Social, Economic, and Environmental impacts of Brownsville Dam Removal

http://home.netcom.com/~horse/digitarium.html

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Oregon Watershed Enhancement Board OWEB

Who we are

Presentation Outline

- Project overview - Desiree
- Biophysical results - Desiree
- Socioeconomic results – Desiree
- Ongoing work
  - Modeling dam removal - Jack
  - Geopolitics of dam removal - Trent
- Project impacts - Desiree

Study objectives

- Document extent, magnitude, and drivers of changes in Calapooia with dam removal
- Provide foundation for long-term projections in Calapooia
- Analyze and propose social, economic, and environmental impact monitoring for dam removal

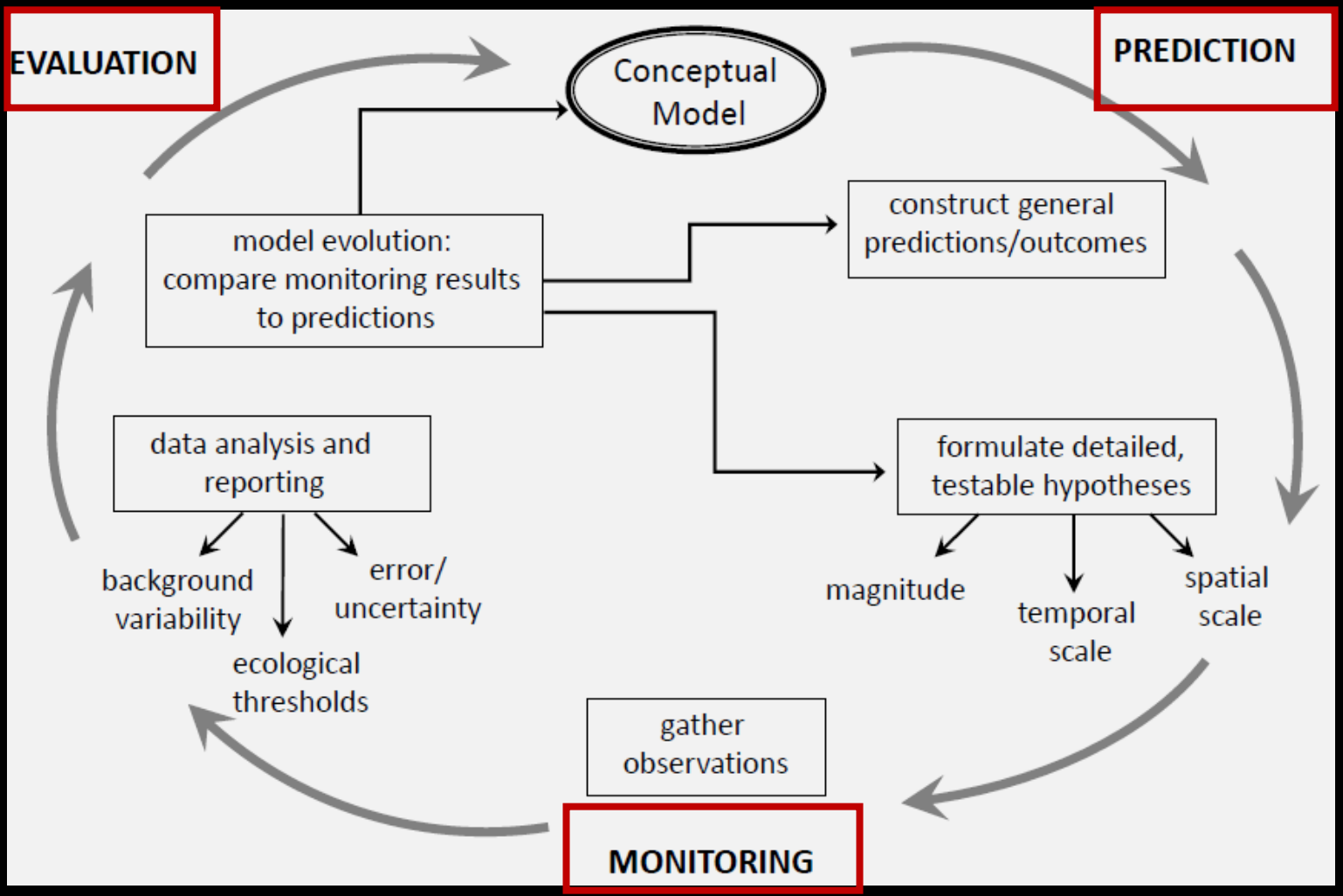
Brownsville Dam removal

Brownsville Dam

River: Calapooia
Purpose: mill diversion, esthetics
Constructed: 1960's
Removal: 2007

As a small case study, tests our limits of detection.

Monitoring process



Monitoring components

- physical
  - substrate size distribution – bulk samples, pebble counts
  - discharge – historical record extension and gaging
  - channel geometry, facies/features
- biological
  - coarse vegetation
  - benthic macroinverts
  - habitat quality
- socio-economic
- geopolitical

Socioeconomic results

- How has the Brownsville Dam removal impacted the social and economic status of the community
- What indicators can be used to characterize and monitor these impacts

Denise Elston
MS – Water Resources Science and Policy

Dam Removal and Societal Considerations

- Born *et al* (1998) suggests dam owners, local communities, interest groups, and regulatory agencies across the country will have to look at the social and economic considerations in more detail

- 2002 Heinz Report concluded that little research exists on the human dimension of dam removal

Approach and Methods

Case Study:

Data gathered directly from individuals or the groups in natural environment to study the interactions, attitudes, and characteristics

Multiple Methods:

Participant Observation

Document Analysis – police reports, newspaper articles, etc.

Semi-Structured Interviews

Health and Social Well-Being Impacts	Quality of the Living Environment (Livability) Impacts	Economic Impacts and Material Well-Being Impacts	Cultural Impacts	Family and Community Impacts	Institutional, Legal, Political, and Equity Impacts
Elimination of location for delinquent behavior	Habitat Restoration	Maintenance cost alleviated/eliminated/ Created financial obligation to operate pump station	**Cultural integrity- degree to which local culture is respected and likely to persist**	Community safety	Conflicting agency agendas
Uncertainty -being unsure of the effects or meaning of dam removal	**Leisure and recreational activities and opportunities**	Change to tourism industry	**Historic structure- Place of interest**	**Community identification and connection-sense of belonging, attachment to place**	**Impact equity distribution of social and economic impacts across the community**
Dam Removal Created Hazard	**Perceived and actual quality of the living environment**	Local employment opportunity	**Loss of cultural or natural heritage- areas of recreational value**	Lack of participatory involvement	**Access to and utilization of legal procedures and advice throughout project**
Annoyance -experiences due to disruption of life	Fire Control	**Standard/Cost of living**	**Change in cultural traditions**	**Changes in social networks**	Meet agency objectives
Sense of Identity	**Perception of personal safety, hazard exposure, and fear of crime**	Liability risks eliminated/ Liability Risk created		**Changes in demographic structure of the community**	Formation of special interest groups as a result of institutional priority to certain groups
Dissatisfaction -due to failure of removal to deliver promised benefits	**Shared vision for the watershed**	Access to public goods & services / change cost recreation shift	**Experience of being culturally marginalized- e.g., structural exclusion of certain groups**	**Perceived and actual community cohesion**	**Participation in decision-making/ Lack of participation in decision making**
(Location for) delinquent behavior		**Replacement costs of environmental services/ Access to public goods/services**		**Social differentiation and inequality**	**Fulfilled legal/ regulatory obligation of administrative order**
Aesthetic Quality	**Aesthetic Quality**	Litigation	**Aesthetic/spiritual qualities**	**Changes in social tension-conflict within the community**	

Economic Impacts

Indicator: Access to public goods and services

Measurement: Distance and Cost to replace the amenities at the Brownsville dam site

"[A negative impact is] losing the recreation resource. You either went swimming at the dam or you went really far away. We would have to go to Foster Dam in Sweet Home or you could go out toward Crawfordsville to a place called Swiss Cheese."

- Community member

Surrounding Recreation: Alternative Use Area Replacement Costs

Name	Location	Distance (miles)	Amenities	Cost for Services	Fuel Cost* ($)
McKercher Park	HWY 228	4.5	Swimming, Picnic Area, Fishing	N	0.80
McClun Wayside	Holley, OR	11.5	Picnic Area, Fishing, some swimming	N	2.01
Waterloo County Park	Waterloo, OR	16.2	Swimming, Fishing, Picnic area, Hiking	Y	2.84
Lewis Creek	Foster Reservoir, Sweet Home OR	23.7	Swimming, Fishing, Hiking, Picnic area	N	4.15

*Assumptions: The travel cost for replacement services was based on vehicle that gets at least 25mpg and current gas price of $2.19 per gallon; Fuel price represents round trip approximation

Data from Linn County Parks and Recreation: *www.co.linn.or.us/parks/* 2009

Institutional, Legal, Political, and Equity Impacts

"I feel that we worked really hard to be transparent. We invited the whole community to come to council meetings not just the Canal Company or Watershed Council members. We made an effort to get to know local shop owners and used the local community to help get the information out."
-Watershed Council member

"It was out there an appropriate amount…there were public meetings. I feel that people got a chance to voice their opinions, if that is what the people wanted."
- Community member

"I feel that most people did not know about what happened. They did not have an opportunity to vote on the issue and by the time I found out about this, the decision was already made" -Canal Company member

Institutional, Legal, Political, and Equity Impacts

Indicator: Participation in Decision Making

Measurement: Published announcements and notices of local meetings

Year	2002	2003	2004	2005	2006	2007	2008
Announcement of public meetings: Watershed Council, City Council, Canal Company	15	17	15	22	31	34	28

Socioeconomic: Take home messages

- Results suggest the dam removal had a minimal effect across the community
- Limited data resources make measuring impacts challenging
- Collaborative partnerships of watershed based management may be a critical mechanisms in the successful coordination of small dam removal deliberation in the future

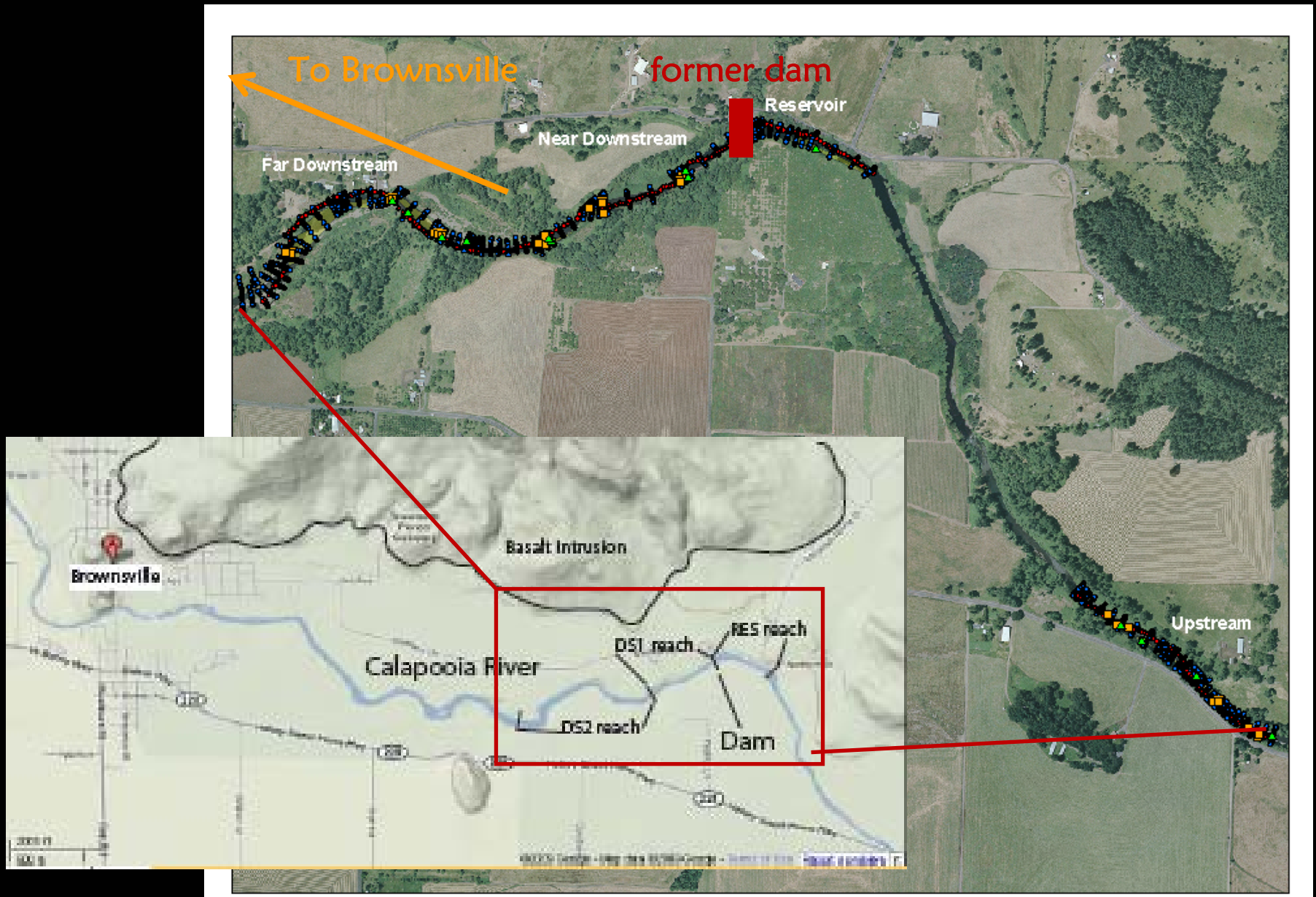
Biophysical results

- What is the extent and significance of impacts to habitat and invertebrates?
- What physical processes explain the observed habitat and invertebrate responses?
- What methods are valid and in the complicated study of dam removals?

Cara Walter
MS – Water Resources Engineering

Kelly Kibler
PhD – Water Resources Engineering

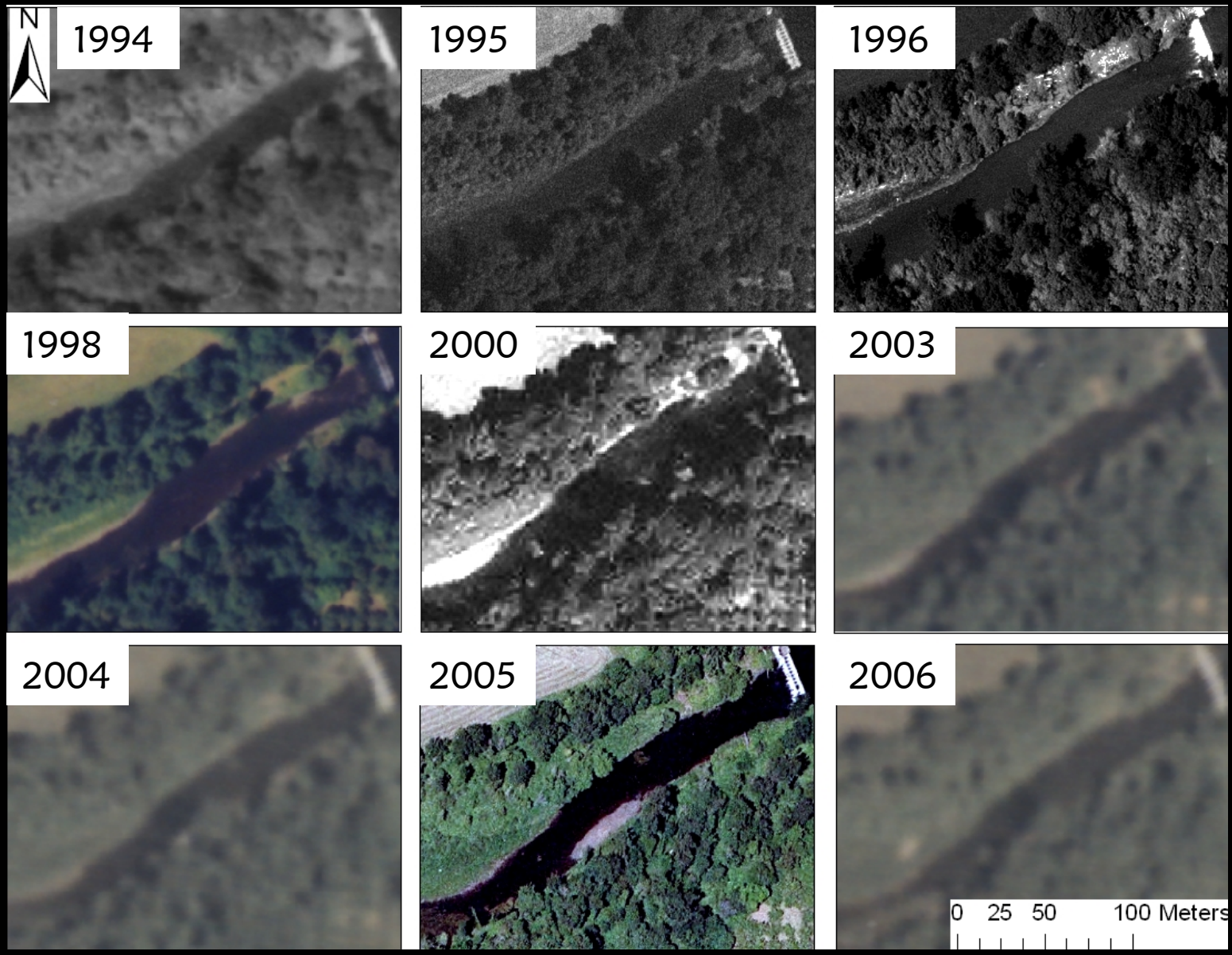
study layout



Biophysical studies

Where did all the sand and gravel go? And what impact will it have on habitat for fish and other organisms?

Historical context



Field surveys

- Channel survey
  - Repeat cross-sections
  - Longitudinal profile along thalweg (deepest part of channel) for each reach
  - Sediment bar mapping
- Sediment sampling
  - Repeat pebble counts on bars and riffles
  - Bulk samples on bars
- Habitat Surveys
- Macroinvertebrate sampling

Reservoir – October 2007

Reservoir – November 2007

Reservoir – August 2008

Reservoir – February 2009

Reservoir – December 2009

Reservoir sediment erosion

- 2007-2008 – 29%
- 2008-2009 – 10%
- 2007-2009 – 39%

18,486 yd3

7,212 yd3

Downstream – October 2007

Downstream – November 2007

Downstream – August 2008

Downstream – February 2009

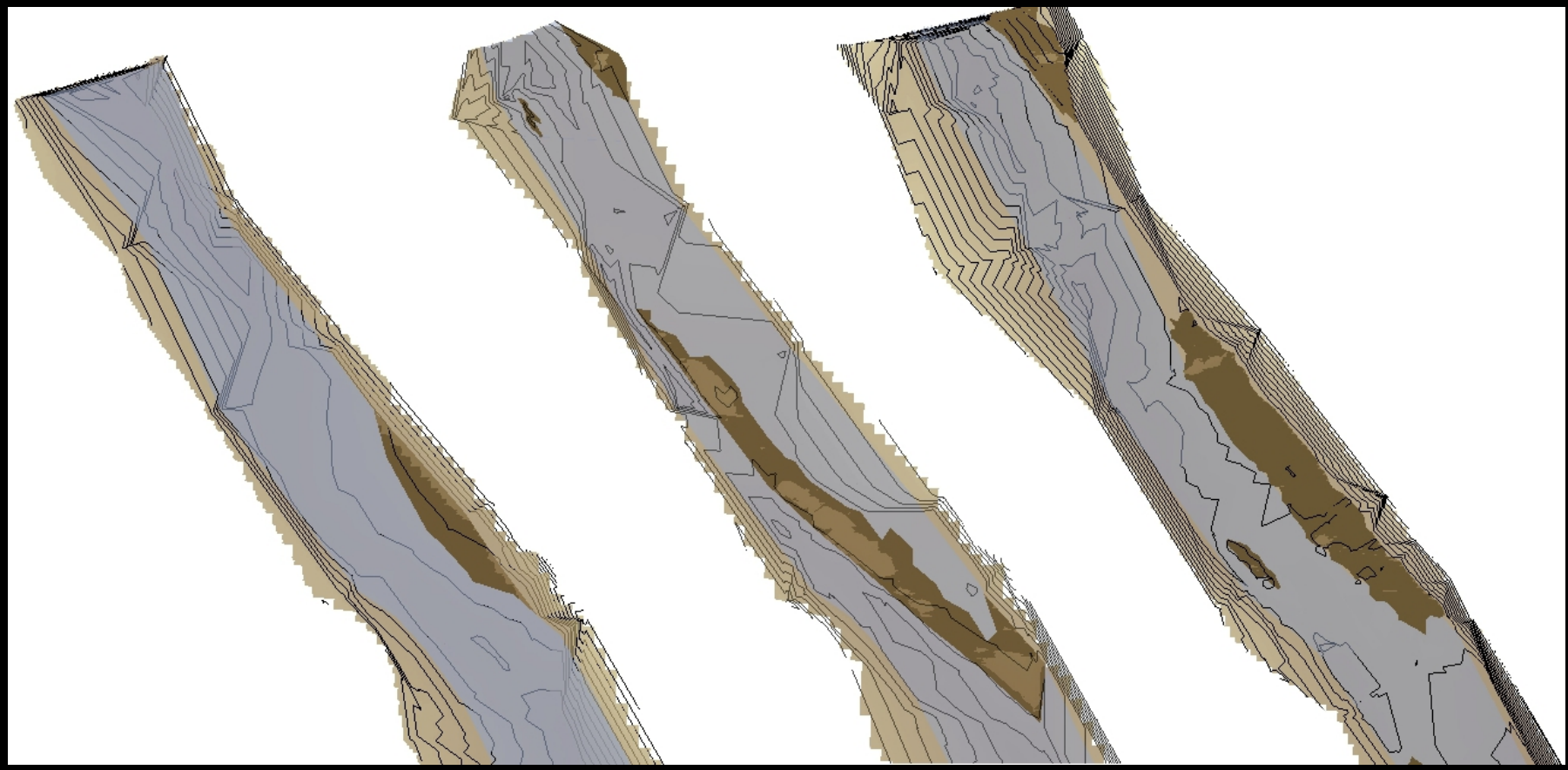
Downstream – December 2009

Results: Downstream Channel Changes

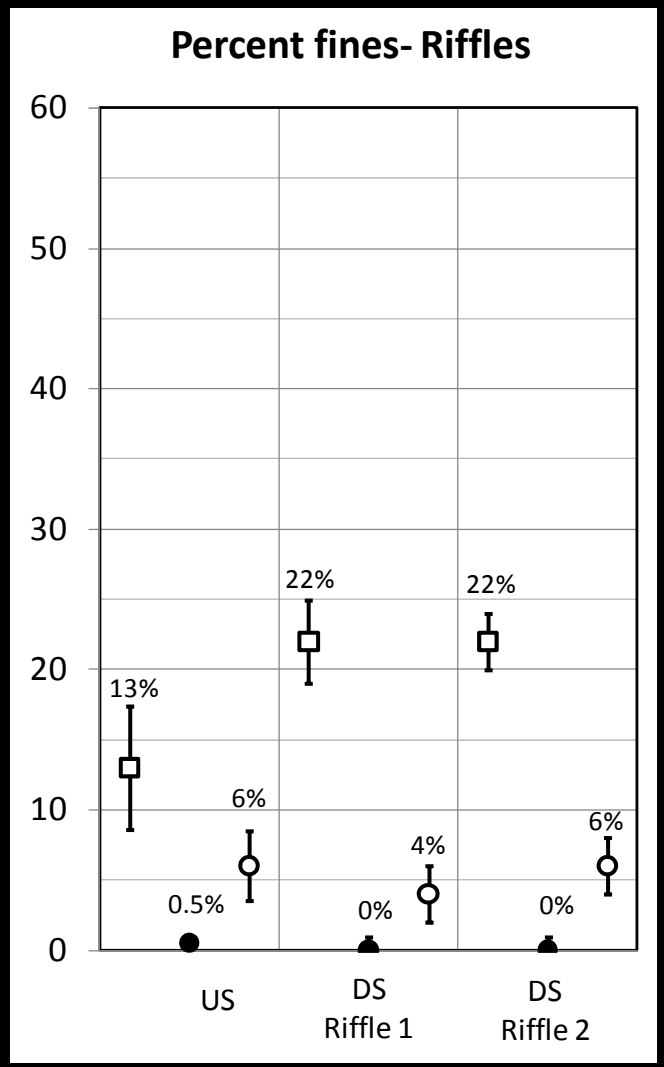
Pre-removal

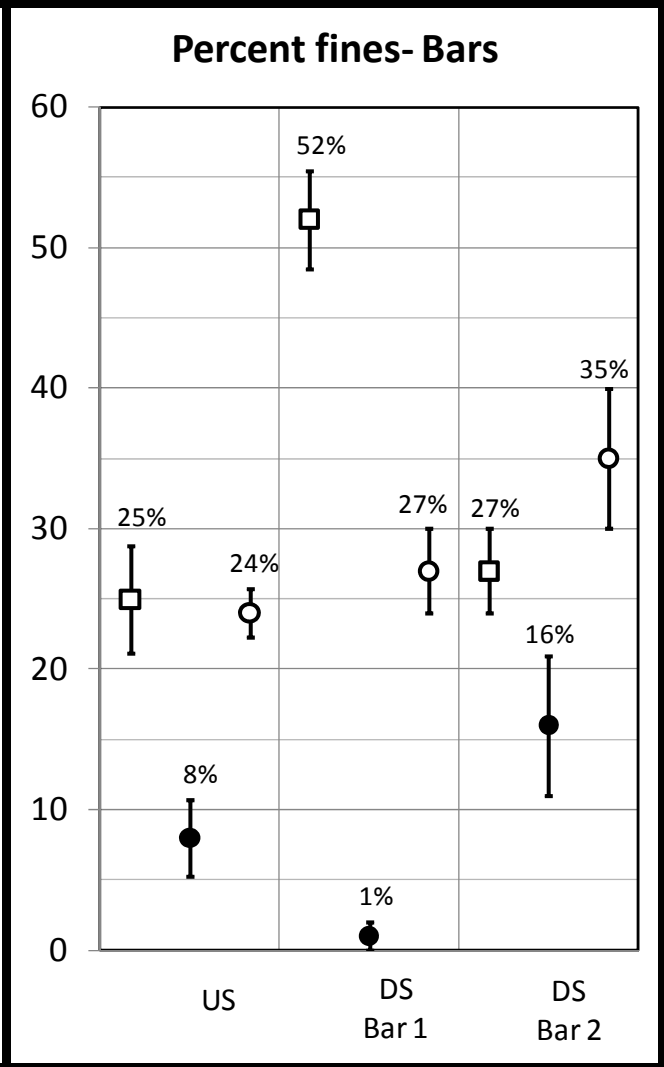
1 year post-removal

2 years post-removal

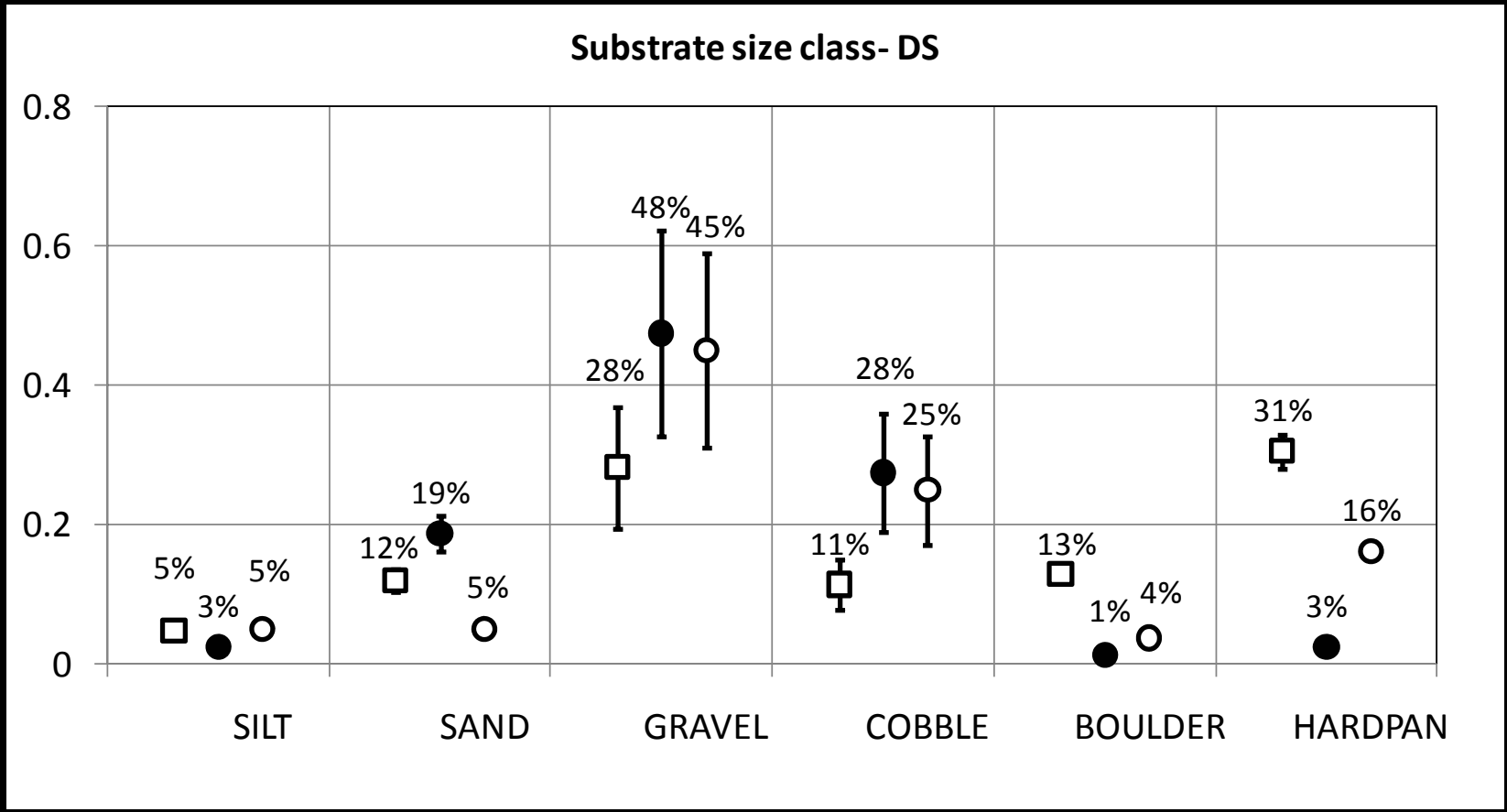


Percent fines in riffles and bars

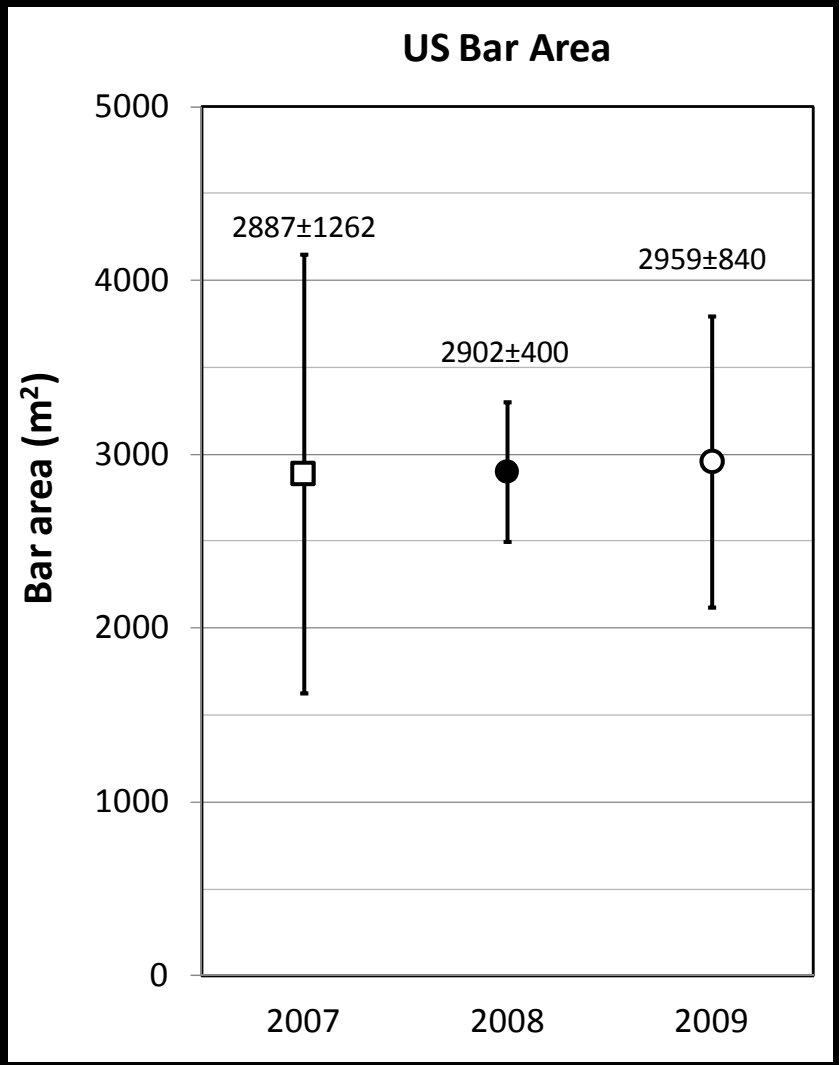


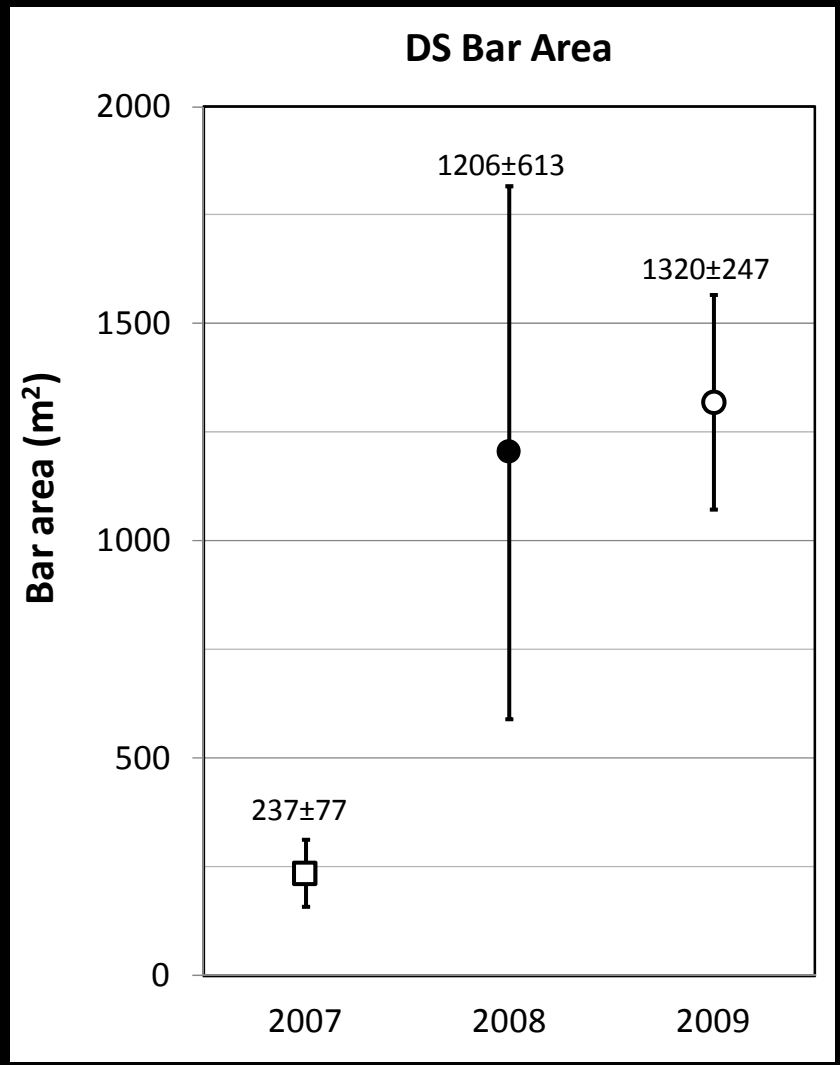


Substrate sizes



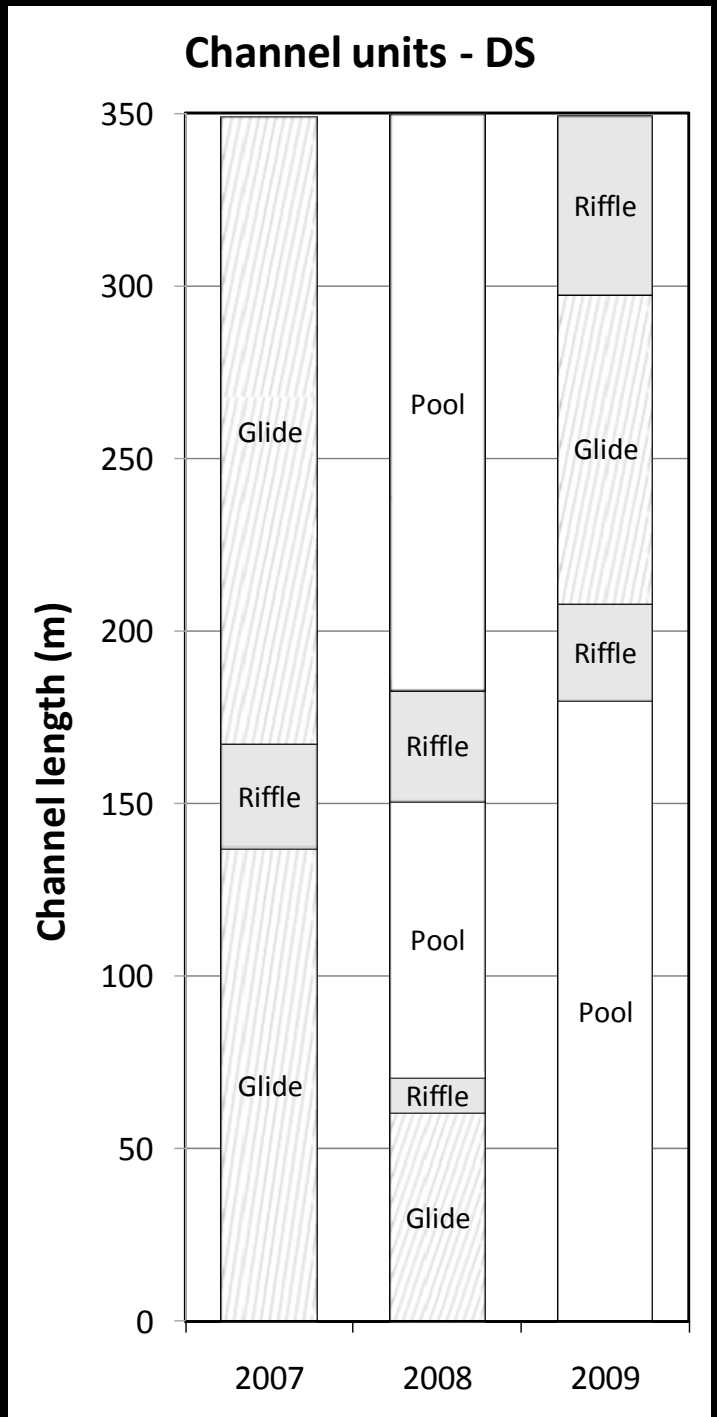
Bar areas





2007 2008 2009

Channel units



Biophysical: Take home messages

- the upstream and downstream channel changes were limited in extent with no detrimental impacts in terms of bank erosion or flood risk

- Project benefits:
  - Unobstructed fish passage
  - Some increases in habitat diversity

- Substantial learning on methods and physical processes of dam removal

Ongoing work

- Place Brownsville results into broader scientific context for dam removal

- Modeling physical processes of dam removal
- Drivers of dam removal decisionmaking

Jack Zunka
MS – Geosciences

Trent Carmichael
MS – Water Resources Science

Modeling dam removal

Objectives:

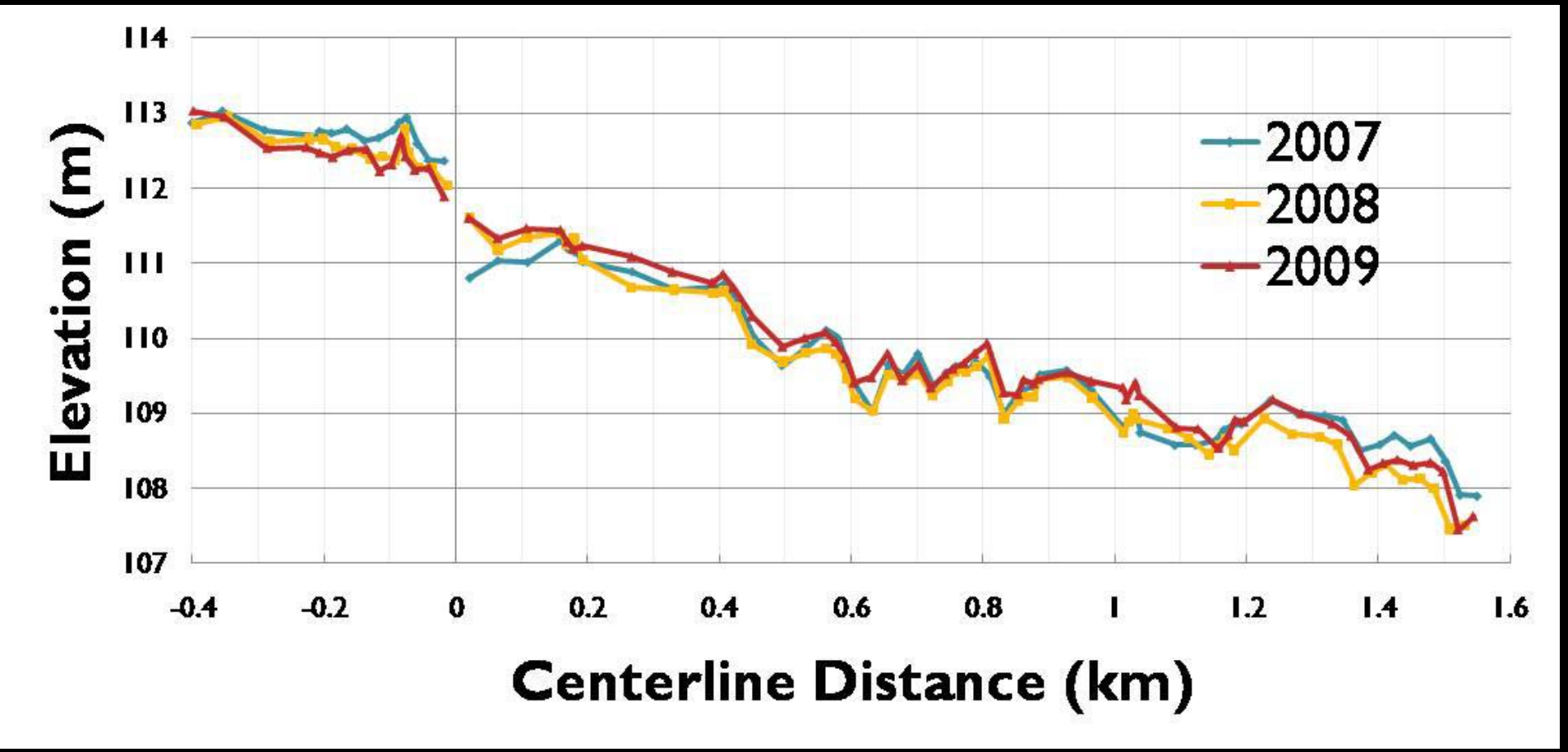
- Evaluate need for concern about the environmental impacts of removing small dams.
- Evaluate overall impact of the removal on geomorphic complexity / habitat diversity in the channel
- Evaluate DREAM-2 as a predictive tool
- Develop quantitative methods for describing 2-D changes

1-dimensional analysis

- Using sediment tranport model (DREAM-2), generate a 1-D, cross-sectionally averaged prediction of channel change following removal

- Compare model outputs spatially and temporally with field data

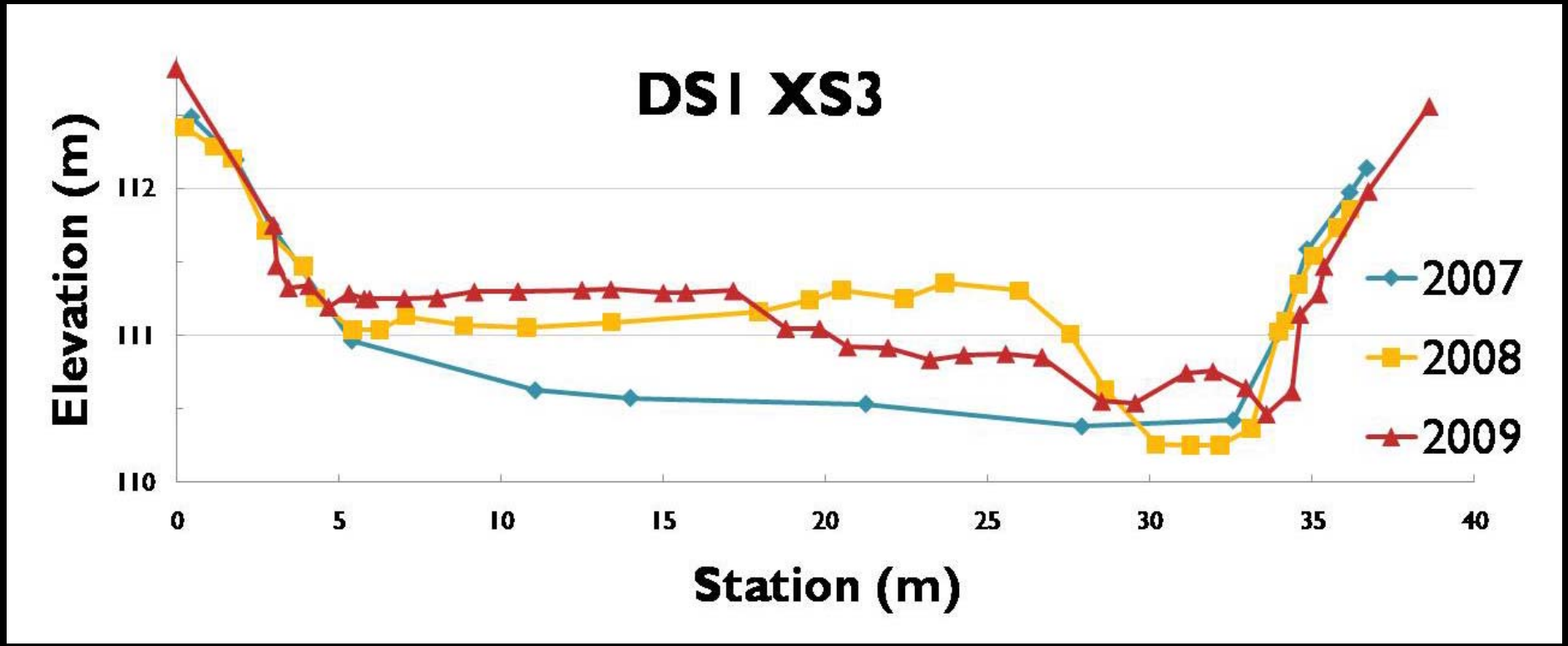
1-dimensional analysis



2-dimensional analysis

- Evaluate differences between predicted vs collected profiles and address questions relating to styles of deposition downstream of former dam in 2-D
  - Is there noticeable DS deposition? Is it occurring as bar growth or pool fill?

2-dimensional analysis



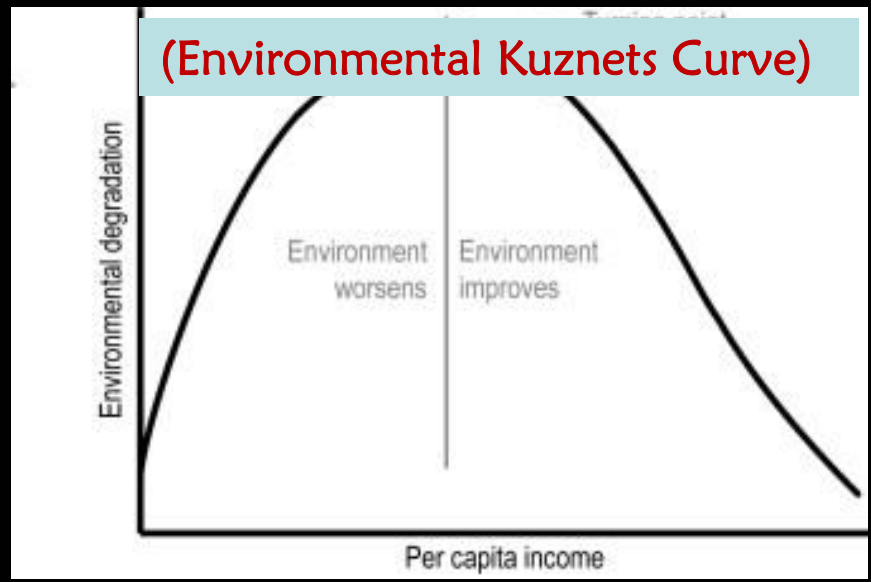
2-dimensional analysis

- Analyze 2-D changes quantitatively using geomorphic complexity metrics
  - Coefficient of Variation (CV) of thalweg depth
  - CV of individual cross sections
  - Mean maximum residual pool depth
  - Variation in thalweg sinuosity
  - D84/D16
  - Change in % sediment size class

Drivers of dam removal decisionmaking

Objectives

- Investigate why one community embraces dam removal while another may not
- Examine the major drivers in dam removal decisions
- Explore theories to explain patterns in dam removal rationale



Dam removal: Emerging Policy

- Lowry (2003) suggests a movement away from traditional development practices
- Passage of environmental legislation and support of federal, state, and local agencies
- Decentralized movements of environmental protection

Photo Source OWEB:
www.oregon.gov/BrownsvilleRemoval.jpg

Why is dam removal becoming an increasingly viable option?

- Most dams built with ~50 year lifespan. Many of the nations' dams are at or near that age
- Removal is often the most economic option
- Regulatory changes and recent dam re-licensing make removal a more likely option
- Environmental restoration has become increasingly important to the general public

Source: http://moldychum.typepad.com/moldy_chum/2007/10/tearing-down-th.html

What drivers influence a community to consider dam removal?

Physical/Environmental

- Aging dams, human safety issues
- Environmental restoration

Social

- Changing land use practices
- Income, education?

Political

- Dam re-licensing, policy changes

Economic

- Funding, cost of alternatives
- Benefit to fisheries?

What drivers affect a community's decision to choose dam removal?

- Social
  - Certainty of outcome, community participation
  - Cultural traditions, historic ties?
- Political
  - Money allocation
- Economic
  - Funding availability, cost of alternatives
  - Change in property values?
- Physical/Environmental
  - Human safety, habitat restoration

Examining drivers

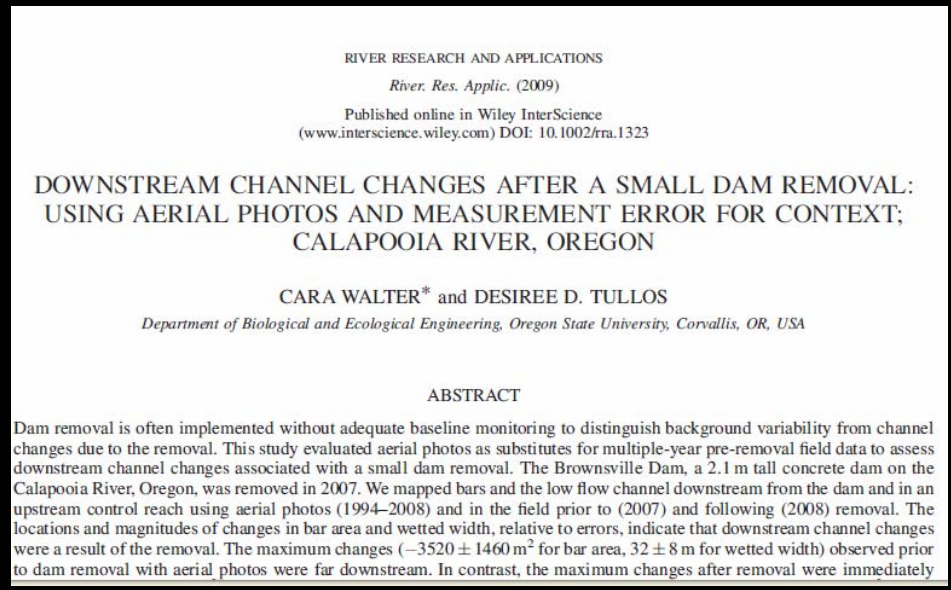
- Research funding sources and availability
- Compile information about dams considered for removal
- Download demographic data
- Compile timeline of important policy changes

Examining drivers

- Discussion with community and agencies involved
- Interest and participation at local to national level
- Analysis of quantitative data (census, land use, etc.) within GIS

Project Impacts

- 3 publications accepted or in review (+3 in prep)
- Dam Removal Monitoring Guide
- Students supported
  - 1 Phd
  - 4 masters
  - 5 undergraduate



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DOWNSTREAM CHANNEL CHANGES AFTER A SMALL DAM REMOVAL: USING AERIAL PHOTOS AND MEASUREMENT ERROR FOR CONTEXT; CALAPOOIA RIVER, OREGON

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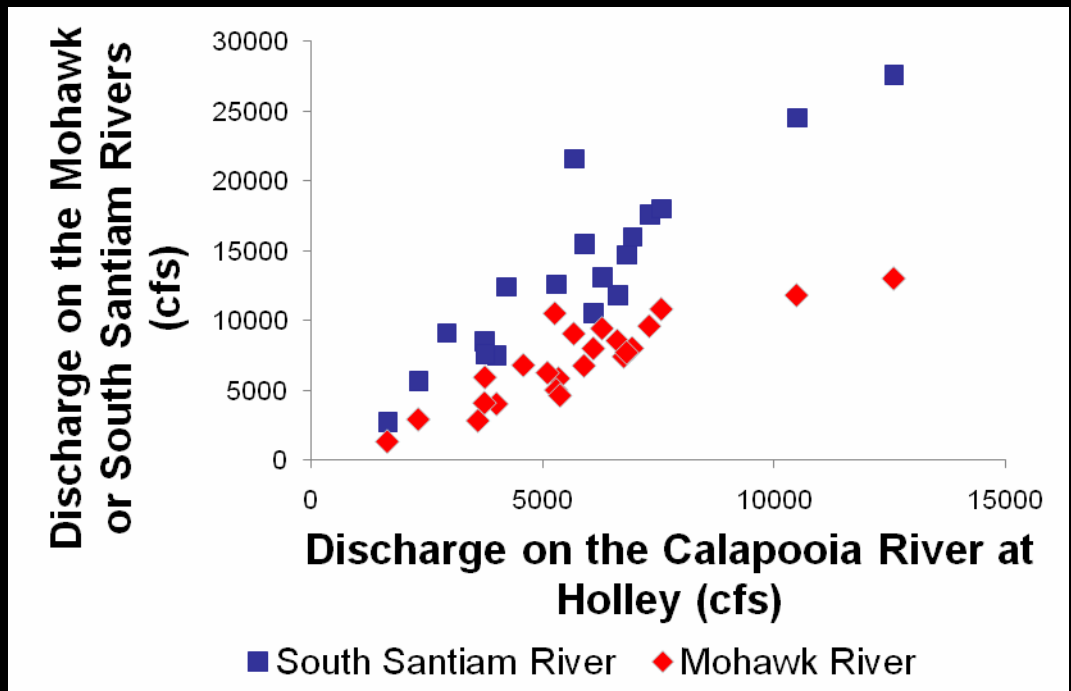
ABSTRACT

Dam removal is often implemented without adequate baseline monitoring to distinguish background variability from channel changes due to the removal. This study evaluated aerial photos as substitutes for multiple-year pre-removal field data to assess downstream channel changes associated with a small dam removal. The Brownsville Dam, a 2.1 m tall concrete dam on the Calapooia River, Oregon, was removed in 2007. We mapped bars and the low flow channel downstream from the dam and in an upstream control reach using aerial photos (1994–2008) and in the field prior to (2007) and following (2008) removal. The locations and magnitudes of changes in bar area and wetted width, relative to errors, indicate that downstream channel changes were a result of the removal. The maximum changes ($-3520 \pm 1460\ m^2$ for bar area, 32 ± 8 m for wetted width) observed prior to dam removal with aerial photos were far downstream. In contrast, the maximum changes after removal were immediately

Project Impacts

Flow records on Calapooia



Project Impacts

"When you have change it helps define the character of the people, it helps establish and formulate community identity. When you are working with people and hearing different view points, people start working together, discussing issues in the community, and try to solve problems based on a greater set of information. Change essentially helps build infrastructure of the community from the bottom-up"

- City Official

Thank you! Questions?

river engineering and restoration

OREGON STATE UNIVERSITY

http://rivers.bee.oregonstate.edu/index.html

January 11, 2010

- welcome
- people
- research
- teaching
- publications
- links
- river engineering tools
- contact

biological and ecological engineering

brownsville dam removal - effectiveness monitoring

Brownsville Dam before removal - August 2007

the tullos lab at Oregon State University is investigating physical and biological responses of the removal of Brownsville Dam on the Calapooia River. Changes in sediment dynamics, channel morphology, invertebrate communities, and riparian habitat are being investigated.

The Brownsville Dam was located at river km 62, about 4 km southeast of the city of Brownsville. It was originally built as a log crib dam in the late 1800's, to divert water into the Brownsville Canal providing water for a variety of mills. The dam failed in the 1940's and was rebuilt in the late 1960's as concrete shell filled with sand and gravel to divert flow into the canal for aesthetic purposes. Removal of the dam was completed in the summer of 2007. The dam was 33.5 m wide with a 4.3 m apron. Historically, the upstream height of the dam was increased from 2.4 meters to 4 meters using

Photo Points

Effectiveness Monitoring Data Library