Using monitoring to assess restoration functions and ecosystem services: an example from the Nisqually River Delta, WA

Isa Woo[1], Melanie Davis[2], and Susan De La Cruz[1]

In partnership with the Nisqually Indian Tribe and the Billy Frank Jr. Nisqually NWR

[1] USGS Western Ecological Research Center, [2]USGS Oregon Cooperative Fish and Wildlife Research Uniln partnership with the Nisqually Indian Tribe and the Billy Frank Jr. Nisqually NWR

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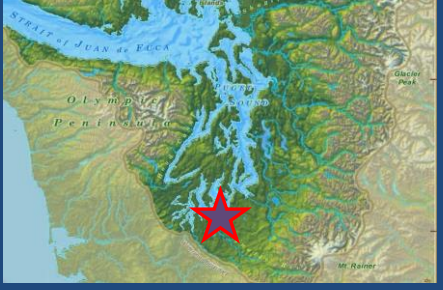
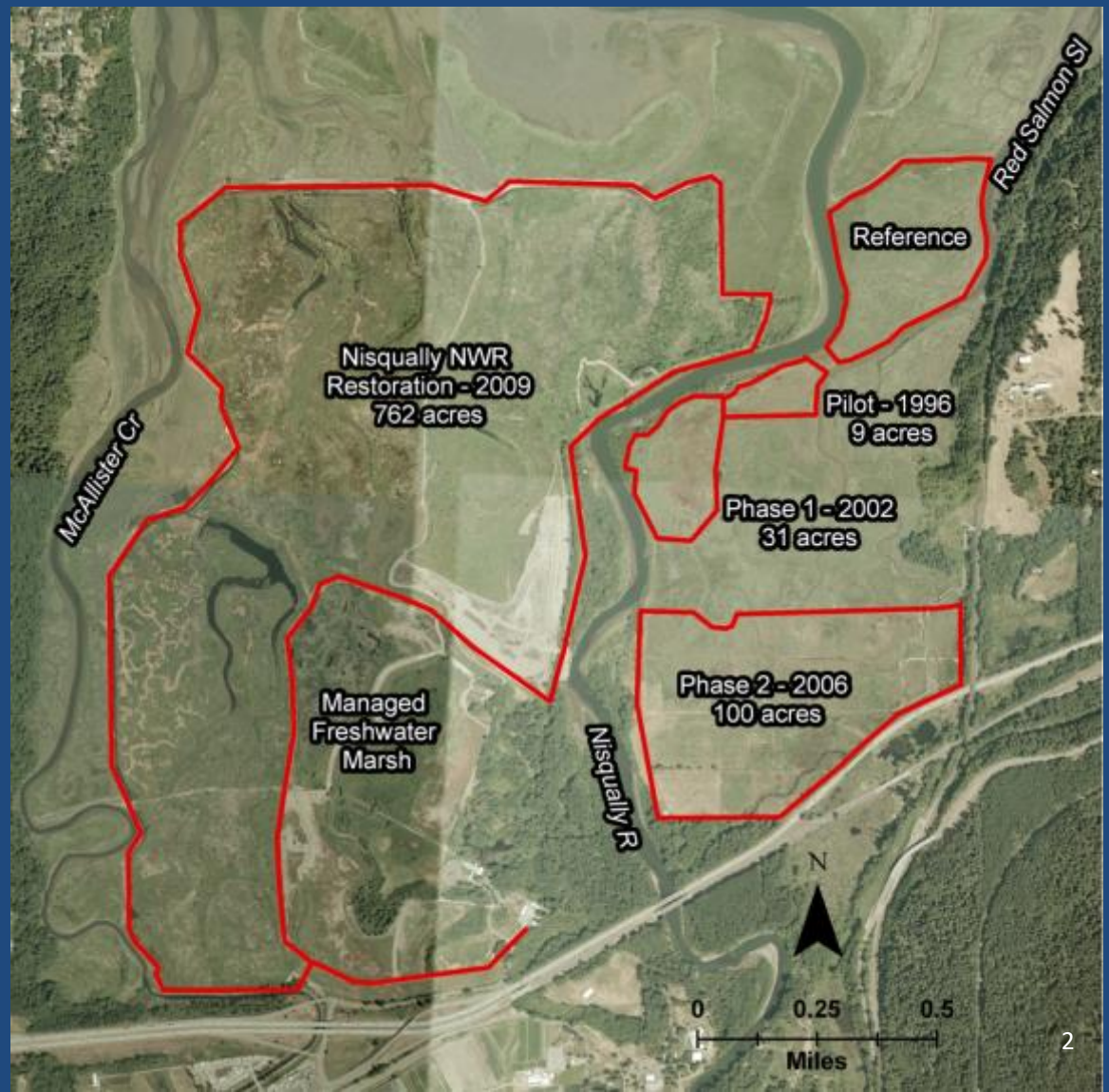
Nisqually Indian Tribe

U.S. FISH & WILDLIFE SERVICE

PMEP Effective Estuary Restoration Symposium, March 12, 2024

Restoring Nisqually Tidal Wetlands

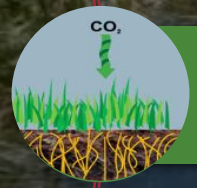




Restoration Functions

Invertebrate Prey Resources & Foodwebs

Fish Bioenergetic Growth Potential



Carbon Sequestration & Soil Carbon Storage

Modeling Habitat Change: SLR, sediment scenarios

Ecosystem Services

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What Are Ecosystem Services?

Benefits that humans derive from nature

Ecosystem Services study led by USGS:

Kristen Byrd, Isa Woo, Emily Pindilli, Monica Moritsch, Anthony Good and others

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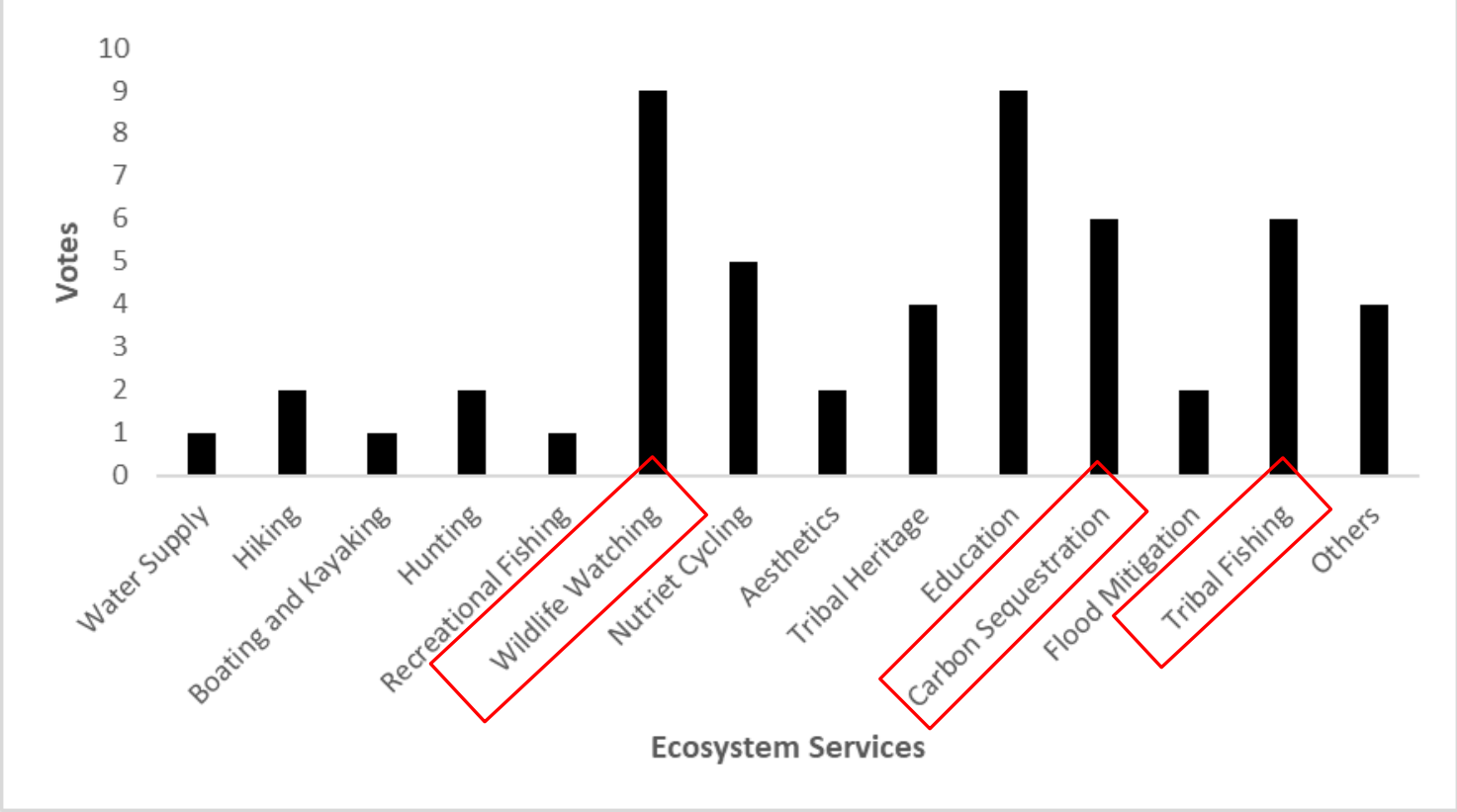
Rabinowitz and Andrews. 2002: https://www150.statcan.gc.ca/n1/pub/16-001-m/16-001-m2022001-eng.htm

Prioritization of Ecosystem Services:

Stakeholder and Partner Meeting 2019



Participants:

- Nisqually Indian Tribe
- WA Dept of Fish and Wildlife
- Nisqually River Council Citizens Advisory Committee
- Nisqually Land Trust
- City of Lacey Parks and Recreation
- City of DuPont
- Ducks Unlimited
- Olympia Coalition for Ecosystems Preservation
- Puget Sound Partnership
- Nisqually River Foundation
- Saint Martins University
- Tahoma Audubon Society
- Evergreen State College
- Capital Land Trust
- Billy Frank Jr. Nisqually NWR
- Olympia-Lacey-Tumwater Visitor and Convention Bureau

Recreational Birdwatching

- Billy Frank Jr. Nisqually NWR: an urban Refuge
- Diverse wildlife habitats support > 250 bird spp

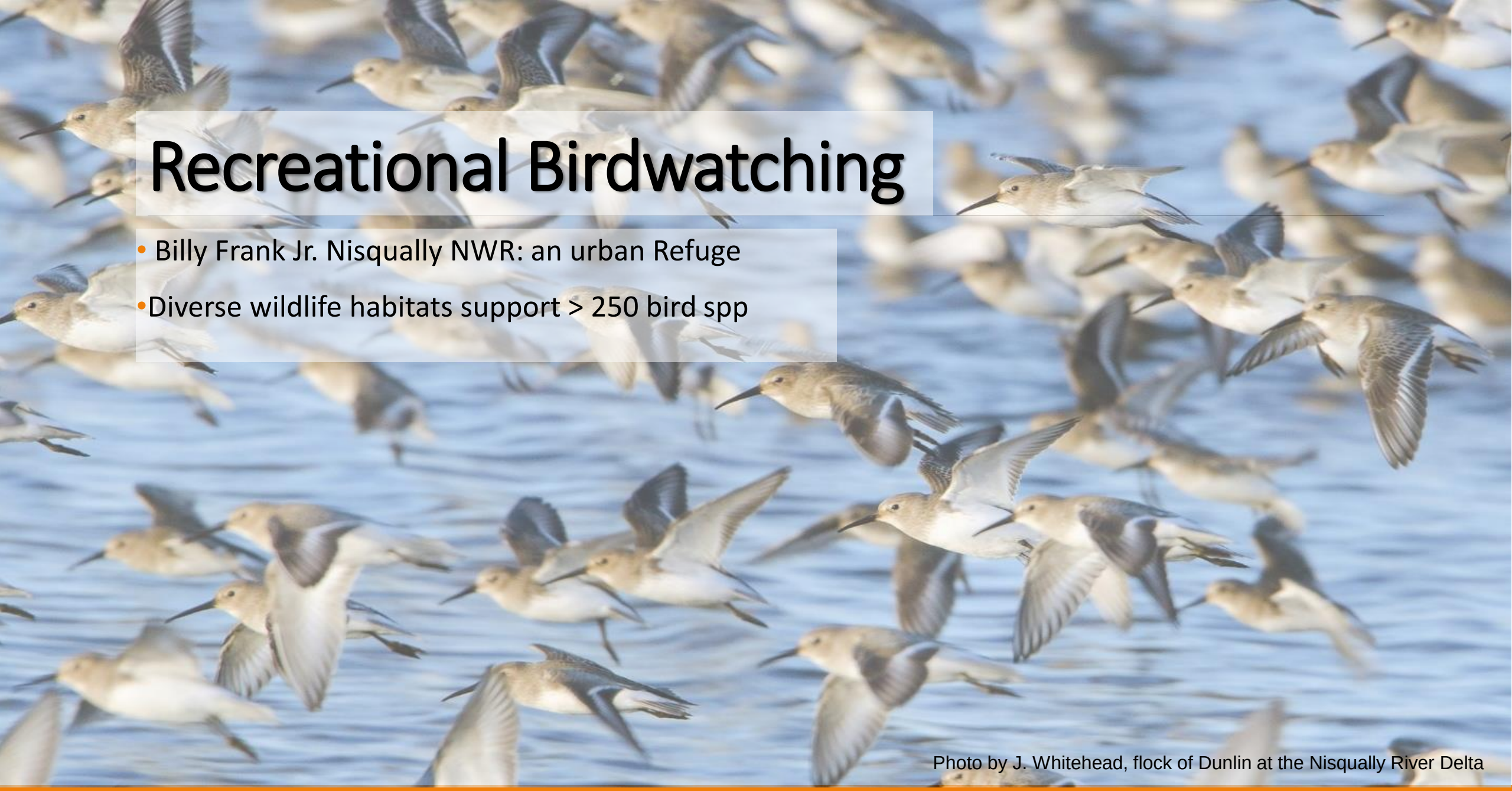
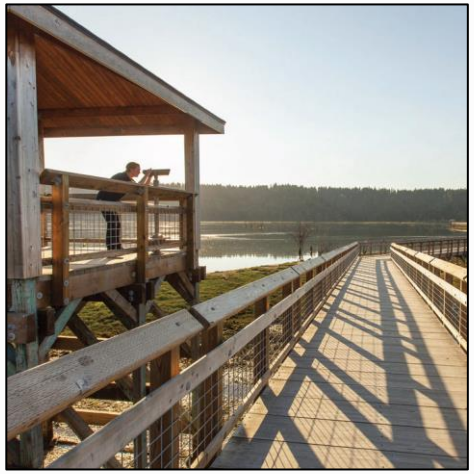


Photo by J. Whitehead, flock of Dunlin at the Nisqually River Delta

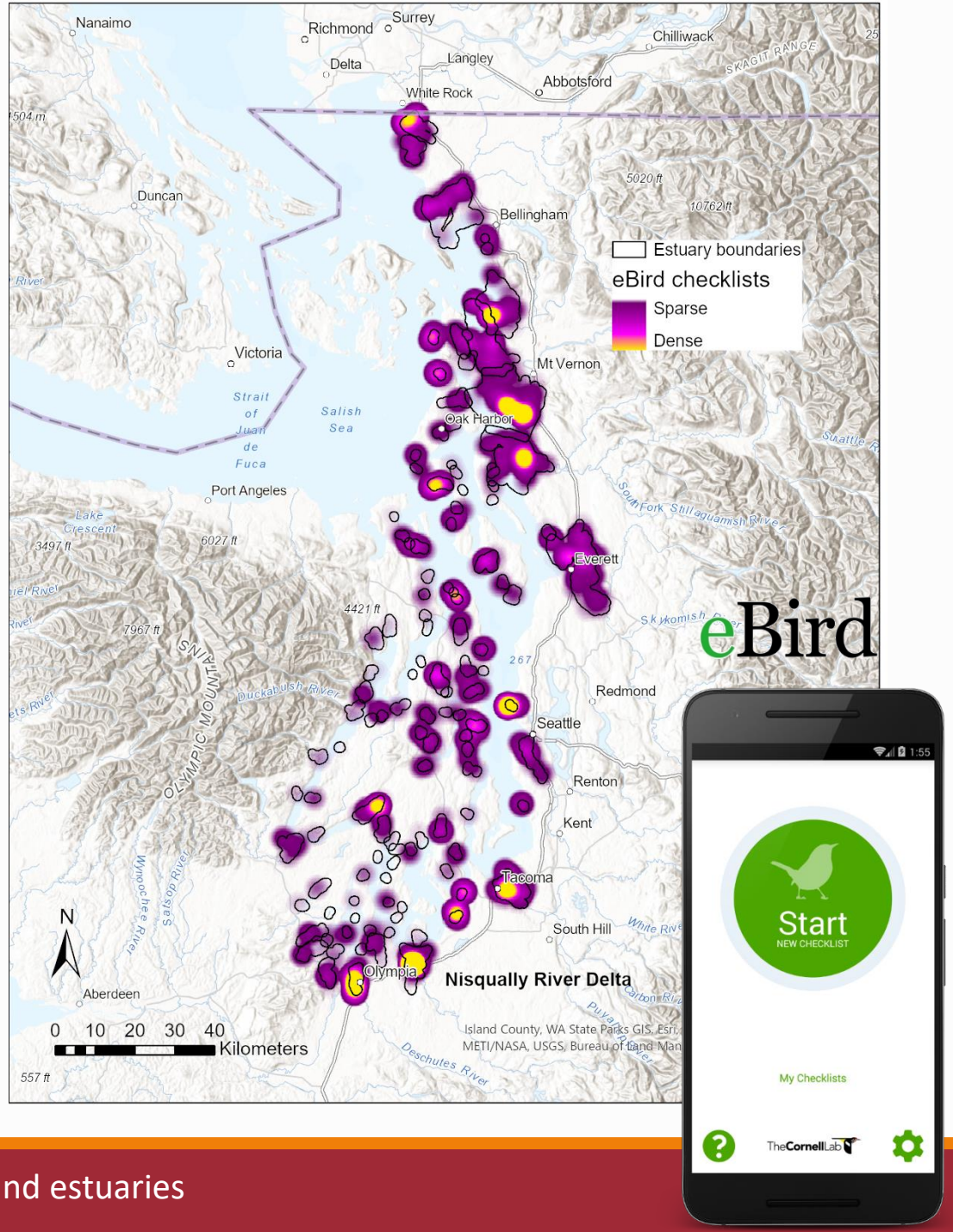
Recreational Birdwatching



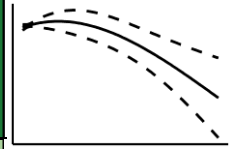
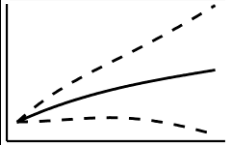
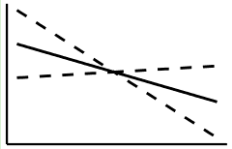
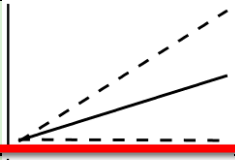
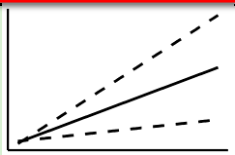
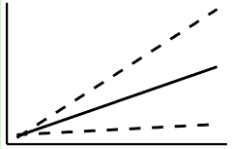
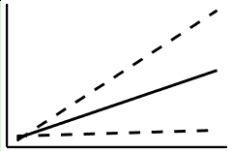
Question: How do estuarine habitats and other features influence the number of birdwatchers at a site?

Used eBird checklists as proxy for visitation; one observer = one visitor-day; n=4680 (summed by estuary, year, season)

Generalized additive mixed models to predict #visitor-days



142,276 checklists from 2010 – 2019, 117 Puget Sound estuaries

Predictor variable	Variable importance	Smoothed relationship
Season	0.997	
Dist. to city	0.997	
Num. spp.	0.962	
Num. rare spp.	0.281	
Habitat evenness	0.163	
Open access area	0.126	
Forested wetland	0.110	
Emergent wetland	0.109	
Aquatic vegetation	0.109	

Recreational Birdwatching Results: What variables are most important?

0.00-0.25	0.26-0.50	0.51-0.75	0.76-1.00

Trends – more birdwatchers

- In winter,
- 17 miles from major city,
- More rare species observed,
- More open access area,
- More forested wetland, emergent wetland, and aquatic vegetation

Approximately 88% of deviance explained (null model with estuary and year only explained 84% deviance)

Tribal Fishing

"As the salmon disappear, so do our Tribal cultures ***and*** *treaty rights. We are at a crossroads, and we are running out of time."*
-Billy Frank, Jr.

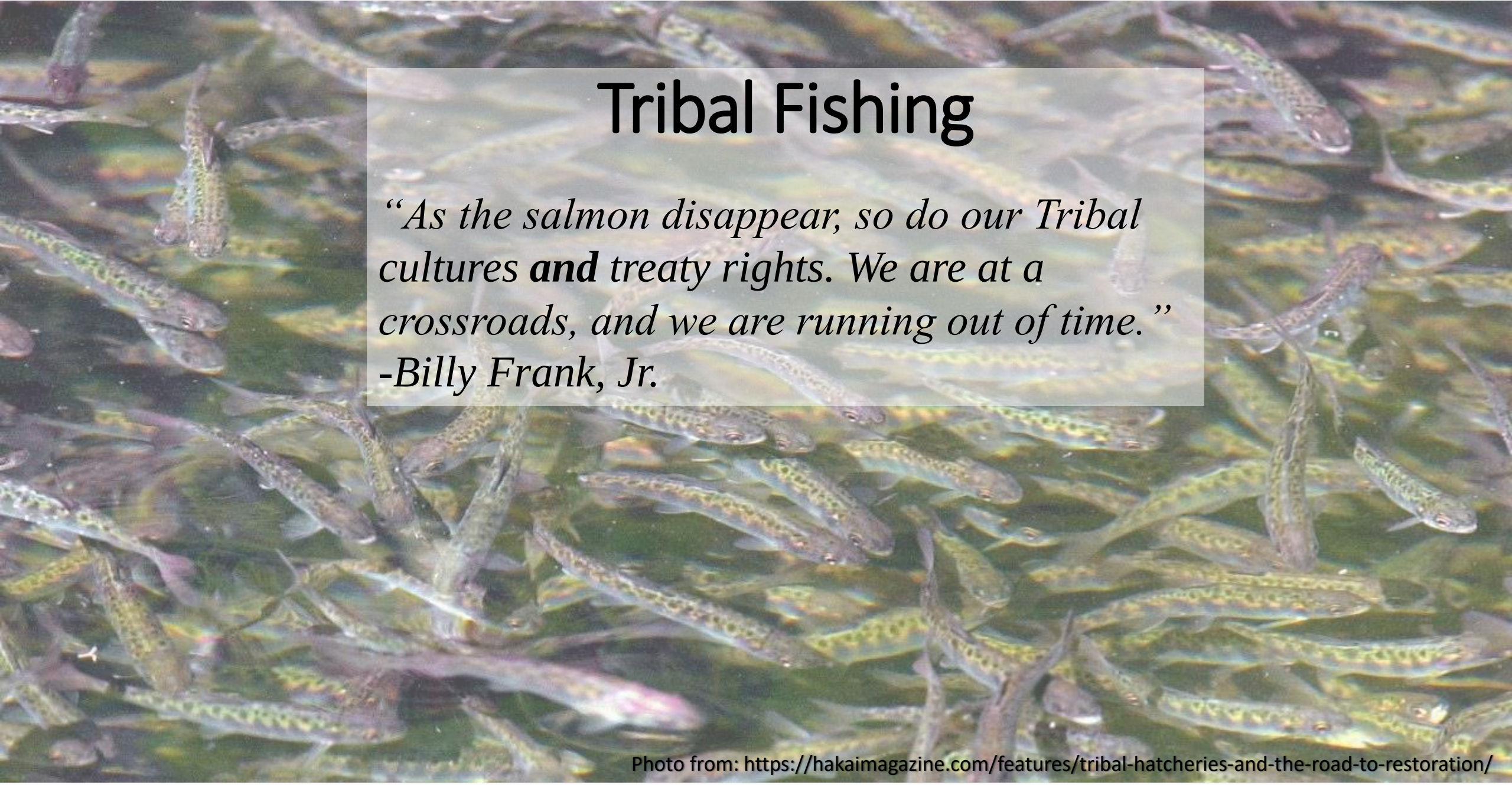


Photo from: https://hakaimagazine.com/features/tribal-hatcheries-and-the-road-to-restoration/

Bioenergetic Growth Potential Models

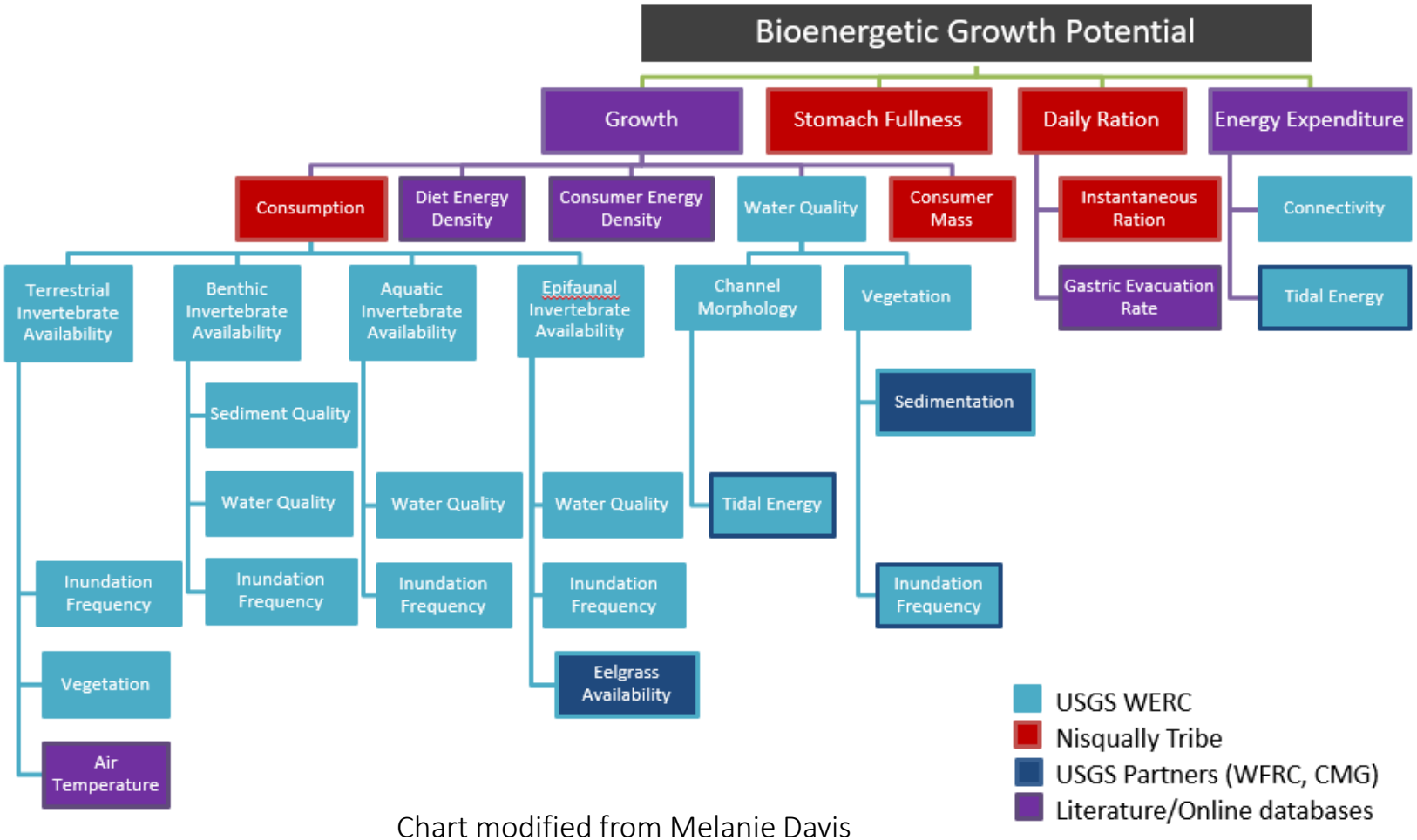
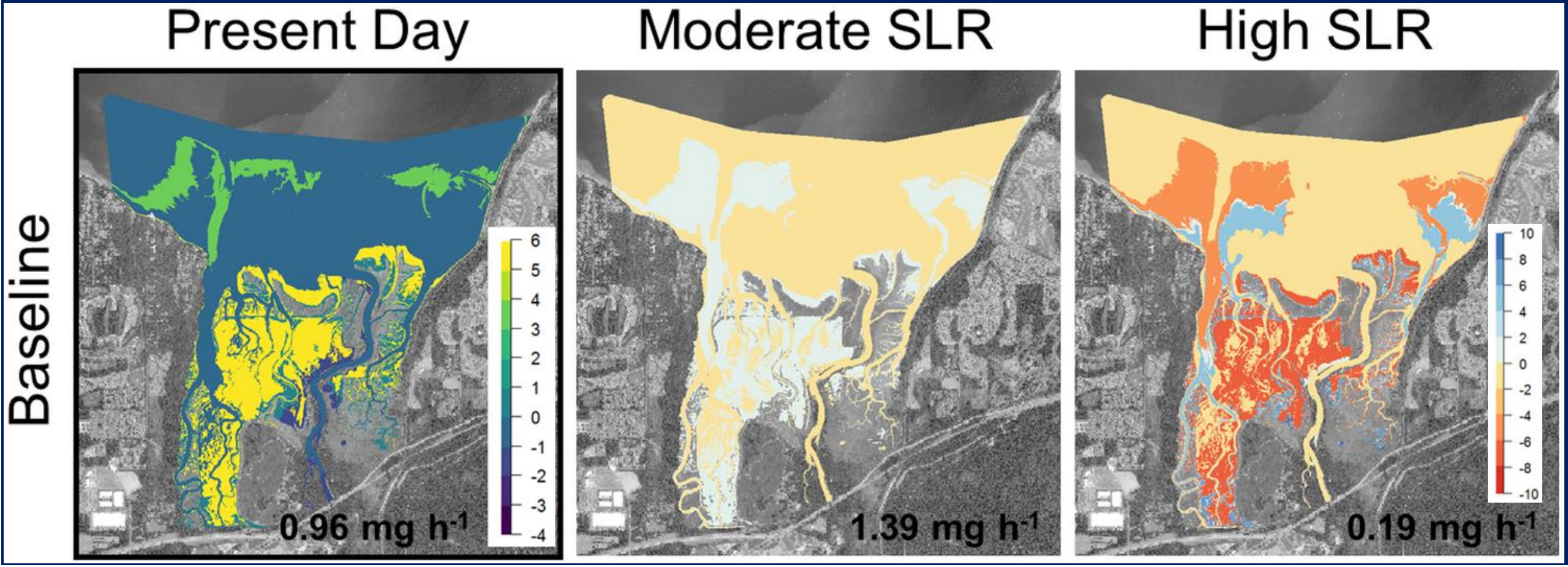


Chart modified from Melanie Davis

Spatial Growth Potential Model



Davis et al. 2022. Estuaries and Coasts 45:1445-1464 https://doi.org/10.1007/s12237-021-01003-3.

Summary

Habitats such as Tidal Forests and Marshes are positively associated with multiple ecosystem services such as carbon storage, tribal fisheries and birdwatching.

Whereas Mudflats and eelgrass beds contribute to a diversity of bird species

Transition to:	Tidal Forest 	Tidal Marsh 	Mudflat/Aquatic Veg 
Carbon	↗	↗	↘
Fisheries	↗	↗	↘
Birdwatching	↗	↗	↗

Byrd et al., in revision

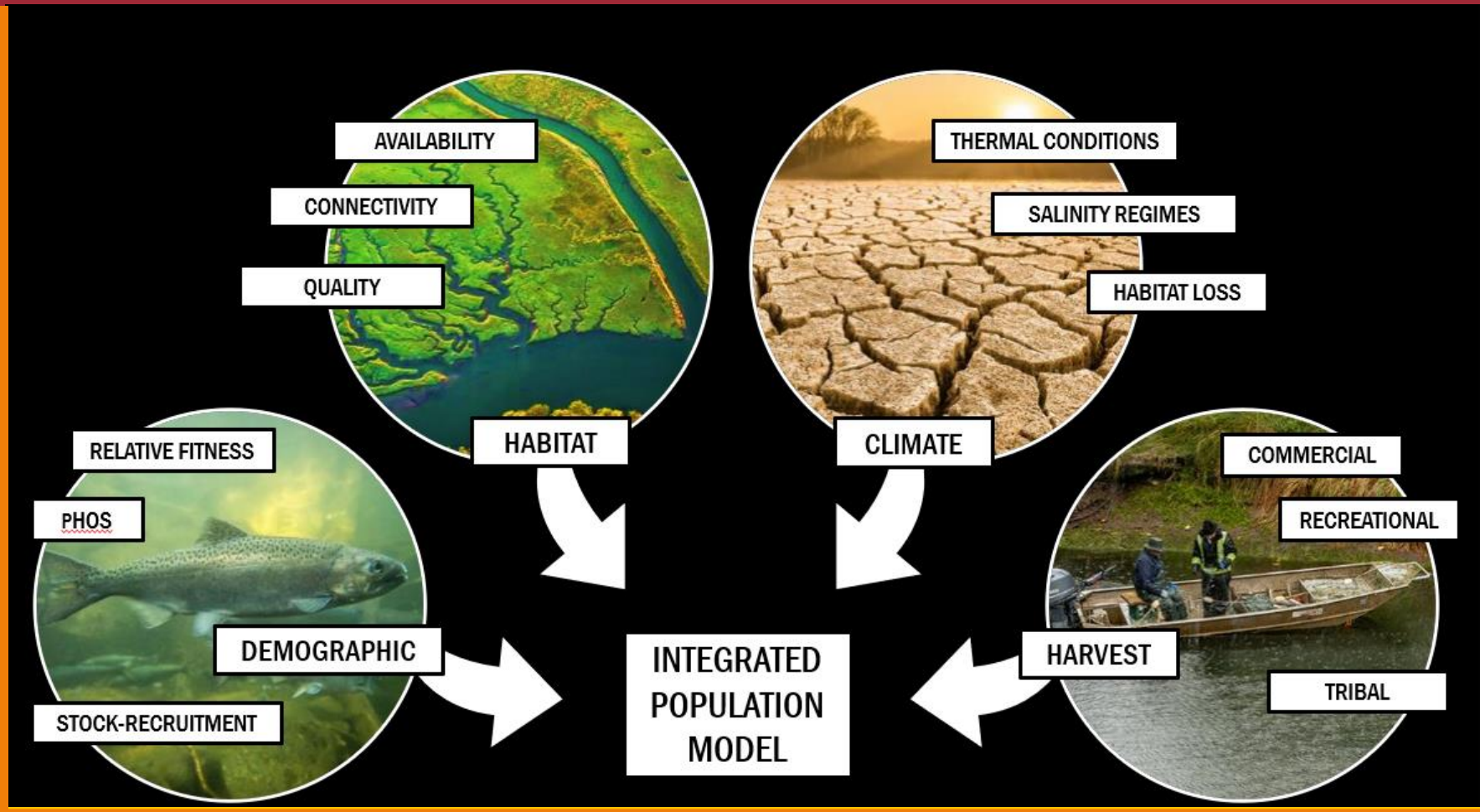
Next Steps

HOW WILL TRIBAL FISHING BE IMPACTED BY CLIMATE CHANGE? AND CAN WE DO ANYTHING ABOUT IT?

PARTNERING WITH NISQUALLY TRIBE
How can we integrate management of Hatchery, Harvest, Habitat Restoration/enhancements

- Led by M. Davis (USGS, OSU), I. Woo, S. De La Cruz (USGS)

If a system had x kinds of data, how well could they implement an h-integrated approach to restoration planning, and what additional data would provide the greatest added value?



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Thank you!

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Glynnis Nakai, Ryan Munes

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Nisqually Delta Restoration and Science Core Team:
USGS, USFWS BFJN NWR, Nisqually Tribe

Isa Woo, Melanie Davis, Susan De La Cruz, Chris Ellings, Sayre Hodgson, Glynnis Nakai

Nisqually Carbon: assessing carbon sources and co-benefits
Interdisciplinary Project Team Leads:

- Foodwebs: Isa Woo, Melanie Davis, Susan De La Cruz
- Habitat mapping: Kristin Byrd
- Soil Carbon: Judy Drexler
- Atmospheric Carbon Flux: Lisa Windham-Myers, Ellen Stuart-Haentjens

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Photo by: Russ