Supporting Hudson Riverfront communities as Climate-Adaptive Leaders

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Cornell University

New York State Water Resources Institute
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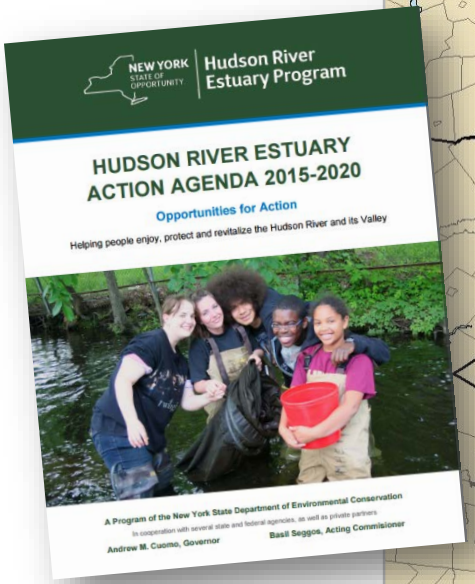
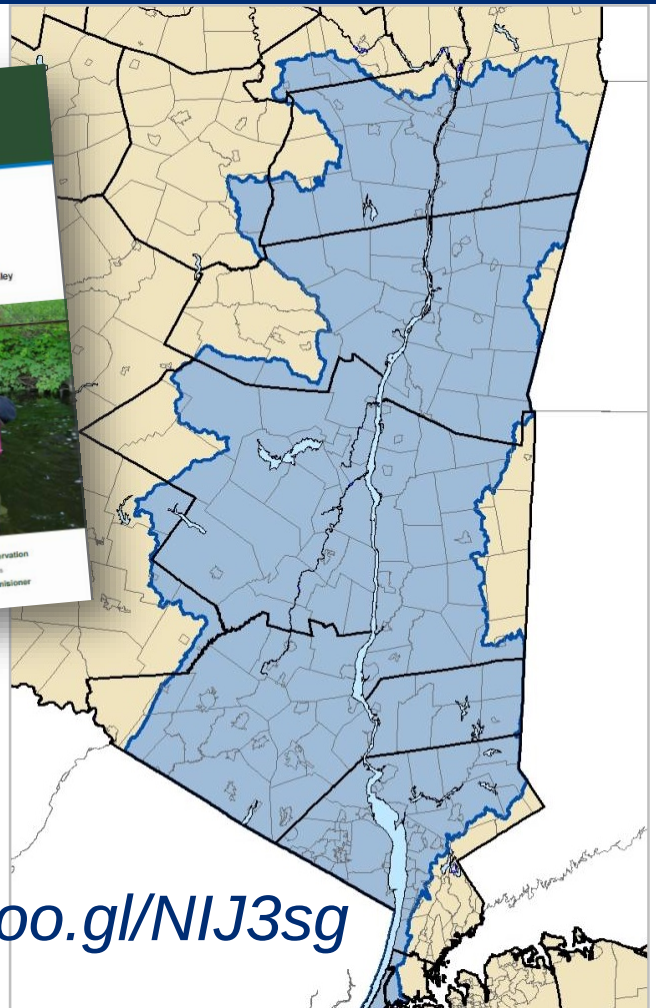
The Hudson River Estuary Program





<u>Working to achieve</u>
<u>6 key benefits:</u>

- clean water
- ***resilient communities***
- vital estuary ecosystem
- fish, wildlife, and habitat
- natural scenery
- education, access, recreation, and inspiration

http://goo.gl/NIJ3sg

How is our climate changing in the Hudson Valley?

New York's climate is changing faster than national and global averages

Climate hazards

Trends in our climate

- Increasing temperatures

- Changing precipitation patterns

- Rising sea level

Climate risks

Impacts to humans

- Heat waves

- Short-term drought

- Flooding

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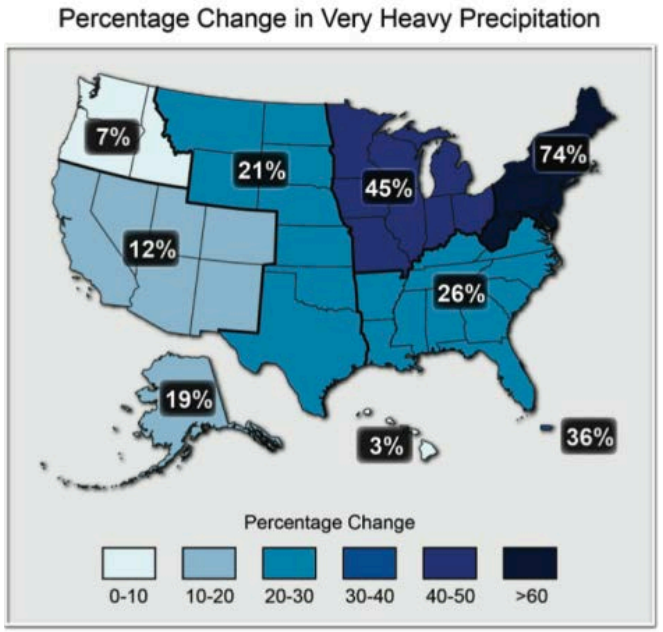
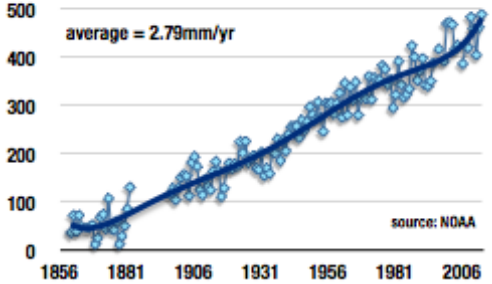
Our “100-year” storm could occur 1.5 to 6x more often with 1.5 to 3.3’ higher flood height by year 2080

- 13” of sea-level rise since 1900, rate increasing
- 71% increase in intense precipitation
- Stormwater runoff from urban development
- Storm surge from hurricanes





NYS has adopted sea-level rise projections

6 NYCRR Part 490, Projected Sea-level Rise. Inches of rise relative to 2000-2004 baseline.

	Region	Long Island					New York City/Lower Hudson					Mid-Hudson				
	Descriptor	Low	Low-Medium	Medium	High-Medium	High	Low	Low-Medium	Medium	High-Medium	High	Low	Low-Medium	Medium	High-Medium	High
Time Interval	2020s	2	4	6	8	10	2	4	6	8	10	1	3	5	7	9
	2050s	8	11	16	21	30	8	11	16	21	30	5	9	14	19	27
	2080s	13	18	29	39	58	13	18	29	39	58	10	14	25	36	54
	2100	15	21	34	47	72	15	22	36	50	75	11	18	32	46	71

- Up to 75” or more additional sea-level rise by 2100
- Considered in funding and permitting

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Hurricanes Irene and Lee and Superstorm Sandy were devastating for Hudson Riverfront communities

It’s within a community’s power to *adapt* to climate change

- Mitigation is extremely important, but we all share one atmosphere
- Climate adaptation is empowering on a smaller scale
- A landowner, community or business can make themselves more resilient

Resilience

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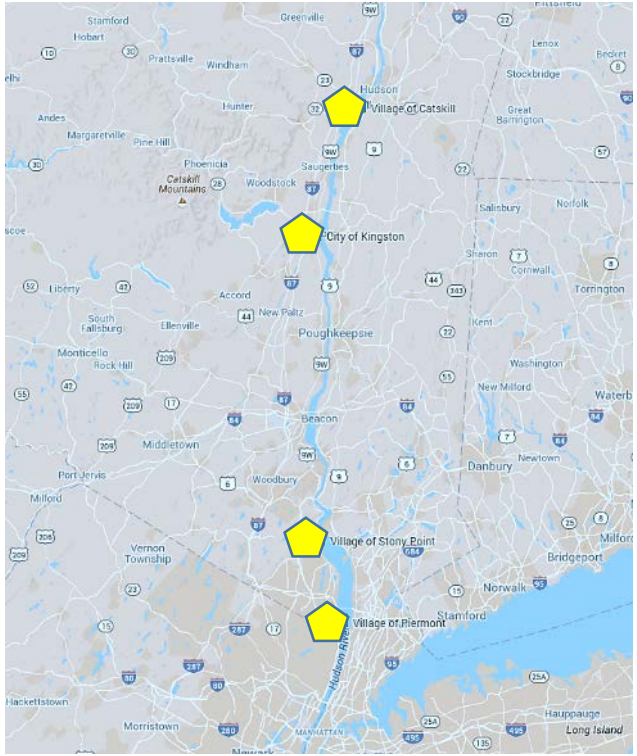
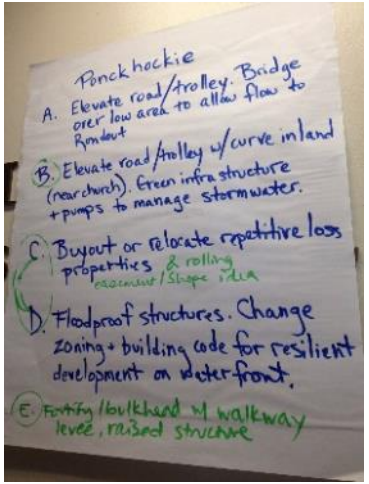
We developed the Waterfront Flooding Task Forces to help communities make hard decisions about their waterfronts



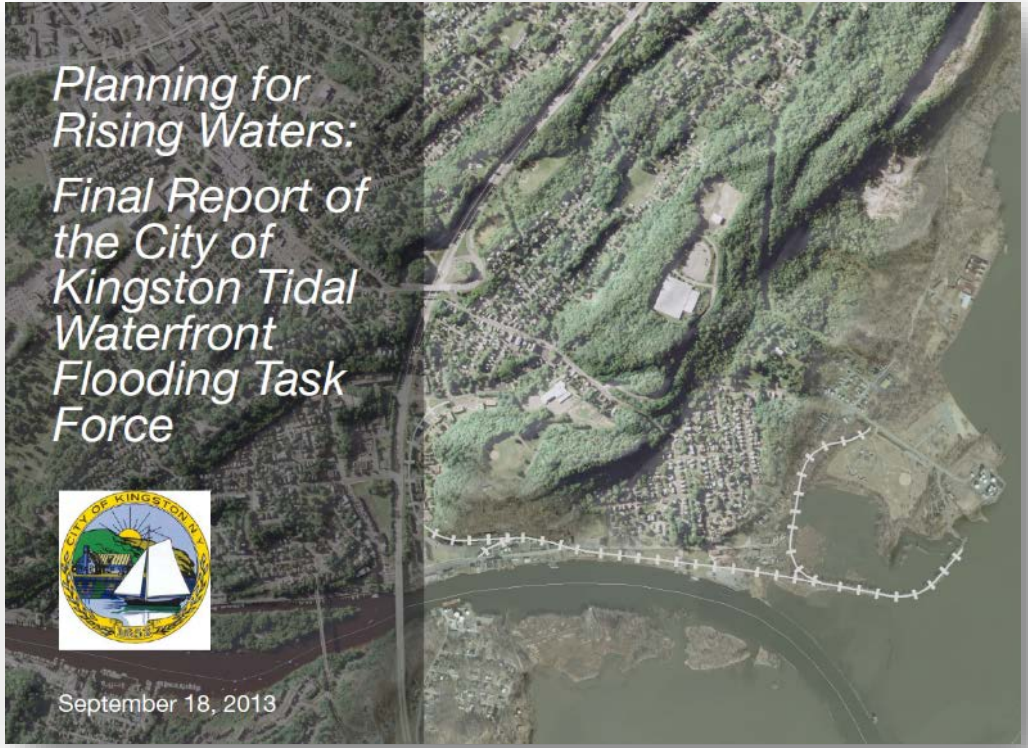


Communities: Catskill, Kingston, Piermont and Stony Point

Partners: DOS, Scenic Hudson, Consensus Building Inst. and more

The task forces under went an eight-month planning process

- Studied their risks today and through the century
- Presented with innovative strategies to adapt
- Developed final reports with community-specific recommendations



Lessons learned from the task forces

- Avoid top down approach
- Building knowledge and trust can take time
- Adapting is a sensitive issue
- Small communities have limited resources to tackle big issues
- Visualizing realistic and relatable solutions is challenging

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All task force communities are working together and making progress

- 91 adaptation actions
  - ✓ 11 complete
  - ✓ 25 in process
  - ✓ 11 on going
- 19 grants totaling $4.8M+
- Incorporating into existing planning and programs
- ***New program: Climate-Adaptive Design***

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The Climate-Adaptive Design (CAD) studio supports communities to envision future possibilities for their waterfront

Using design to inspire

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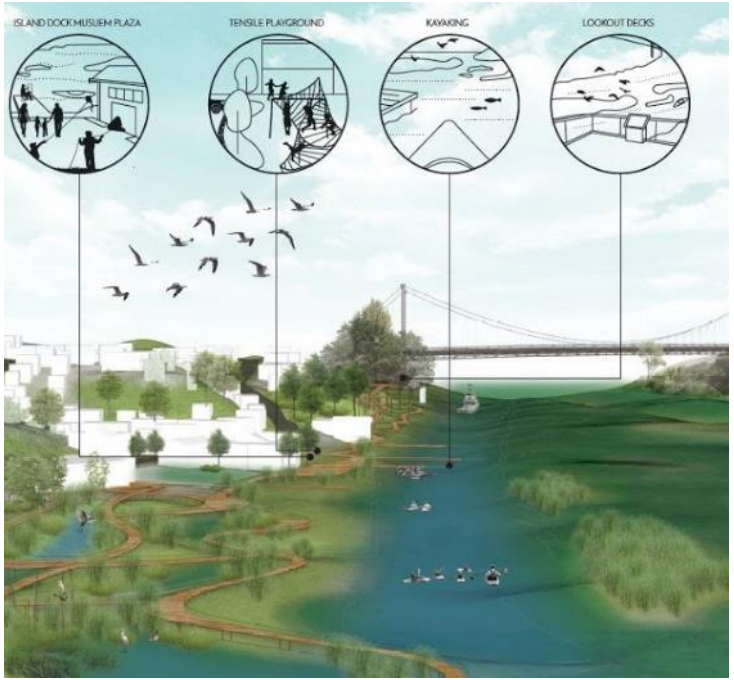
A collaboration with Cornell University Department of Landscape Architecture

Benefits to the community from CAD

- Positive approach to ***motivate community members to take climate adaptive action***
- ***Inspirational, resilient designs*** in both digital and physical formats
- ***Educating and encouraging conversation*** about climate adaptation.
- Student and CAD team time is provided at ***no cost*** to your community and ***may count toward match requirements*** for grant funding.



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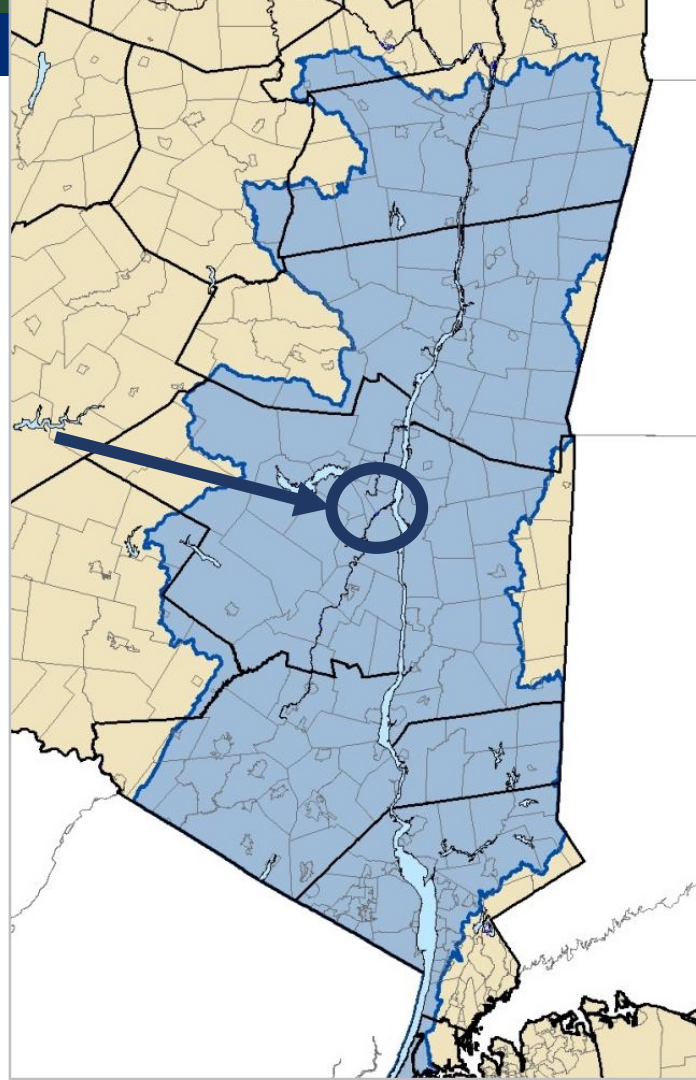
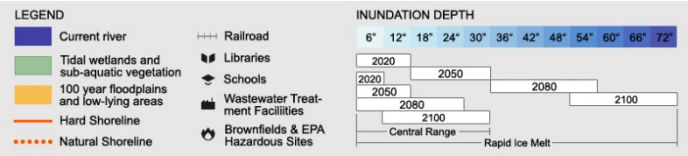
Case study: City of Kingston



Current condition



Current condition + 1% flood

LEGEND

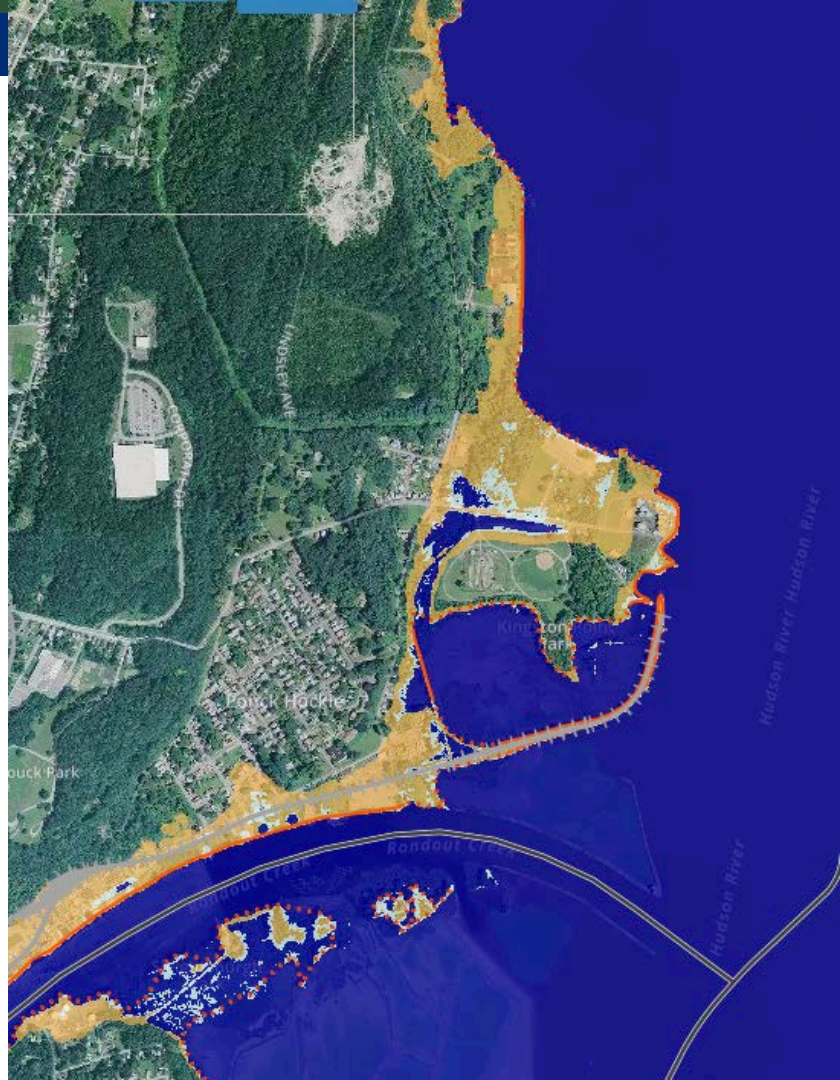
- Current river
- Tidal wetlands and sub-aquatic vegetation
- 100 year floodplains and low-lying areas
- Hard Shoreline
- Natural Shoreline
- Railroad
- Libraries
- Schools
- Wastewater Treatment Facilities
- Brownfields & EPA Hazardous Sites

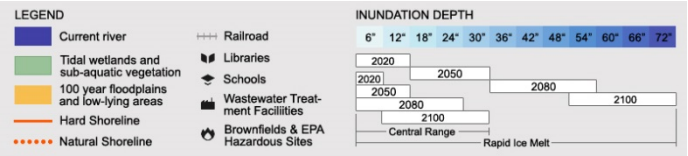
INUNDATION DEPTH

6" 12" 18" 24" 30" 36" 42" 48" 54" 60" 66" 72"

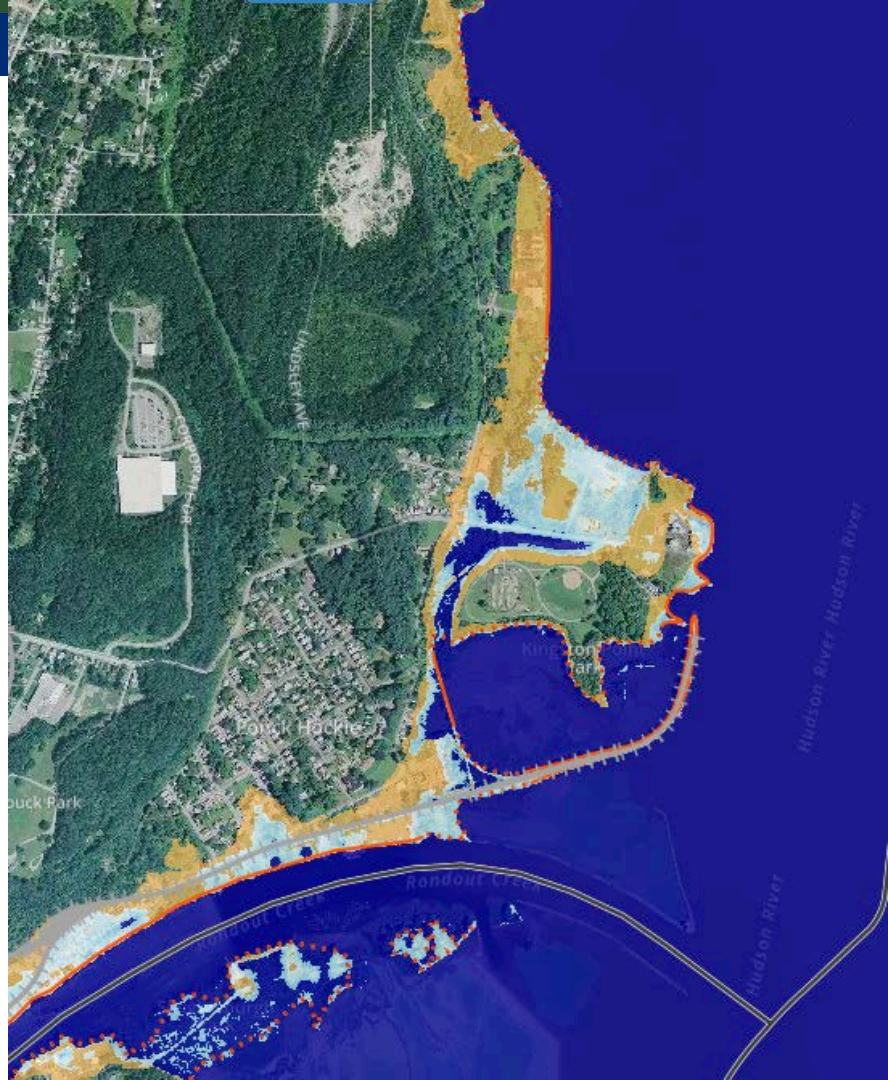
2020
2020
2050
2050
2080
2080
2100
2100
Central Range
Rapid Ice Melt

+12” sea-level rise (~2020s)





+30” sea-level rise (~2050s)



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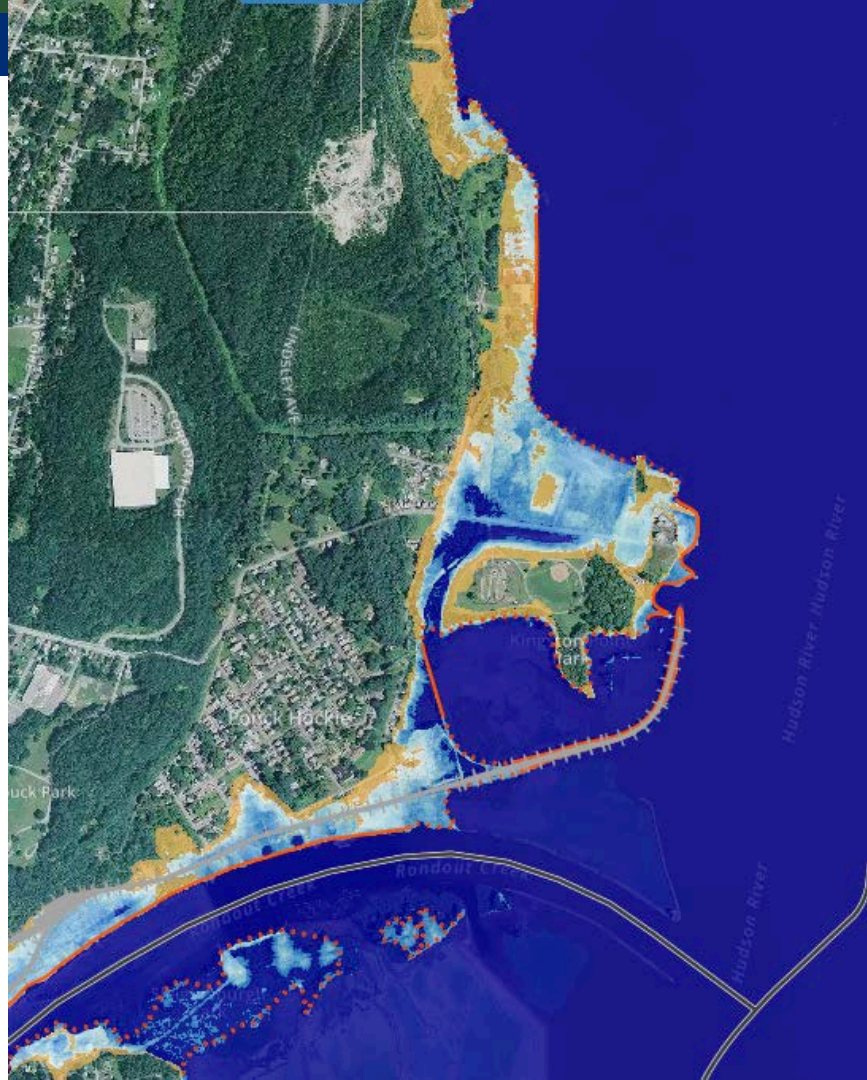
2020
2050
2080
2100

2020
2050
2080
2100

Central Range

Rapid Ice Melt

+54” sea-level rise (~2080s)



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6" 12" 18" 24" 30" 36" 42" 48" 54" 60" 66" 72"

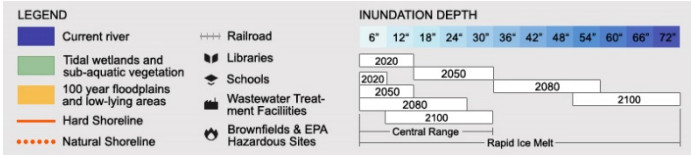
2020
2050
2080
2100

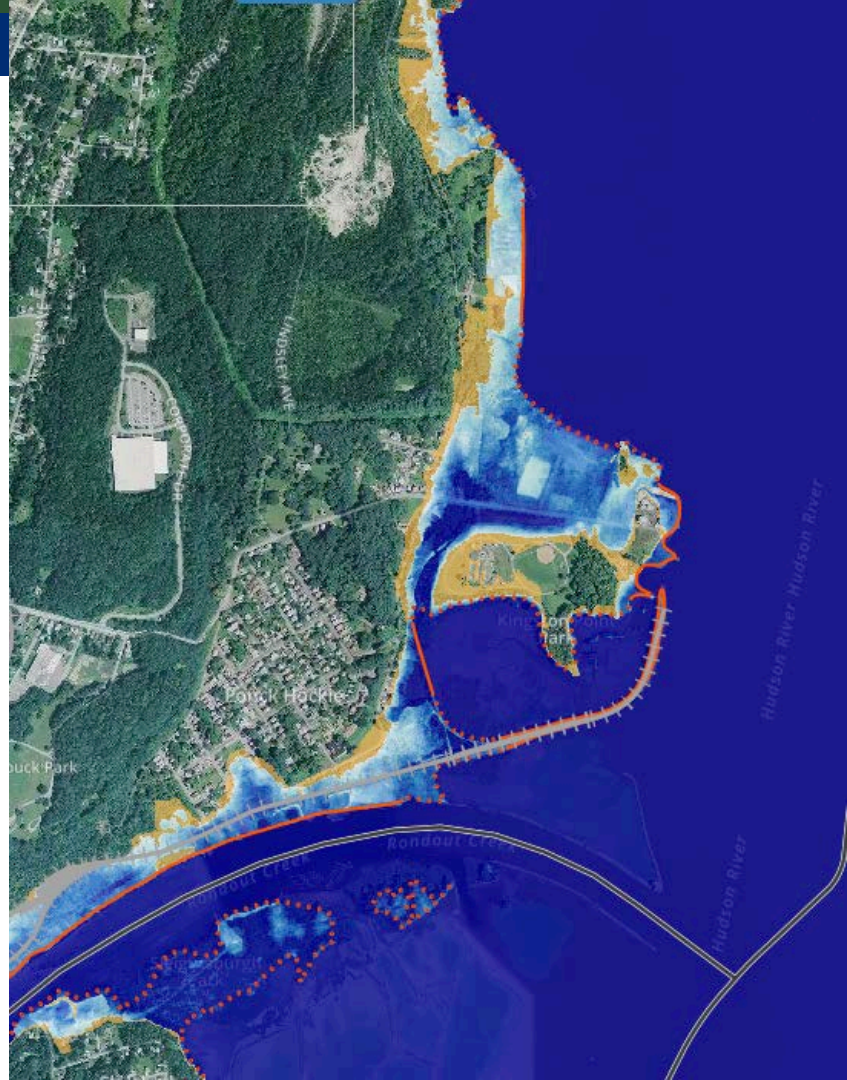
2020
2050
2080
2100

Central Range

Rapid Ice Melt

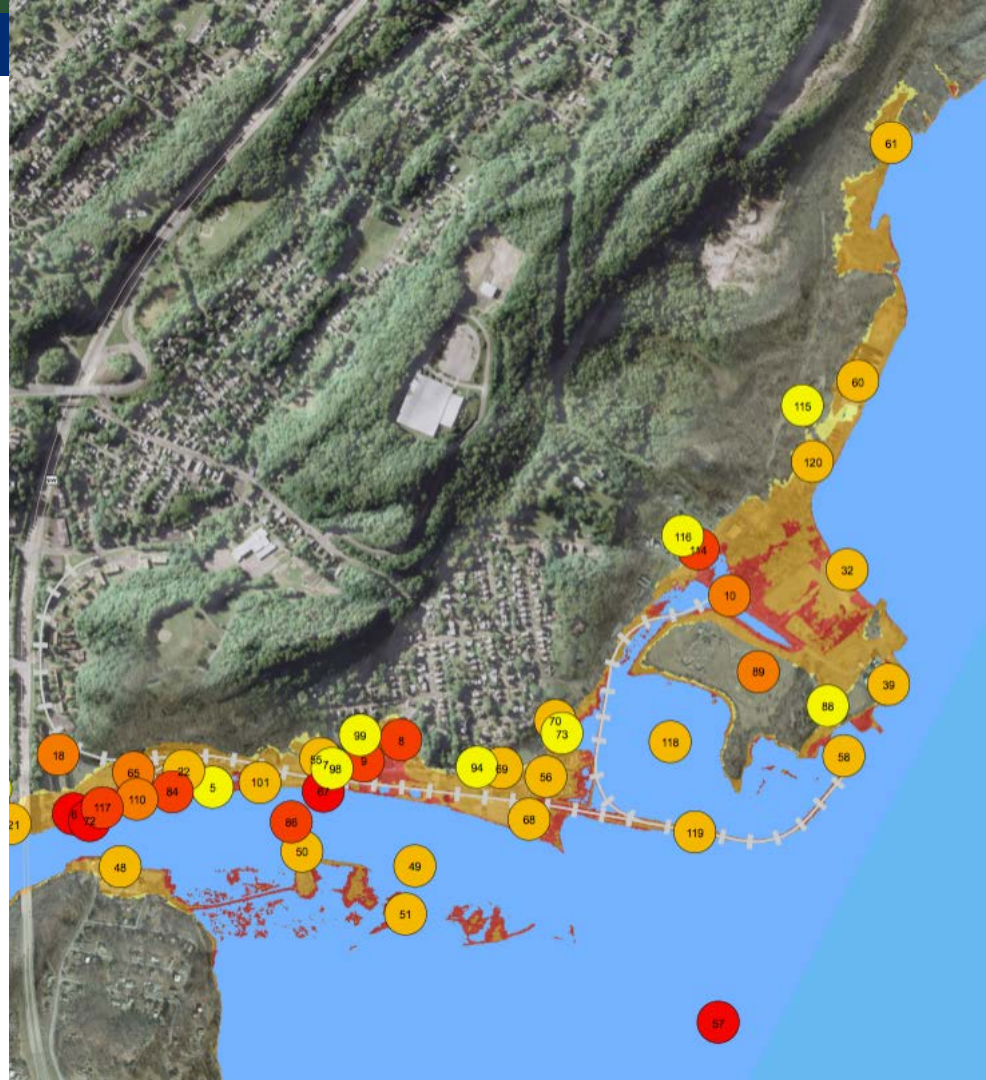
+72” sea-level rise (~2100)





Students consider the many assets at risk, as identified by the community

High and Extreme Risk w/ 3’ of sea-level rise: St. Mary’s Benevolent Society, Sailor’s Cove, North St. residents, Kingston Point Beach, Heritage Energy tanks, marsh, Trolley and more



CAD dives into existing projects and plans

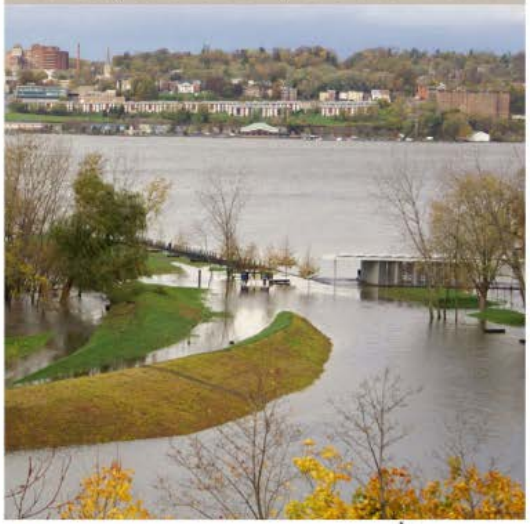
Hudson Riverport Plan

City of Kingston's Brownfield Opportunity Area (Dept. of State)

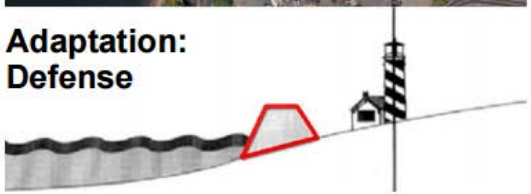
Students study flood adaptation strategies

Coastal defense: Solutions that protect existing critical infrastructure - including sea walls, rip rap, levies and hardened shorelines

Strategic accommodation: Solutions that permit flooding - including raised infrastructure, adaptive design strategies and compatible land uses



Managed relocation: Solutions that allow for inundation and flooding while promoting the migration of tidal wetlands and other important natural resources



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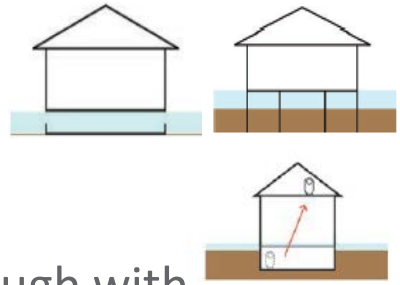
Including adapting buildings by elevating + wet floodproofing



What: Structure designed or retrofitted to allow water to flow through with minimal to no damage

How: First floor + utilities raised above base flood elevation, elevated on piles or foundation with flood vents

Local examples:

Old Savannah Restaurant

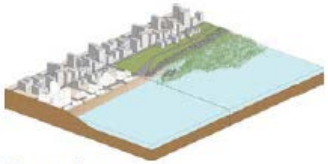
and

Clearwater Home Port

And many more climate resilient strategies

- Conserving open space
- Strategic relocation of highest risk buildings
- Allowing for marsh migration
- Increasing shade for cooling
- Right-sizing culverts and bridges

Waterfront Parks



Strategic Retreat

Students prioritize water-dependent uses

Water-dependent uses

Activities that can only be conducted on, in, over, or adjacent to a body of water. Examples: shipping facilities, dry docks, marinas, mooring areas, yacht clubs, boat yards, museums that interpret maritime activities, commercial fishing and recreational operations, facilities for shipping petroleum products and aggregates, ferry landings, support facilities for waterborne commerce and recreation, recreational fishing areas, swimming areas, and recreational boat launches.

Water-enhanced uses

Activities that do not require direct access to the water, but whose riverfront location adds to the public's use and enjoyment of the water's edge. Examples: restaurants, museums, hotels, spas, parks, community gardens, public plazas, esplanades, squares, playgrounds, and mixed-use (retail, office, residential).

Non water-dependent uses

Activities not requiring direct access to the water and whose riverfront location does not contribute to public use and enjoyment of the water's edge. Examples: car washes, auto sales and storage operations, auto repair facilities, self-storage units, and manufacturing not involving waterborne transportation.

Students highlight green infrastructure strategies

- Rainwater Harvesting
- Rain Gardens
- Planter Boxes
- Bioswales
- Permeable Pavements
- Green Streets and Alleys
- Green Parking
- Green Roofs
- Urban Tree Canopy
- Land Conservation

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Students highlight shorelines with natural and nature-based features

- Living shorelines (marsh sill)
- Ecologically enhanced bulkheads and revetments
- Constructed wetlands



Natural and nature-based features offer many co-benefits

Reduces hazard vulnerability

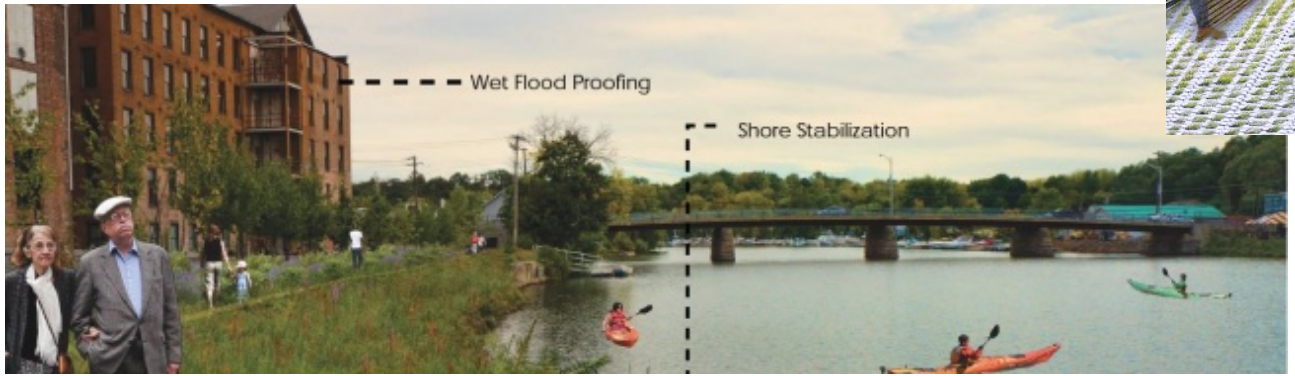
- Storm surge/tide reductions, wave attenuation
- Erosion control and shoreline protection

Ecological co-benefits

- Water purification
- Wildlife, habitat diversity
- Fishery habitats provision
- SAV, marsh and forest habitats
- Carbon sequestrations
- Air quality improvement

Student’s final design boards can help Kingston visualize a range of future conditions

- Thinking outside the box
- Phasing, short- to long-term
- Varying costs + feasibilities



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After CAD: ideas to leverage designs after the semester ends

- Put the CAD designs on display to the public
- Continue working with a CAD student
- Integrate CAD designs and ideas into existing projects
- Apply for funding to further develop and implement CAD designs

New video series on Climate Smart Communities Adaptation Actions (PE7)

Develop climate adaptive strategies

tinyurl.com/CSCvideoCAD

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Lessons learned

Successes at the community level

- Municipal support
- Grant funding
- Updating and new plans

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Challenges at the community level

- People time
- Engaging residents and diverse stakeholders
- Implementing projects on the ground

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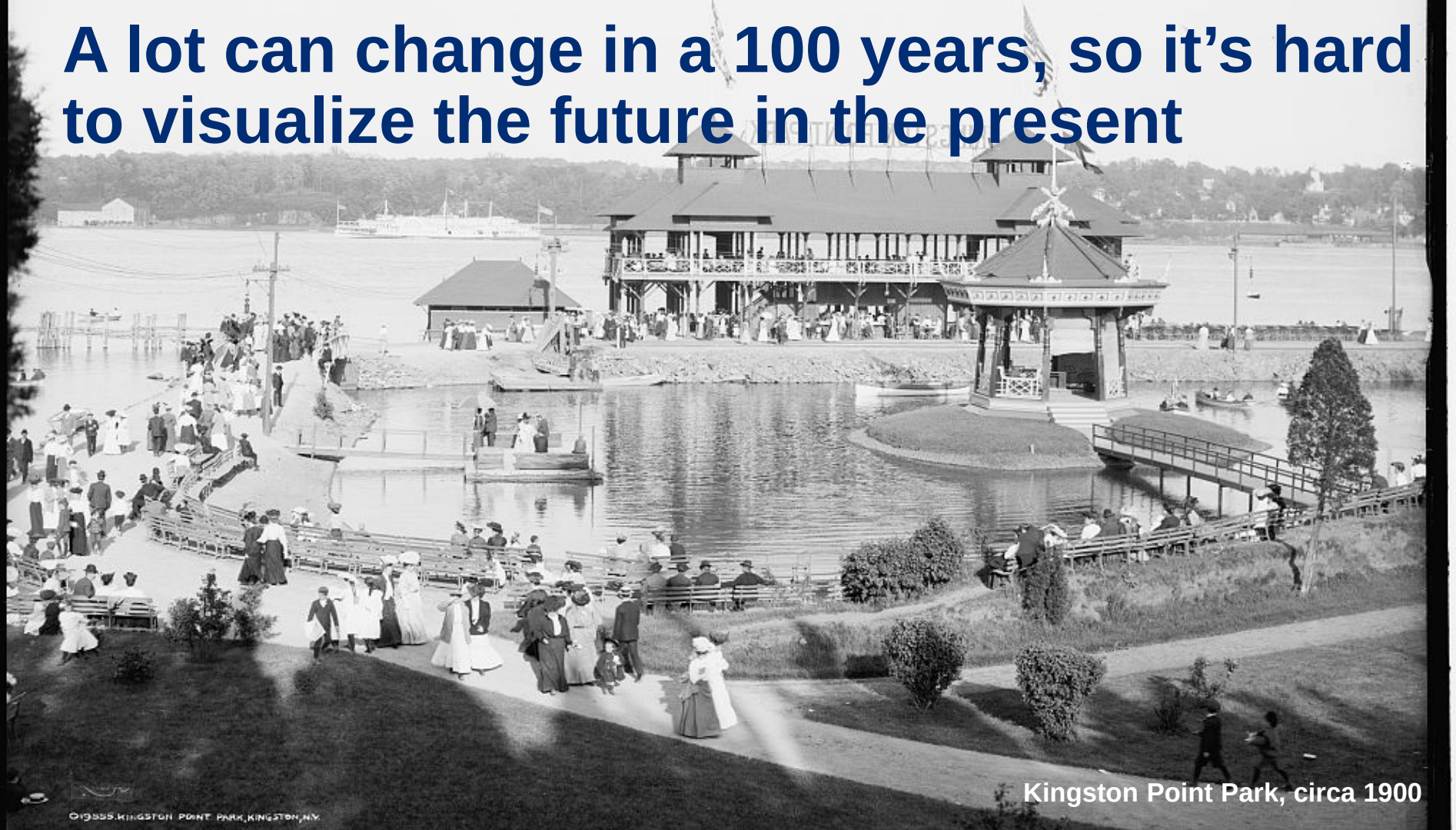
What communities need help with

- Stricter state floodplain and building code regulations
- Resilience coordinators
- People! Students! Volunteers!

A lot can change in a 100 years, so it’s hard to visualize the future in the present



Kingston Point Park, circa 1900

How do you envision a climate resilient future in your community?

Long Dock Park, Beacon, NY

Sign up for grant announcements + more!

Climate Resilience in the Hudson River Estuary newsletter

http://tinyurl.com/ClimateNewsletter

For more info, contact Libby Zemaitis

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