	4	***Med***	***High***	***High***	***High***

Table 4. Conversion Matrix for Determining Risk from the Criteria Rankings for Negative Outcomes.

Is It Risky? (rev 6-28-07)

Combining Magnitude and Certainty

		Certainty (understanding + predictability)			
		1	2	3	4
Magnitude	1	***Med***	***Med***	***Low***	***Low***
	2	***High***	***Med***	***Med***	***Low***
	3	***High***	***High***	***Med***	***Med***
	4	***High***	***High***	***High***	***Med***