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# Tidal Wetland Response to Changes in Inundation Patterns in the Lower Columbia River and Estuary

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- 1 Pacific Northwest National Laboratory
- 2 Portland State University
- 3 Lower Columbia Estuary Partnership

Columbia River Estuary Conference

## How does hydrologic change affect wetland vegetation cover and distribution?

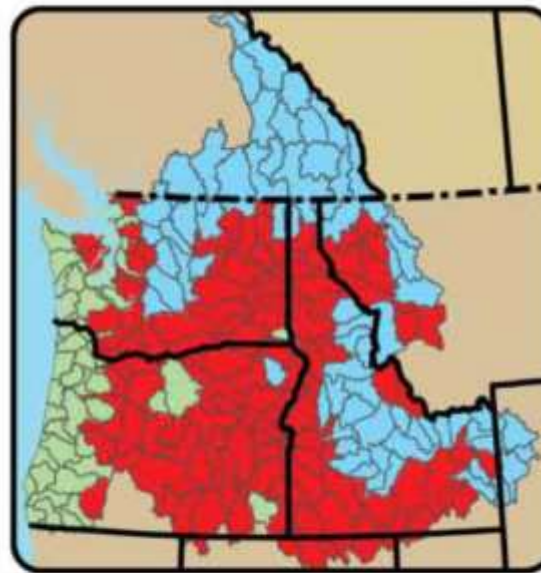


# Climate Change Predictions

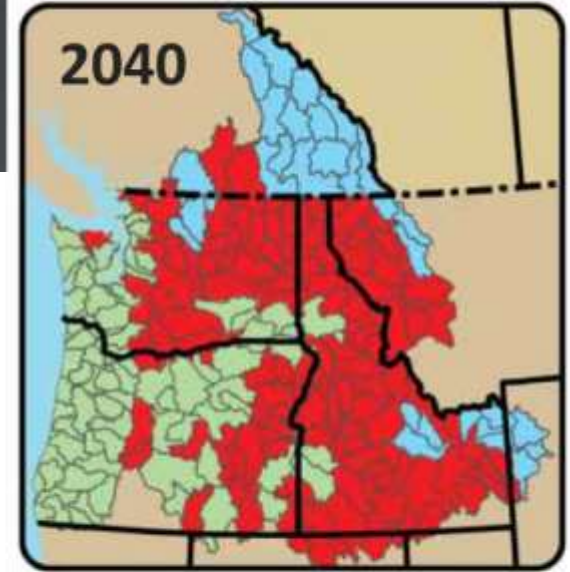
## Ratio of Peak SWE to October to March Precipitation



Historical



2040



2020



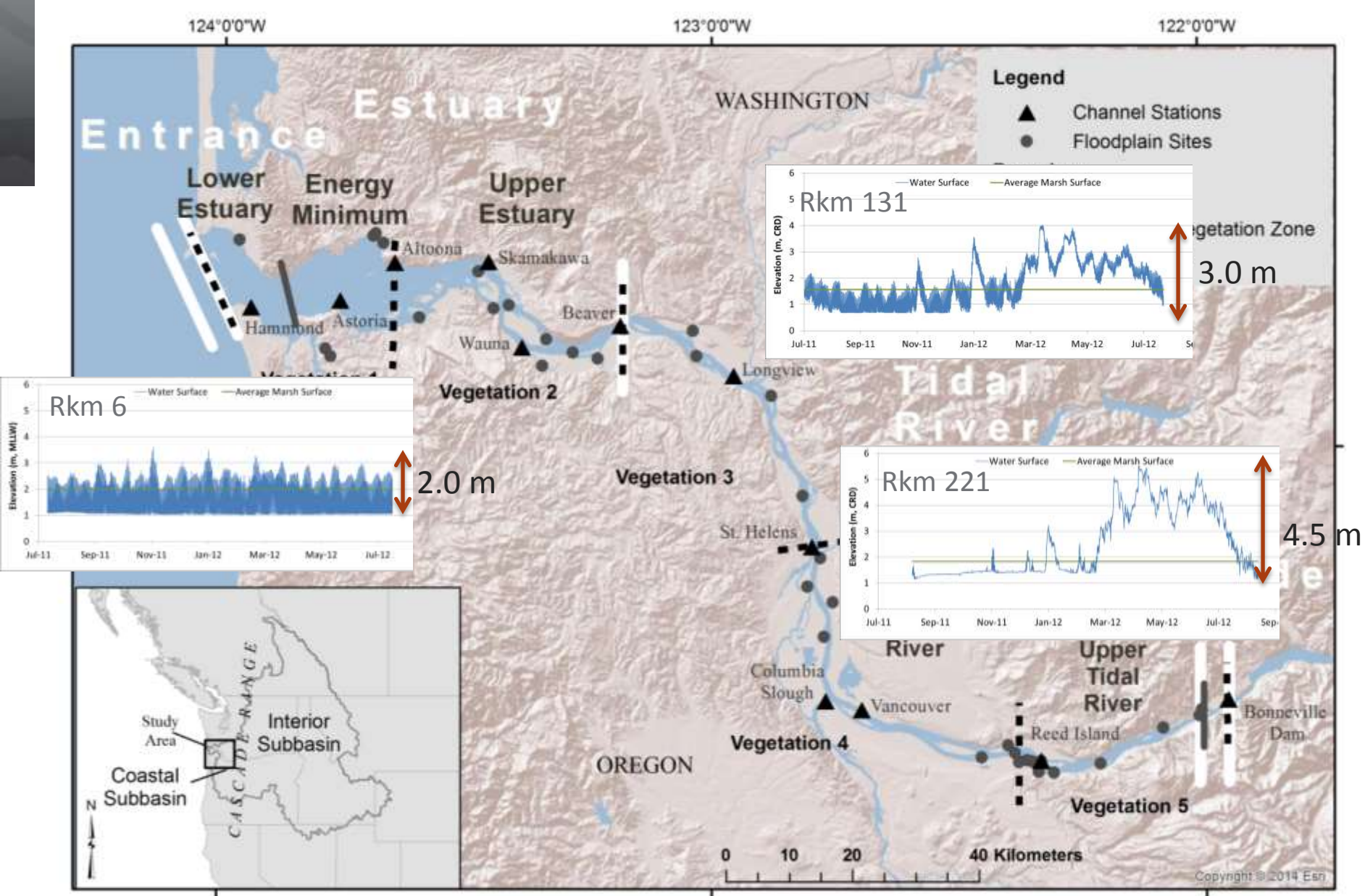
2080



Hamlet, A. F., Elsner, M. M., Mauger, G. S., Lee, S. Y., Tohver, I., & Norheim, R. A. (2013). An overview of the Columbia Basin Climate Change Scenarios Project: Approach, methods, and summary of key results. *Atmosphere-ocean*, 51(4), 392-415.

- Data collection efforts
- Analysis methods
- Hindcasting
- Forecasting

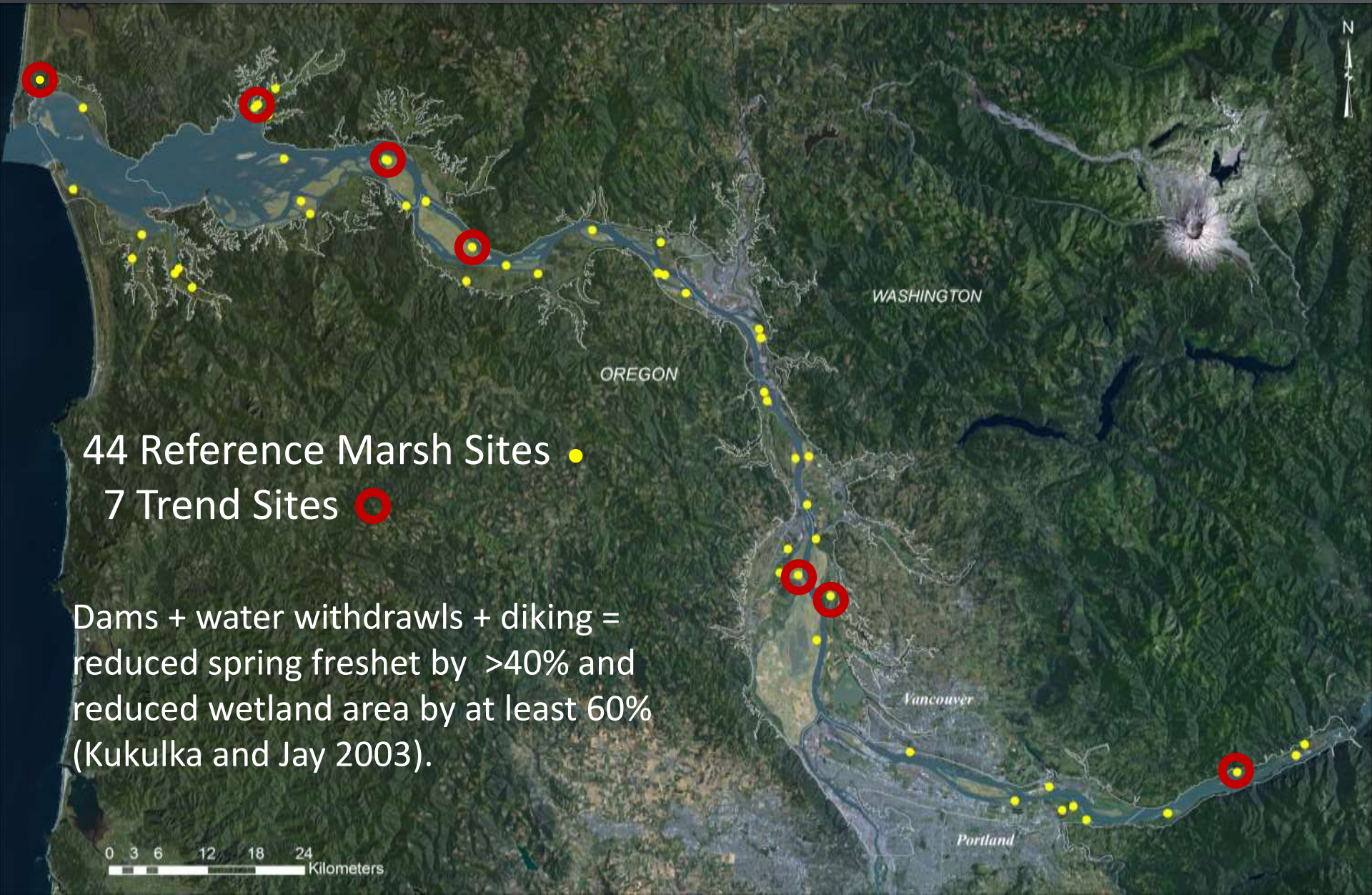




Jay, D.A., A.B. Borde, and H.L. Diefenderfer. In revision. Tidal-Fluvial and Estuarine Processes in the Lower Columbia River: Part II. Water Level Models, Floodplain Wetland Inundation, and System Zones. Estuaries and Coasts.



# Study Sites



# Methods

## ► Field Data

- RTK GPS elevation data
- In situ water surface elevation
- Vegetation species cover and composition
- Vegetation mapping
- Temperature
- Sedimentation rates
- Above-ground biomass



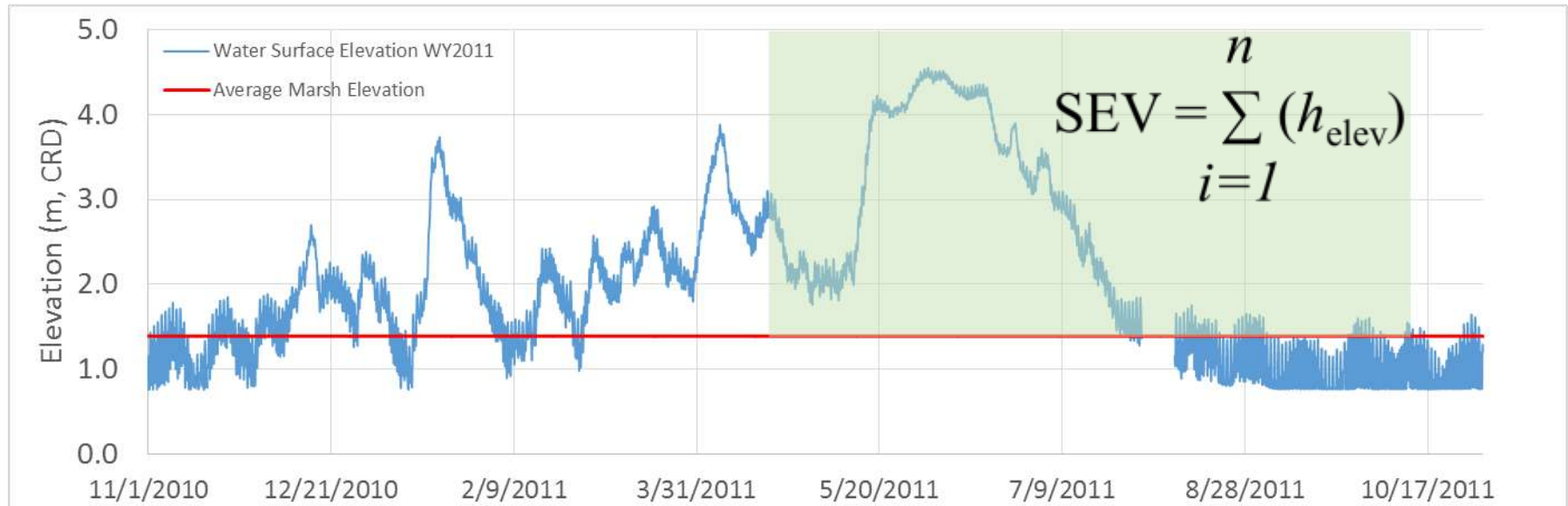
CREC 2016





## ► Sum Exceedance Value

Gowing et al., (1998)



## ► Modeling

- Regression
- Vertically Integrated Delft3D

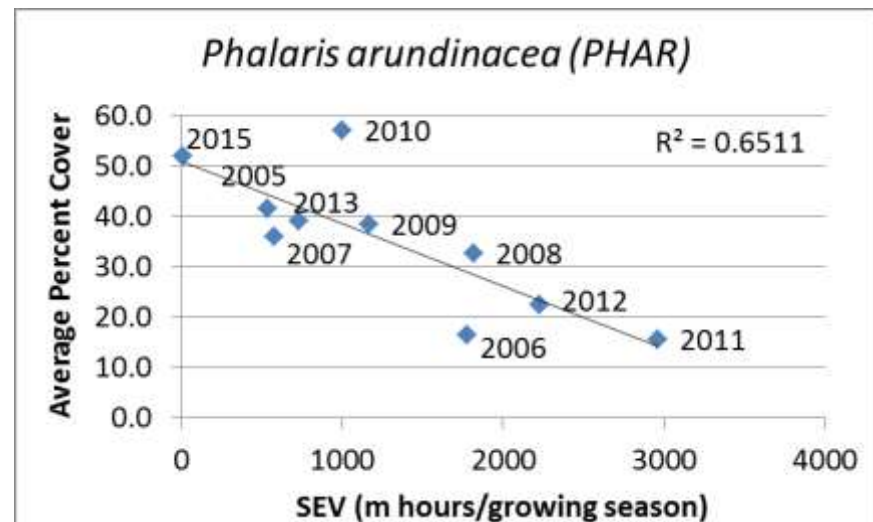
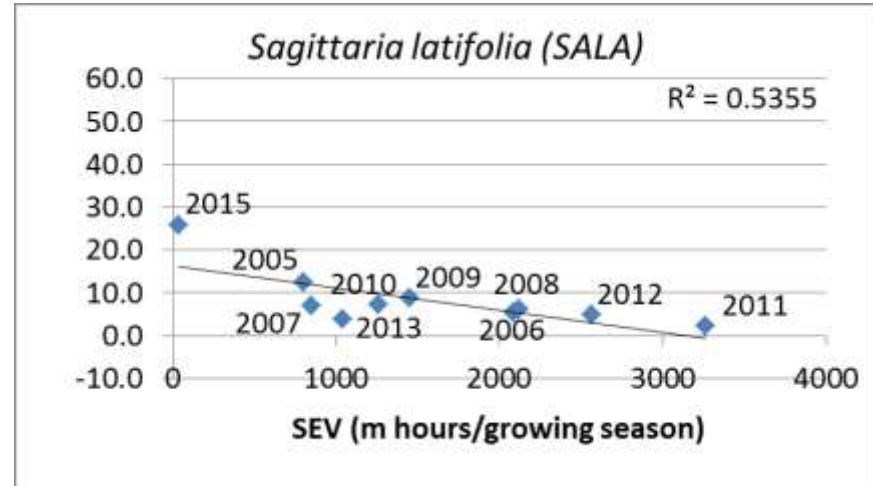
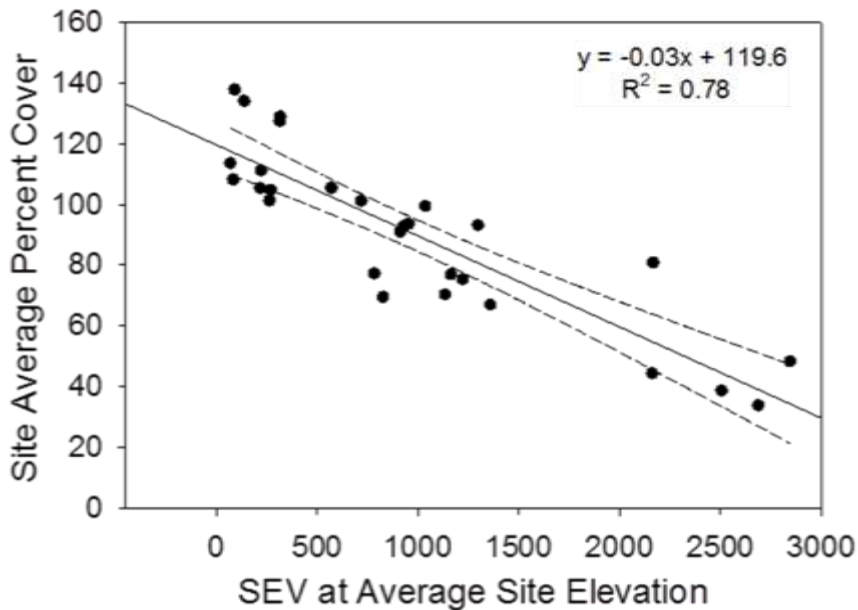




# Vegetation Cover and Inundation

## Cunningham Lake

### Estuary-wide



# Station versus Site Inundation

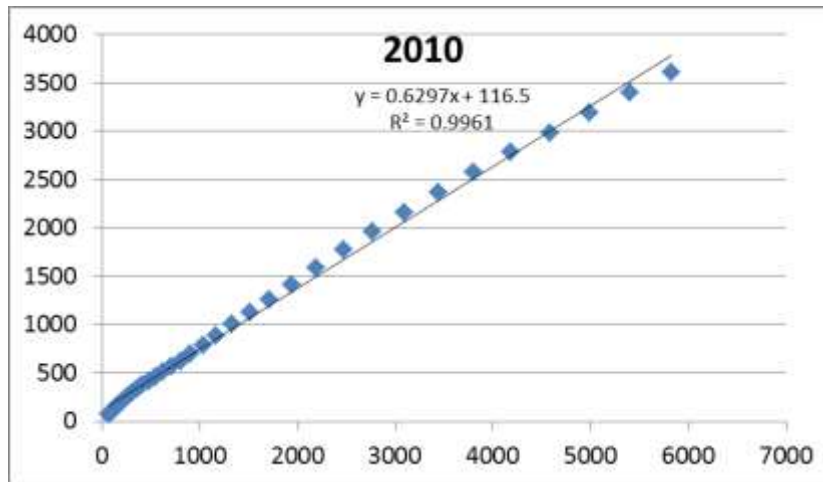


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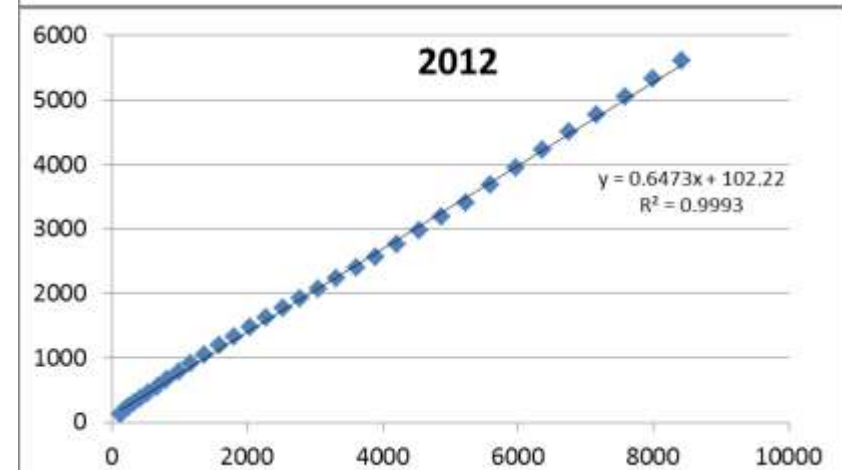
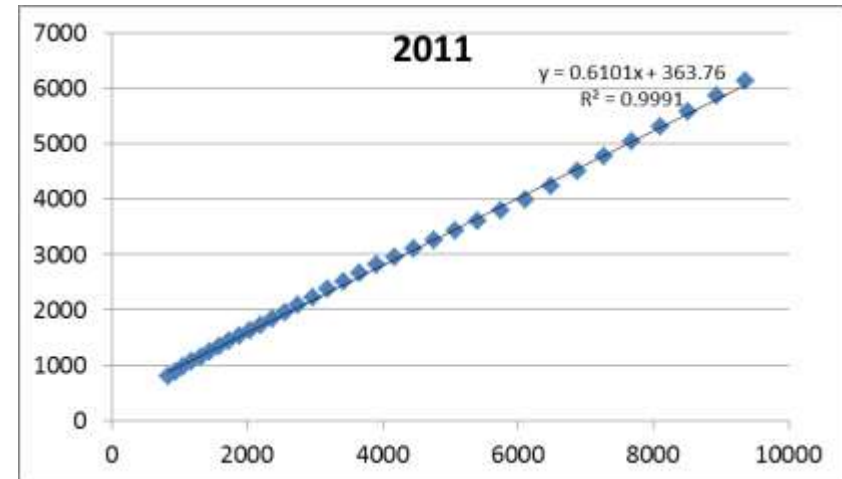
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## Potential SEV

Site  
SEV

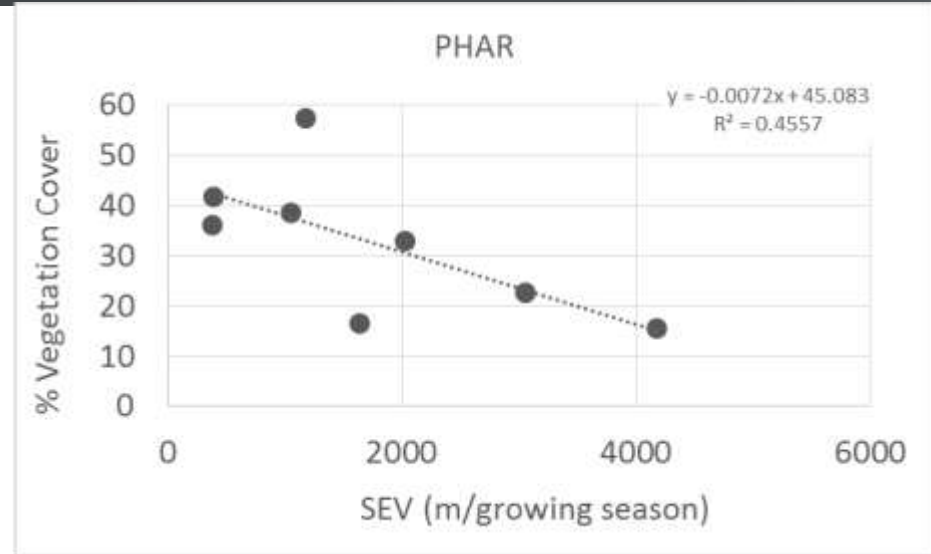
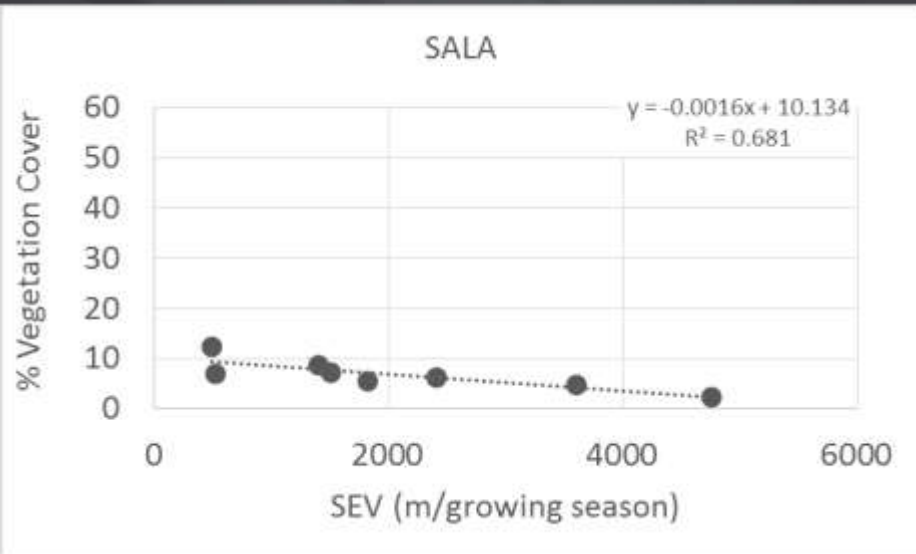


Station  
SEV

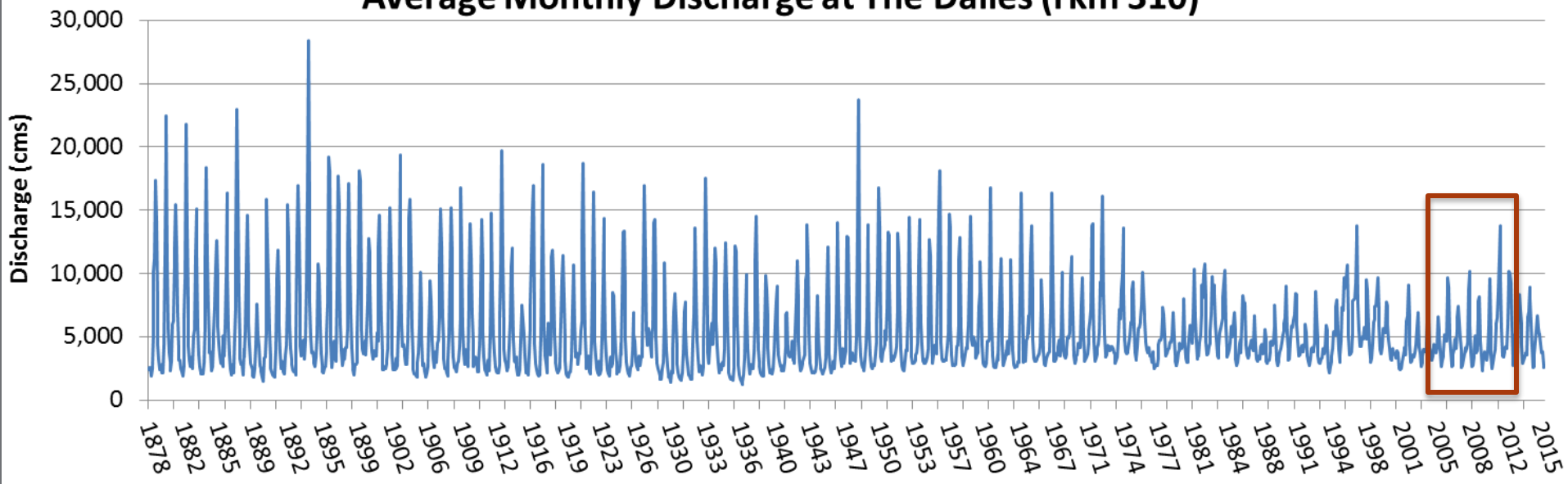


Jay, D.A., A.B. Borde, and H.L. Diefenderfer. 2016. Tidal-Fluvial and Estuarine Processes in the Lower Columbia River: Part II. Water Level Models, Floodplain Wetland Inundation, and System Zones. *Estuaries and Coasts*. Available online.

# Vegetation Cover and Inundation 2005-2012

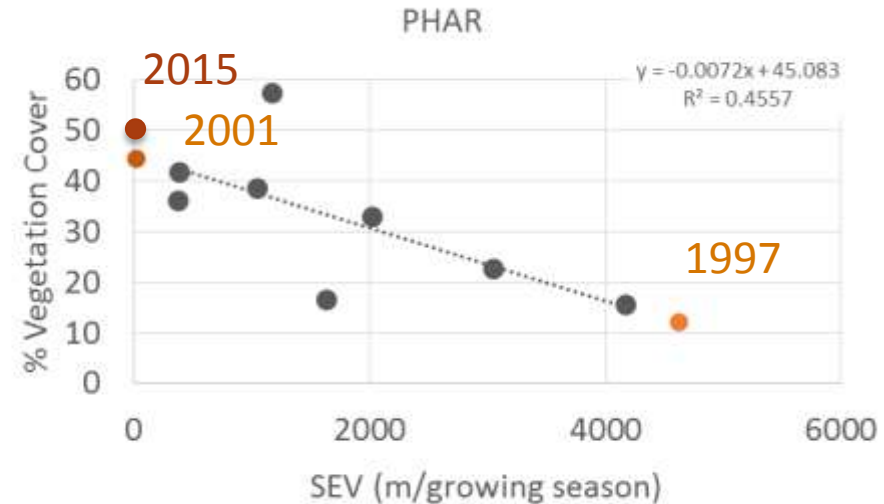
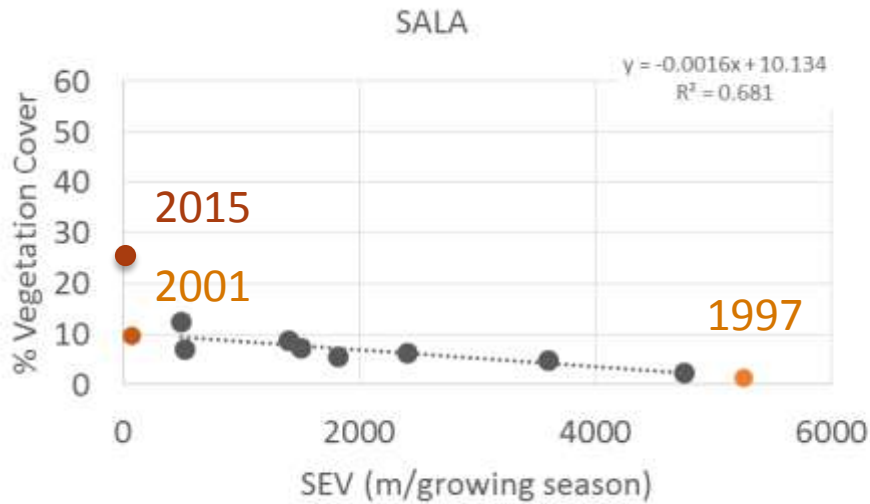


## Average Monthly Discharge at The Dalles (rkm 310)

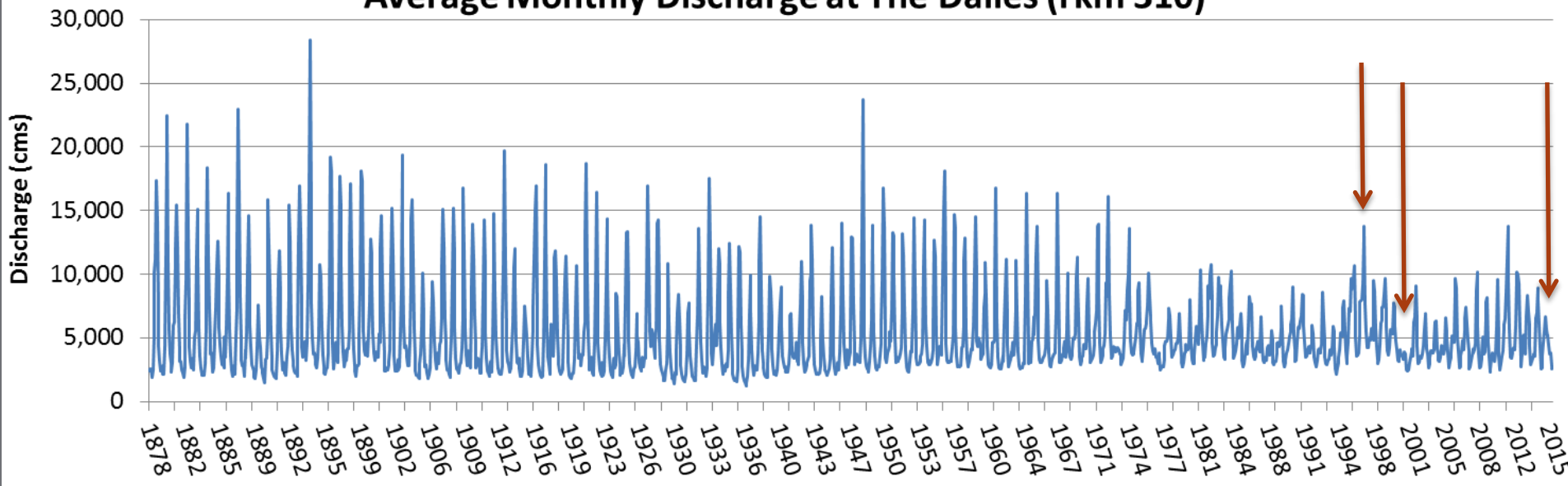




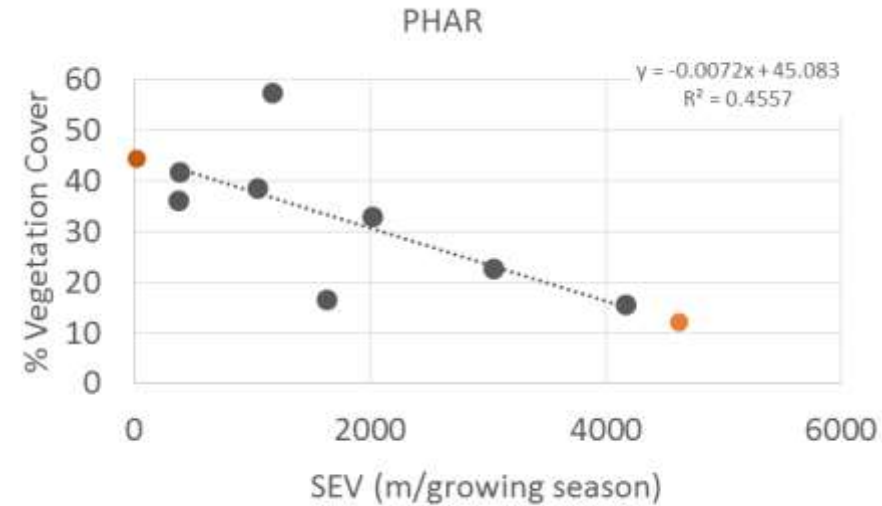
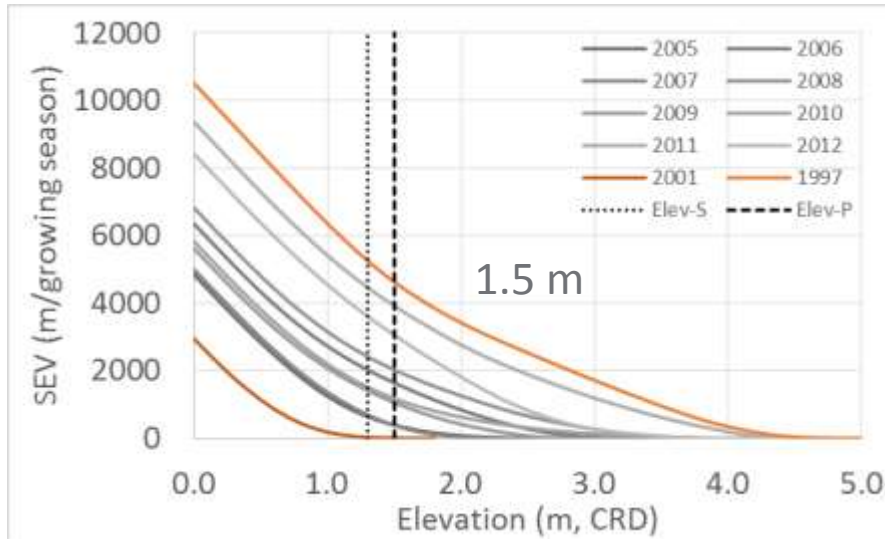
# Vegetation Cover and Inundation 1997, 2001



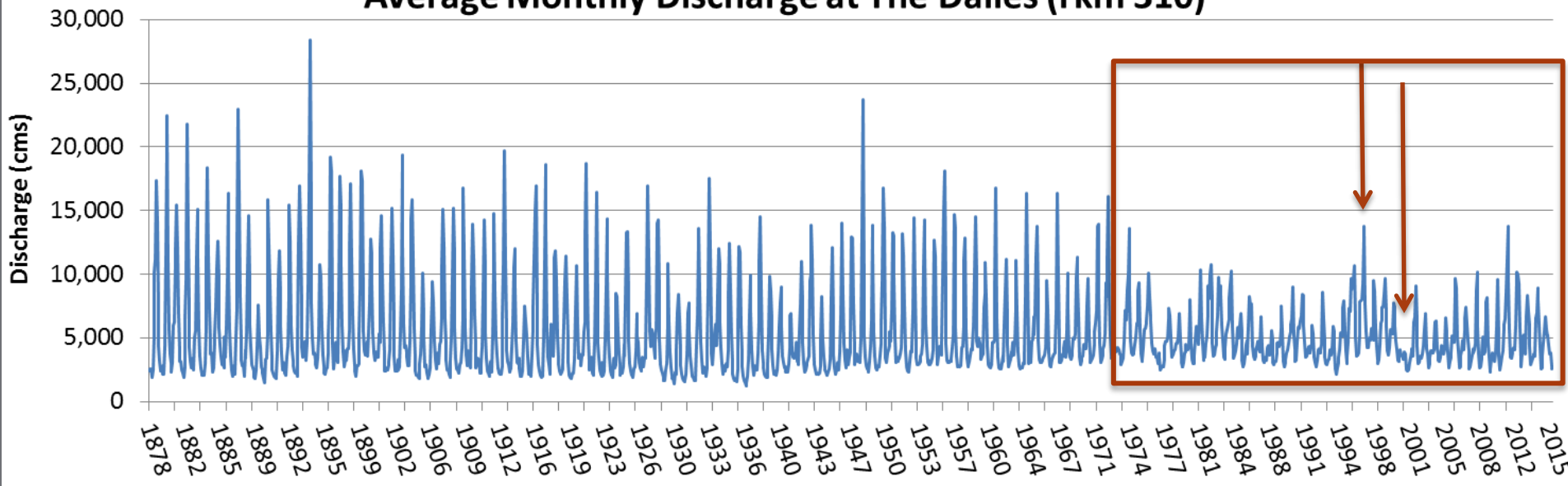
## Average Monthly Discharge at The Dalles (rkm 310)



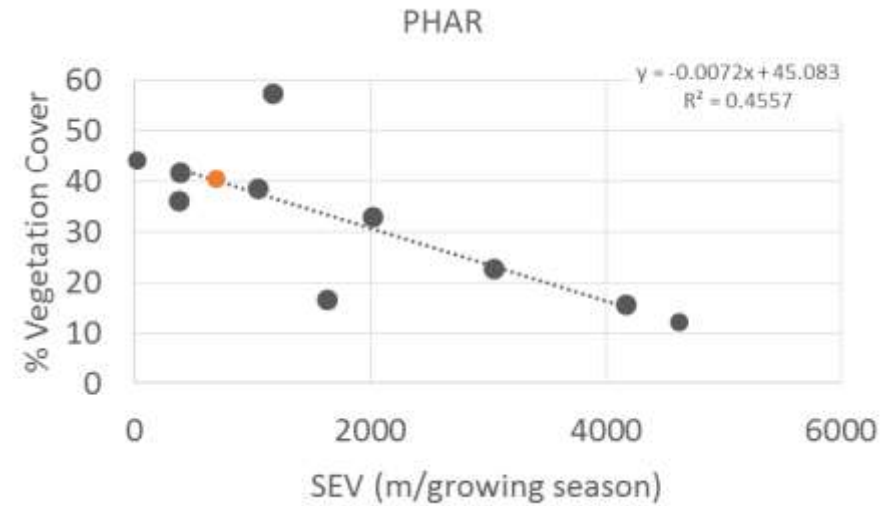
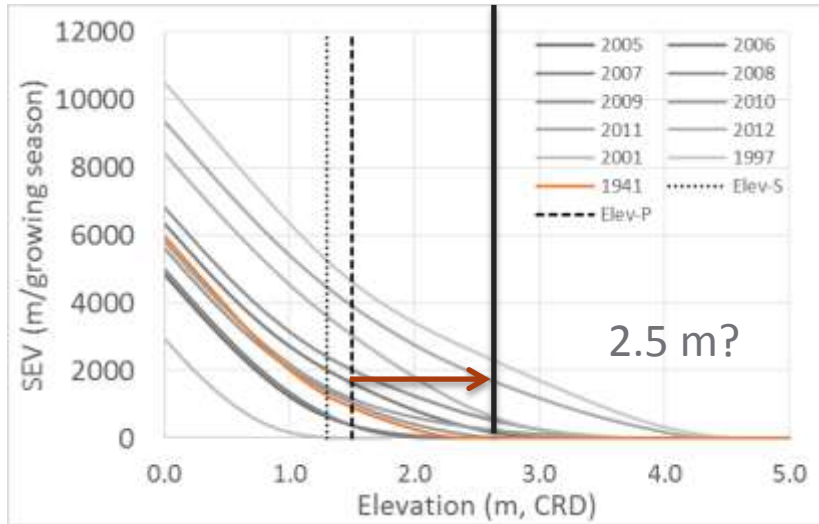
# Vegetation Cover and Inundation 1975 – 2015



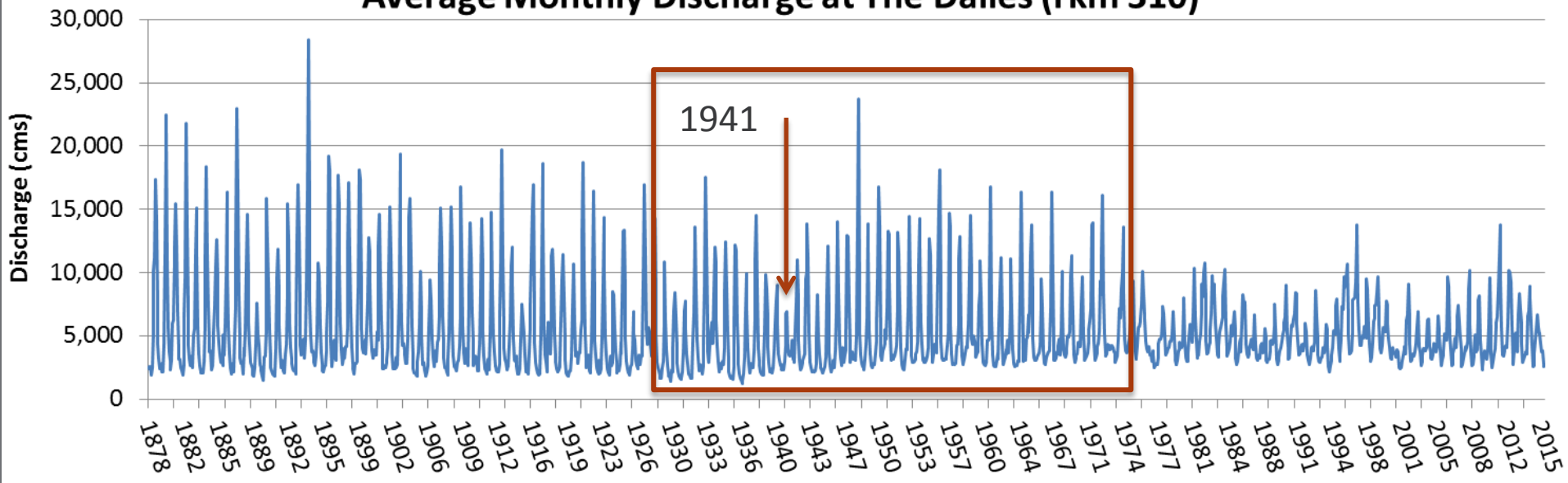
## Average Monthly Discharge at The Dalles (rkm 310)



# Vegetation Cover and Inundation 1930 - 1975

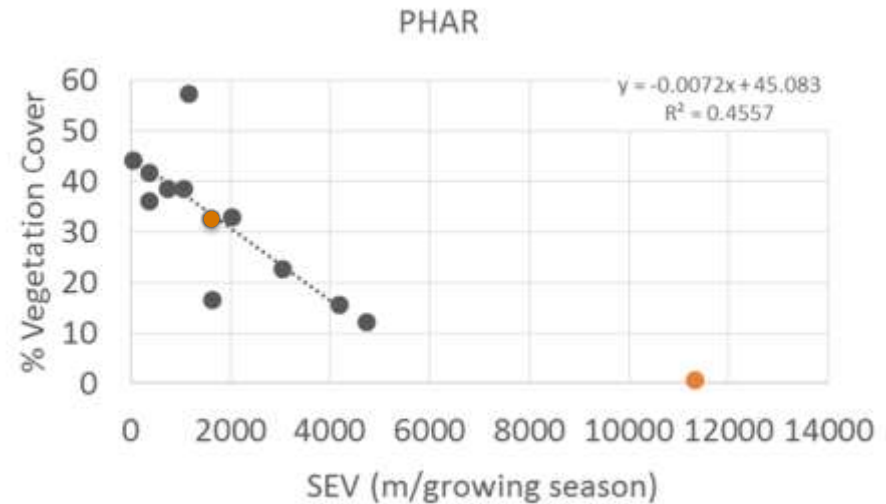
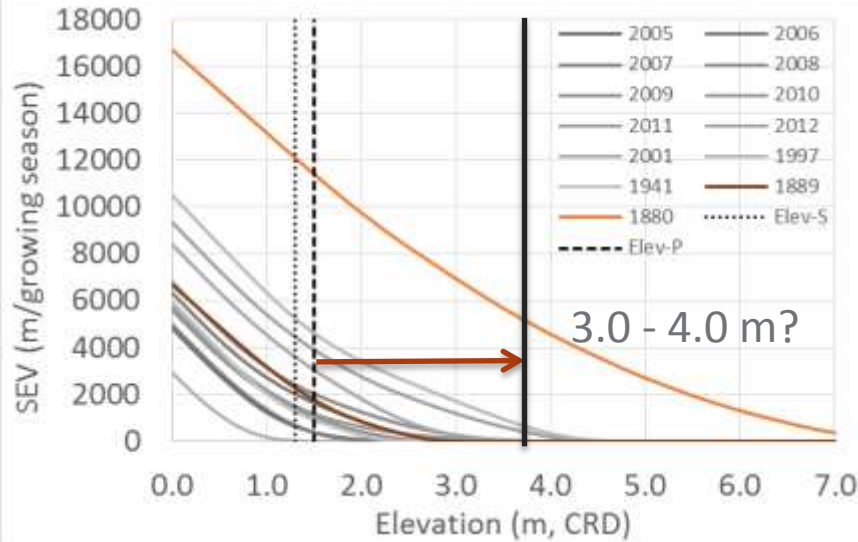


## Average Monthly Discharge at The Dalles (rkm 310)

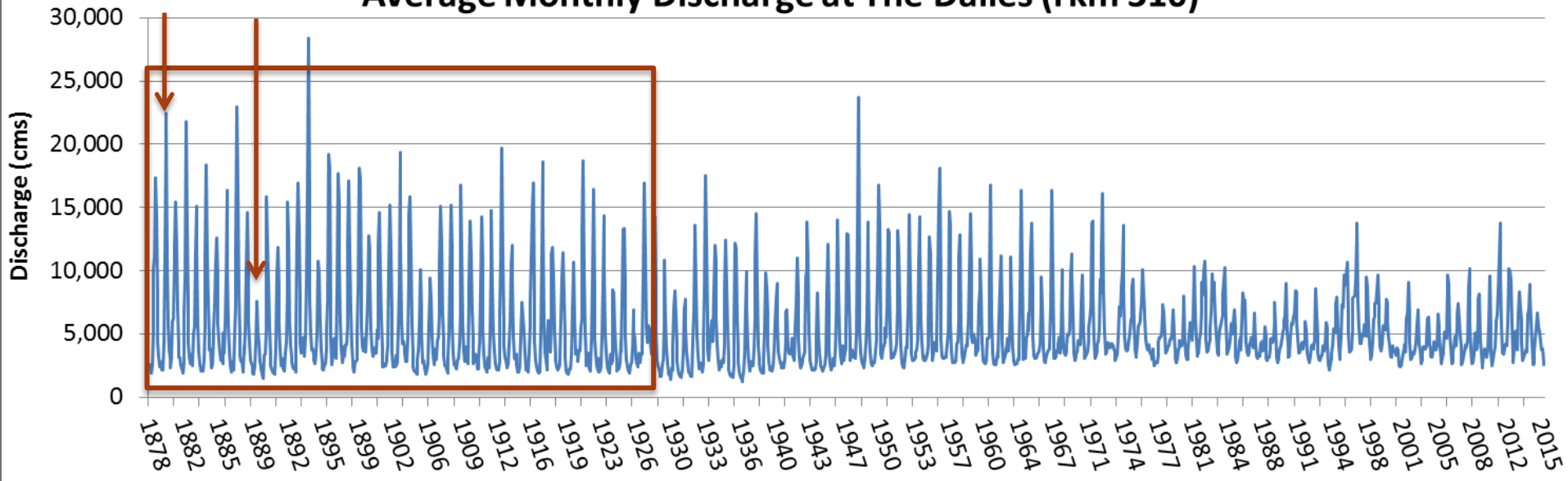




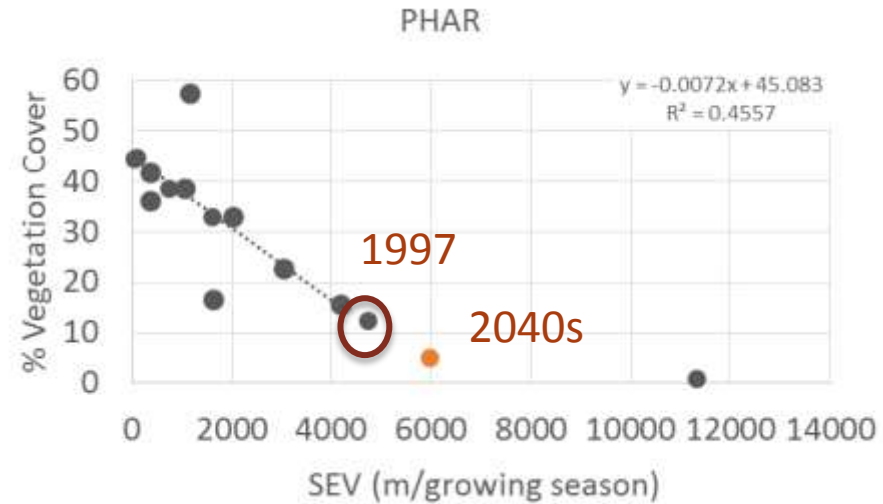
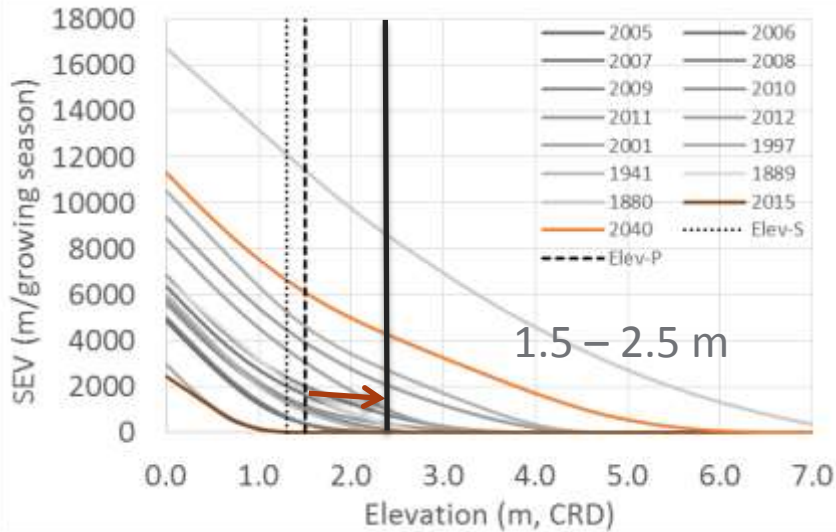
# Vegetation Cover and Inundation Historically Higher Elevation?



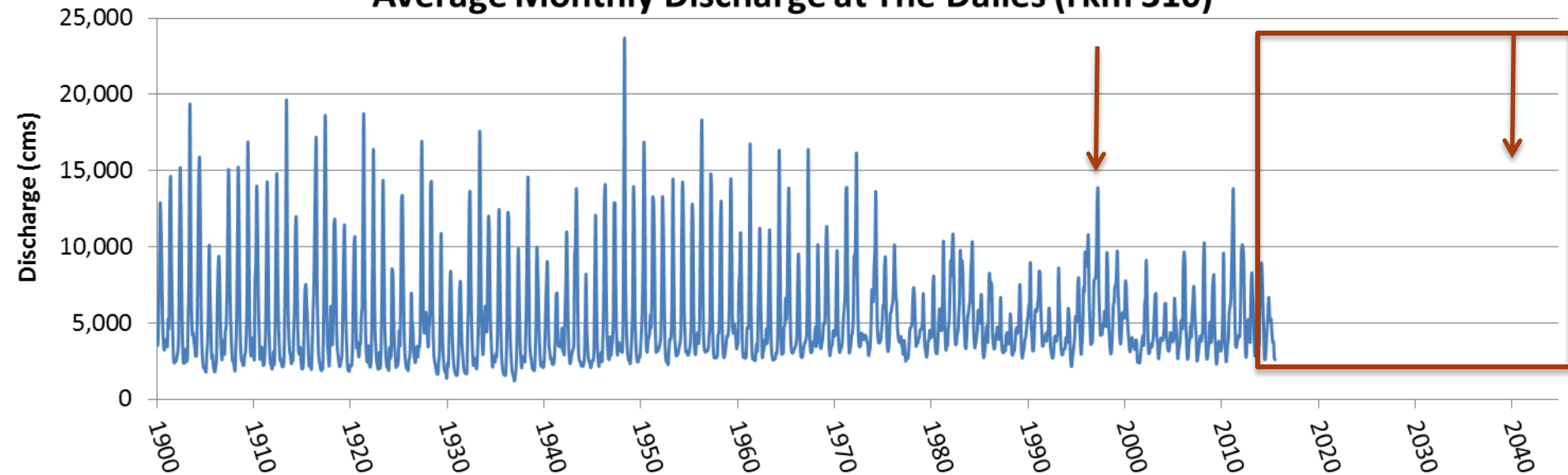
## Average Monthly Discharge at The Dalles (rkm 310)



# Vegetation Cover and Inundation 2016-2050



## Average Monthly Discharge at The Dalles (rkm 310)



- ▶ The SEV calculation provides a means to evaluate wetland elevation based on historical and predicted water levels
- ▶ Historical inundation regimes likely resulted in wetlands occurring at higher elevations than today
- ▶ Future scenarios indicate that changes in timing of runoff may result in higher inundation levels compared to present day.



- ▶ Evaluate additional types of water years
- ▶ Incorporate scenarios for flow regulation
- ▶ Extend the outlook
  - Farther in the future
  - The entire lower river and estuary
- ▶ Add
  - Productivity
  - Sediment accretion rates





# Acknowledgements

## ► Field assistants:

- Nikki Sather
- Kathryn Sobocinski
- Dave Nichols
- Julia Ledbetter
- Krista Jones
- Jina Sagar
- Matthew Schwartz
- Keith Marcoe
- Amanda Bryson
- Cynthia Wright
- Ron Kauffman
- Sarah Apsens
- Alli Simpson
- Alli Cutting

## ► Modeling:

- Lumas Helaire
- Stefan Talke
- Andrew Mahedy

