

Overview of NRDA Scaling SETAC

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Outline

NRDA Scaling Overview

REA Framework

- > Discounting
- > Uncertainty
- > Risk

TEA Framework

- > Discounting
- > Uncertainty
- > Risk



Scaling Overview

Goal

- > Compensate for spill-related loss of ecological services

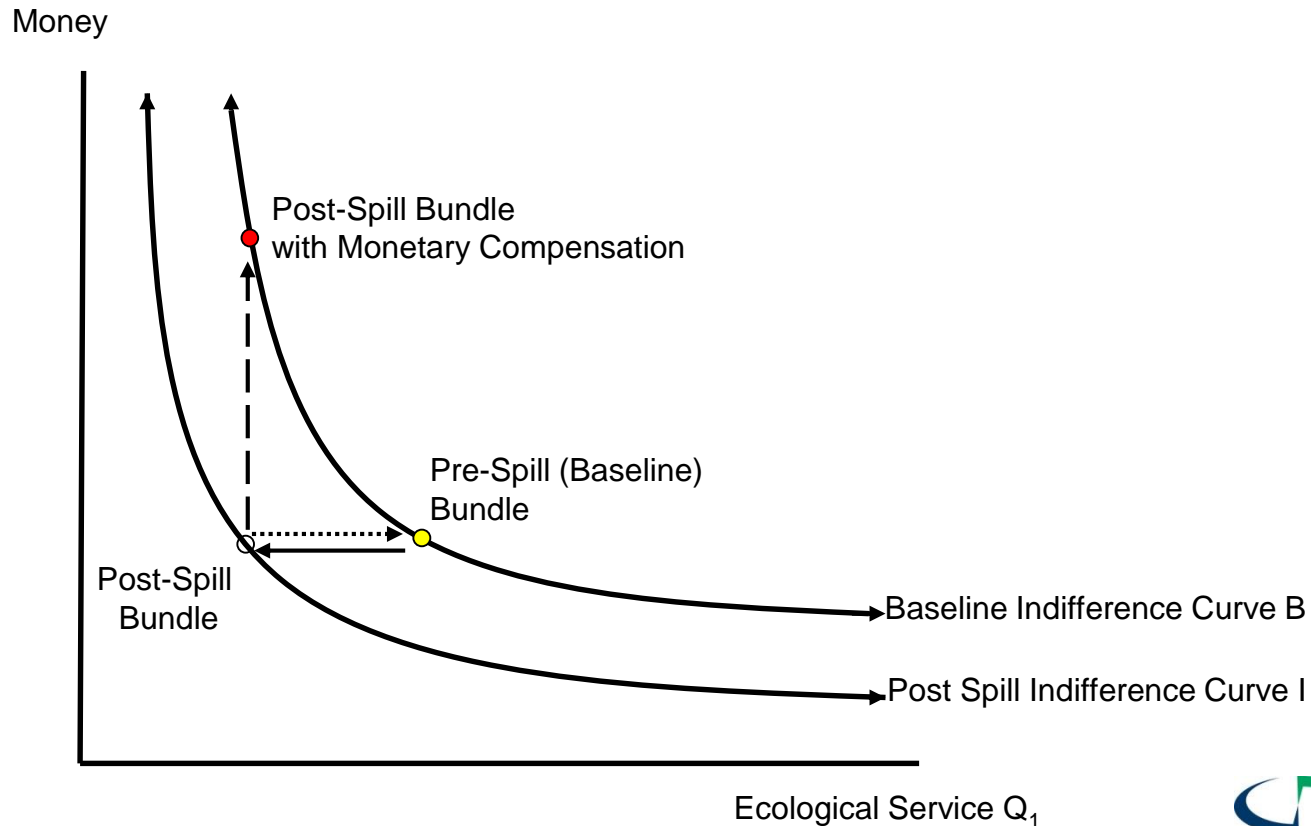
Scaling Approaches

- > Focus on ecosystem services with economic models
 - Habitat Equivalency Analysis (HEA)
 - Focus on services provided by habitat
 - Unit of observation “Discounted Acre Year”
 - Resource Equivalency Analysis (REA)
 - Focus on services provided by a population
 - Unit of observation “Discounted Species Year”
 - Trip Equivalency Analysis (TEA)
 - Focus on recreational opportunity
 - Unit of observation “Discounted Trip Days”

Scaling Overview: HEA, REA, and TEA are Economics

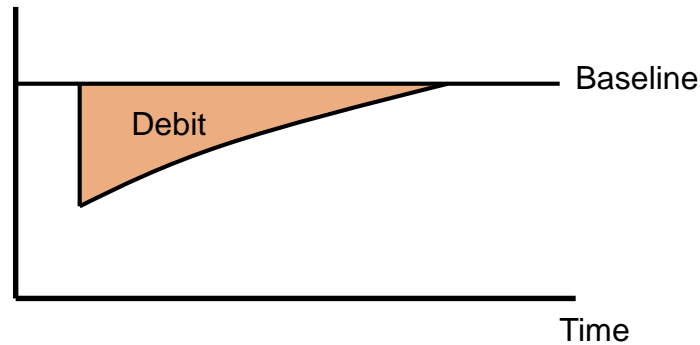
Compensation is an economic concept

> HEA, REA, and TEA are simplified economic models

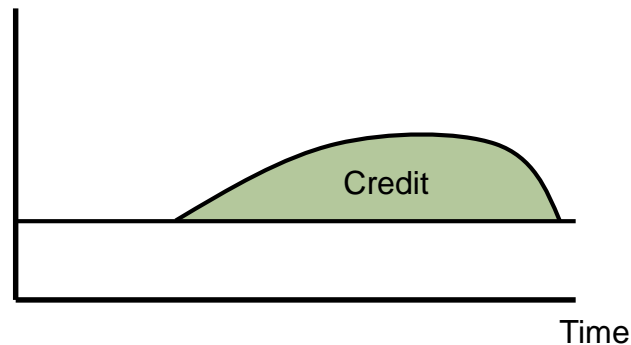


Scaling Overview: HEA Habitat Equivalency Analysis

Per Acre
Composite Service
Oiled Site



Per Acre
Composite Service
Restored Site

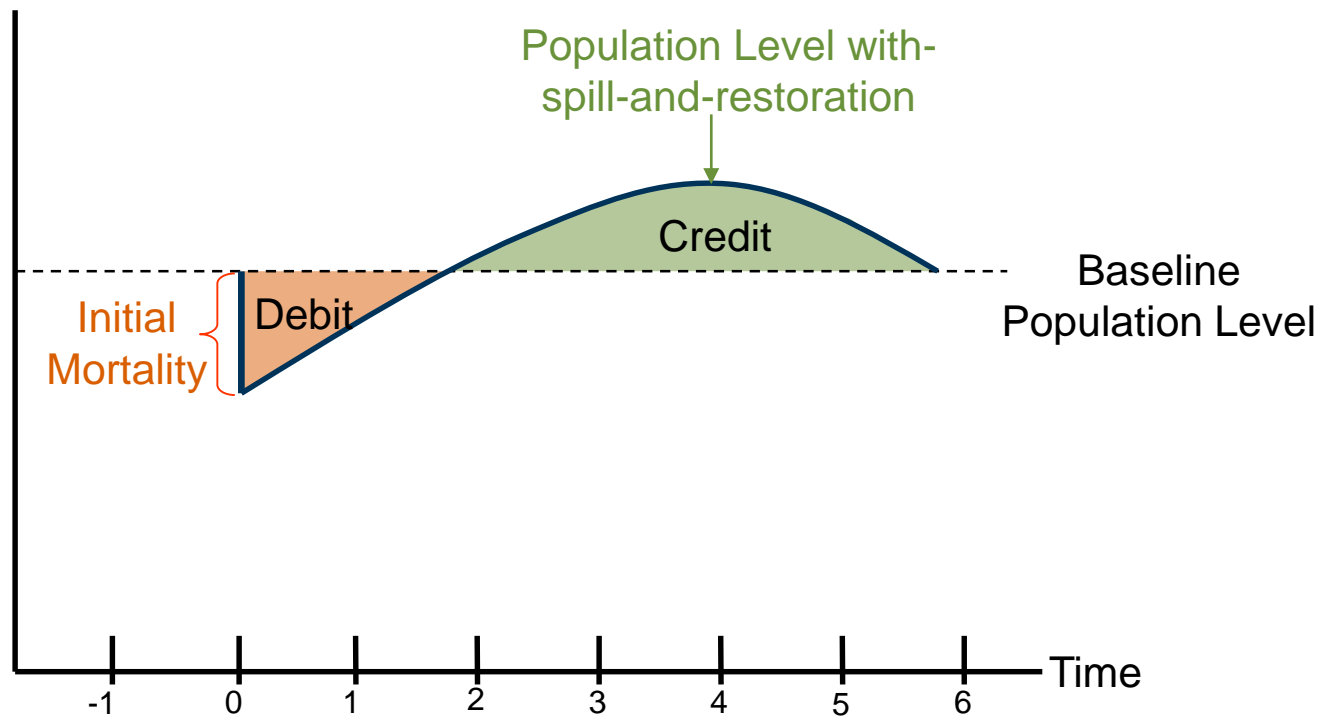


Adjust Size of Restoration Project Until
Total Debit = Total Credit

Scaling Overview: REA

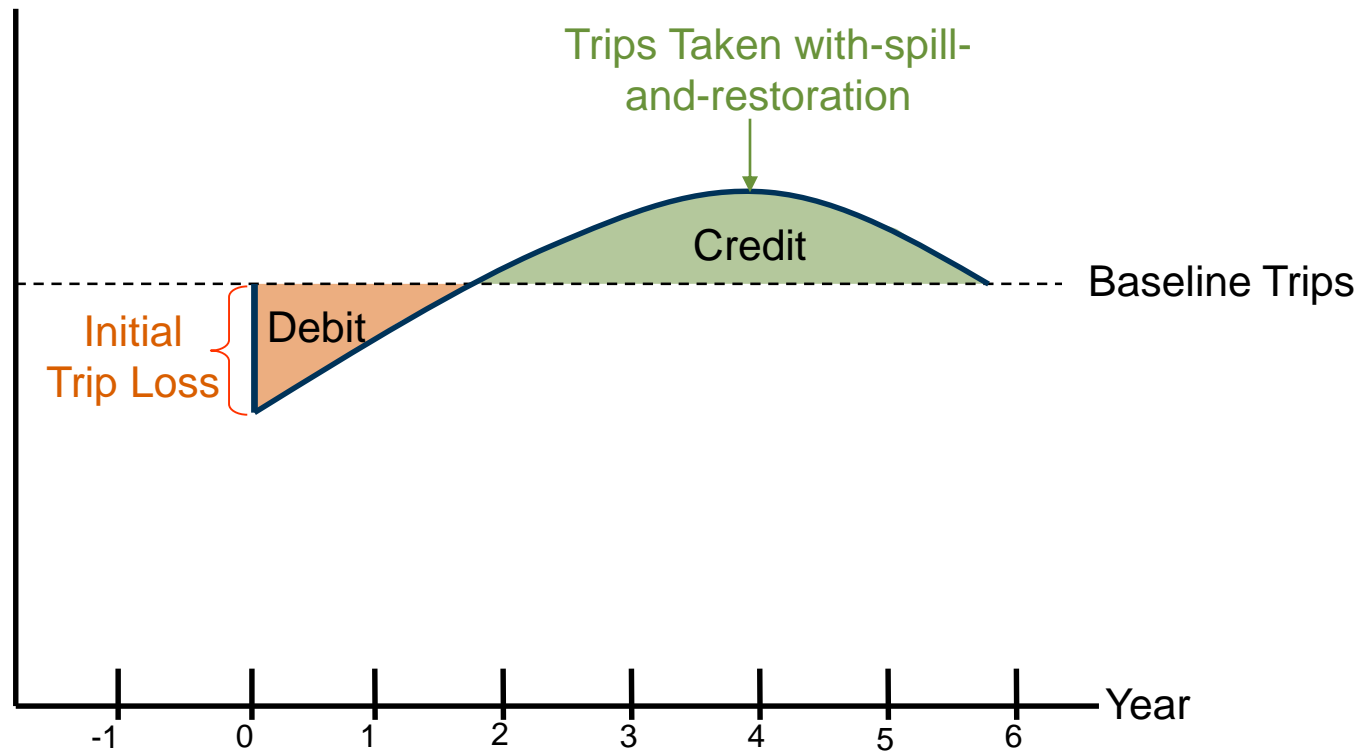
Resource Equivalency Analysis (REA)

Number of Individuals
in Population



Scaling Overview: TEA Resource Equivalency Analysis (REA)

Number of Trips Taken
Annually

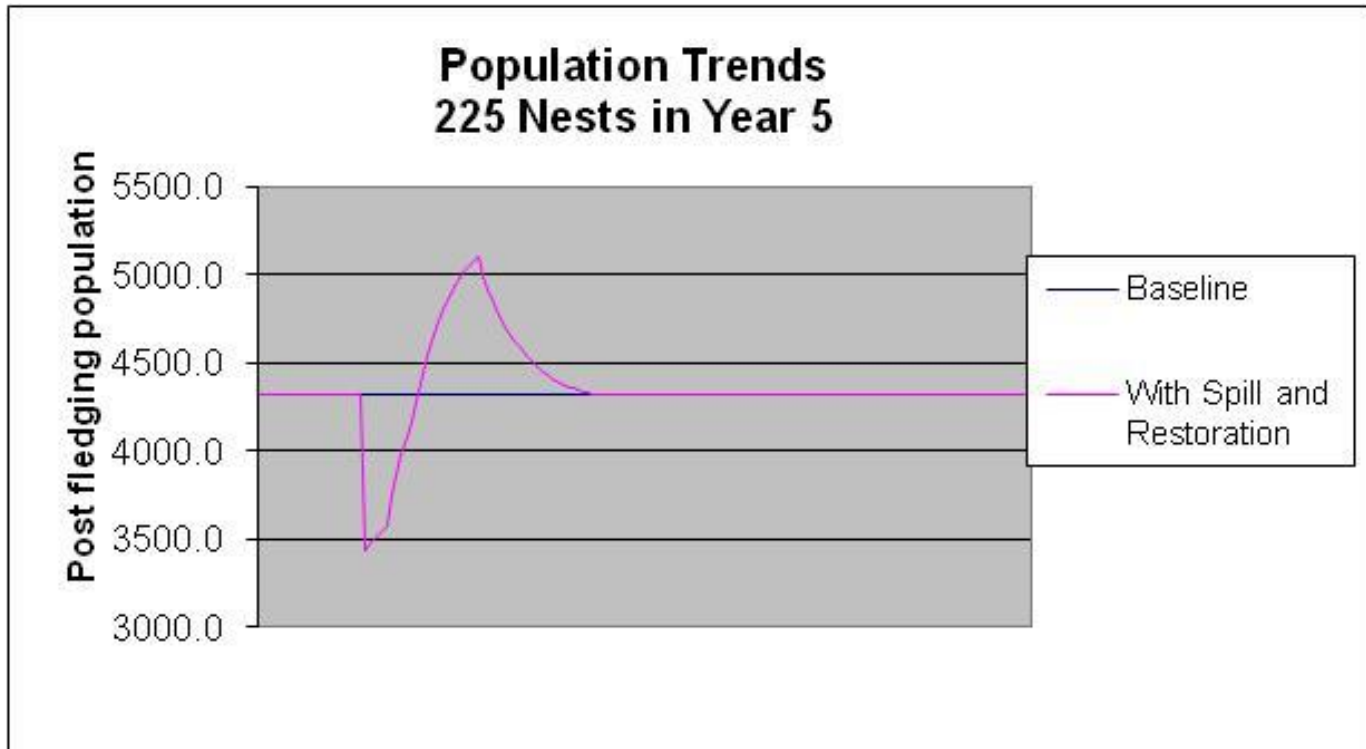


Scaling Overview: Integrating HEA, REA, and TEA

Doing HEA, REA, and TEA for a single incident, is challenging
> Service Accounting



REA Framework

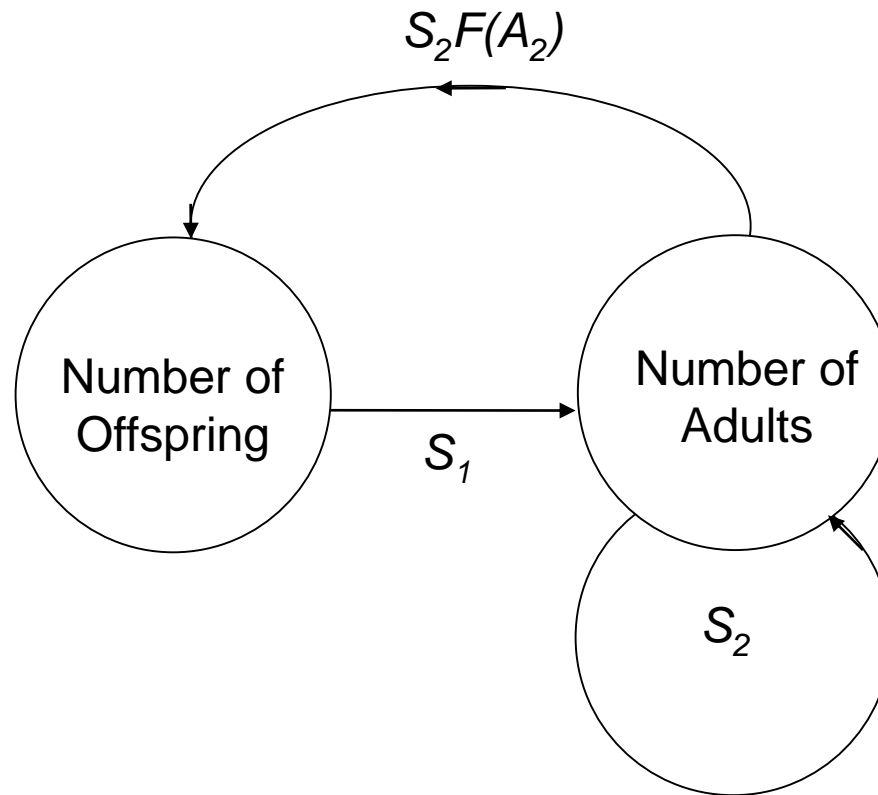


REA Framework: Four Ecological Inputs

There are only four REA questions:

- > What was the magnitude of acute mortality?
- > What was the effect on productivity in the year of the spill?
- > What is the long term effect of the spill and restoration on annual survival?
- > What is the long term effect of spill and restoration on annual productivity?

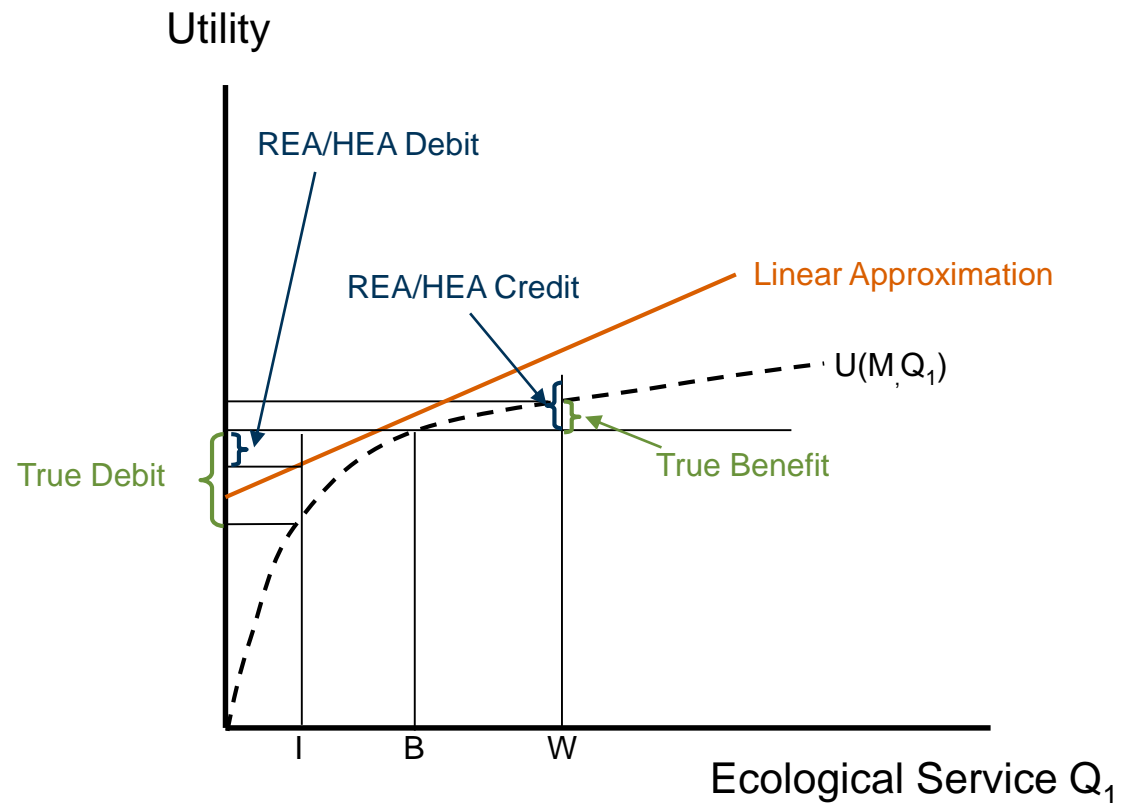
REA Framework: Integrating the 4 Ecological Inputs



REA Framework: Non-Ecological Considerations

REA Framework should also address

- > Discounting
- > Uncertainty
- > Risk



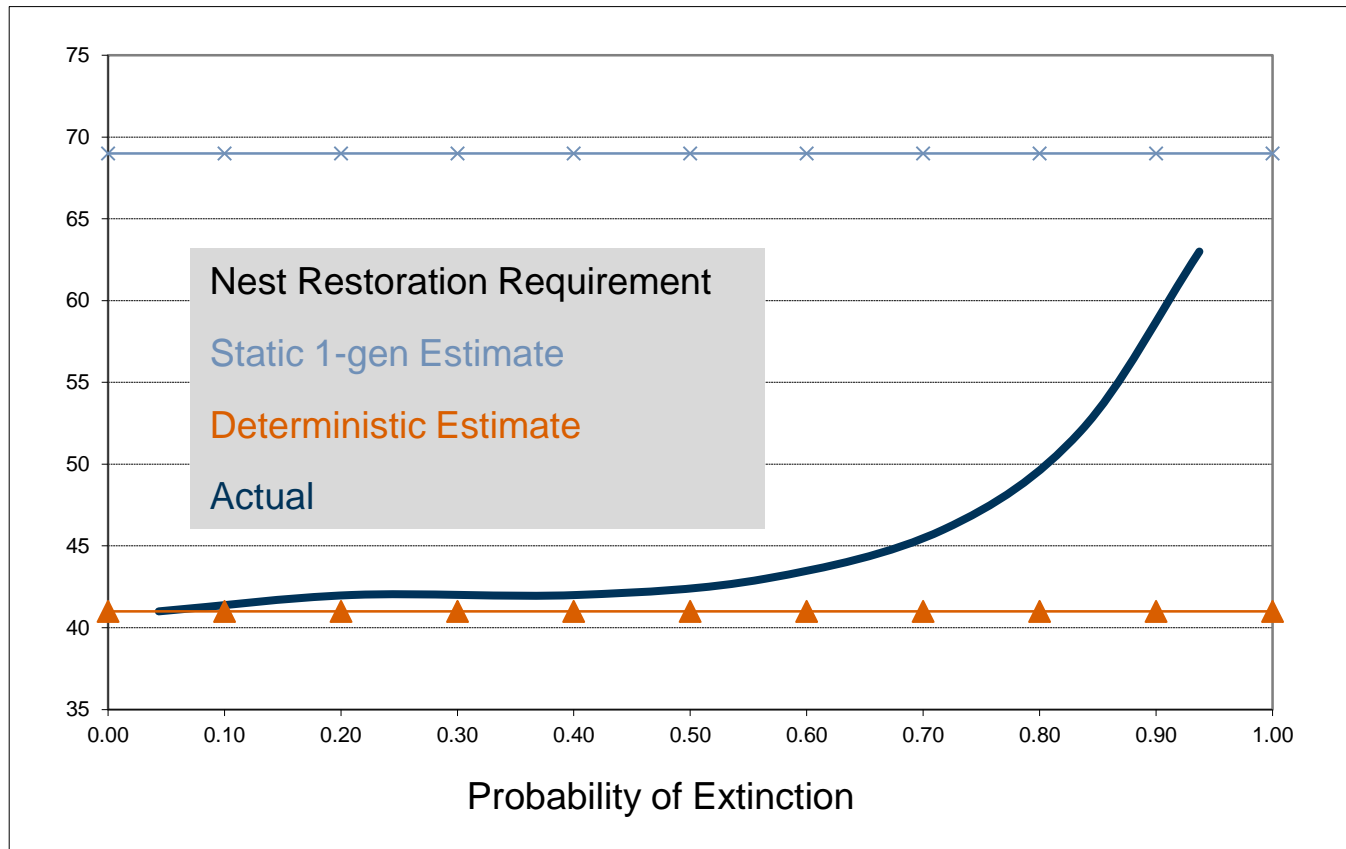
REA Framework: Discounting

- > Discounting makes services provided in future less valuable than services provided today
- > Economists cite two reasons for discounting
 - Rate of time preference
 - Return to capital
- > Discounting is not done to reflect uncertainty associated with the future
- > NRDA's generally use a constant 3% annual discount rate

REA Framework: Uncertainty

- > What is uncertainty?
- > Uncertainty has multiple sources
- > NOAA (1999) outlines technical reasoning and basis to address NRDA uncertainty
 - Uncertainties are to be evaluated explicitly, using ranges or probability distributions where possible;
 - If variables are represented by ranges or distributions, then the expected value of the overall outcome distribution should be used (Monte Carlo);
 - If variables are represented as point estimates rather than with ranges or distributions, the expected value should be used as the point estimate;
 - May use institutional controls (adaptive management) to reduce uncertainty related to restoration success.

REA Framework: Uncertainty Cont'



REA Framework: Risk

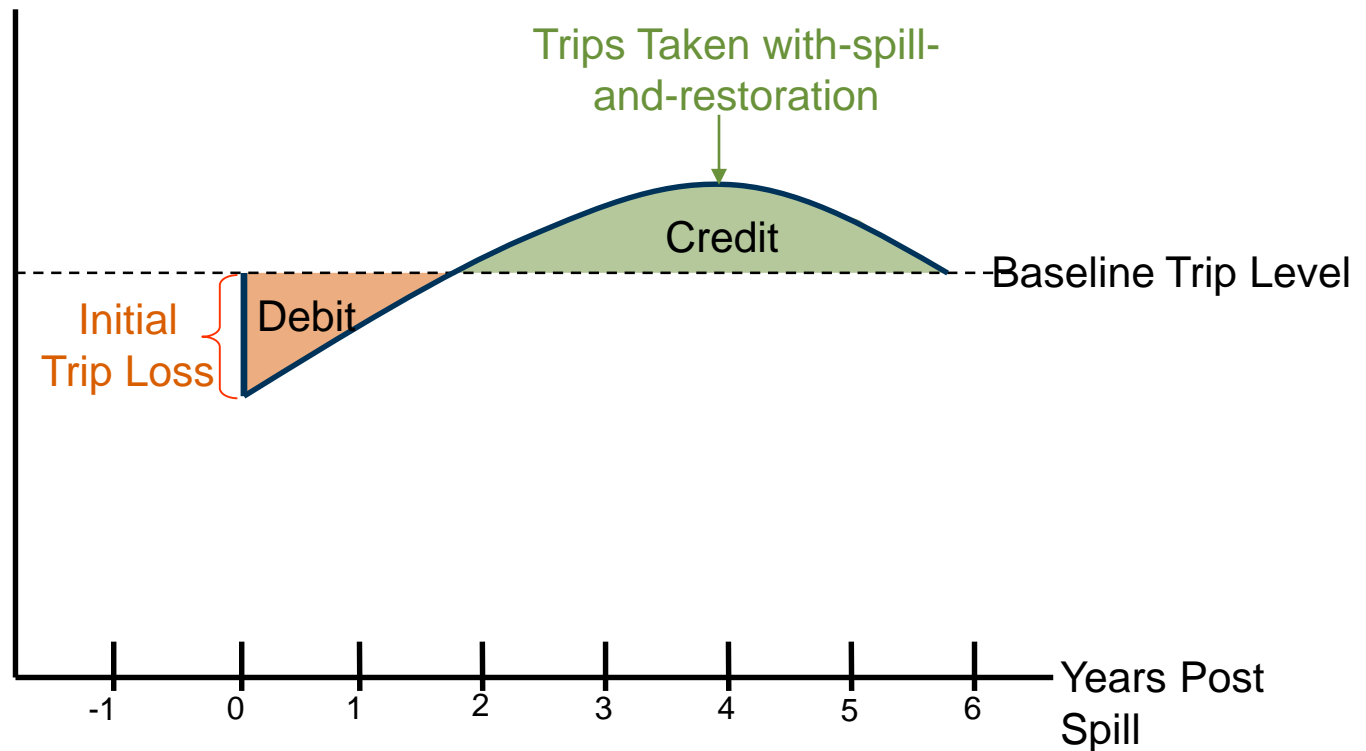
What is Risk?

NOAA guidance suggests

- > Expected values to estimate NRD liability then add some amount to address risk preferences. While informal, the “contingency factor approach” is more tractable than biasing point estimates of a series of individual variables
- > Adjusting discount rate allowed but explicit contingency factor is preferred
- > Economics literature and behavior suggest relatively modest adjustments

TEA Framework Resource Equivalency Analysis (REA)

Number of Trips Taken
By Public



TEA Framework: Change in Welfare (Well-Being)

$$\frac{1}{\beta_{TC}} \sum_i \left\{ \ln \left[\sum_{j=1}^J \exp(X_{ij}\beta) \right] - \ln \left[\sum_{j=1}^{J-1} \exp(X_{ij}\beta) + \exp(X_{ij}\beta + \alpha) \right] \right\}$$

Welfare change

Simplifies to:

\$ Value per Trip

×

Change in Trips

TEA Framework: Welfare in NRDA Scaling Context

Loss due to injury = Gain from restoration

Value per trip x lost trips = Value per trip x restored trips

~~Value per trip x lost trips = Value per trip x restored trips~~

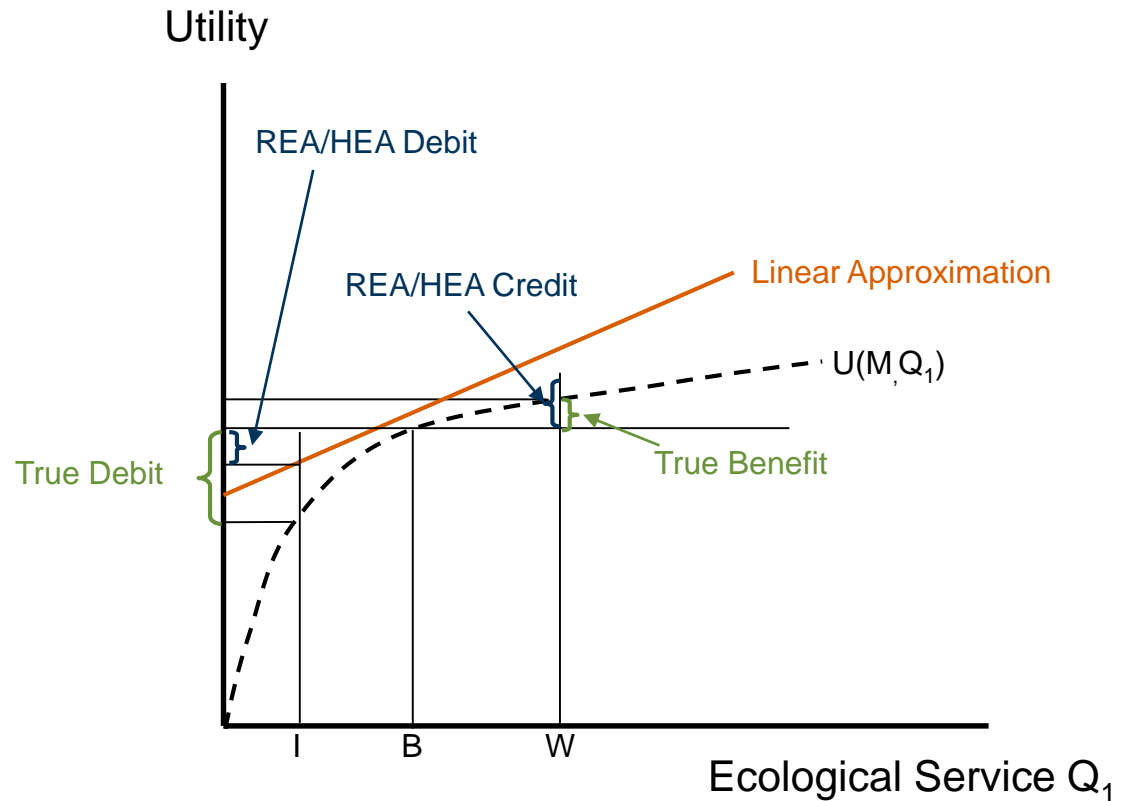
Lost trips = Restored trips

This logic is similar to the logic behind HEA and REA
Service to Service

TEA Framework: Non-Recreation Considerations

REA Framework should also address

- > Discounting
- > Uncertainty
- > Risk



TEA Framework: Discounting, Uncertainty, Risk

Discounting

- > Why: Rate of time preference, return to capital
- > What: Constant 3 percent annual

Uncertainty

- > Why: Scaling is uncertain; need best practice
- > What: Use Monte Carlo and expected values

Risk

- > Why: Public may be risk averse
- > What: Modest contingency factor

Summary

1. Scaling prevents net loss of ecological services due to spill
 - > HEA-Focus on composite service provided by habitat
 - > REA-Focus on services provided by individual members of population
 - > TEA-Focus on recreational trip taken by public
2. Underlying logic is economic
 - > Identify framework to integrate all approaches if used for single incident
3. Compare services provided under baseline to services provided with-spill-and-restoration
 - > Restoration adjusted to ensure no net loss of services
4. Existing guidance on discounting, risk, and uncertainty is established

