



Western Washington University
Western CEDAR

Salish Sea Ecosystem Conference

2014 Salish Sea Ecosystem Conference
(Seattle, Wash.)

Apr 30th, 1:30 PM - 3:00 PM

The Fox and the Hound: Zeus's Paradox and Prioritizing Ecosystem Recovery

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Currens, Kenneth P.; Labiosa, William; and McManus, Elizabeth, "The Fox and the Hound: Zeus's Paradox and Prioritizing Ecosystem Recovery" (2014). *Salish Sea Ecosystem Conference*. 110.
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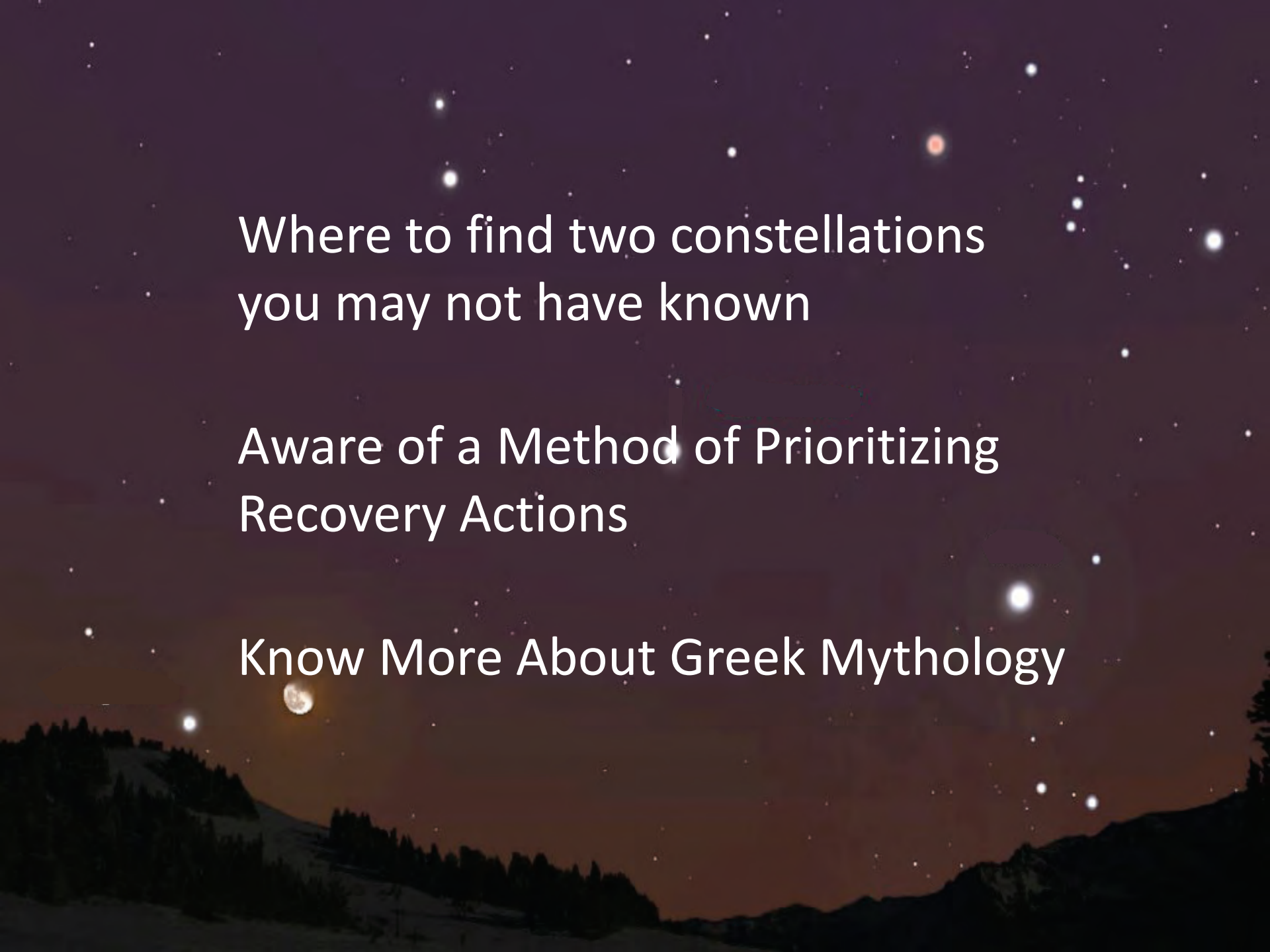
The Fox and the Hound: Zeus' Paradox

and the Problem of Prioritizing Ecosystem Recovery

Kenneth Currens
Northwest Indian Fisheries Commission
& Puget Sound Partnership

Elizabeth
McManus
Ross Strategic

Bill Labiosa
U.S. Geological Survey

A night sky filled with stars of various colors and sizes, with a crescent moon visible in the lower left. The background shows a dark, silhouetted landscape of hills and trees.

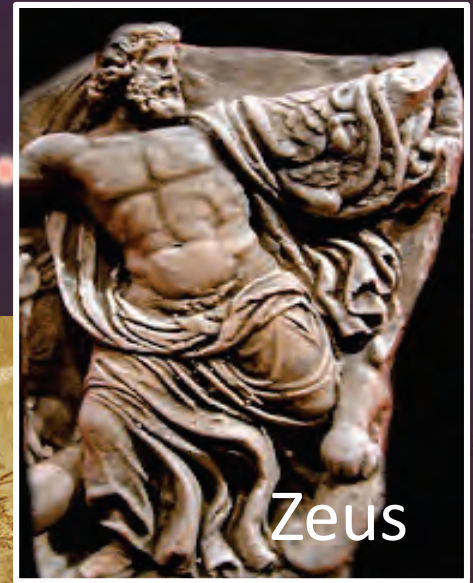
Where to find two constellations
you may not have known

Aware of a Method of Prioritizing
Recovery Actions

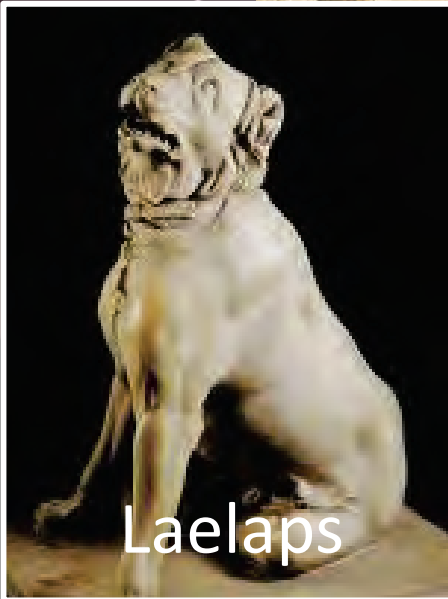
Know More About Greek Mythology

Eternity

Zeus' Paradox



Zeus



Laelaps



King Minos



Zeus' Paradox ?

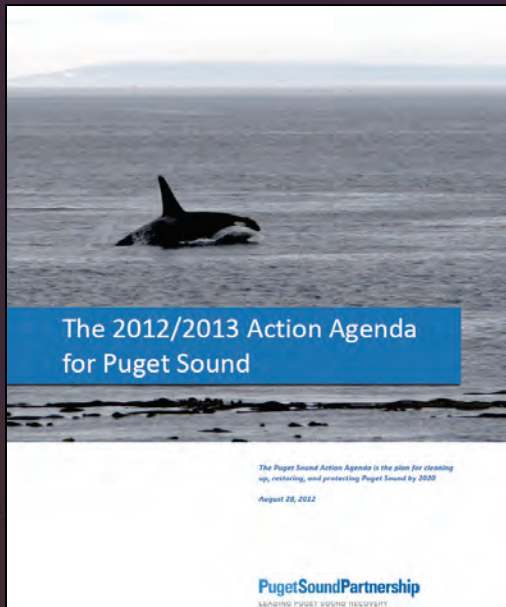
Technical Effectiveness

Prioritizing Recovery Actions

Expediency & Fairness

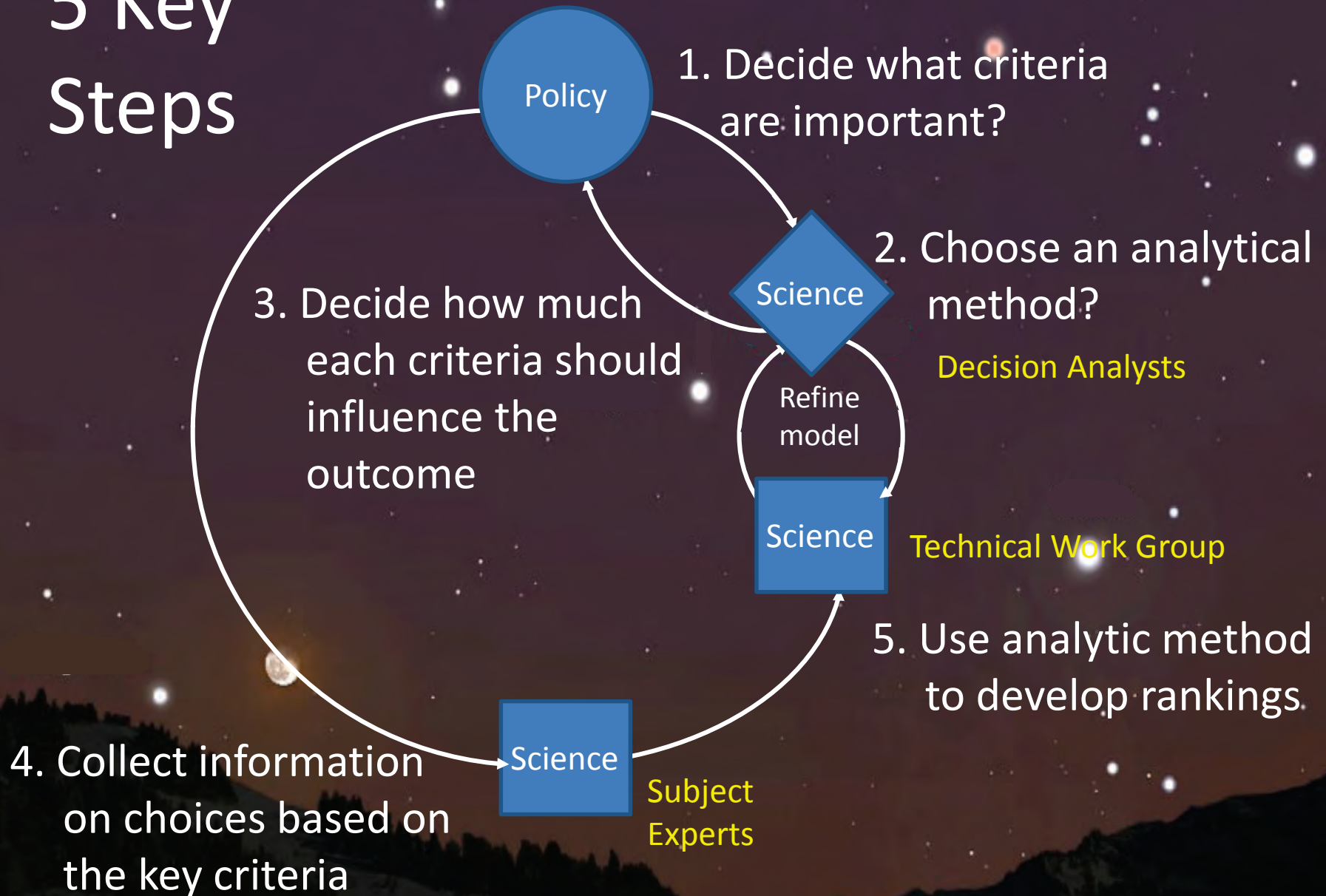


“Snowcaps to Whitecaps” Southern Salish Sea



- Five broad categories of strategies
- 73 sub-strategies across freshwater & terrestrial, marine & nearshore, and pollution categories
- Hundreds of actions

5 Key Steps



1. Decide what criteria are important?

- Ecological Outcomes
- Strategic Outcomes
- Implementation Considerations
- Tribal Treaty Rights



Ecosystem Coordination Board

Advisory board made up decision makers from 27 different groups: tribes; state, federal, and local governments; businesses; environmental interests

Do Not Include In Ranking
But Provide Information

1. Decide what criteria are important?

Ecological Outcomes:

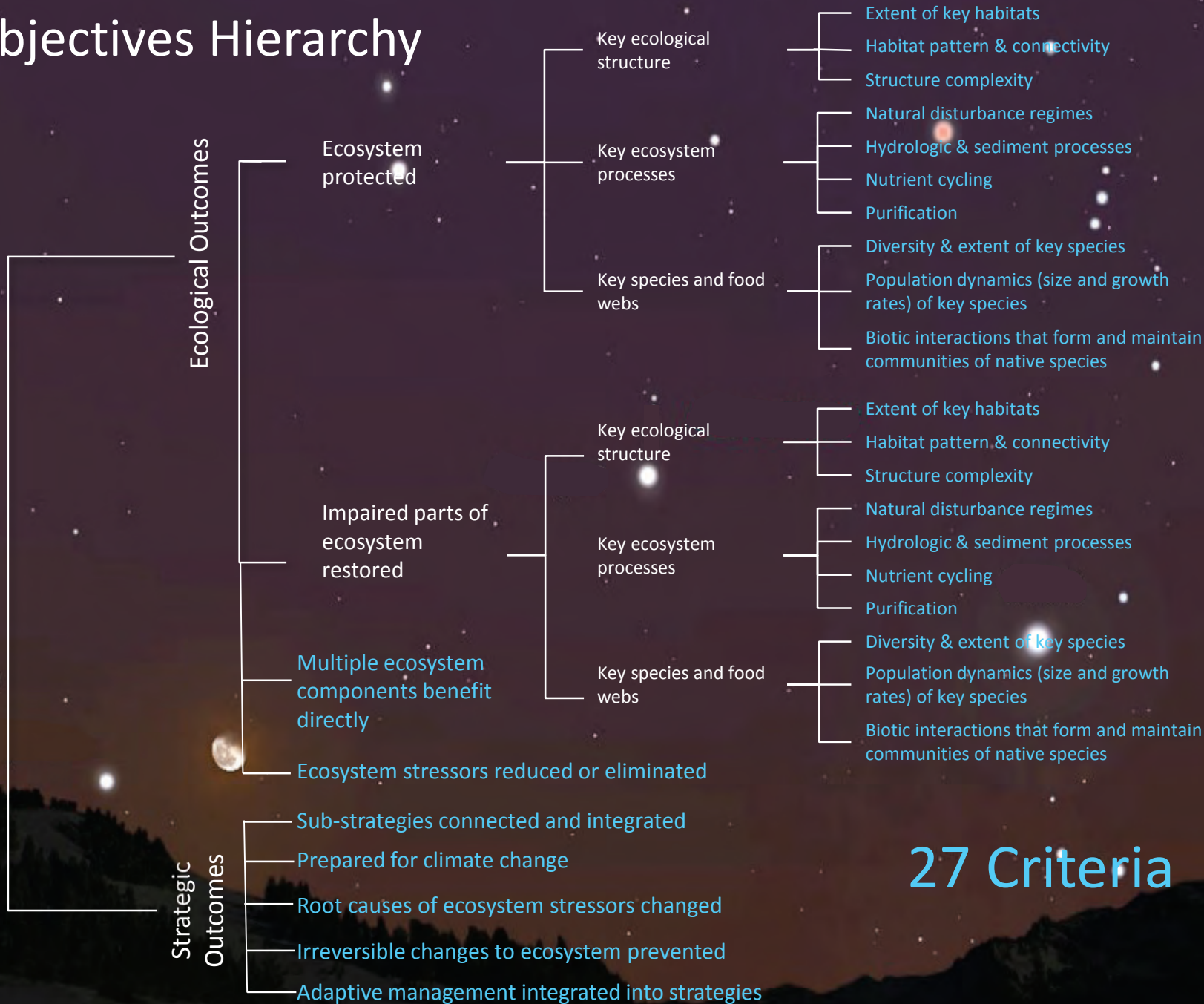
- Protected Ecosystem – ecosystem processes, habitats & species, functions
- Impaired parts ecosystem restored
- Ecosystem stressors reduced or eliminated
- Multiple parts of ecosystem benefit

1. Decide what criteria are important?

Strategic Outcomes:

- Sub-strategies connected & integrated
- Prepared for climate change
- Root causes of ecosystem stressors addressed
- Irreversible changes prevented
- Adaptive management integrated in sub-strategies

Objectives Hierarchy



27 Criteria

2. Chose an analytical method

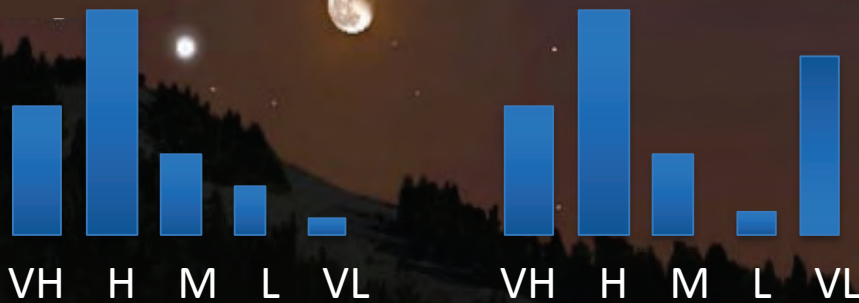
Additive multi-attribute utility theory model (Keeny and Raiffa 1976)

$$U(x_1, x_2, \dots, x_m) = k_1 U_1(x_1) + k_2 U_2(x_2) + \dots + k_m U_m(x_m) \\ = \sum_{i=1}^m k_i U_i(x_i)$$

Big
Weighted
Average

$$U_i(x_i) = \sum_{j=1}^5 p_{ij} U_{ij}(x_{ij})$$

- Adjust for non-linearity in ordinal categories (e.g., Low, Moderate, High)
- Describe uncertainty probabilistically



3. How much each criteria should influence the outcome?

Ecosystem
Coordination
Board



Science Panel

Ecological Outcomes
Strategic Outcomes

Weight
0.5
0.5

Ecological Outcomes if Well Implemented

- Reduced or eliminated ecosystem stressors
- Multiple ecosystem components directly affected
- Ecosystem protected
- Ecosystem restored

0.49
0.02
0.34
0.15

Strategic Outcomes

- Sub-strategies connected and integrated
- Prepared for climate change
- Root causes of ecosystem stressors changed
- Irreversible changes to ecosystem prevented
- Adaptive management integrated into strategies

0.02
0.12
0.41
0.33
0.12

4. Collect information on choices based on criteria

- ECB tasked 40+ different subject experts representing a broad group of organizations
- Used an on-line survey tool
- Evaluated 73 “**sub-strategies**” across freshwater, terrestrial, marine and nearshore, and pollution categories
- 27 questions to assess each sub-strategy
- For each questions, experts estimated their certainty that the expected effect might be very high, high, moderate, low, or very low
- “Very high”, “high”, “moderate”, “low”, and “very low” were defined to reduce ambiguity

5. Use analytic method to develop rankings

- All sub-strategies were ranked
- Rankings organized by domain: freshwater & terrestrial, marine and nearshore, and pollution
- Policy makers used the rankings to form three strategic initiatives:
 - Protect and restore habitat
 - Prevent pollution from urban stormwater runoff
 - Recover shellfish beds

What Did We Learn?

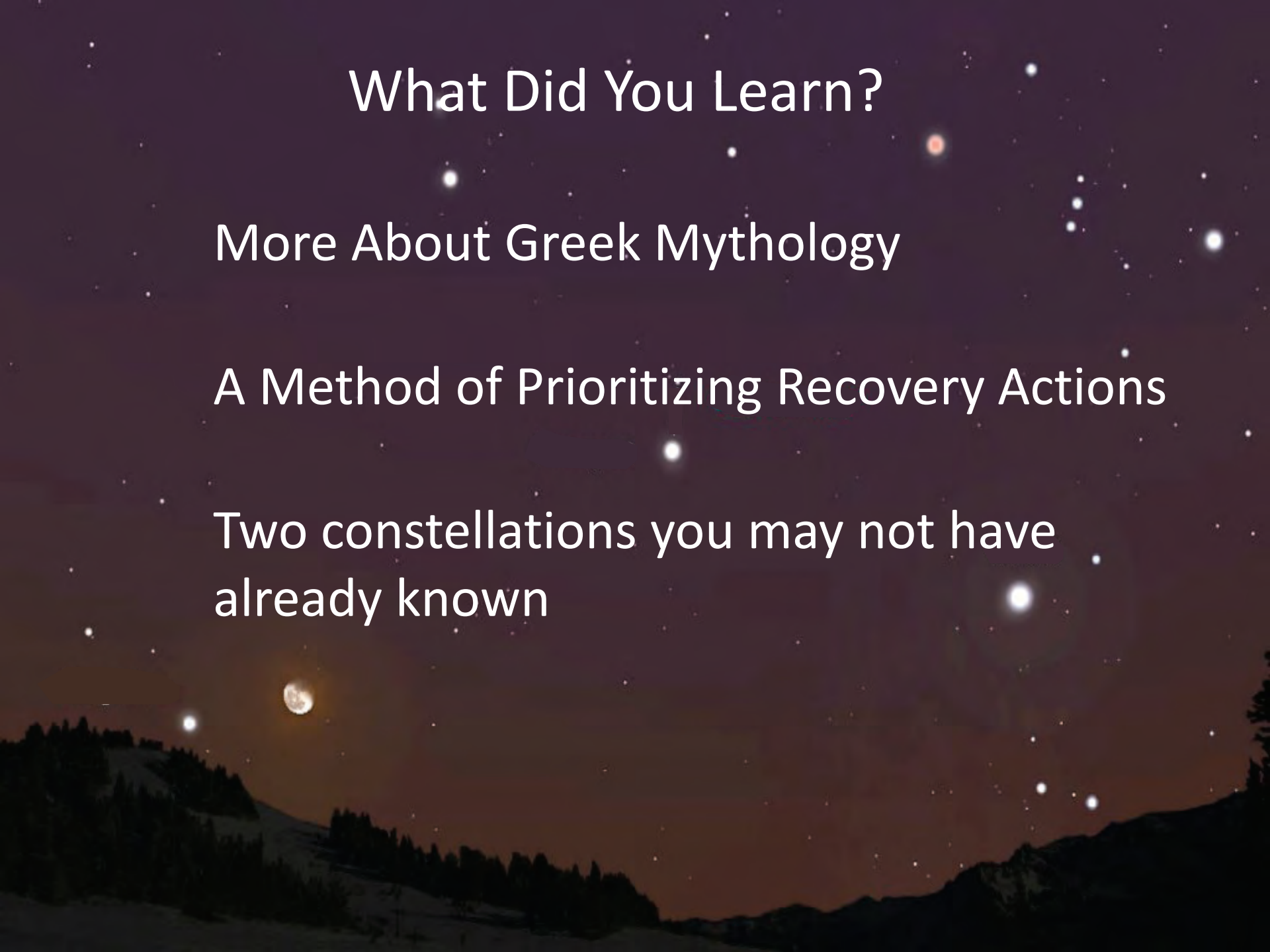
- It works!
- Hard work
 - Policy participants were uncomfortable with quantitative weighting
 - Technical participants were uncomfortable using expert judgment but learned to provide estimates of their uncertainty
- Ratings of ecosystem stressors heavily influenced the results, which led to an effort to improve stressor ratings
- Improved by including implementation considerations, such as cost-effectiveness and readiness

What Did You Learn?

More About Greek Mythology

A Method of Prioritizing Recovery Actions

Two constellations you may not have
already known





Orion

Canis Minor
"The Fox"

Procyon

Sirius

Canis Major
"The Hound"

Regulus

