

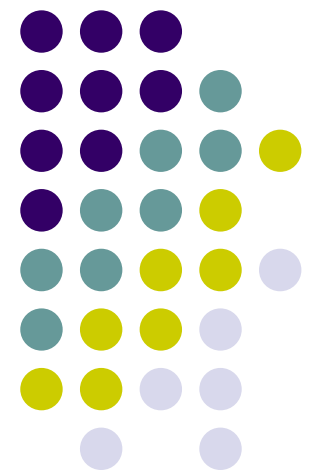
Using monitoring to reduce uncertainty



In WRIA decision-making

Josh Latterell

May 2008 Science Symposium





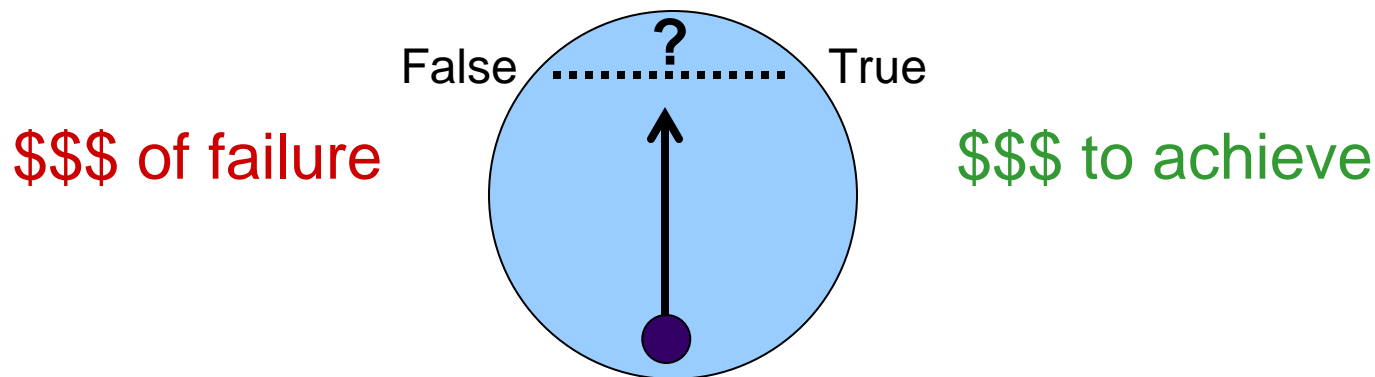
Definitions

Uncertainty

- A state of having limited knowledge where it is impossible to exactly describe the existing state or the outcomes resulting from our actions.

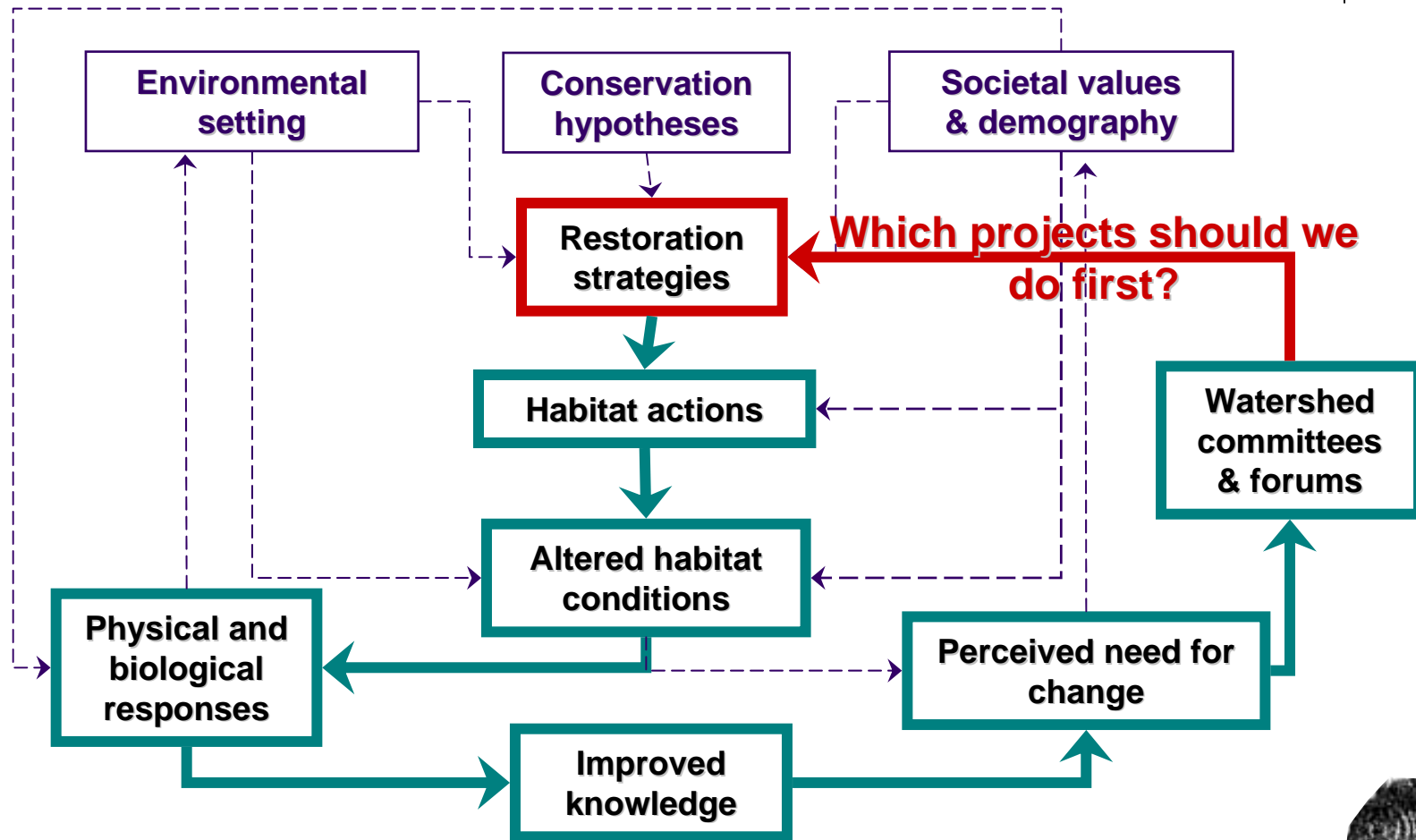
Risk

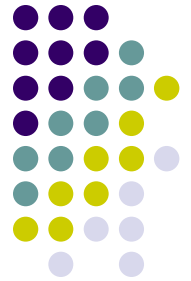
- A state of uncertainty where some outcomes result in 'costs' of varying magnitudes





Project prioritization





Thomas Bayes, at
your service.

I can help you
integrate your
assumptions and
estimate your
uncertainty.



(1702 — 1761)

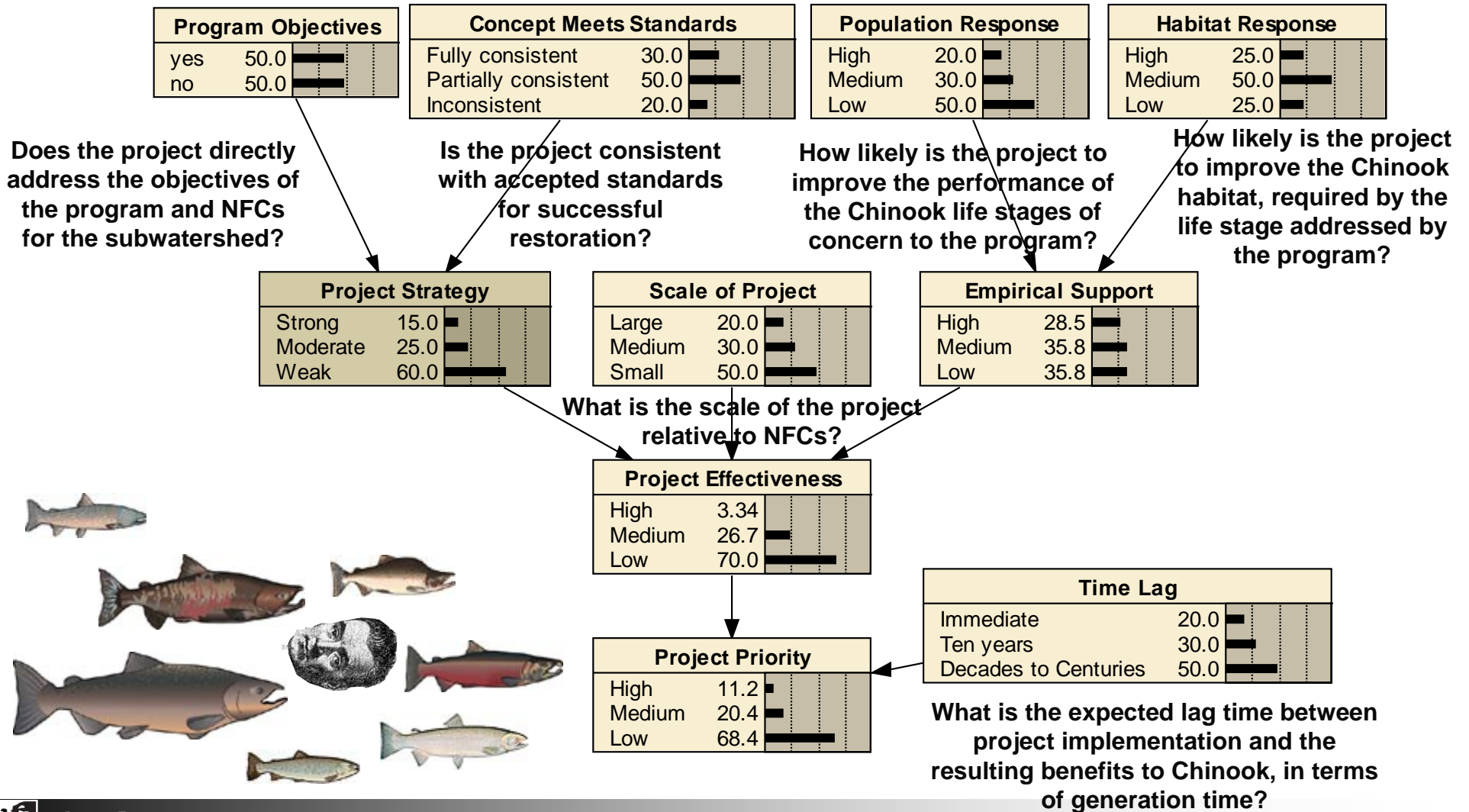
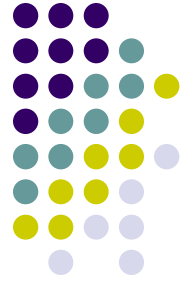


Step 1. State your assumptions

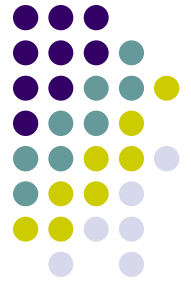
- Projects that are likely to be effective and provide benefits to Chinook in the near-term should be done first.
- Project effectiveness is influenced by:
 - Strength of the strategy
 - Objectives
 - Accepted standards
 - Scale of the project
 - Larger is better
 - Addresses bottlenecks
 - Empirical support
 - Habitat
 - Population

Step 2. Create a Bayesian network

“A cause-and-effect map of your assumptions”



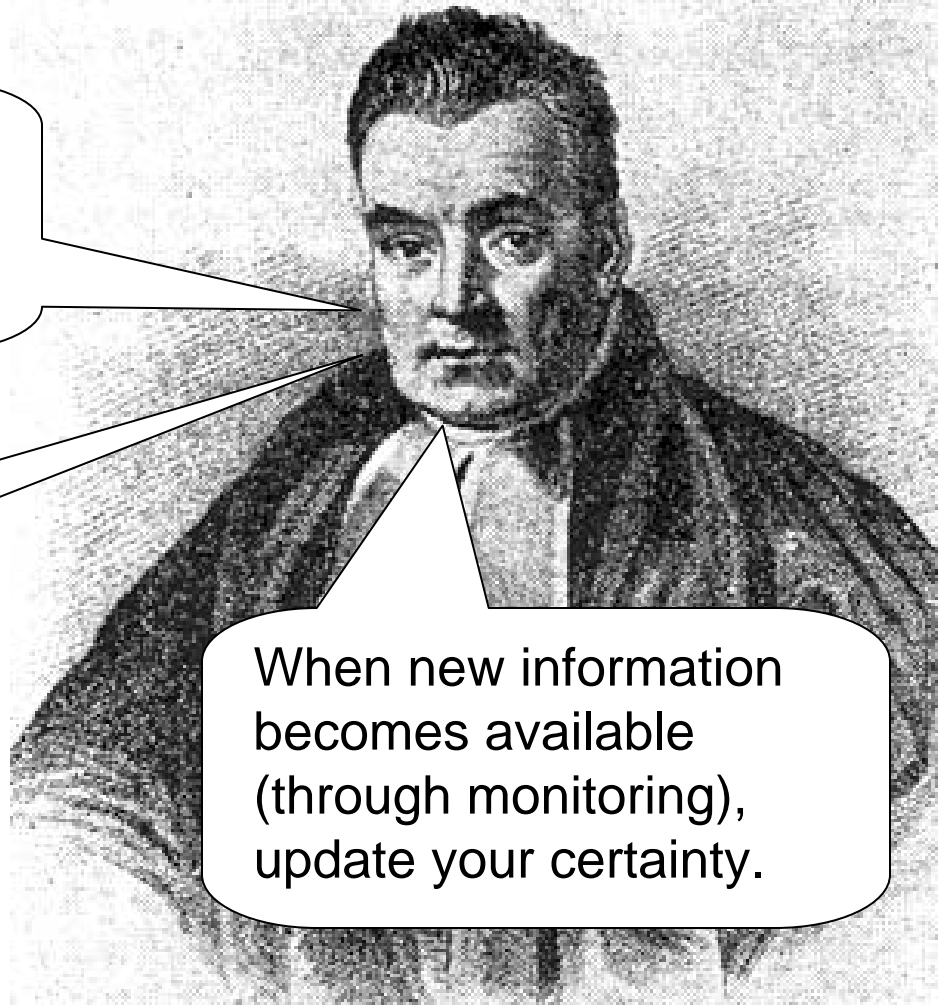
Step 3. Estimate your certainty in project effectiveness



Bayes' Theorem is:
Given event b , the
likelihood of event a is x .

Use your prior
knowledge to infer your
certainty that a project
will be effective.

When new information
becomes available
(through monitoring),
update your certainty.

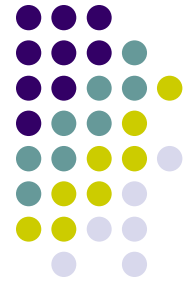


Premise



When solving problems, we begin with some understanding of the system and continually improve that understanding through further study.

Conditional probability table



Certainty in project effectiveness (%)

Strategy	Empirical	Scale	Certainty in project effectiveness (%)		
			<i>High</i>	<i>Medium</i>	<i>Low</i>
<i>Strong</i>	<i>High</i>	<i>Large</i>	100	0	0
		<i>Medium</i>	80	20	0
		<i>Small</i>	70	20	10
	<i>Medium</i>	<i>Large</i>	20	80	0
		<i>Medium</i>	10	90	0
		<i>Small</i>	0	80	20
	<i>Low</i>	<i>Large</i>	0	60	40
		<i>Medium</i>	0	50	50
		<i>Small</i>	0	40	60

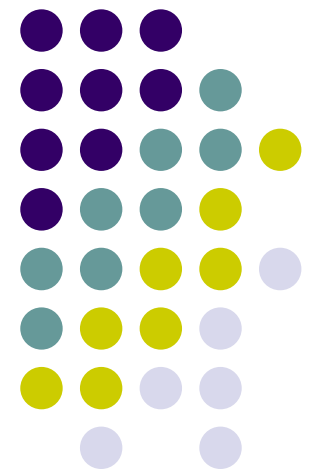
What are the inputs?

Observational evidence (data)

Simulation (e.g., EDT) results

Subjective Opinion

Common-sense



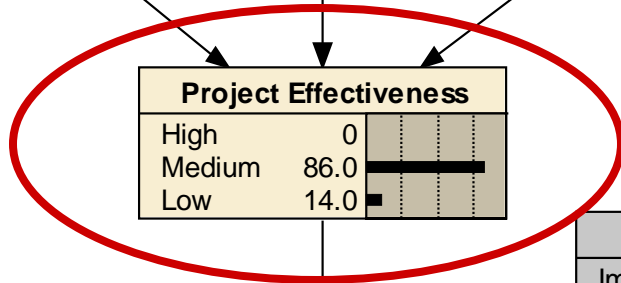


Program Objectives		Concept Meets Standards		Population Response		Habitat Response	
yes	100	Fully consistent	0	High	0	High	100
no	0	Partially consistent	100	Medium	100	Medium	0
		Inconsistent	0	Low	0	Low	0

Project Strategy	
Strong	0
Moderate	100
Weak	0

Scale of Project	
Large	0
Medium	100
Small	0

Empirical Support	
High	60.0
Medium	40.0
Low	0

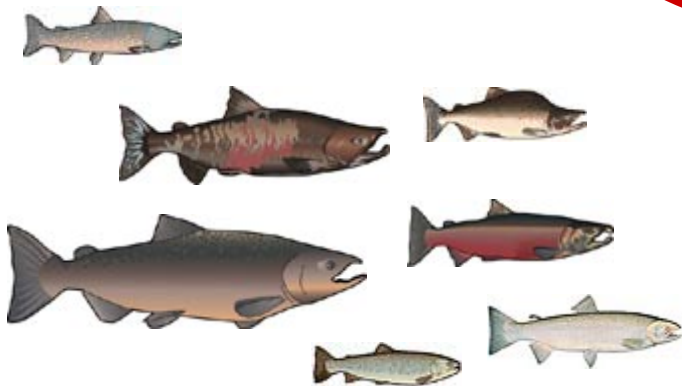


Project Effectiveness	
High	0
Medium	86.0
Low	14.0

Given our assumptions and prior knowledge, we are 86% certain that this project will achieve a 'medium' level of effectiveness.

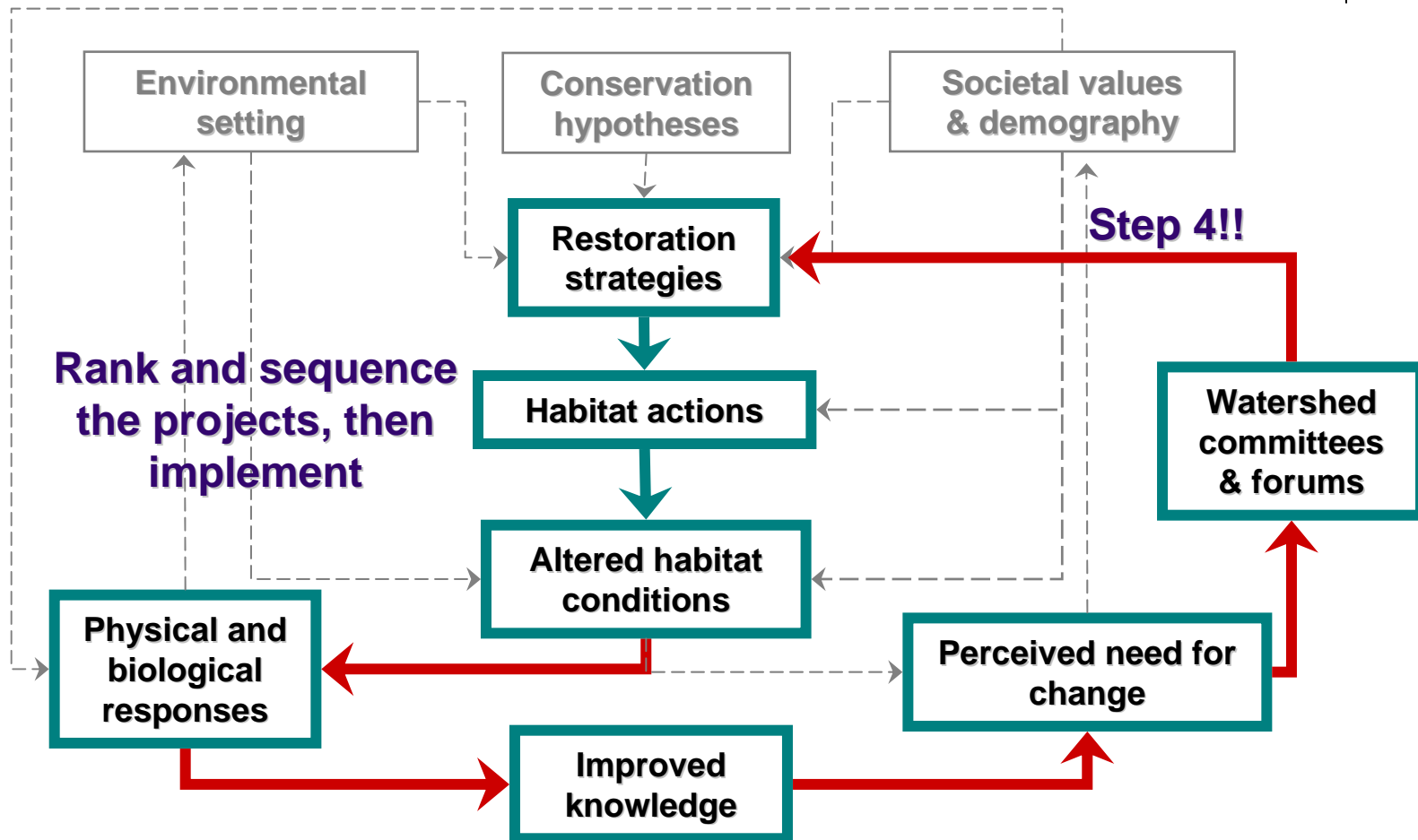
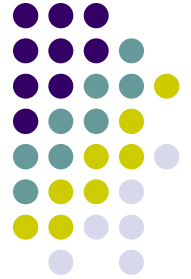
Time Lag	
Immediate	0
Ten years	100
Decades to Centuries	0

Project Priority	
High	12.9
Medium	61.6
Low	25.5

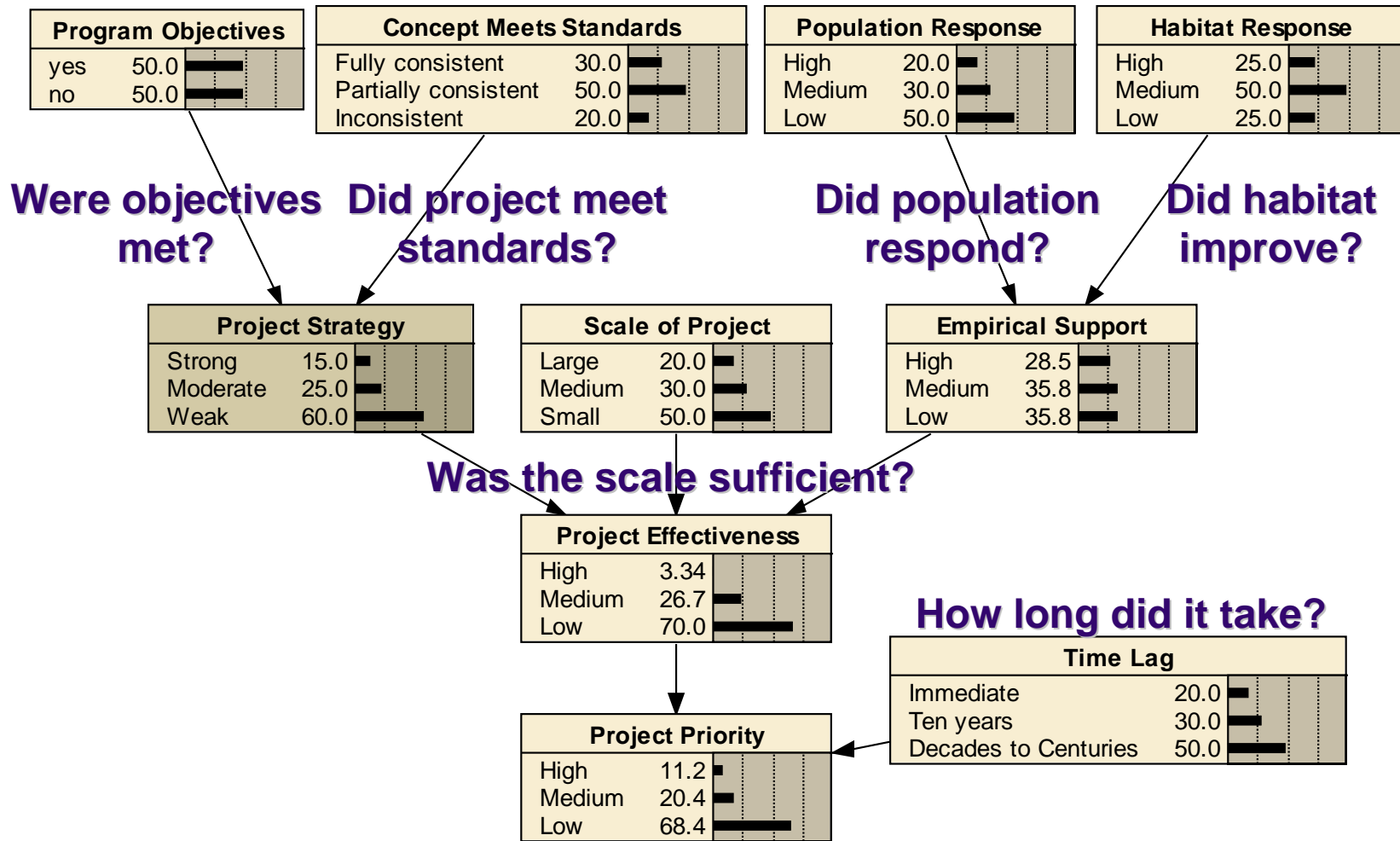
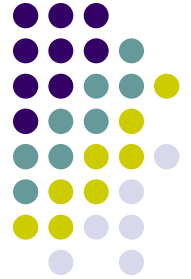




Update your knowledge!



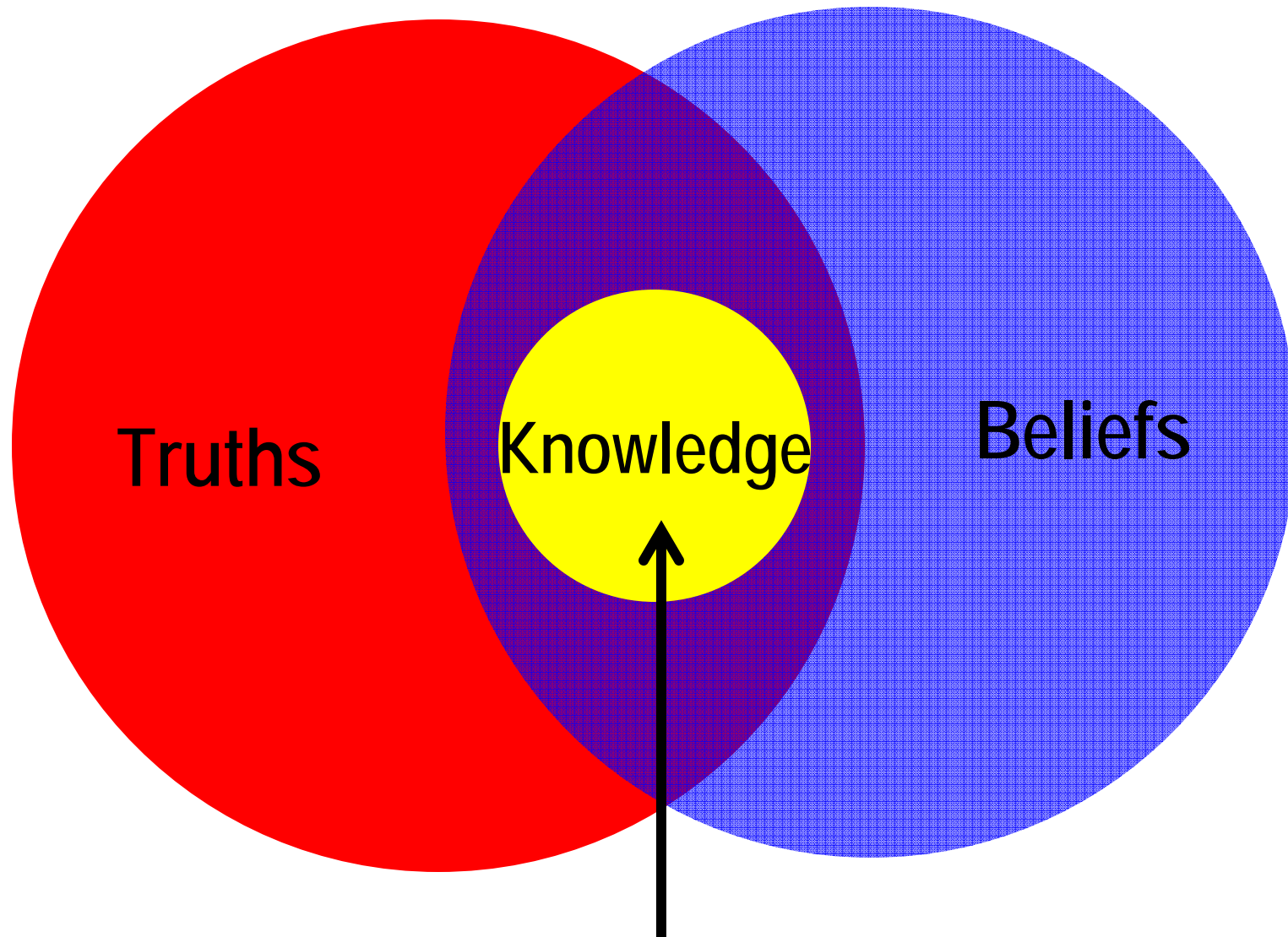
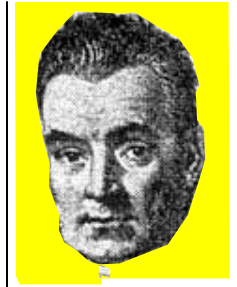
Step 4. Use monitoring results to revise the conditional probability tables





Certainty in project effectiveness (%)

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Monitoring can help tell us which of our beliefs are truths

Acknowledgements



- Kate O’Laughlin
- WRIA 9 Tech Committee



Tasks

1. Choose diagnostics related to VSP
2. Create conditional probability tables
 - Observations, simulations, Delphi process, conservation hypotheses
3. Test the model, evaluate certainty
 - Does it make sense?
 - Contrast alternative reasonable scenarios
4. Analyze sensitivity
 - Which variables/actions most strongly affect the outcome?
 - What new information (or action) will improve certainty?
5. Peer review
6. Test (validate) the model with observations
7. Implement action and monitor results
8. Repeat from Step 2...