Quantifying the Effectiveness of Restoration Using Water Quality in an Agriculturally Dominated Watershed: A Case Study from Marsh Creek, ID

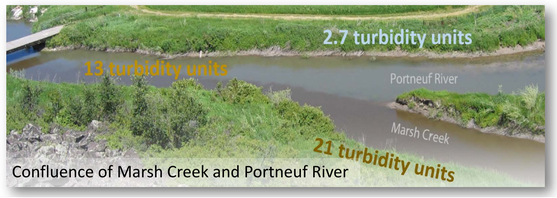
Graham Meese, Ben Crosby Idaho State University, Geosciences

Contact: meesgrah@isu.edu

Award # IIA-1301792

Study Motivation

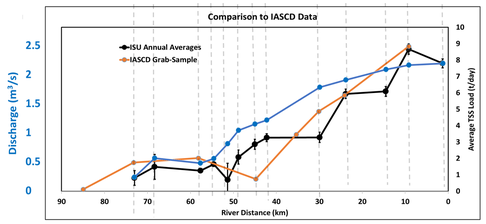
In 1985, SE Idaho was the 5th worst region in the US for fine sediment, and Marsh Creek was ranked 3rd worst in Idaho (IDEQ,2010).



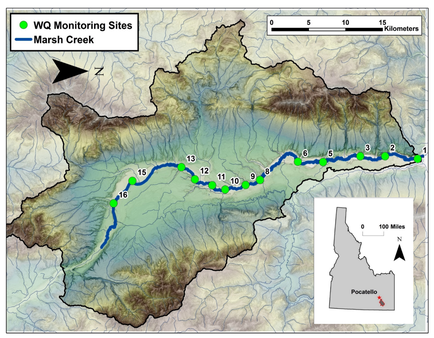
Confluence of Marsh Creek and Portneuf River

Current Knowledge

-Bank-sourced sediment loads remain high, increasing dstm.
-Local, state and federal agencies support land conservation.



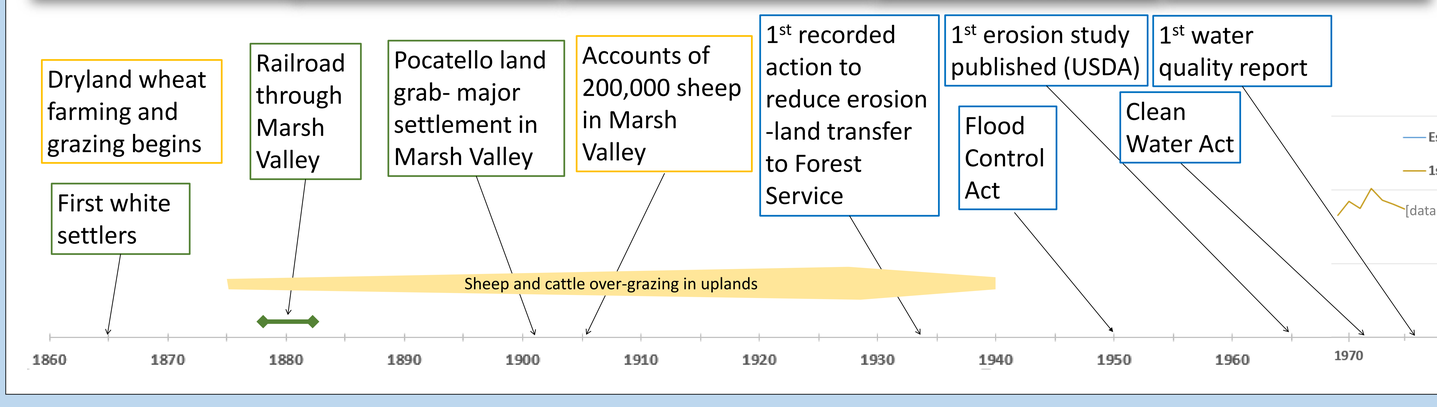
ISU annual averages from 2016-2017 (Guilinger, 2017).
IASCD grab samples from 2008-2012 (IASCD, 2013)

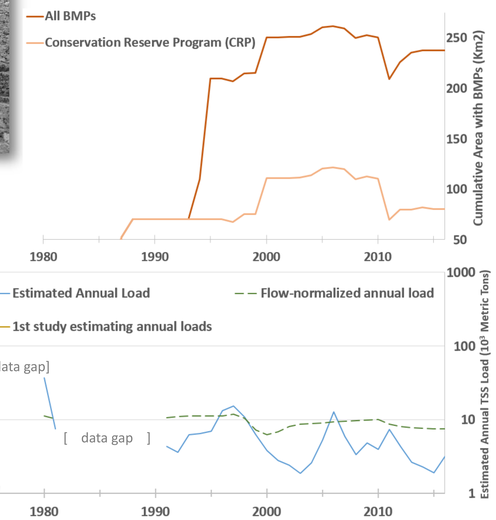


Methods

- We aggregate and synthesize historic land use, water quality, and restoration data from all available sources.
- We analyze water quality and quantity data using the USGS EGRETci package in R stats (Hirch et al., 2015) to assess the effectiveness of conservation efforts on reducing total suspended sediment (TSS) loads in Marsh Creek.
- We measure channel change by collecting, stitching and analyzing historic aerial imagery using Agisoft Photoscan and ArcMap 10.4

Timeline and Water Quality Analysis

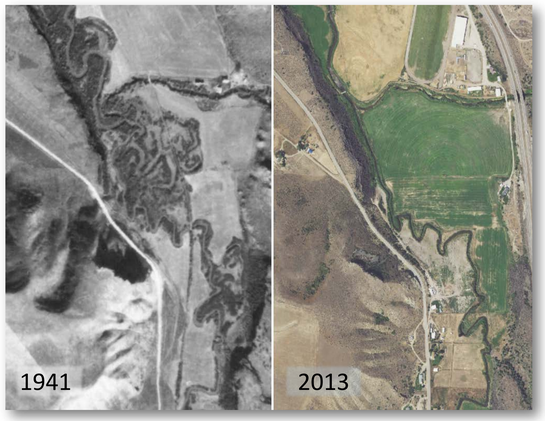




Land Use History

Initial fine sediment problems were due to overgrazing of sheep and cattle along with dry farming **in the upland benches** of Marsh Valley.

The channel of Marsh Creek was modified to serve the railroad, irrigators, grazers, urban development and flood control.



Channel Metrics	1941	2013	% Change
Ave. channel width (m)	9.0 +/- 3.0	8.9 +/- 2.8	Not significant
Channel Length (km)	20.65	18.73	-9.3 %
Sinuosity	2.09	1.89	-9.6%

Conservation Programs

Who's Paying for Restoration?

Federal, state, and local funds are matched by private landowners through cost-sharing programs

- Clean Water Act (319 Grants)
- US Farm Bill (EQUIP and SAQUIP)

1980s- early 1990s: SAQIP and CRP programs. Conservation efforts focused on reducing upland erosion on agricultural fields.

Late 1990s-present: With funding from the Clean Water Act's 319 grants, efforts moved toward riparian bank stabilization, off-channel watering and infrastructure relocation. Monitoring efforts were implemented, but remained scattered and separate.

Who's working to implement BMP's

- Idaho Department of Environmental Quality (IDEQ)
- National Resource Conservation Service (NRCS)
- Portneuf Soil and Water Conservation District
- US Forest Service
- US Fish and Game
- Trout Unlimited
- Private Landowners

Conservation Effectiveness

Best Management Practices (BMPs)

Upland	Lowland
No Till/low till	Riparian fencing
Direct seed	Riparian revegetation
CRP	Off-Channel watering
Berms / terraces	Corral relocation
Sediment basins	Waste storage
Seeding	Spring exclusions

Results and Conclusions

- Restoration efforts and changes in farming and grazing practices in upland areas reduced fine sediment erosion and stream load since the initial studies in 1977-1990's
- Flow-normalized annual TSS flux from 1980-2016 has decreased 3700 metric tons. The main source of today's sediment loads are bank erosion along lower Marsh Creek.
- Progressive implementation of conservation actions appear to be corelated with a decline in annual sediment loads in the late 1990's.