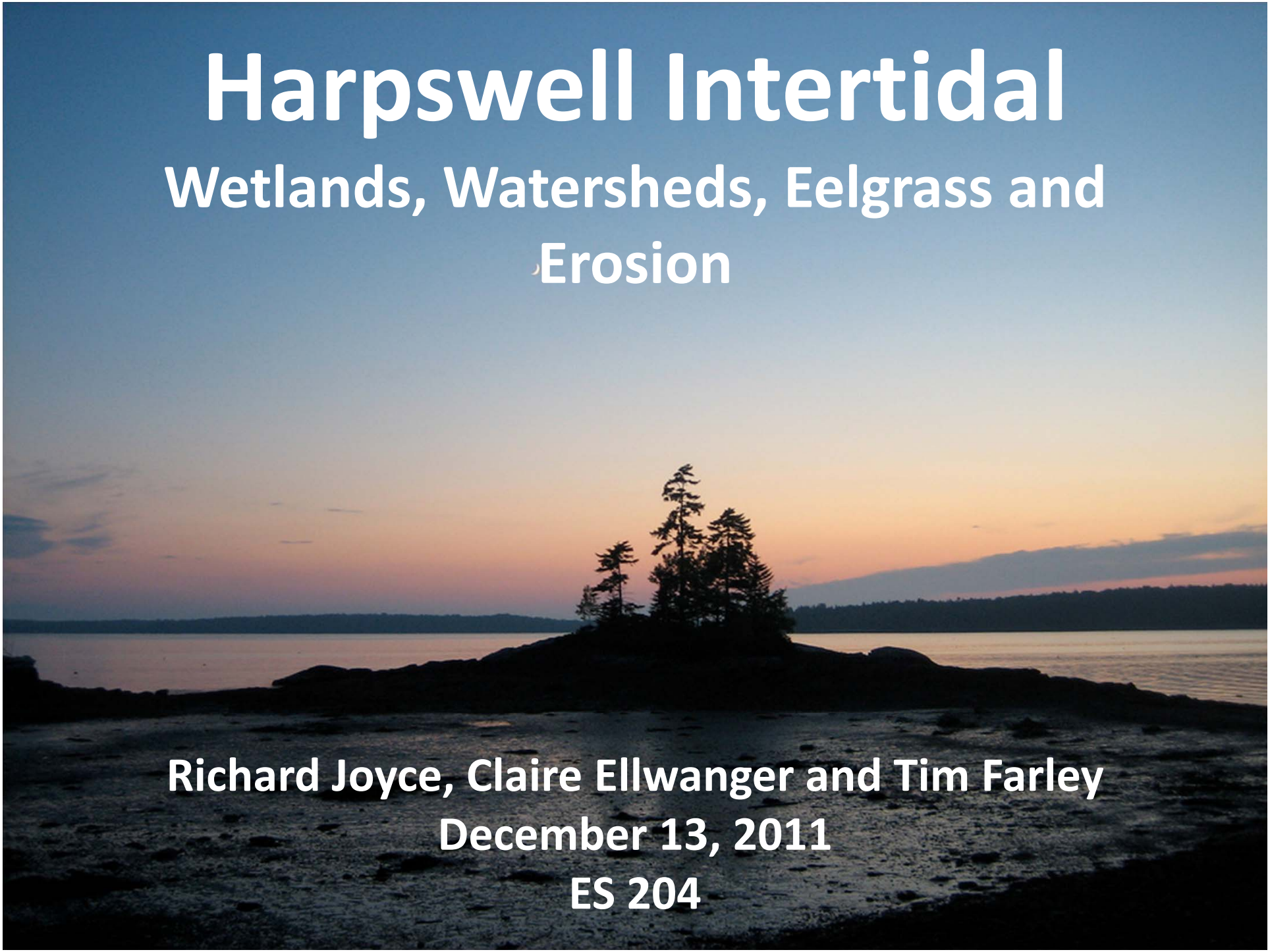


Harpswell Intertidal

Wetlands, Watersheds, Eelgrass and Erosion

Richard Joyce, Claire Ellwanger and Tim Farley

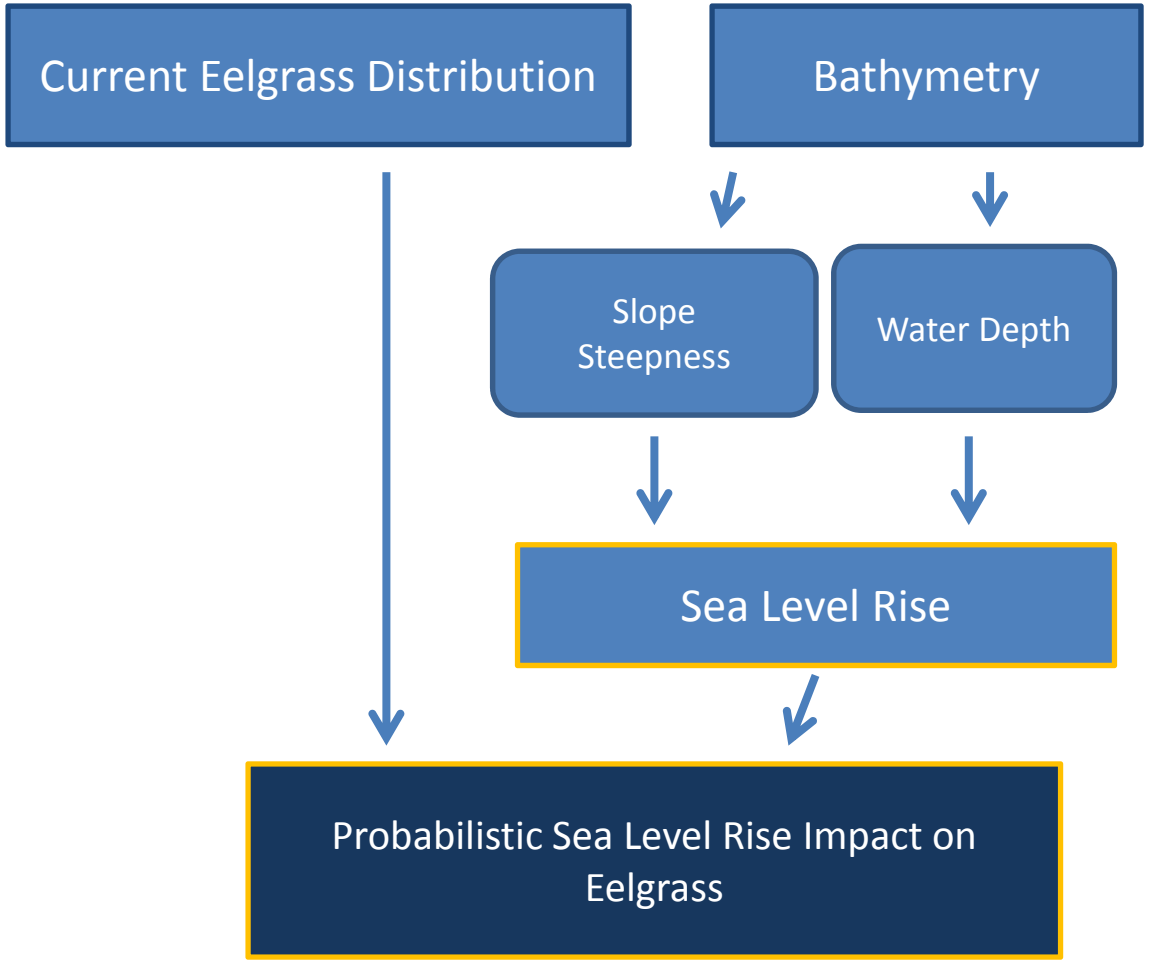
December 13, 2011

ES 204

Project Focus

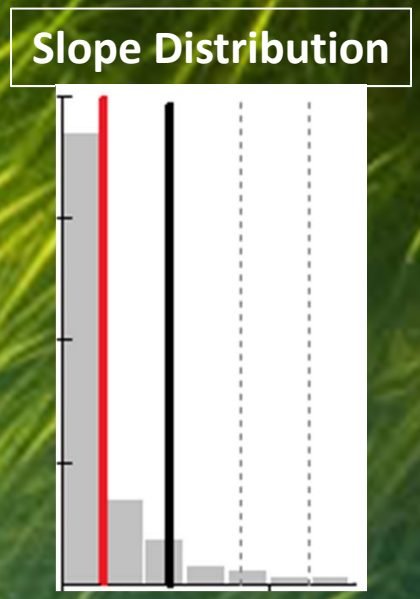
- Help **Harpswell Conservation Commission** with strategic planning for conservation of coastal natural resources
  - Predictions based on 2-foot Sea Level Rise
    - Potential future distribution of eelgrass
    - High-marsh and low-marsh shifts
  - Create a watershed map of Harpswell
  - Determine erosion vulnerability across Harpswell

Concept Flow Chart for Eelgrass



Eelgrass Methodology

- Probabilistic Method
- ± 1 Standard Deviation
- Slope (0.0 to 1.6°)
- Depth (-0.8 to 3.6 feet)
  - Mean Low Low Water
- Substrate also considered
  - Non-factor



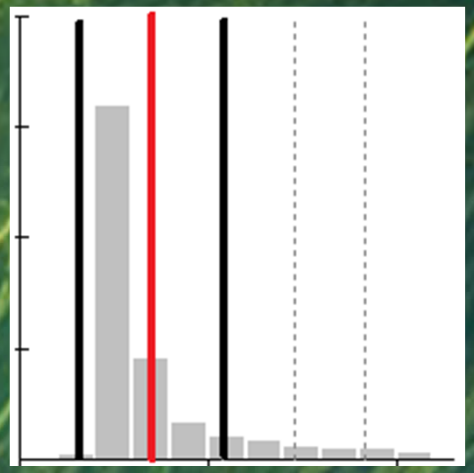
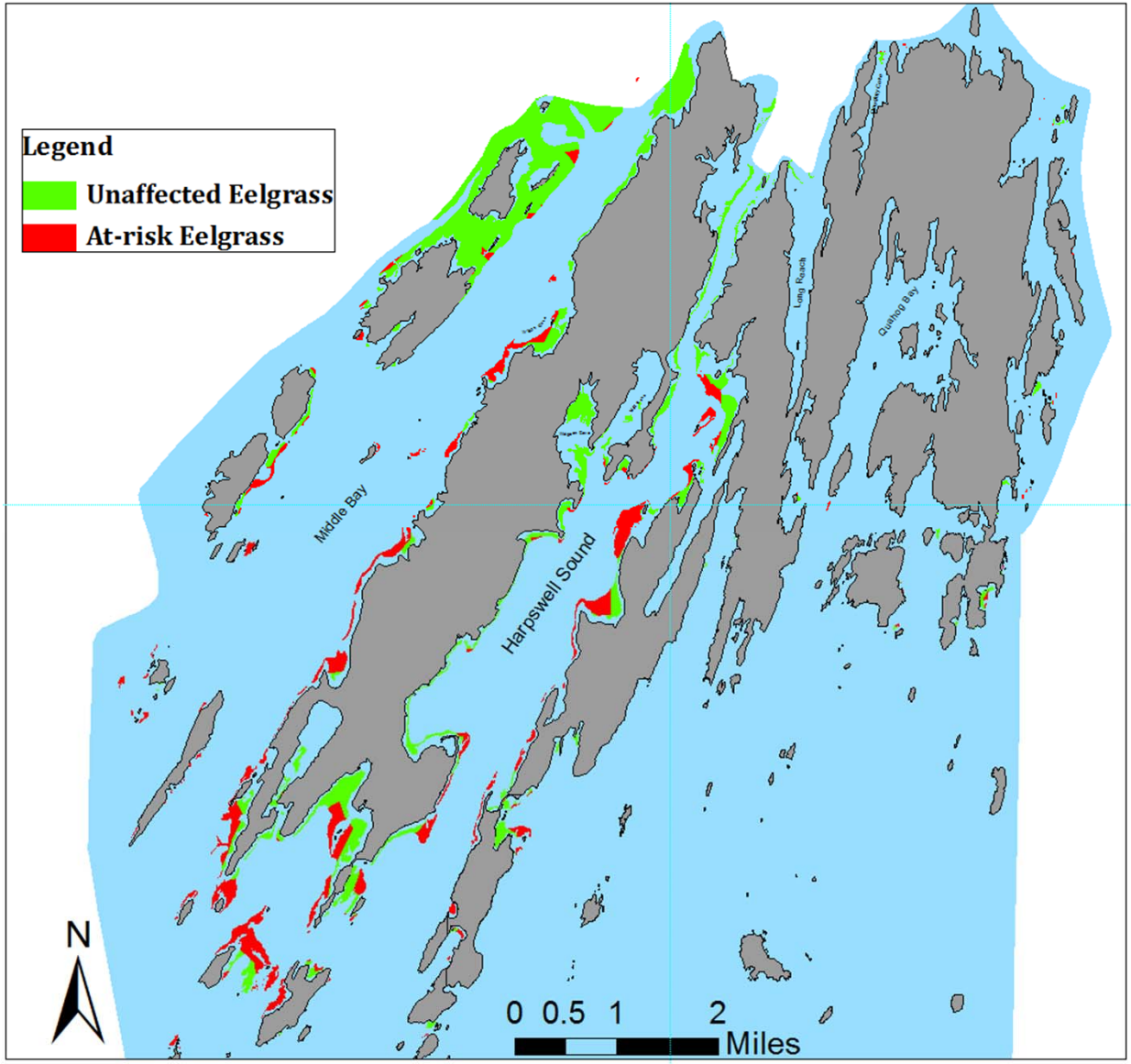


Photo credit: New Hampshire Division of Forests and Lands

Eelgrass Results

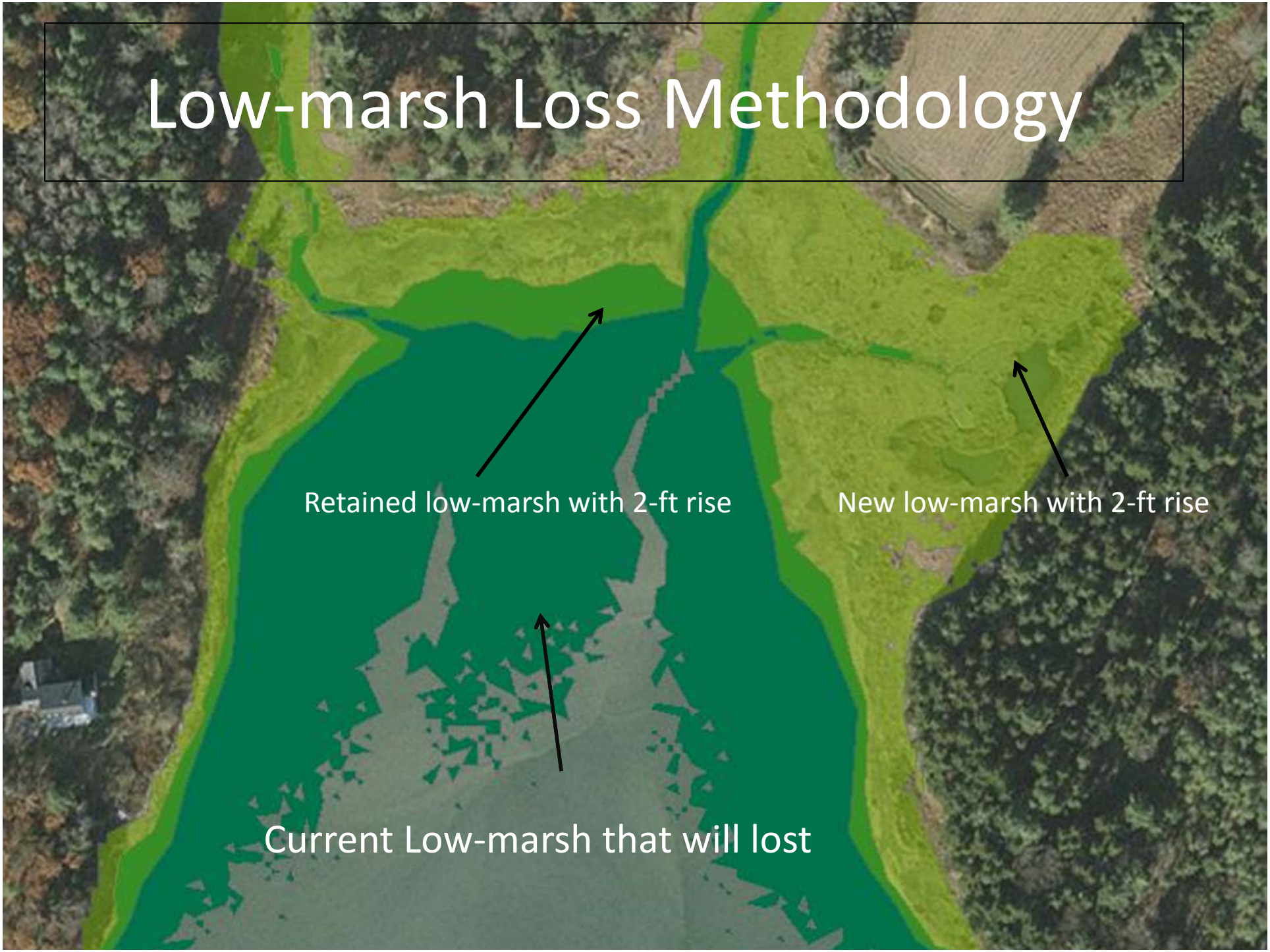


Eelgrass Conclusions

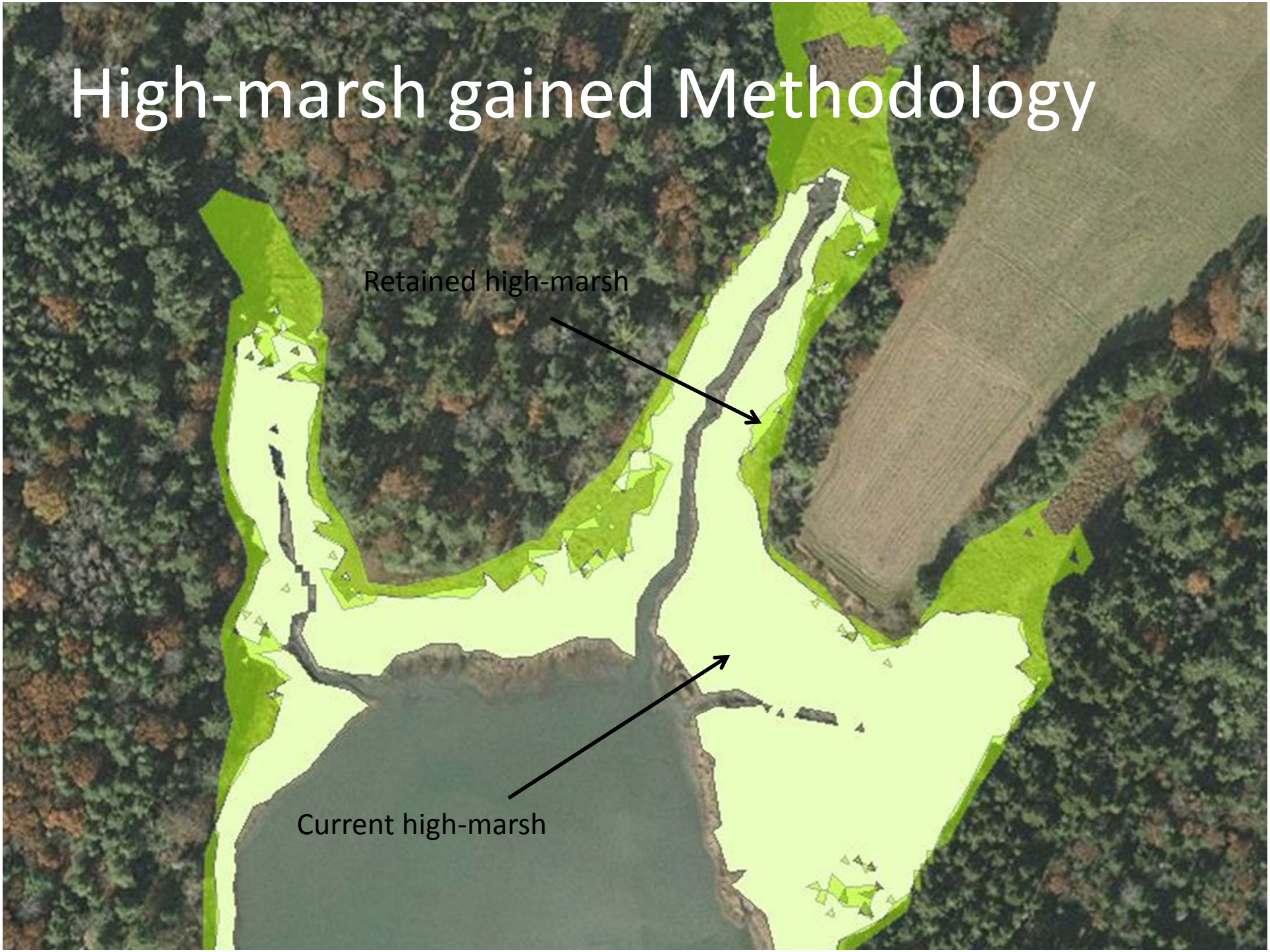
- Most eelgrass will not be affected
- Unaffected only represent highest probability areas
  - Eelgrass exists in other conditions, so at risk eelgrass may not be affected
- Long term sea level will not necessarily significantly harm eelgrass
  - Potential for gains
- Project improvements
  - Data on wave exposure
  - Less conservative sea level rise assumptions

Photo credit: New Hampshire Division of Forests and Lands

Low-marsh Loss Methodology



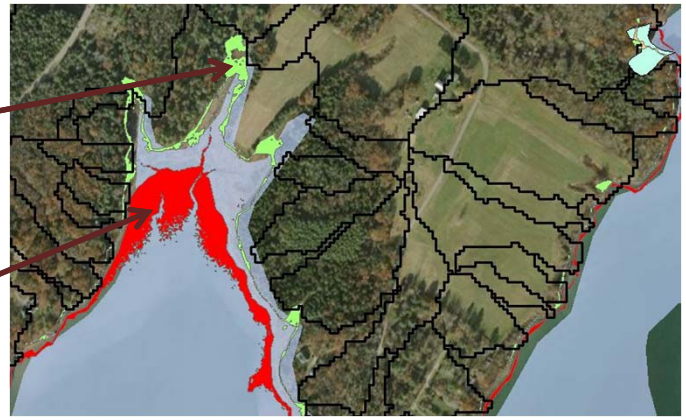
High-marsh gained Methodology



Salt-marsh and Wetlands Conclusions

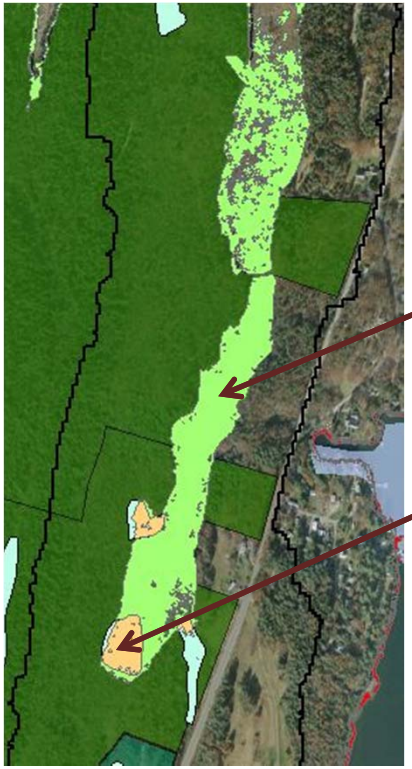
New high-marsh

Lost low-marsh



In many areas, more lost low-marsh than new high-marsh

- Long Reach Focus Area
  - Gentle slope= high-marsh gain
  - High-marsh will encroach on some freshwater wetlands

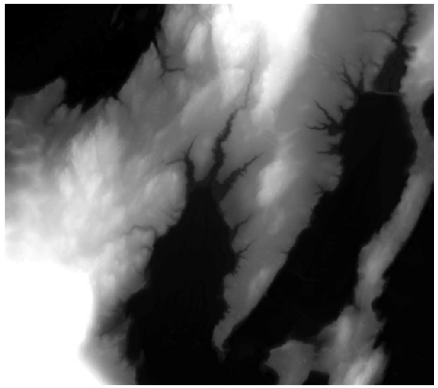


New high-marsh

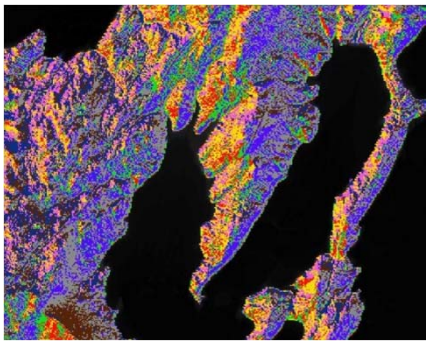
Freshwater wetlands encroached on by high-marsh

Watershed Methodology

Remote-sensed bare-earth elevation

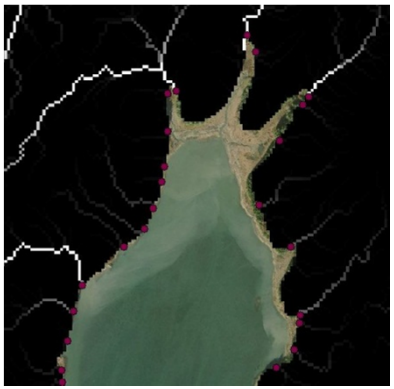


Flow-direction

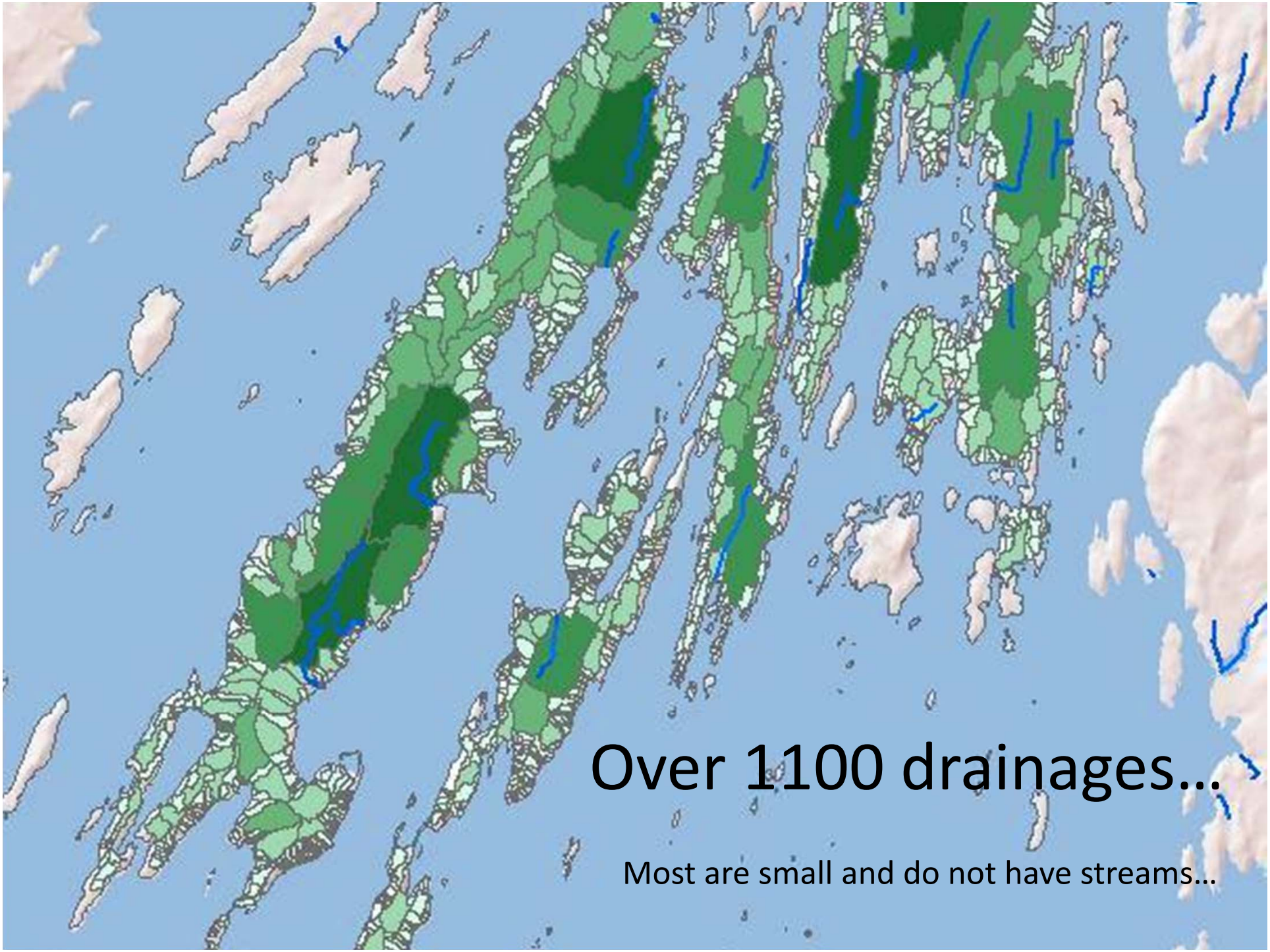


Flow-accumulation

Digitize pour points



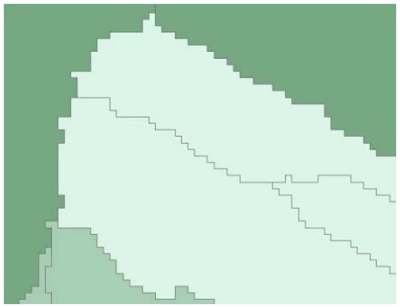
Watersheds!


Over 1100 drainages…
Most are small and do not have streams…

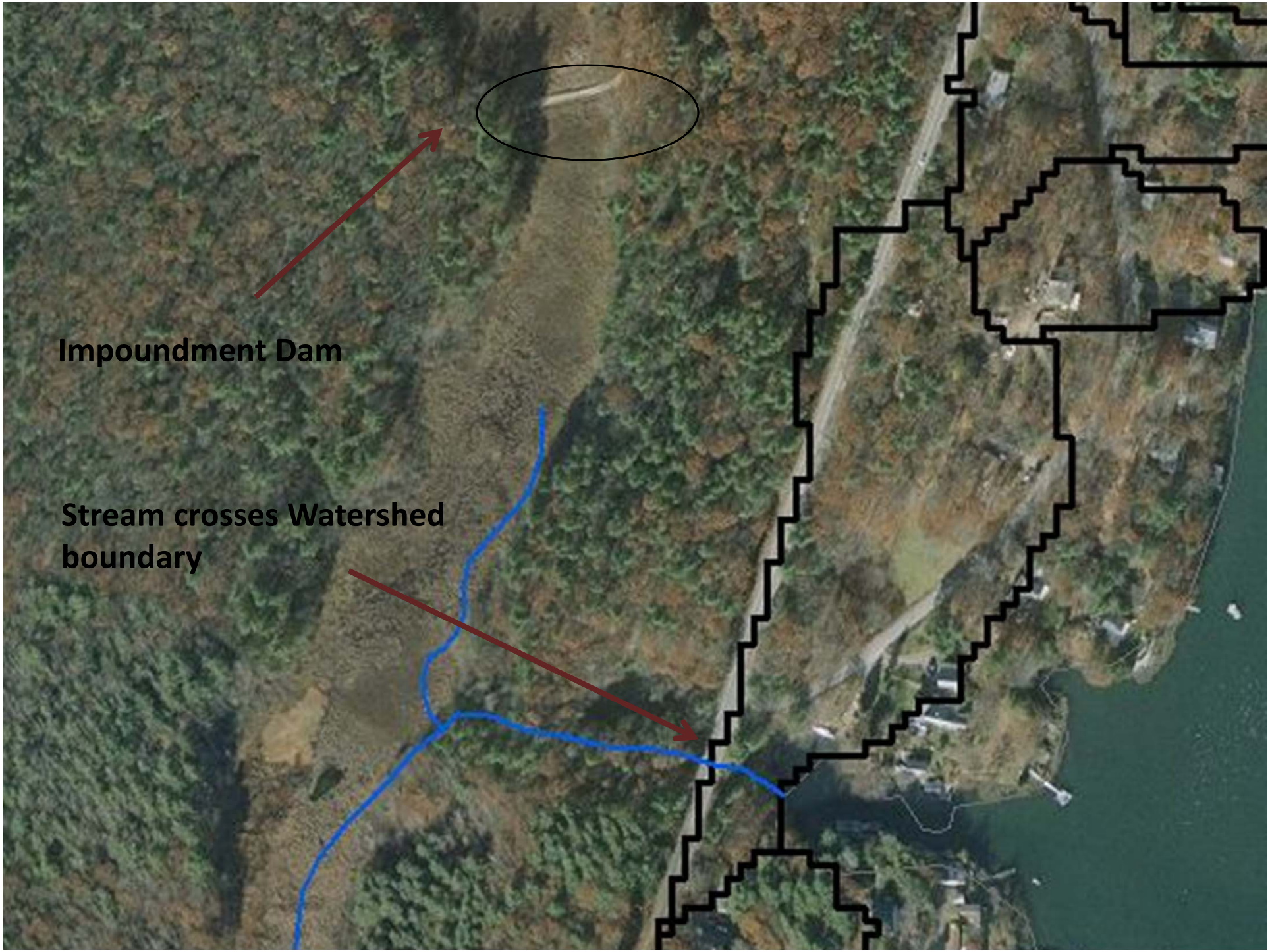
Harpswell's Watersheds

- Connecting land-use to coastal water quality and ecosystems

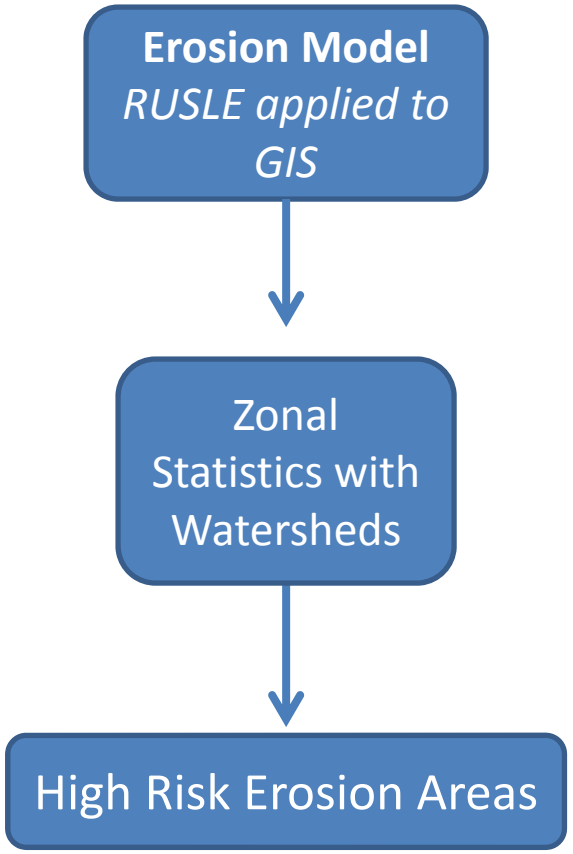
- Based on cells that are 6.5x6.5 meters, so the lines are not exact



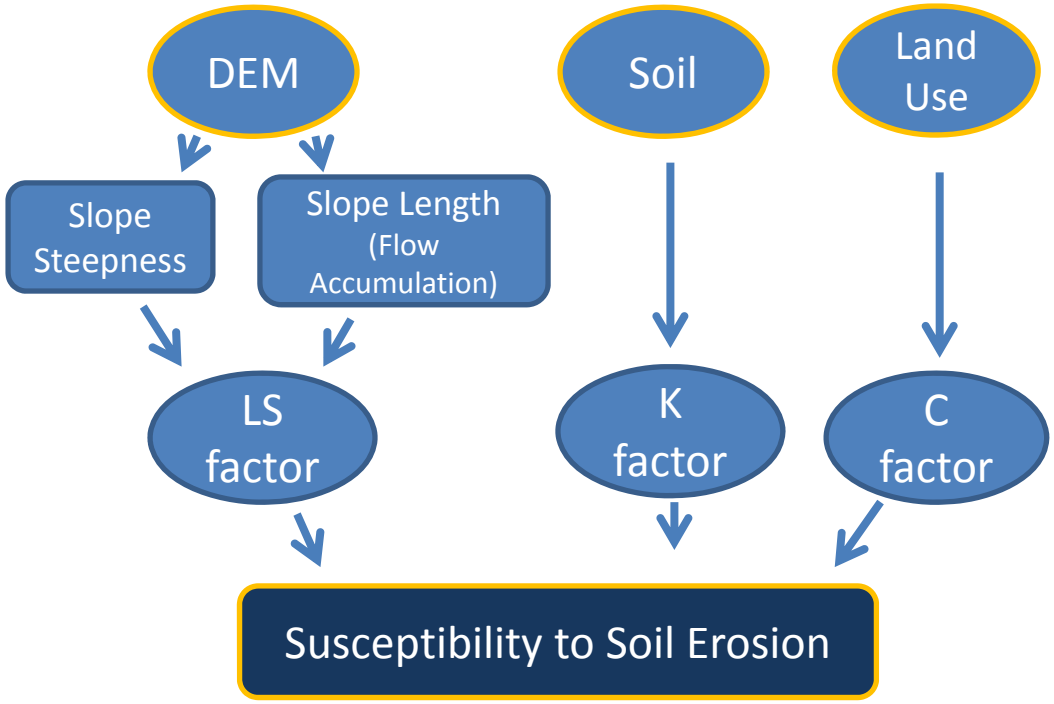
- Impoundment dams create glitches


Impoundment Dam
Stream crosses Watershed boundary

Concept Flow Chart of Erosion

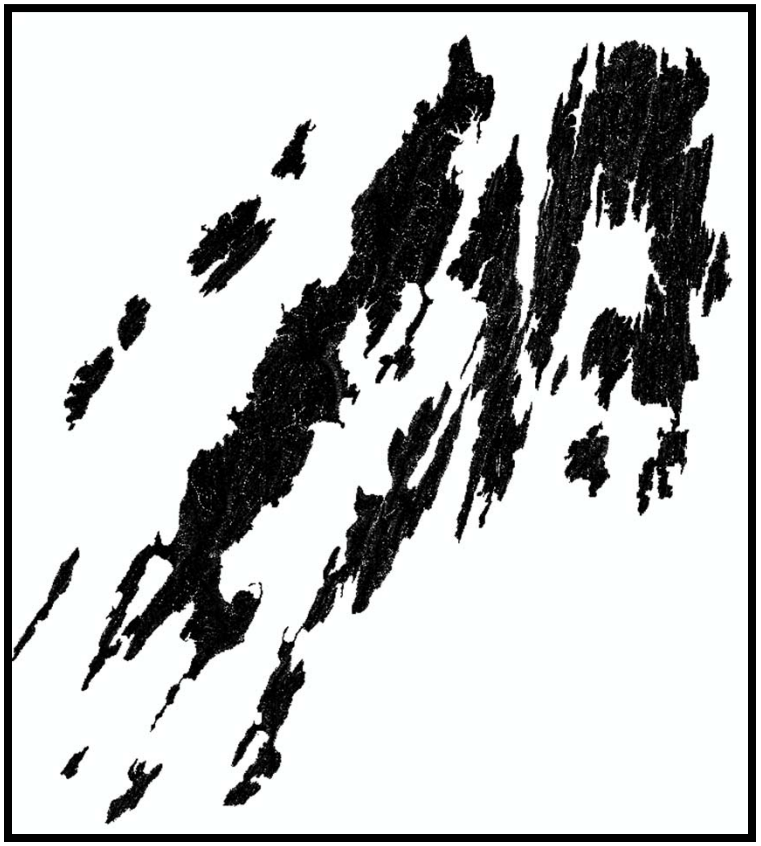


Erosion Methodology



LS Factor

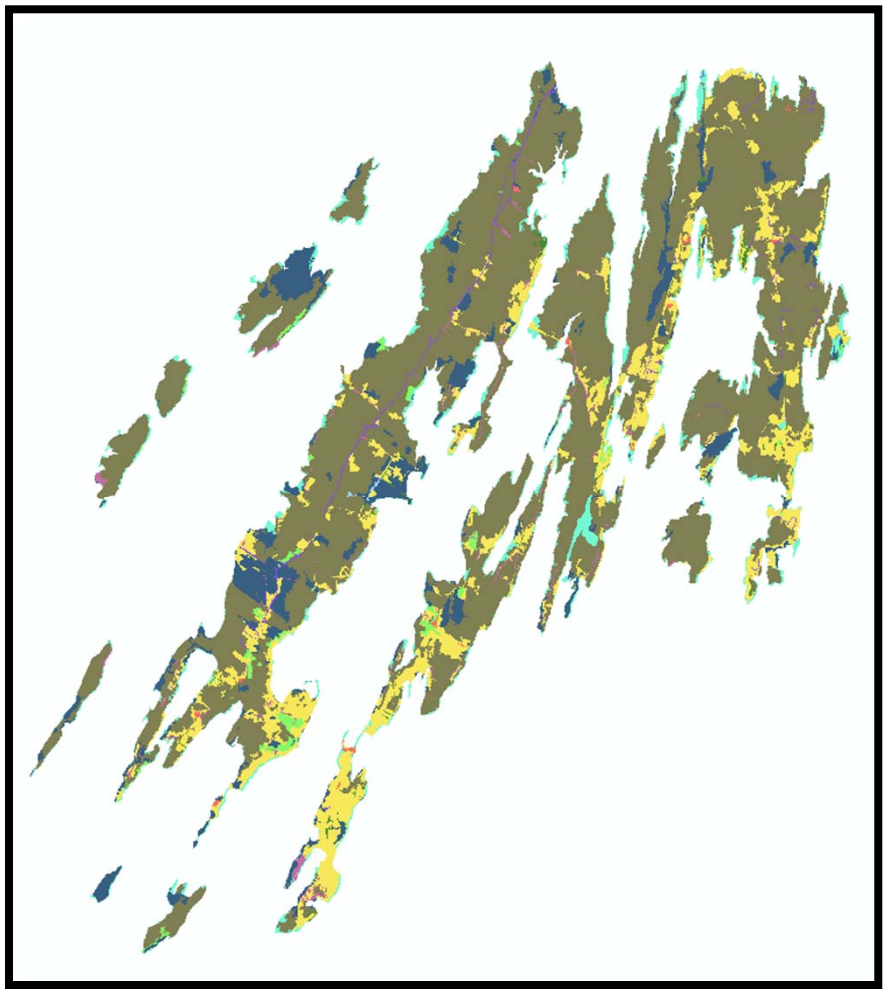
Pow ([flow accumulation] * cell size / 22.13, 0.06) *
Pow (Sin ([Slope of DEM] * 0.01745) / 0.0896, 1.3)



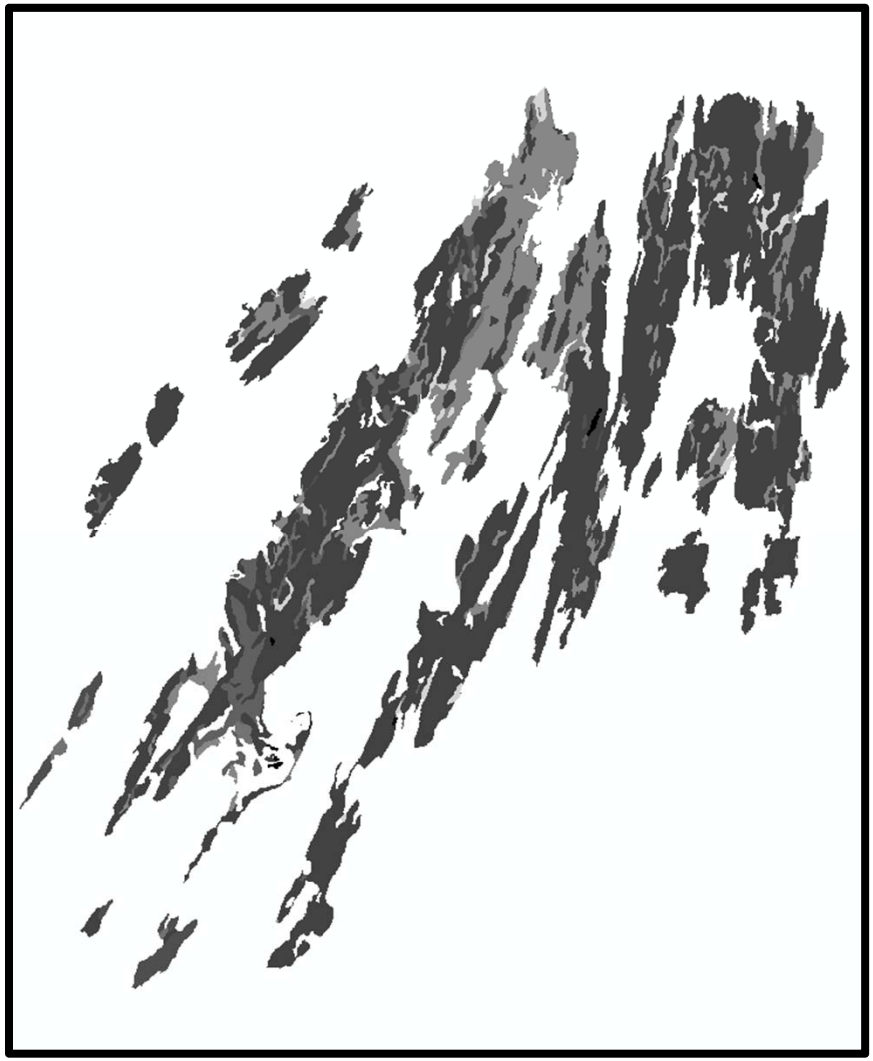
C Factor

Appendix A: Land Use Basis for C factor Estimation

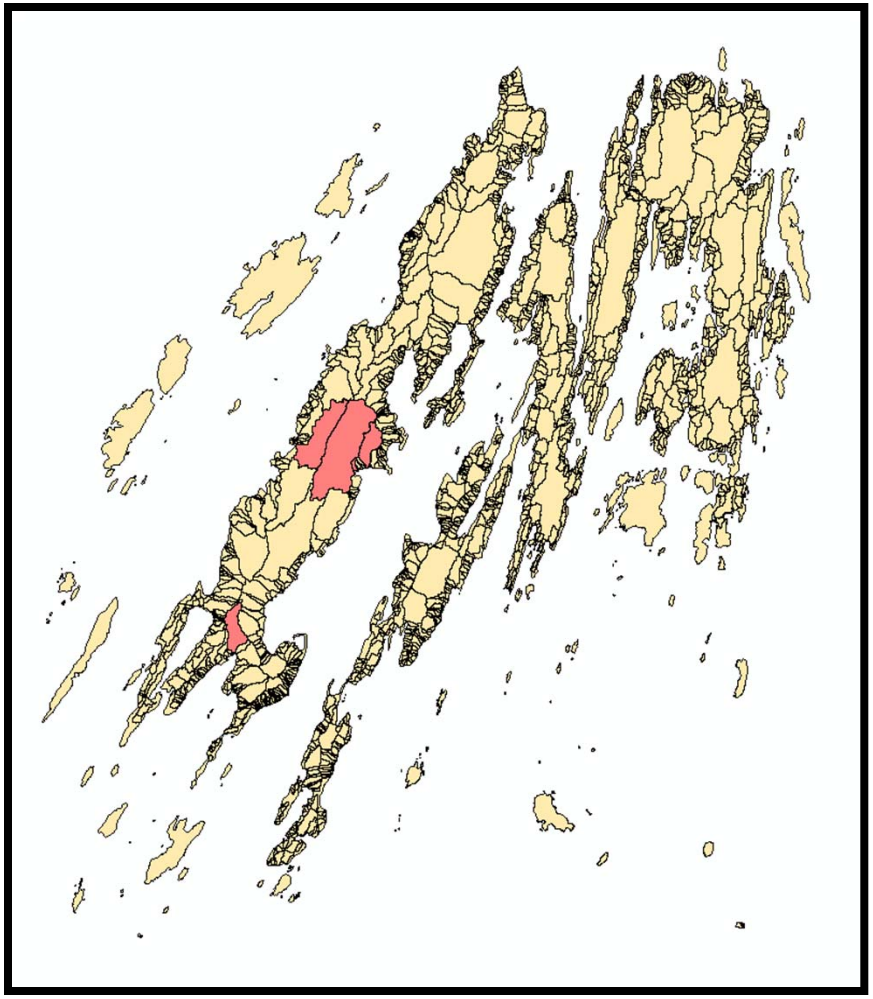
Land Use Description	C Value Basis	C Factor
Lakes	depositional sinks	0.0001
Marinas & fish camps	depositional sinks	0.0001
Reservoirs - pits, retention ponds, dams	depositional sinks	0.0001
Reservoirs less than 10 acres	depositional sinks	0.0001
River/lake swamp (bottomland, may include cypress)	depositional sinks	0.0001
Streams and waterways	depositional sinks	0.0001
Airports	paved, occasional construction	0.0005
Auto parking facilities	paved, occasional construction	0.0005
Bus and truck terminals	paved, occasional construction	0.0005
Commercial and services	paved, occasional construction	0.0005
Communications	paved, occasional construction	0.0005
Electrical power facilities	paved, occasional construction	0.0005
Institutional	paved, occasional construction	0.0005
Other light industrial	paved, occasional construction	0.0005
Roads and highways	paved, occasional construction	0.0005
Sewage treatment & water supply plants	paved, occasional construction	0.0005
Residential, high density - 6 or more dwelling units/Acre	paved, grass, occasional construction	0.0007
Residential, low density - less than 2 dwelling units/Acre	paved, grass, occasional construction	0.0007
Residential, medium density - 2-5 dwelling units/Acre	paved, grass, occasional construction	0.0007
Cypress (if distinct as in domes or pure stands)	low-lying forest / grassland	0.0010
Depressional pine	low-lying forest / grassland	0.0010
Emergent aquatic vegetation	low-lying forest / grassland	0.0010
Freshwater marshes	low-lying forest / grassland	0.0010
Mixed scrub-shrub wetland	low-lying forest / grassland	0.0010
Wet prairies	low-lying forest / grassland	0.0010
Wetland coniferous forests & mixed wetland hardwoods	low-lying forest / grassland	0.0010
Wetland forested mixed	low-lying forest / grassland	0.0010
Coniferous, longleaf pine - xeric oak, pine flatwoods	forest	0.0020
Upland mixed coniferous/hardwood	forest	0.0020
Forest regeneration	dense grass, shrubs, light canopy	0.0030
Golf courses	dense grass, shrubs, light canopy	0.0030
Parks and zoos	dense grass, shrubs, light canopy	0.0030
Shrub and brushland, woodland pastures	dense grass, shrubs, light canopy	0.0030
Cemeteries	disturbed grass, shrubs, light canopy	0.0050
Electrical power transmission lines	disturbed grass, shrubs, light canopy	0.0050
Herbaceous range, horse farms, mixed rangeland	disturbed grass, shrubs, light canopy	0.0050
Marinas & fish camps	disturbed grass, shrubs, light canopy	0.0050
Open land	disturbed grass, shrubs, light canopy	0.0050
Rural land in transition without positive indicators of intended activity	disturbed grass, shrubs, light canopy	0.0050
Unimproved & improved pastures	disturbed grass, shrubs, light canopy	0.0050
Disturbed land - rural land in transition, fill, burned	disturbed, sparse grass	0.0070
Inactive land with street pattern but no structures	disturbed, sparse grass	0.0070
Railroads	disturbed, sparse grass	0.0070
Crops & ornamentals	crops, disturbed soil,	0.4000
Nurseries and vineyards	crops, disturbed soil,	0.4000
Clays & Sand	disturbed, no cover	0.7000
Sand & gravel pits (must be active)	disturbed, no cover	0.7000
Spoil areas	disturbed, no cover	0.7000
Timber processing	disturbed, no cover	0.7000



K Factor



Erosion Results with Watersheds



Erosion Conclusions

- 5 watersheds most vulnerable to erosion in Harpswell
- Erosion is not one of the biggest concerns for Harpswell
- RUSLE equation is more tailored to farm land and construction zones

Overall Conclusions

With sea level rise

- Lots of low marsh will be inundated
- Migration of high marsh limited by coastal topography
- High marsh will encroach on some freshwater wetlands
- Most Eelgrass will not be affected

Erosion is not a high priority concern

Thank you to…

- Eileen Johnson—GIS guru and raster master
- Mary Ann Nahf, Ann Nemrow, Deirdre Strachan, and the rest of the Harpswell Conservation Commission