Methods and Metrics for Quantifying Ecologic Benefits of River Restorations

Katie Jagt, PE
Consulting Engineer to American Rivers

Mary Matella
PhD Candidate, UC Berkeley

Problem Statement

- Inundated habitat is critical to threatened fish species

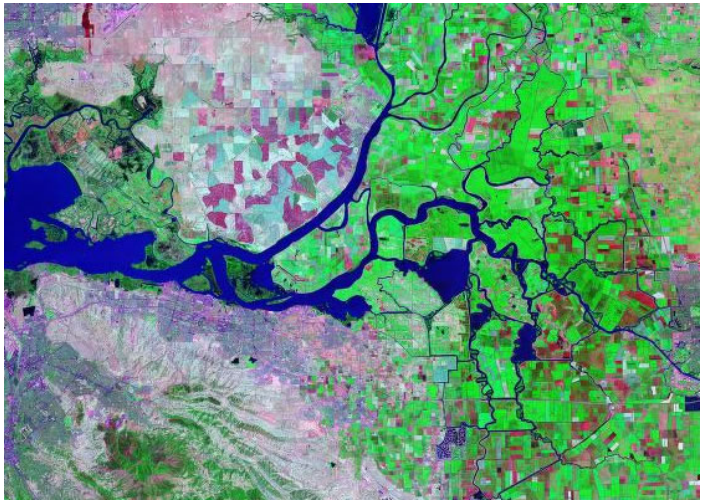
- Today, this habitat is a fraction of its historic value

- Habitat restoration must include floodplain restoration

- There had been no method of adequately quantifying habitat.

Goals for the metric

- Useful both as a screening and design tool.
- Adapted to measure habitat/benefit for a variety of species/objectives.
- Easily applied by any agency or consultant that uses standard tools and available data.
- Transparent and replicable i.e. not subject to distortion by hidden assumptions, qualitative indices, or weighting factors.



Ecosystem Variables

Physical

- Depth
- Velocity
- Cover
- Vegetation
- Connectivity

Hydrologic

- Duration
- Frequency
- Timing

Borrowing Ideas ?

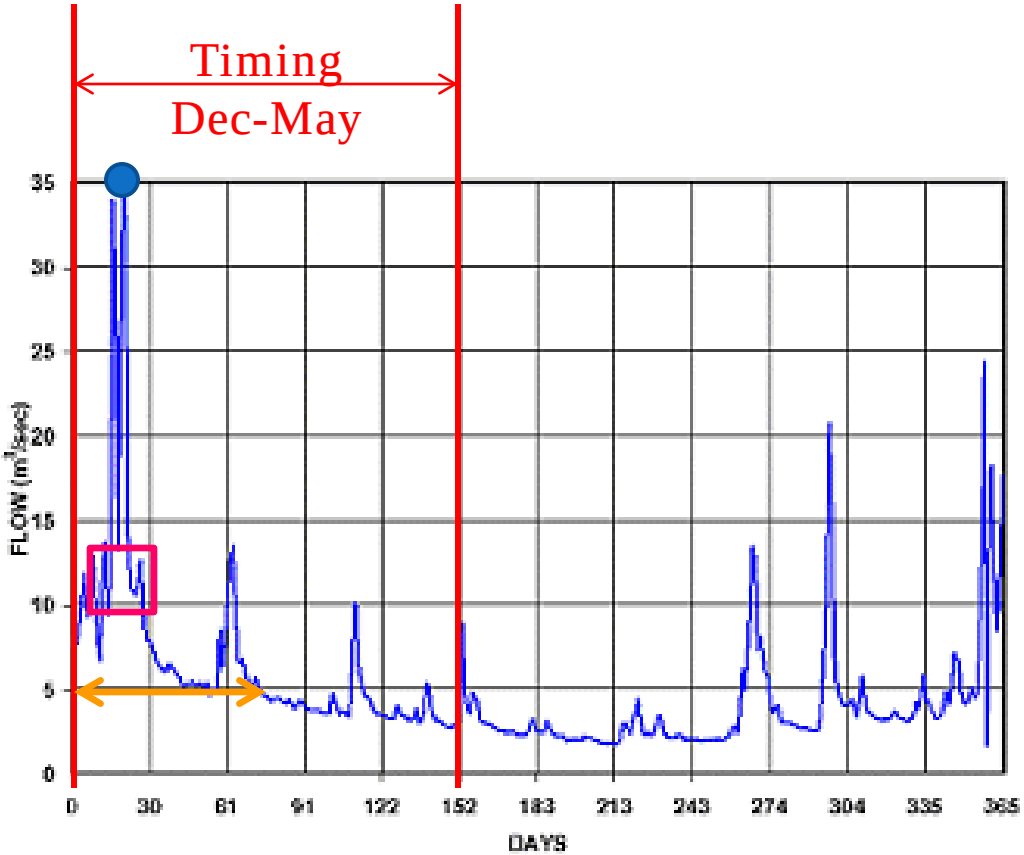
Intensity (depth) - Duration-Frequency Curves in Hydrology → Area-Duration-Frequency Curves for Habitat?

Estimated Annual Damage in Flood Risk Analysis → Estimated Annual Habitat

Ecosystem Relationships

Ecological Relevance	Season	Duration	Frequency
Splittail spawning and rearing	Feb – May	At least 21 days	At least 4 yr return period
Chinook salmon rearing	Dec – May	At least 14 days	At least 2 yr return period
Phytoplankton production	Dec – May	At least 2 days	1.3 yr return period
Zooplankton production	Dec – May	At least 14 days	1.3 yr return period
Benthic macroinvertebrate production	Dec – Sep	At least 1 day	2 yr return period

Hydrologic Requirements



Durations

1-Day

3-Day

7-Day

14-Day

21-Day

28-Day

60-Day

ADF Curves: Definition

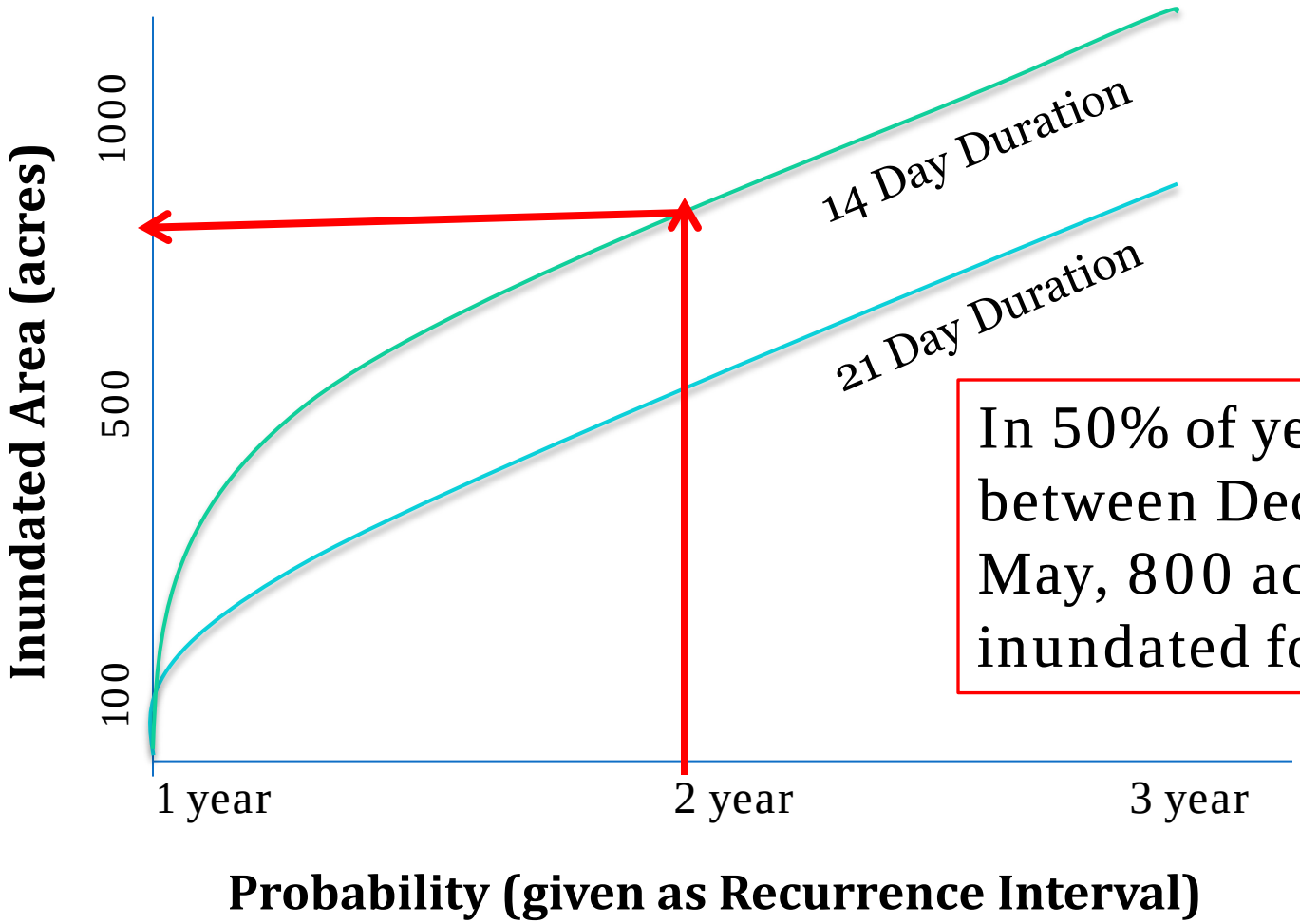
Intensity (depth)-Duration-Frequency Curves in Hydrology

Defines the variable we are interested in for design (intensity) as a function of duration and frequency.

Area-Duration-Frequency Curves

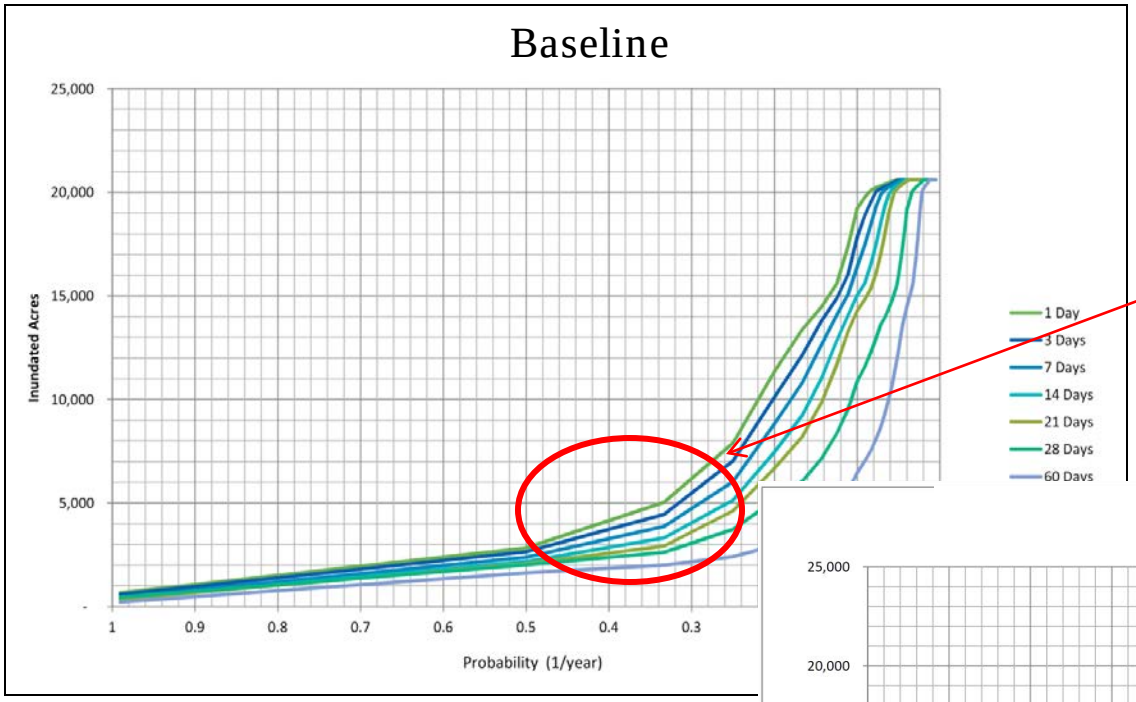
Defines the variable we are interested in for design (quantity of functional habitat) as a function of duration and frequency.

Develop ADF Curves

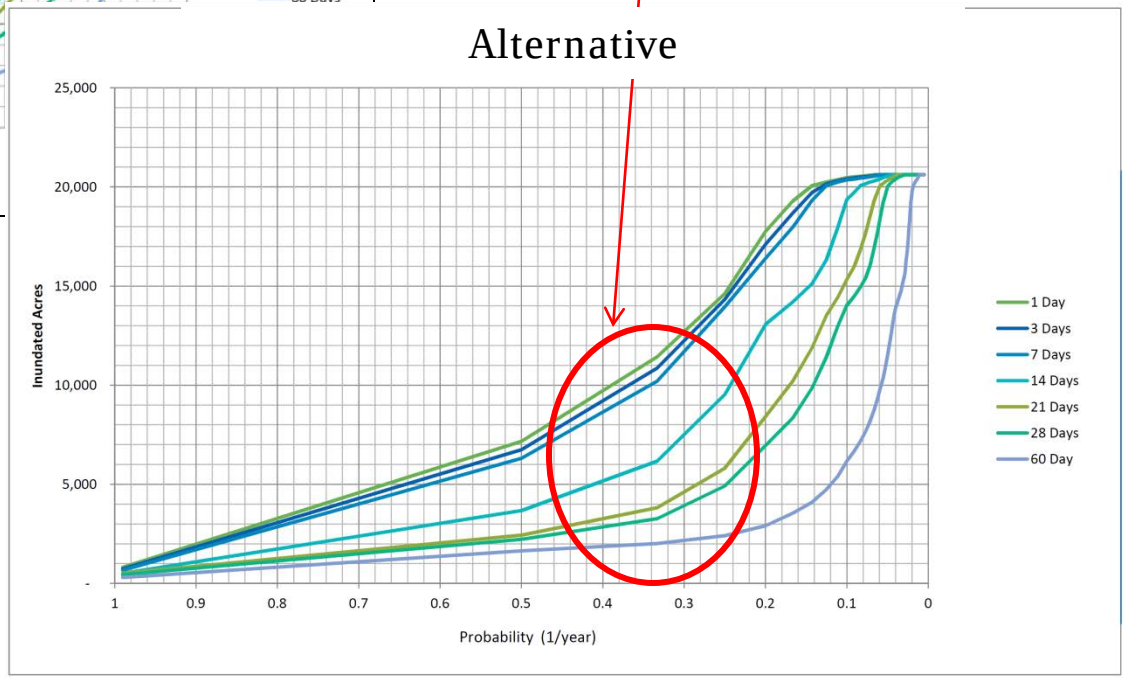


In 50% of years, between December and May, 800 acres are inundated for 14 days.

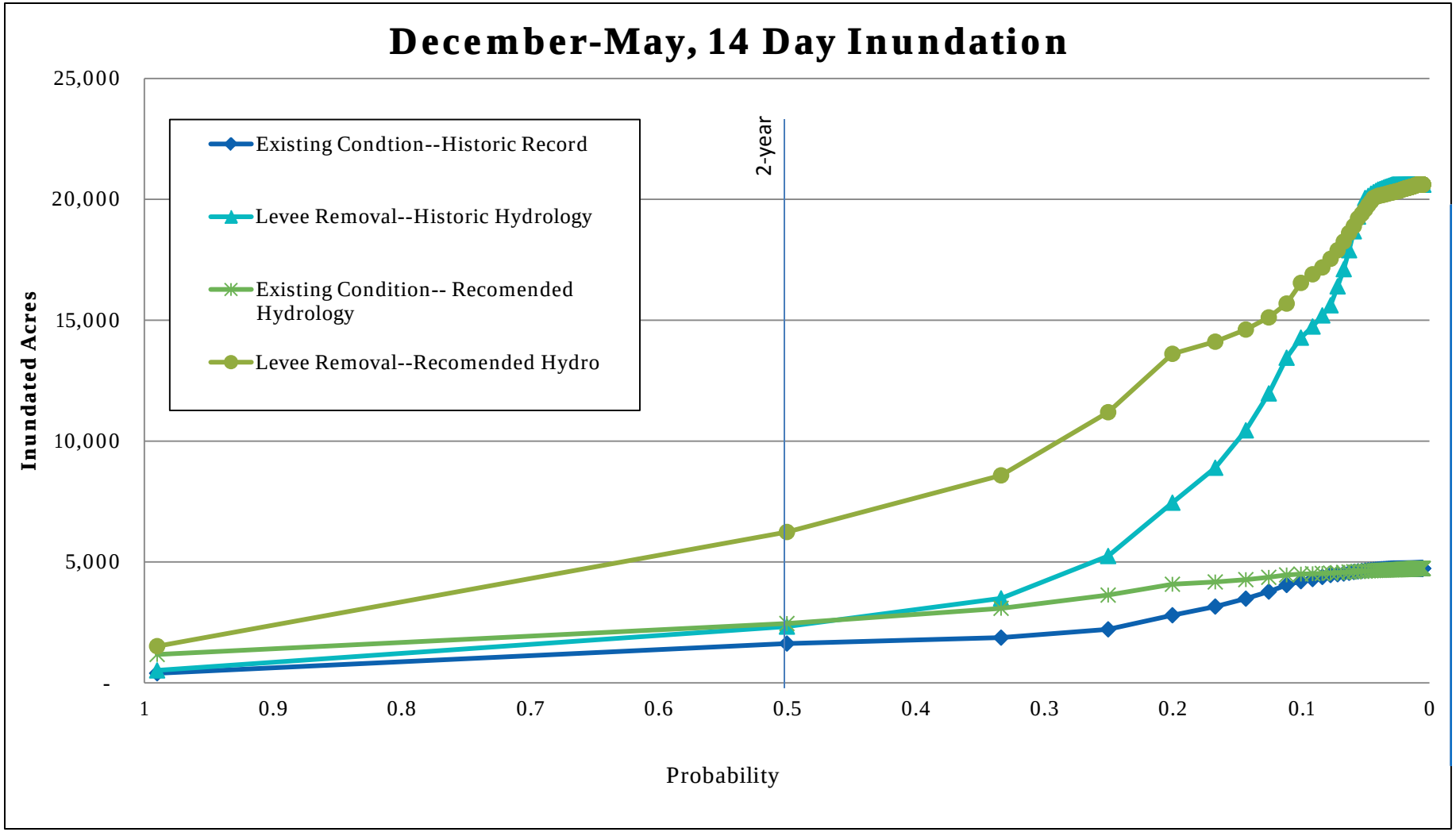
ADF Curves: Example



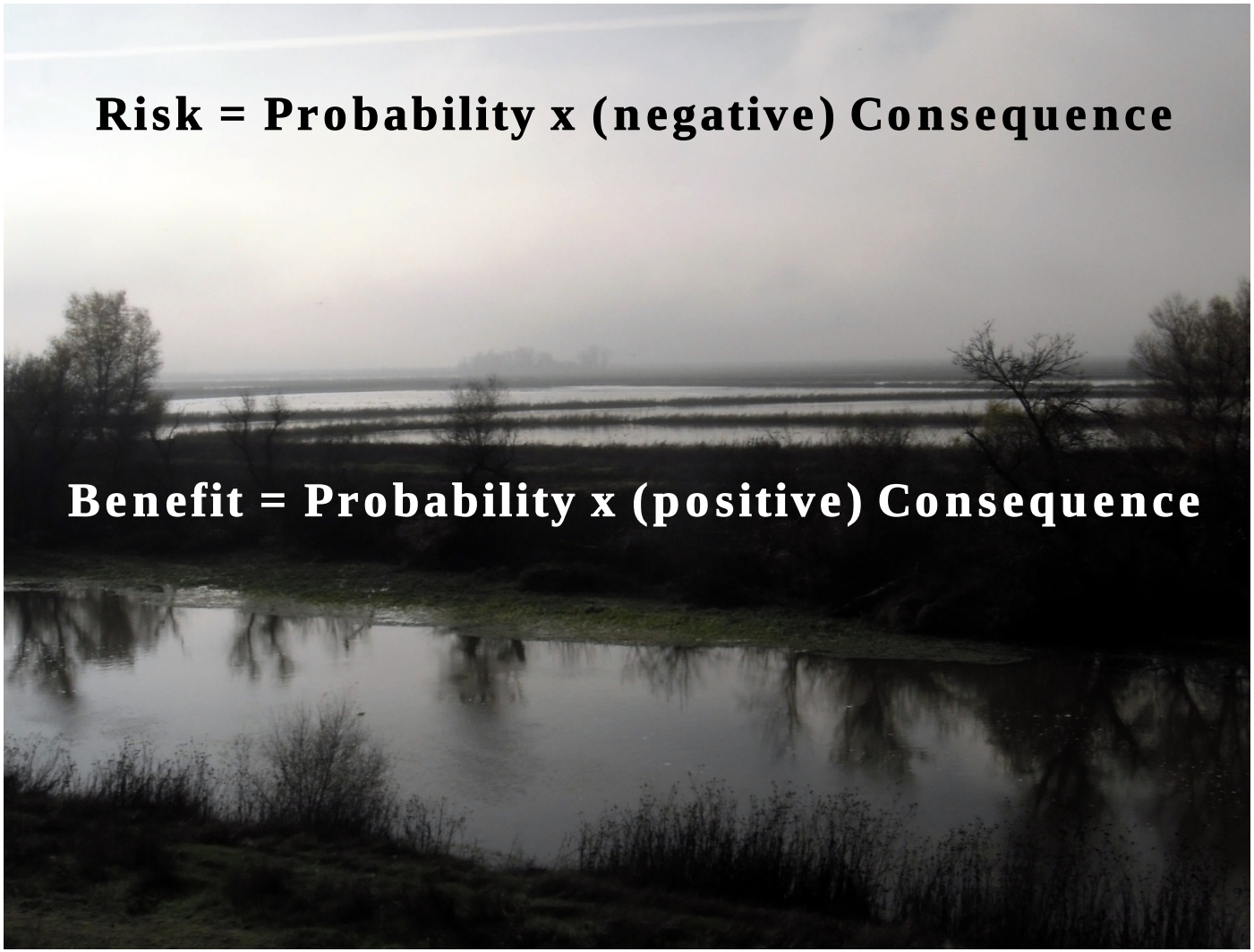
Benefit of Actions



ADF Curves: Species Specific



Benefit as Risk



EAH Value: Definition

Estimated Annual Damage in Flood Risk Analysis

Defines the total (negative)risk in an area as an annual monetary loss.

Estimated Annual Habitat

Defines the total (positive)benefit in an area as an annual habitat gain.

Flexibility

Physical Alterations

- Levee setbacks
- New bypasses
- Floodplain grading
- Weir and grade control structures
- Dredging
- Side channel reconnection

Hydrologic Alterations

- Weir Notching/lowering
- Reservoir Operations
- Climate Change

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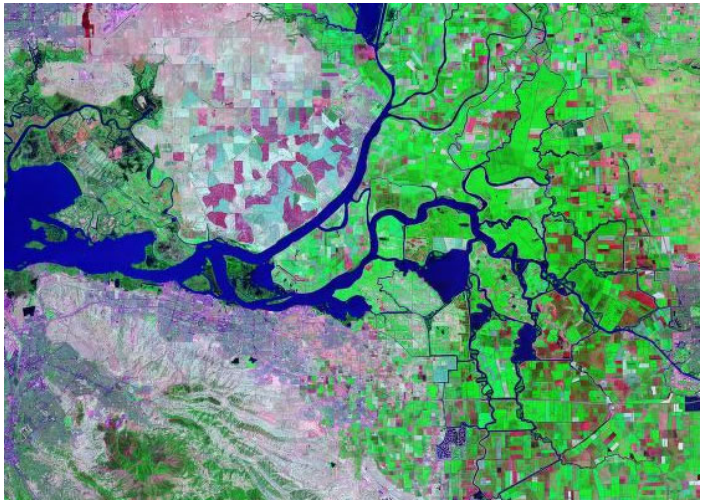

Questions?

katiejagt@gmail.com

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Thank you, especially to John Cain, Mary Matella, Mark Tompkins, and Rich Walkling

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