EVALUATING THE IMPACT OF TRIBUTARY DAM REMOVALS ON TIDAL WETLANDS WITHIN THE HUDSON RIVER ESTUARY

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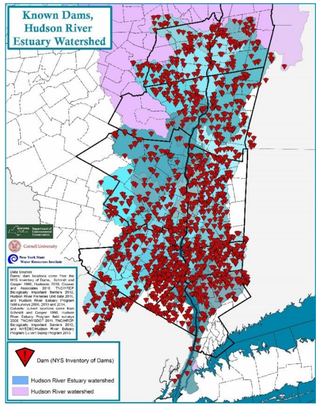
Guiding Questions



Dams in the Hudson River estuary watershed

When a dam is removed, the freed river will transport more sediment to the estuary

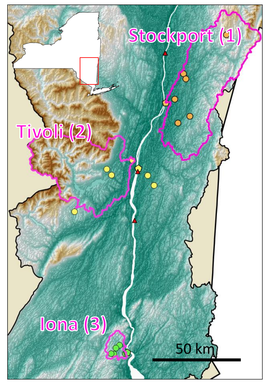
1. How does the sediment mass released compare with sediment input from the watershed?
2. Where does it go in the estuary?

NERRS Science Collaborative

Advisory Committee at meeting in June 2017.

Advisory Committee	Dam owners, consultants, and regulators	Natural resource managers	State & Federal agencies
Concerns	Individual dams and region immediately downstream	Multiple dams in a tributary and adjacent wetlands	Dams and wetlands across Hudson watershed
Example members	NYS Dam Safety Unit NYS Division of Water Fuss and O'Neill Engineering The Chazen Companies	Hudson River NERR Scenic Hudson The Cary Institute The Nature Conservatory	Hudson River Estuary Program NOAA Restoration Center USGS

Measuring sediment in impoundments

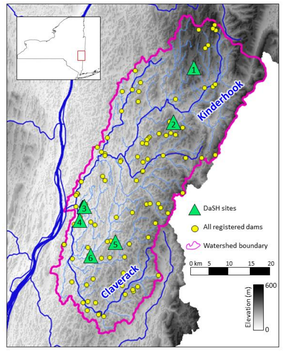


Study watersheds (year of project).

- **Three tidal marsh and catchment systems**
- **range of geology, land use, and relief characteristics**
- **Estimate watershed yields and dam sediment trapping**
- **Evaluate sediment needs of tidal marshes**

Stockport site characteristics

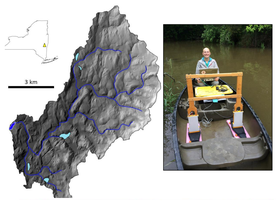
No.	Site	Sediment Bulk ρ (g/cc)	Sed LOI (%)	Watershed Area (km²)	Slope (m/km)	% forest
1	Black River Pond	1.19	25.6	15.5	124	95*
2	Hand Hollow	1.29	3.0	0.34	191	99.6
3	McCagg Pond	1.46	5.3	9.2	72	48.5
4	Stottville	1.54	5.4	438	160	64.1
5	Summit Lake	1.53	7.5	56	198	76.2
6	Red Mills Pond	1.45	8.7	150	177	67

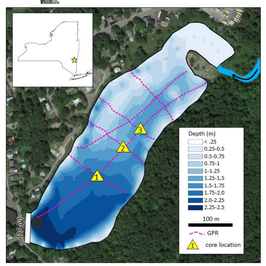


Stockport watershed, with all registered dams and project study sites (listed in table).

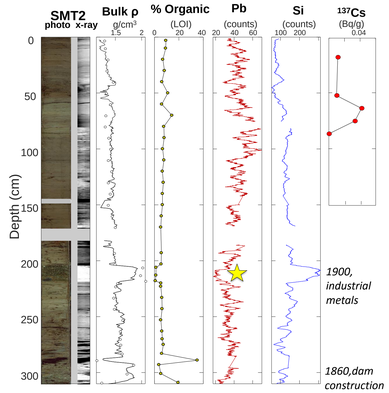
Summit Lake (example impoundment)

Goals:
- Map sediment volume
- Characterize sediment
- Evaluate changes in deposition rate

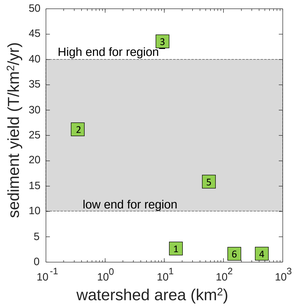




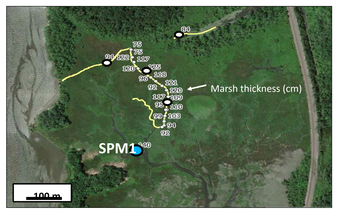
Summit Lake watershed (top) and impoundment (bottom), with core locations and ground penetrating radar (GPR) tracks

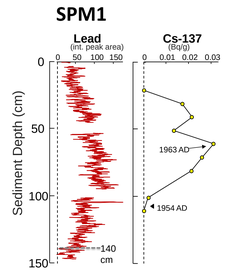


Observed Yields (impoundment trapping)

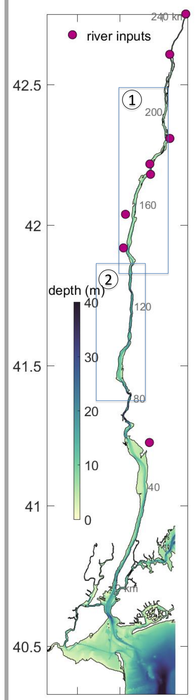


Stockport Marsh deposition

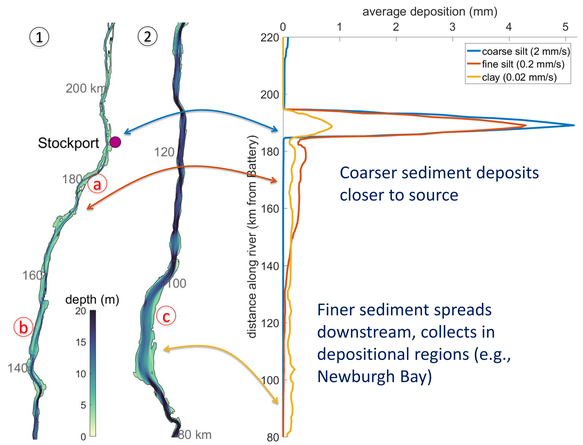




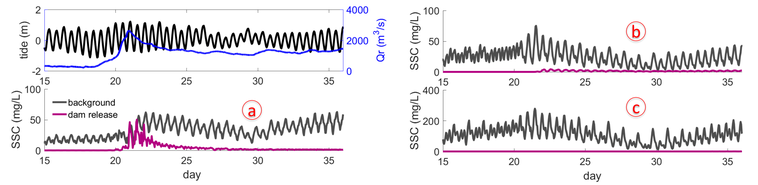
Modeling sediment in the estuary



- 3-D hydrodynamic and sediment transport model
- Tributary inputs increased to simulate dam removal
- Model tracks deposition of different size classes



For example, dam releases from the **Stockport watershed** (Kinderhook Creek) are simulated as **3x the typical sediment loading**, testing size classes of **coarse silt** (settling velocity = 2 mm/s), **fine silt** (0.2 mm/s) and **clay** (0.02 mm/s). This case is run for a **typical spring freshet**, and sediment deposition from the release is plotted along the estuary after about 1 month (above). Seaward transport and the location of deposition are **highly sensitive settling velocity**, highlighting the importance of grain size measurements in the field studies.



How do dam releases affect **turbidity in the estuary?** For the same simulation (3x background from Stockport for 0.02 mm/s) we compare **suspended sediment concentration** (SSC) from the **dam release and all other sediment sources** at 3 locations (marked above) along the estuary and see that the impacts are only notable during discharge events near the tributary mouth.