Core Mission

- Ensure *clean water*
- Protect and restore fish, wildlife, and their *habitats*
- Provide water recreation and river *access*
- Adapt to *climate change*
- Conserve world-famous *scenery*
Streams are highways

Dams and poorly installed culverts act as road blocks

Connected streams are stronger
Barriers Impact

- **Habitat**
- **Aquatic communities**
- **Sediment and debris**
- **Water quality**
- **Hydrology**
- **Maintenance/Replacement costs**
- **Liability**
- **Dam failure**
- **Recreation value**
- **Property value**

Clear Creek
Connected Streams

Barriers Impact

- Habitat
- Aquatic communities
- Sediment and debris
- Water quality
- Hydrology
- Maintenance/Replacement costs
- Liability
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- Recreation value
- Property value
Connected Streams

Barriers Impact

- Habitat
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- Hydrology
- Maintenance/Replacement costs
- Liability
- Dam failure
- Recreation value
- Property value
Economics of barrier mitigation

Number of barriers

- More than 66% not fully passable and constricting the channel (Janushowski-Hartley et al. 2013, Gillespie et al. 2014 Fisheries Magazine, USFS 2013)
- 1 million culverts statewide (NYSDOT)
- We’ve assessed over 1000 culverts, ~600,000 culverts in the state
- 5700 dams in NYS Dam Inventory, on average 69 years old (Vedachalem and Riha, 2013)
Cost of Culvert Mitigation

- Better culvert design can raise upfront costs by 50-100% (TNC 2013), 9-22% (Gillespie et al, 2014, Fisheries Magazine)
- $77,582 median cost for dam removal (n=225, Biohabitats, 2010)
Economics of barrier mitigation

Cost of Culvert Failure

- Dispersed cost
- But locally, you’ll hear about it
  - Cost of maintenance
  - Cost of replacement
  - Effect on residents
  - Disruption in commerce, tourism and travel
  - Emergency services
- Emergency replacement costs more than a planned replacement
Biologically Important Aquatic Barriers

- The Nature Conservancy and Hudson River Estuary Program

- Prioritized barriers
  - watershed condition
  - river network
  - Natural Heritage Program Important Areas

- Field-verified
Culvert Prioritization project

- Field work identifies culverts
- Assess culvert passability
- Model current and future stream flow
- Prioritize culverts
- Work with municipalities to fund replacement of top priorities
Culvert Prioritization project
Culvert Prioritization project
Culvert Prioritization project

- 285 culverts
- 121 undersized culverts (124 in 2050)
- 165 impassable culverts
- 50,000 acres assessed
- 80% of Ancram assessed
Many culverts are undersized

PunchBrook and Shekomeko
Recurrence Interval

Hollowville Creek
(Columbia County)

- <1yr: 122
- 1yr: 15
- 2yr: 9
- 5yr: 14
- 10yr: 11
- 25yr: 17
- 50yr: 13
- 100yr: 9
- 200yr: 13
- 500yr: 60
Culverts are largely on town roads

PunchBrook and Shekomeko

![Bar chart showing number of crossings across different recurrence intervals for town, county, and state. The chart includes bars for 500yr, 200yr, 100yr, 50yr, 25yr, 10yr, 5yr, and 1yr recurrence intervals.]
Figure 2. Distribution of return period of culvert peak flow capacity (submerged outlet), displayed by road ownership and watershed.
Improving Watershed Resiliency

- Plan for climate adaptation
- Integrate water resource protection into municipal plans
- Move infrastructure out of floodplains
- Create partnerships, work intermunicipally and with watershed groups
Improving Watershed Resiliency

- Protect forests, wetlands, floodplains
- Restore vegetation along streams
- Replace undersized road crossings
- Remove dams where feasible
- Manage runoff with green infrastructure
- Build demonstration sites
Replace poor culverts with better designed culverts
  - DPW needs to be supported if they decide that a larger culvert is worth the upfront costs because of the long-term savings

Funding opportunities

Resources
  - American Rivers
  - Cornell Cooperative Extension Hudson River Resiliency webpage
  - Land trusts and non-profits
  - NYSDEC Hudson River Estuary Program webpage

Other Estuary Program projects
Database:

- StreamContinuity.org, with pictures
Aquatic barriers “...sit unneeded, unused, undermaintained — a growing ecological and fiscal liability” National Forest System Legacy Roads and Trails program 2013
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Hudson River Estuary Program
New York State Department of Environmental Conservation
in cooperation with
NYS Water Resources Institute at Cornell University