Responding to Major Storm Impacts: Ecological Impacts of Hurricane Sandy on Chesapeake & Delmarva Coastal Bays

Bill Dennison, Brianne Walsh, Mark Trice, Tom Parham

STAR Meeting
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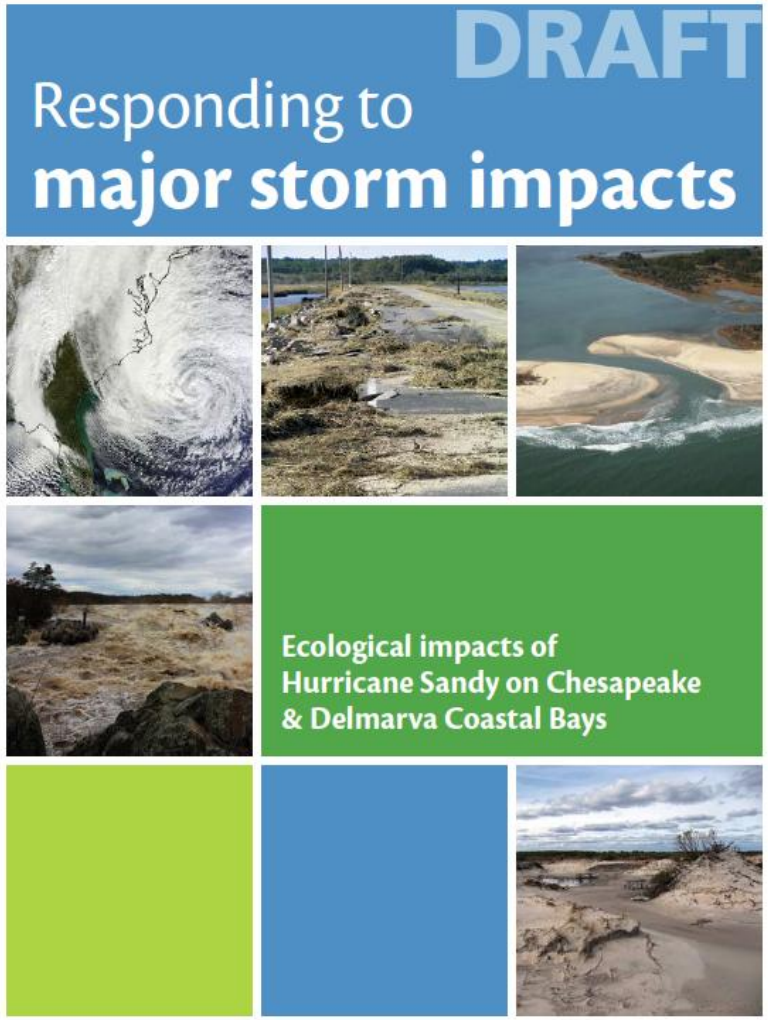
Annapolis, MD

NFWF

University of Maryland
CENTER FOR
ENVIRONMENTAL SCIENCE

Background

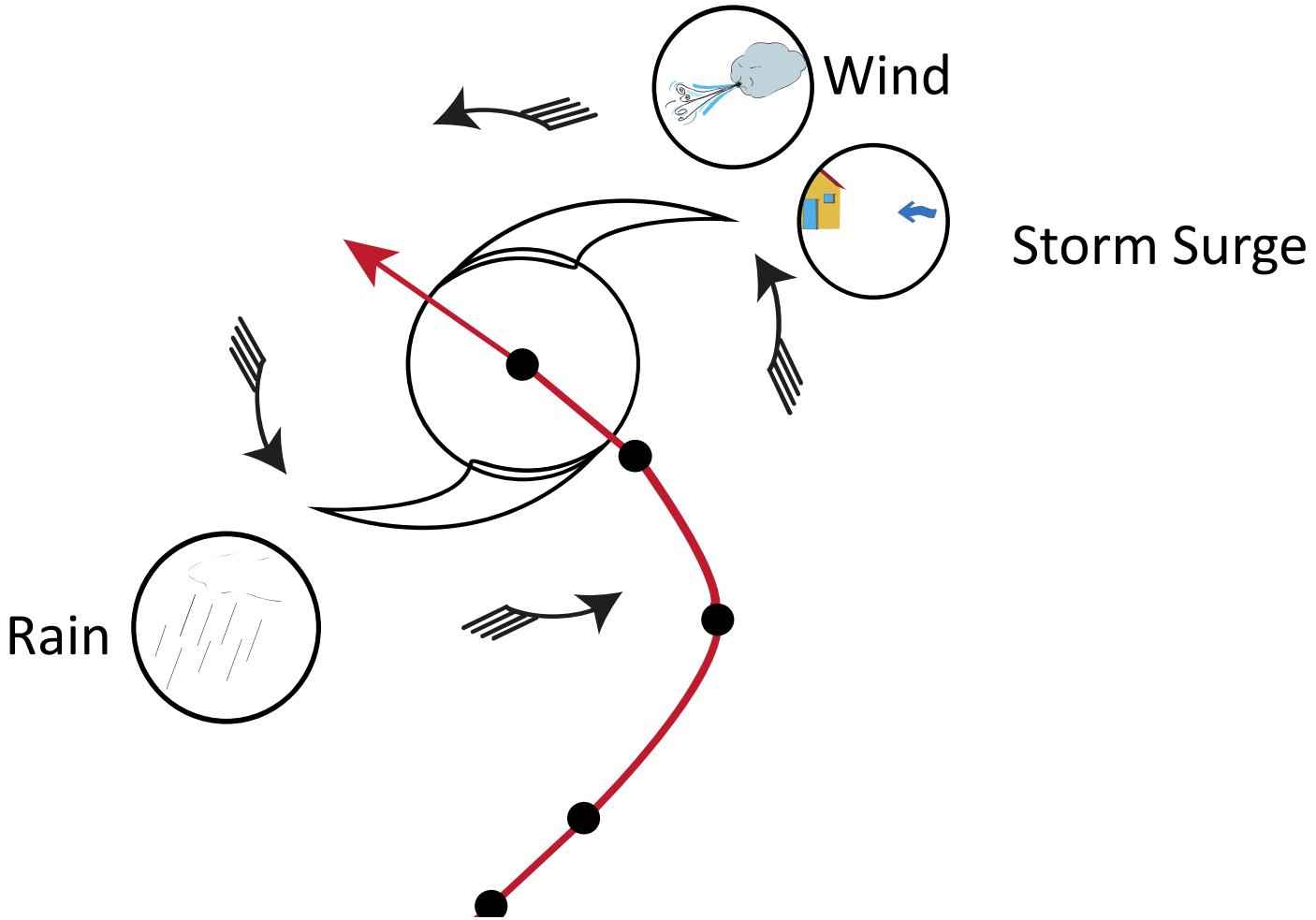
- National Fish & Wildlife Foundation established a Hurricane Sandy Wildlife Response Fund with the following objectives:
  - Conduct a rapid response of impacts from North Carolina to Rhode Island, with emphasis on habitats and associated wildlife.
  - Undertake limited mitigation activities to ameliorate Hurricane Sandy impacts where feasible.
- University of Maryland Center for Environmental Science and Maryland Department of Natural Resources are coordinating the Chesapeake Bay and Delmarva coastal bays assessment
- Draft 19 pp. newsletter produced to summarize key findings
- Assessment presented in two parts:
  1. Interim Assessment submitted to NFWF on November 21, 2012
  2. Final Assessment to be submitted on December 14, 2012



Contributors

- Bill Dennison, Alexandra Fries, Tracey Saxby, and Brianne Walsh from the Integration and Application Network, University of Maryland Center for Environmental Science.
- Katie Foreman from the Chesapeake Bay Program.
- Dave Wilson from the Maryland Coastal Bays Program.
- Bruce Michael, Mike Naylor, Tom Parham and Mark Trice from the Maryland Department of Natural Resources.
- Anthony Chatwin and David O'Neill from the National Fish and Wildlife Foundation.
- Peyton Robertson from the NOAA Chesapeake Bay Office.
- Nick Dipasquale from the United States Environmental Protection Agency Chesapeake Bay Program.
- Don Boesch from the University of Maryland Center for Environmental Science.
- Cassie Gurbisz, Cindy Palinkas, and Larry Sanford from the University of Maryland Center for Environmental Science Horn Point Laboratory.
- Scott Phillips and Peter Tango from the U.S. Geological Survey.
- Brian Sturgis from the U.S. National Park Service.
- Jim Fraser and Sarah Karpanty from the Virginia Polytechnic Institute and State University (Virginia Tech).

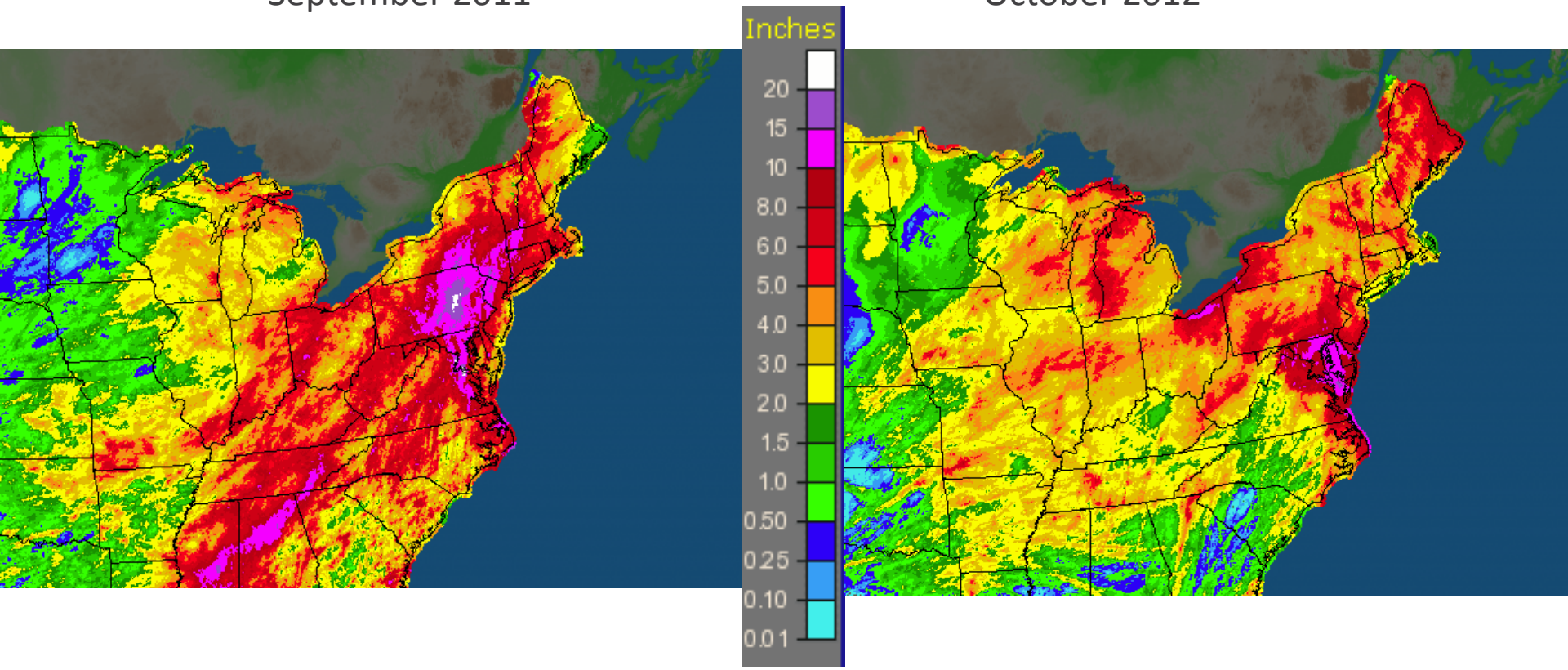
Position relative to storm track affects the relative wind speeds, storm surge, and rainfall amounts



Tropical Storm Lee rainfall concentrated in Susquehanna watershed; Hurricane Sandy rainfall in Maryland

Tropical Storm Lee
September 2011

Hurricane Sandy
October 2012



Images from National Weather Service Advanced Hydrologic Prediction Service, CONUS+ Puerto Rico Monthly Observed Precipitation

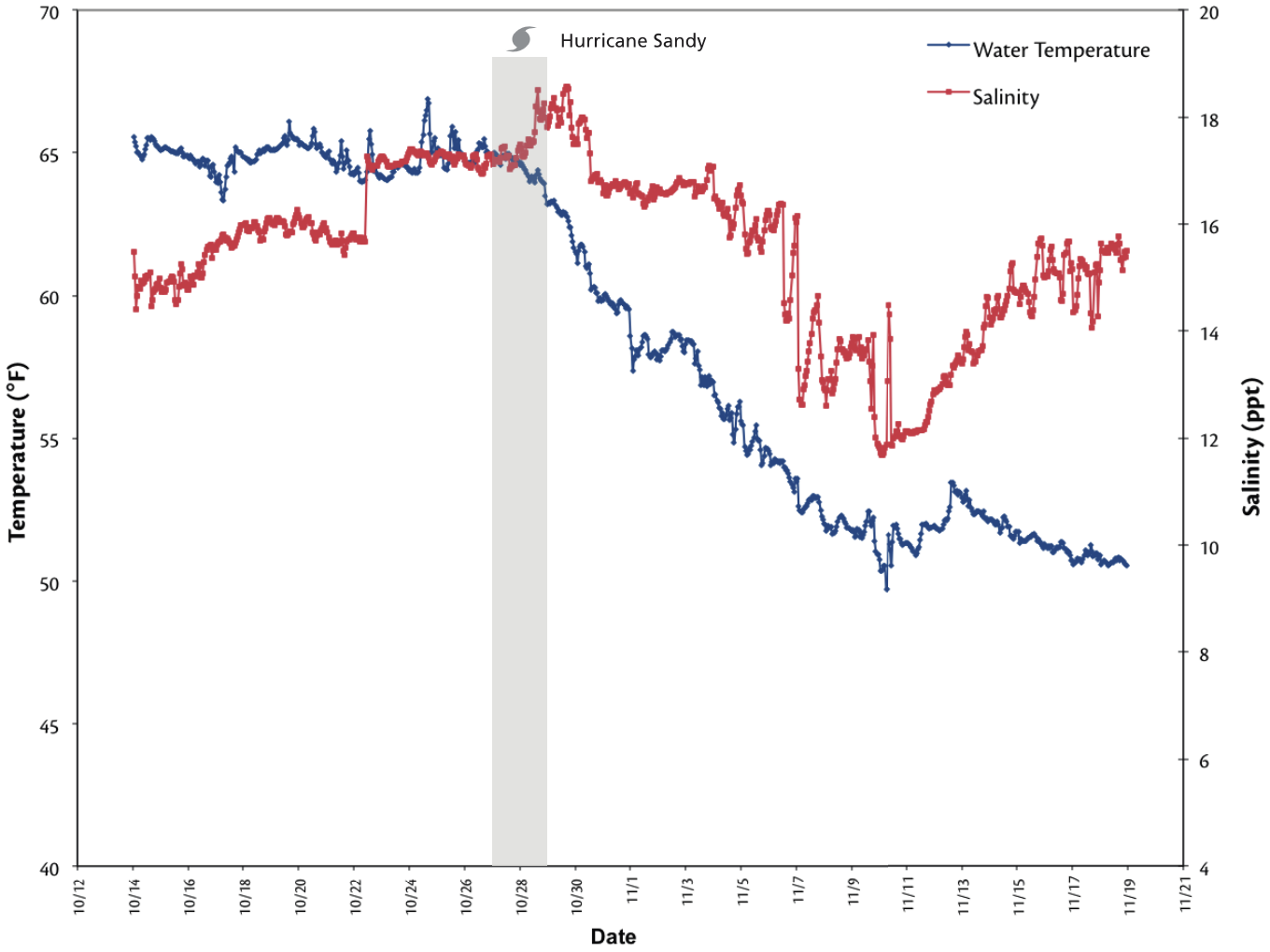
Tropical Storm Lee plume visible; Hurricane Sandy plume not evident

Tropical Storm Lee
14 Sept 2011

Hurricane Sandy
11 Nov 2012

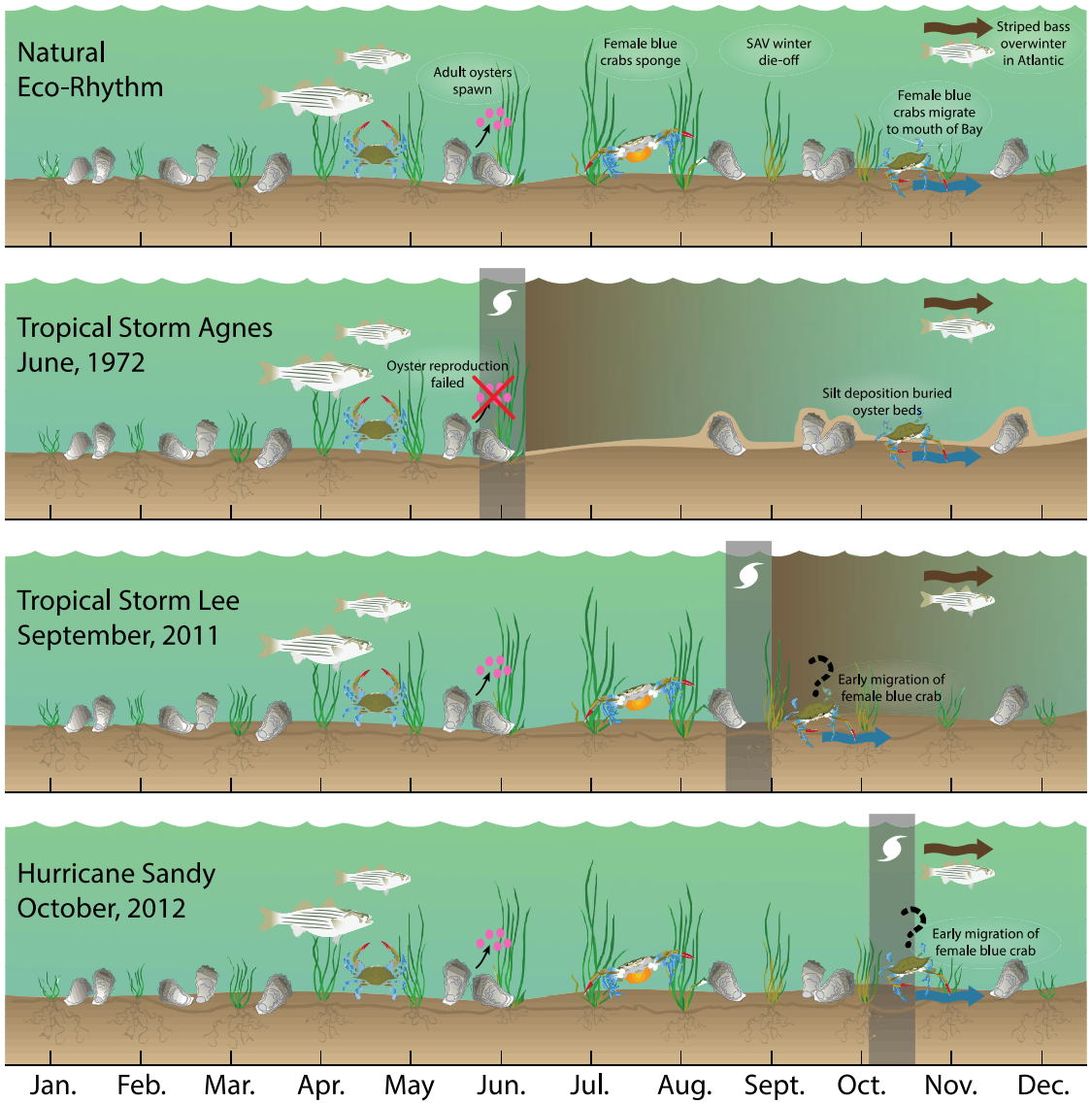
Images from Chesapeake MODIS Satellite Imagery and Data

Chesapeake Bay experienced a 10 degree drop in water temperatures following Hurricane Sandy

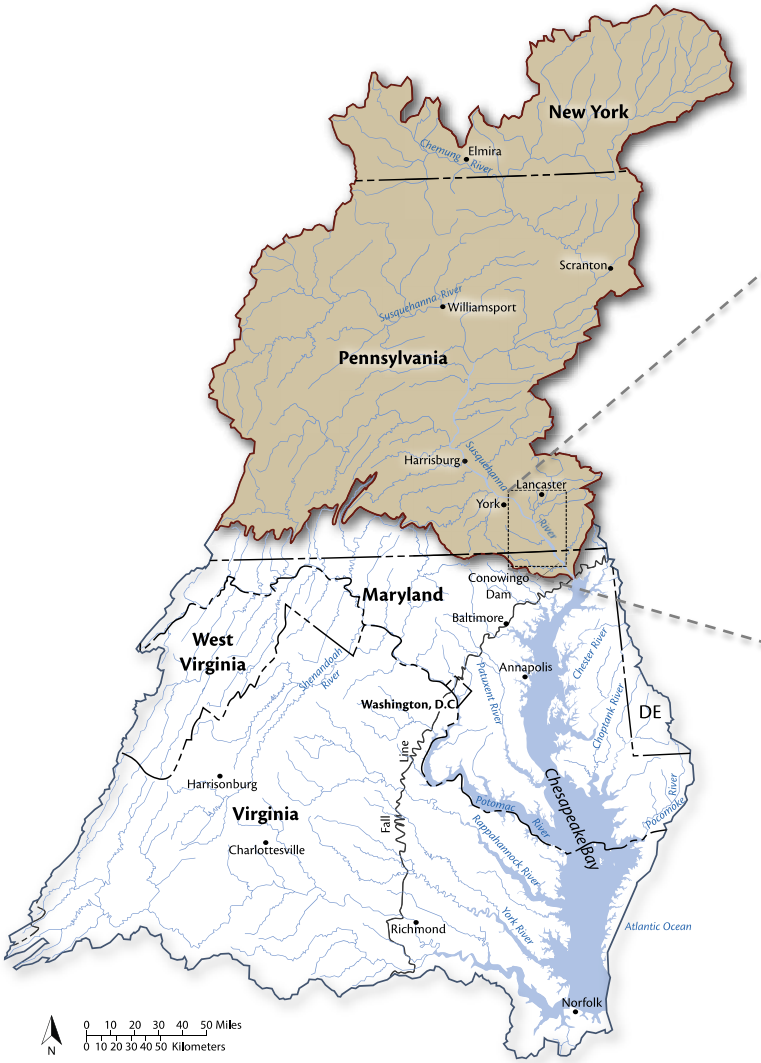


CBIBS buoy Gooses Reef

Timing of storm events affects impacts



Conowingo Dam is located at the bottom of the extensive Susquehanna watershed



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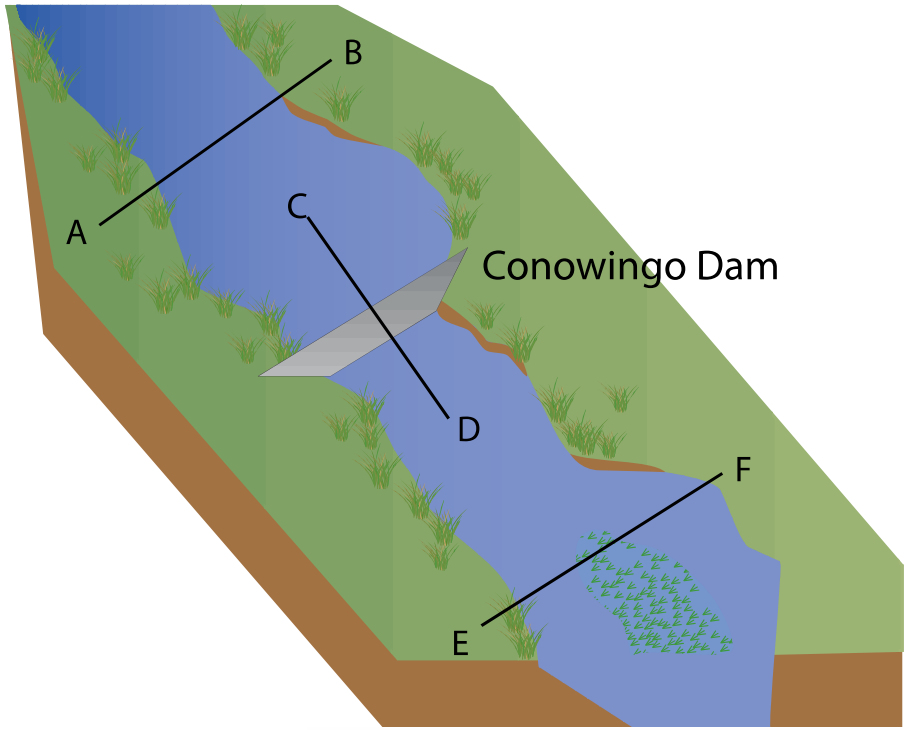
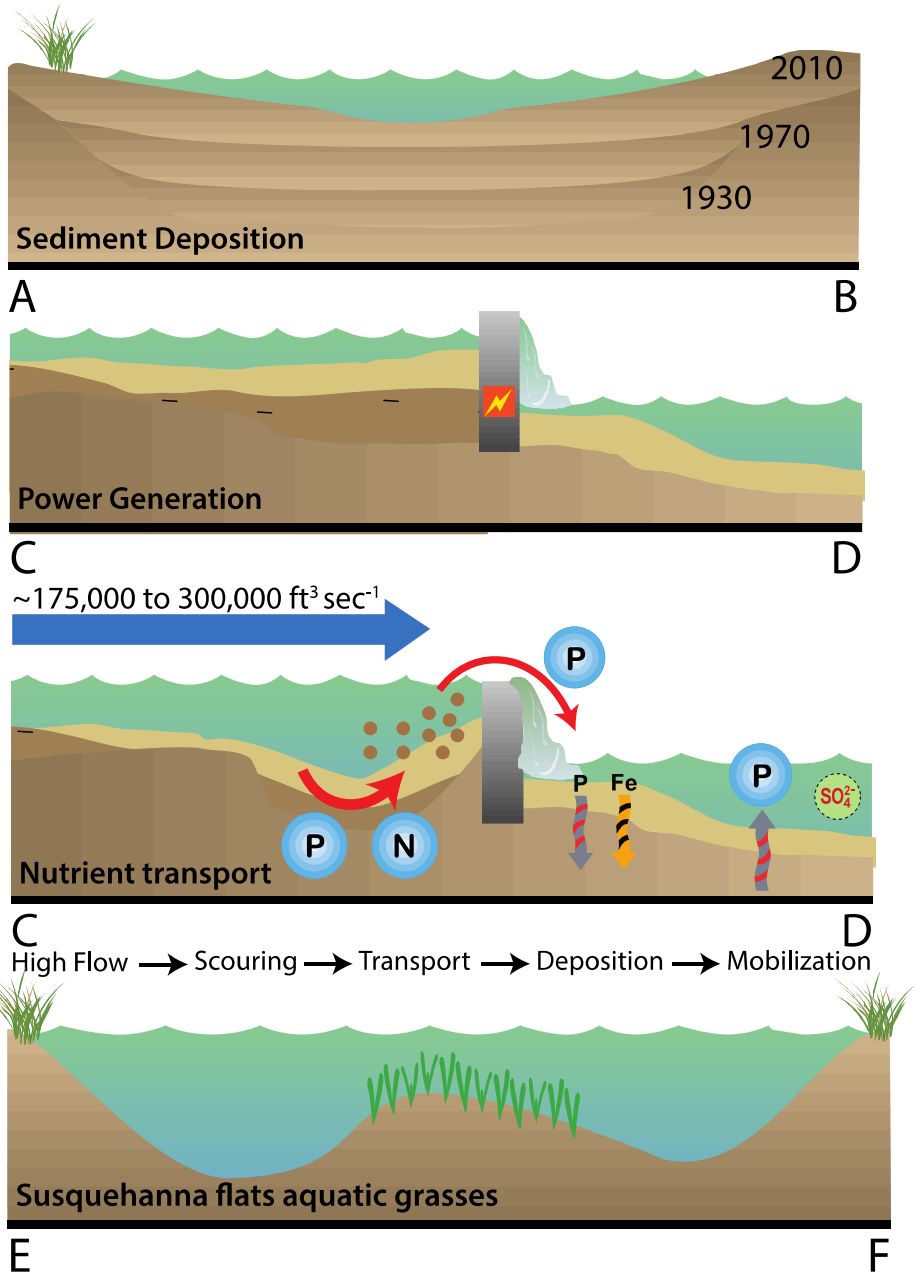
Conceptual depiction of Conowingo Dam reservoir and Susquehanna flats





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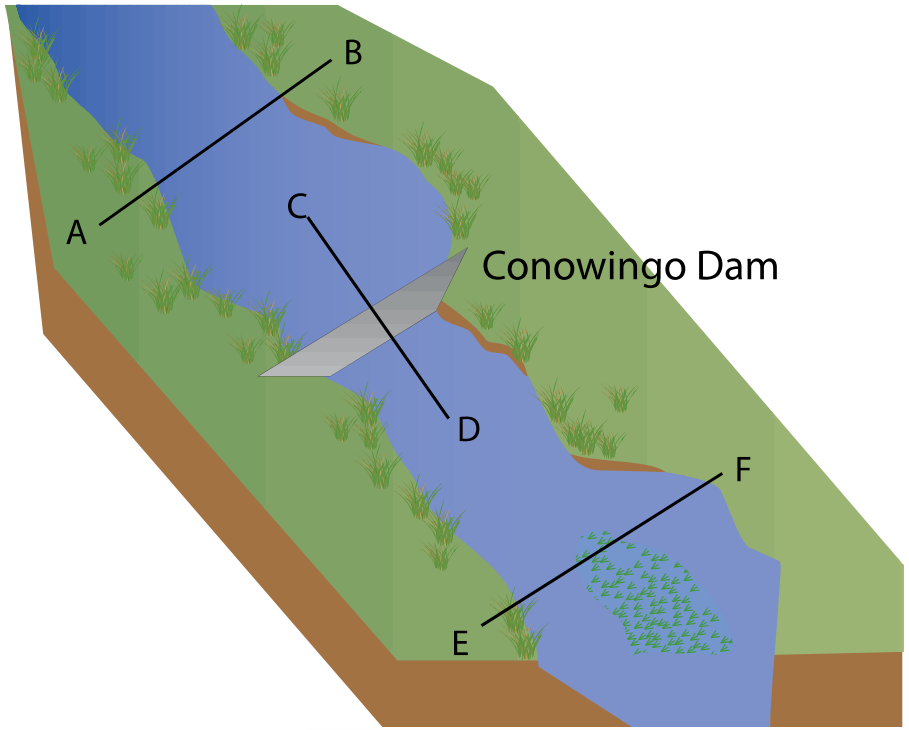
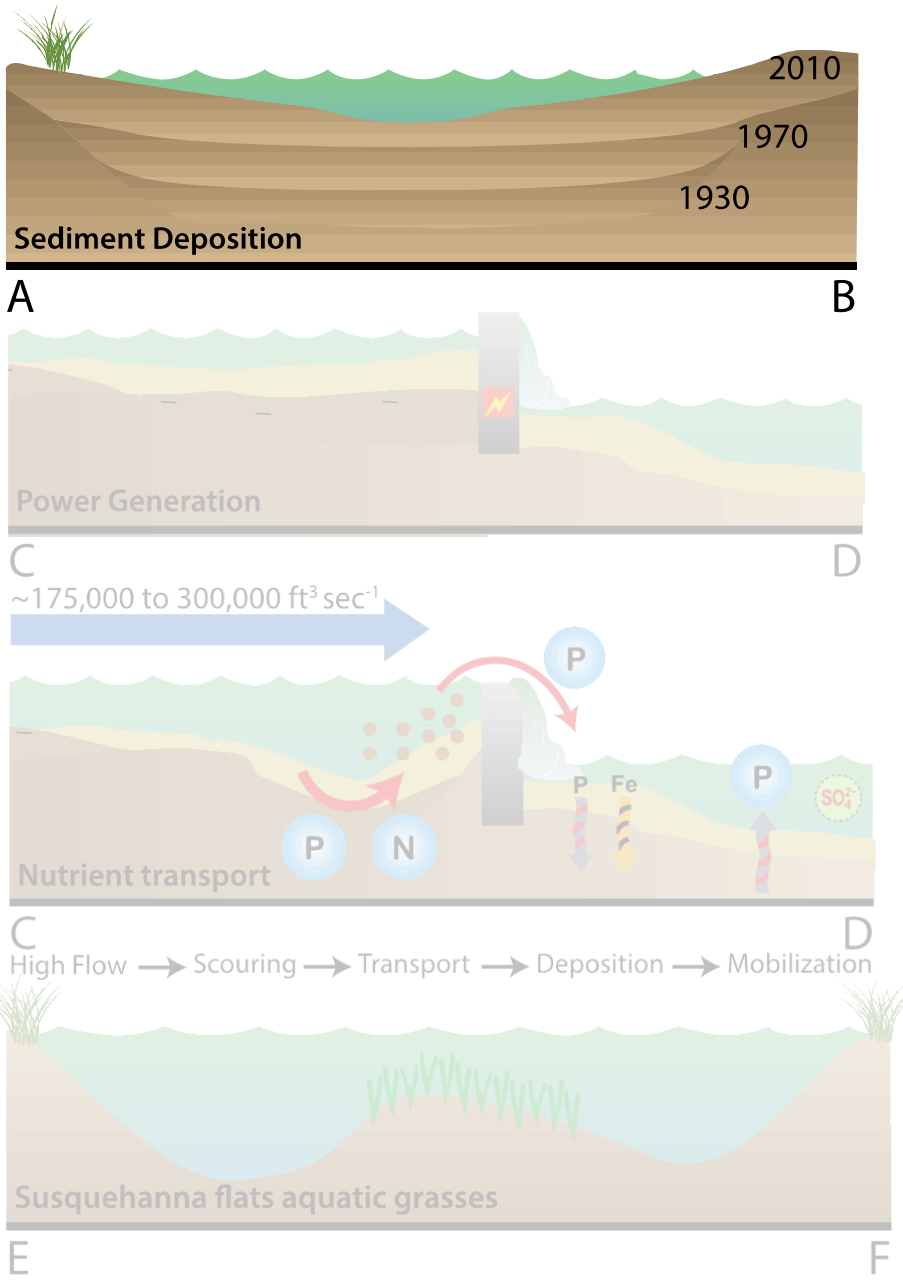
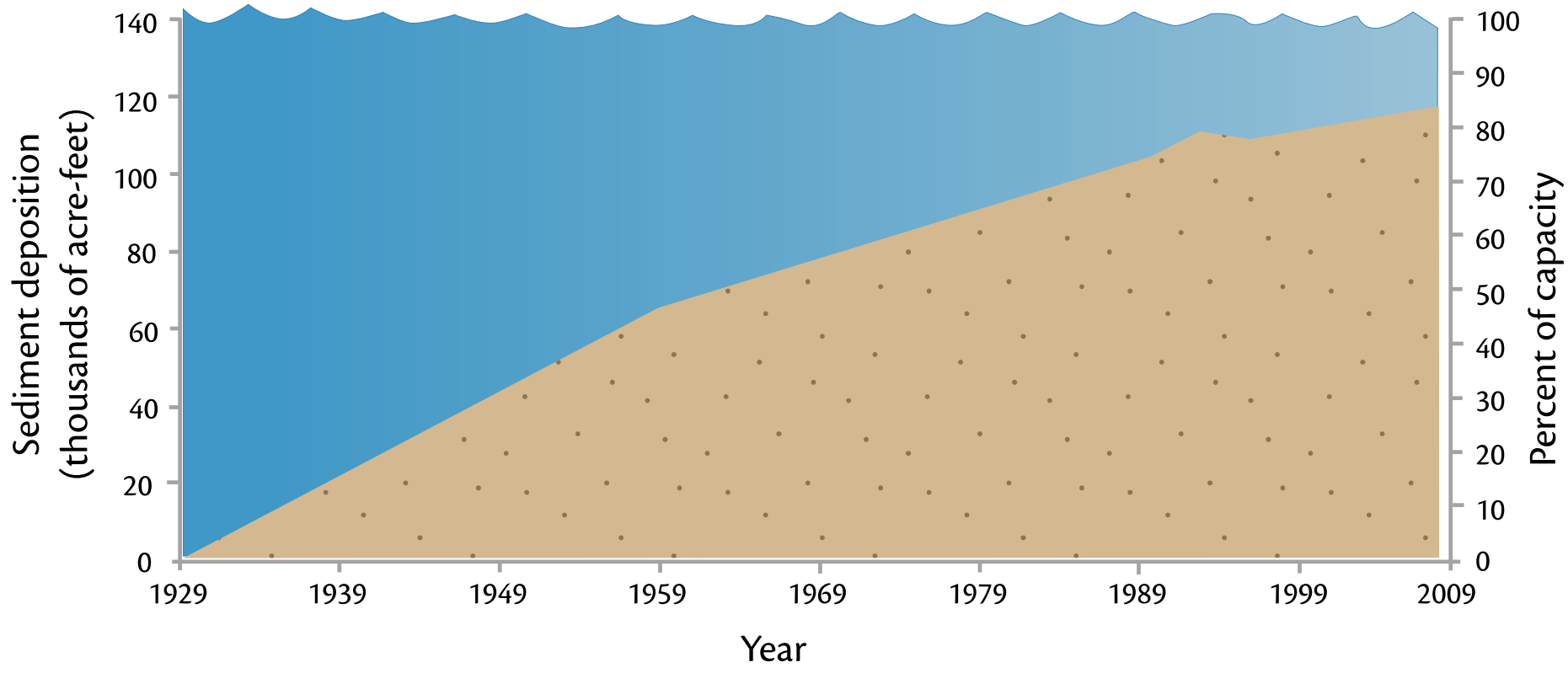




Sediment deposition in the Conowingo Reservoir



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Adapted from Hirsch, 2012

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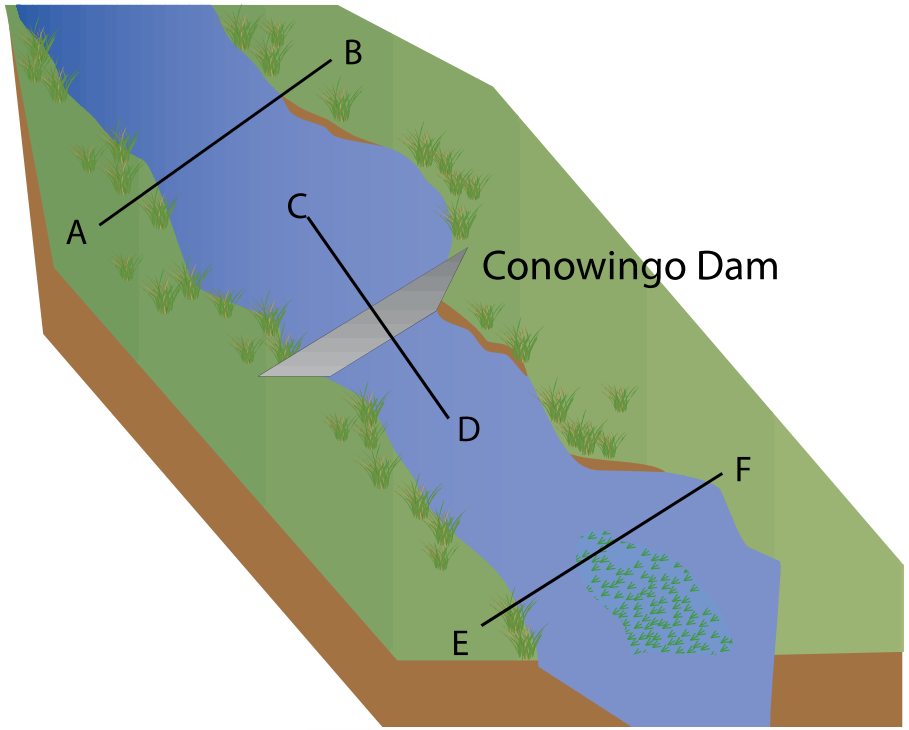

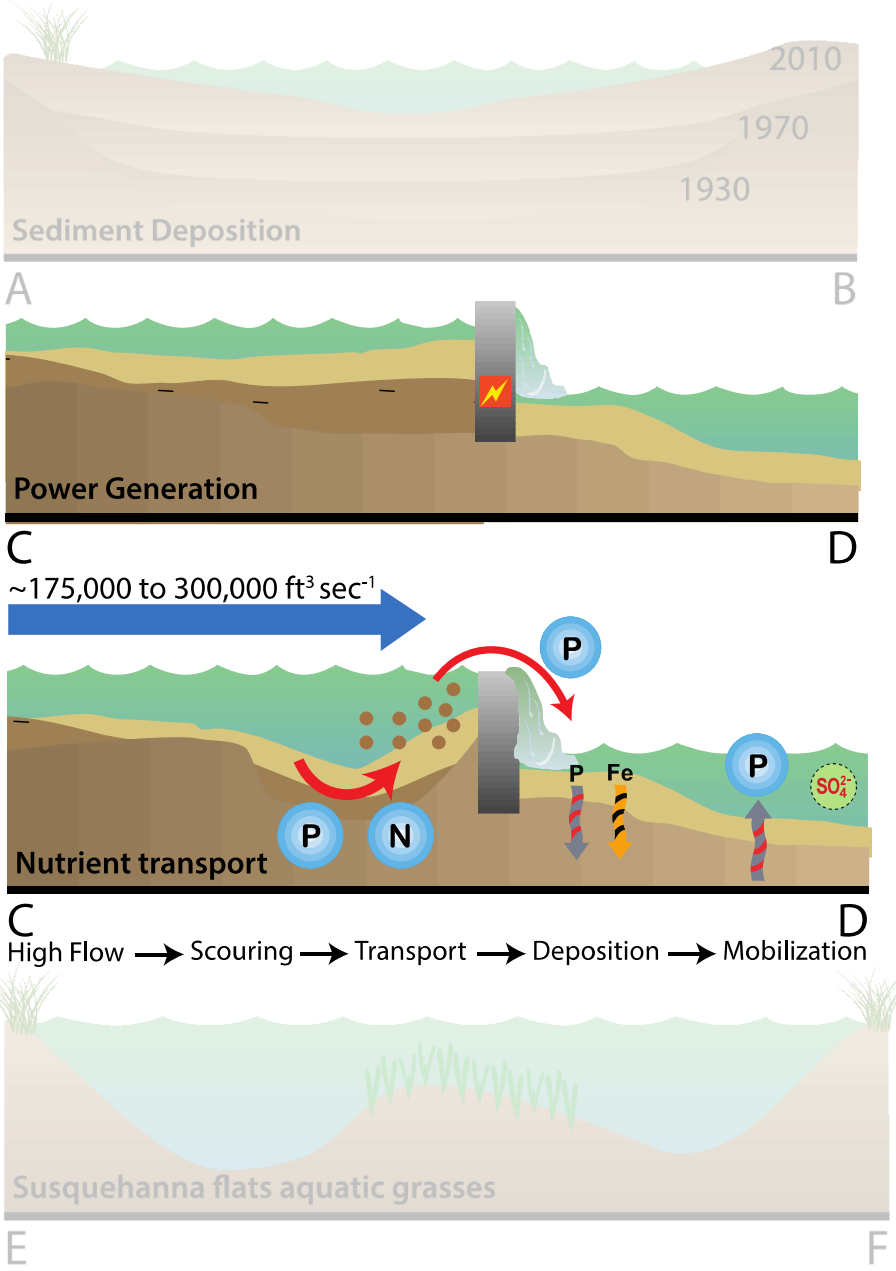

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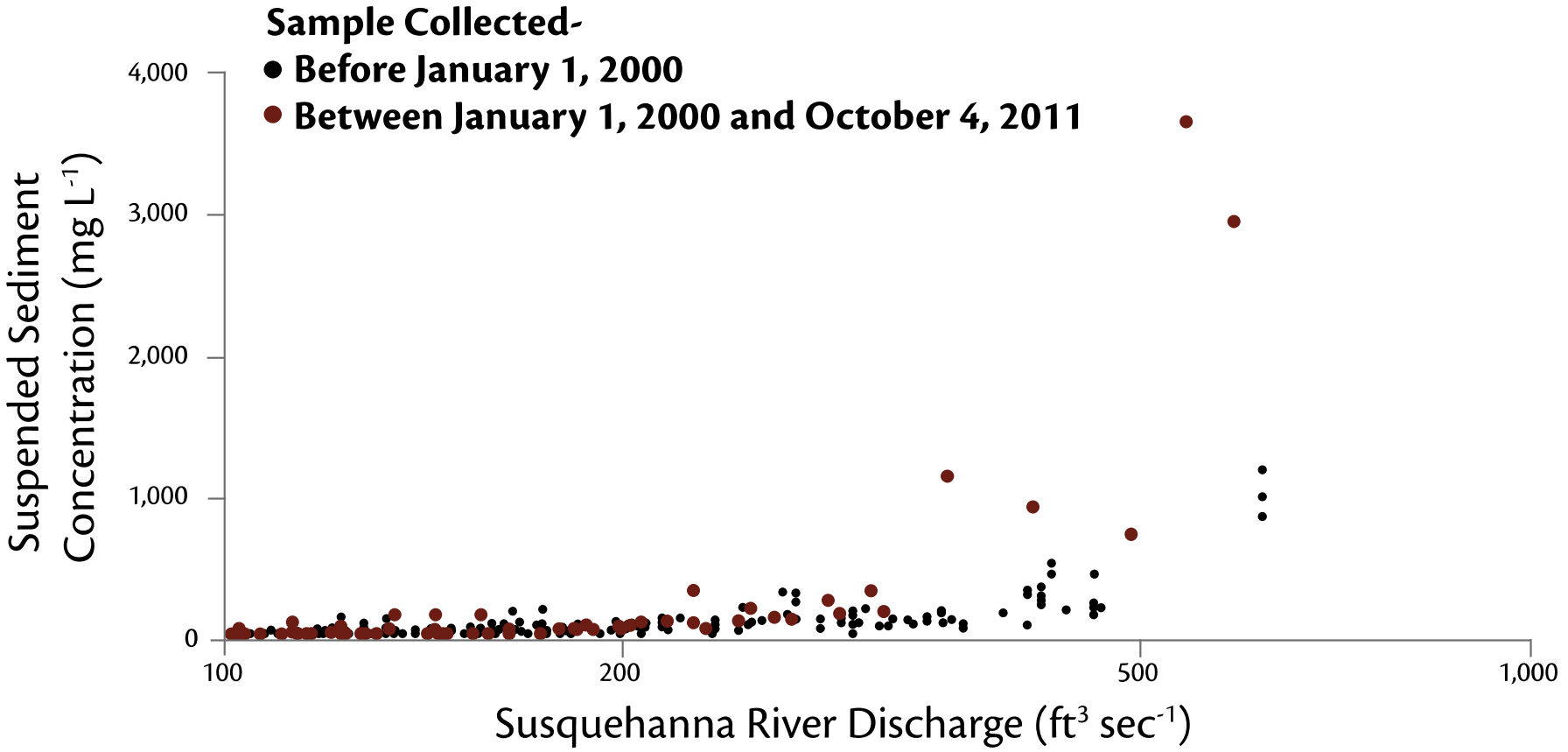
At high flows since 2000, sediments are not effectively trapped by Conowingo Dam



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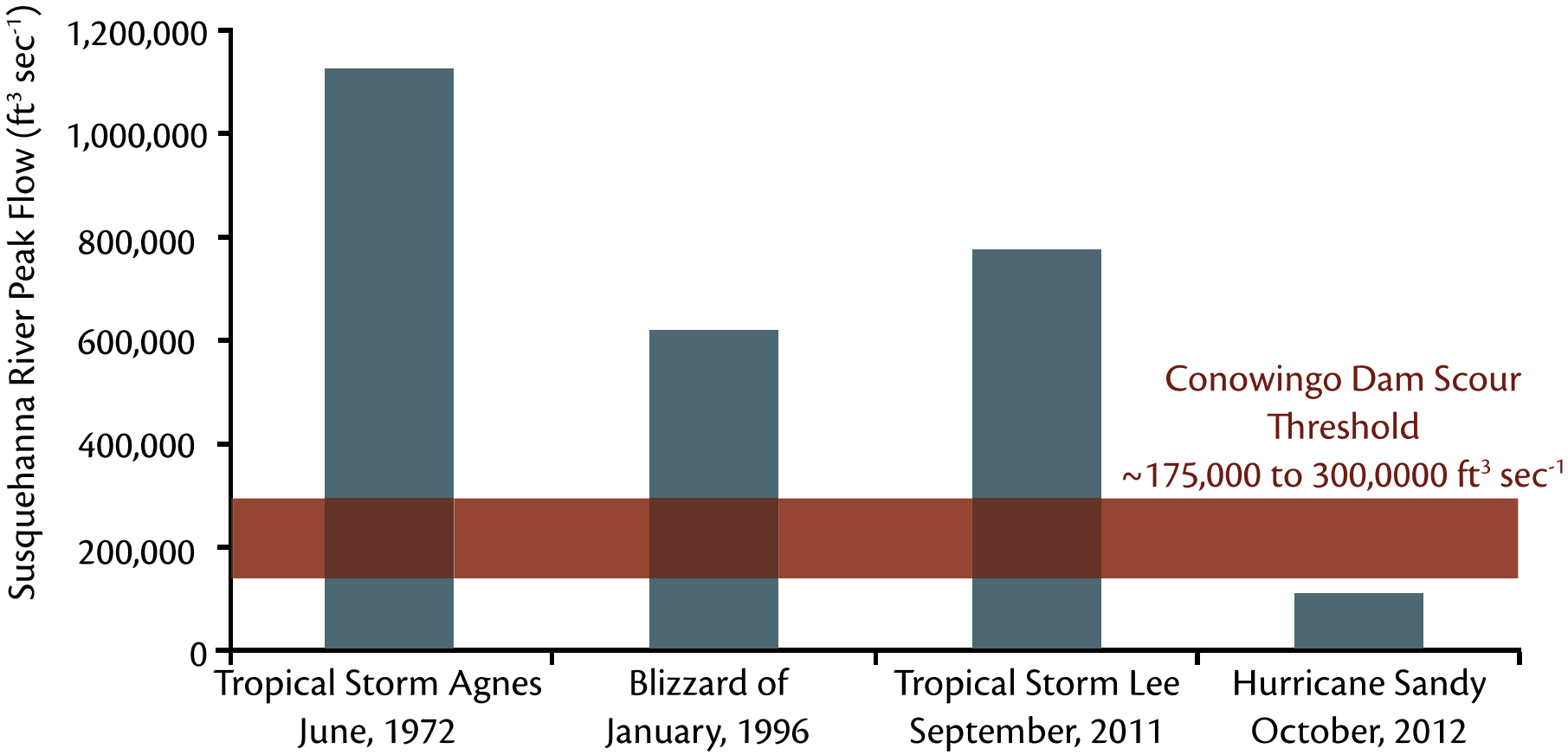
Susquehanna river flow during major events



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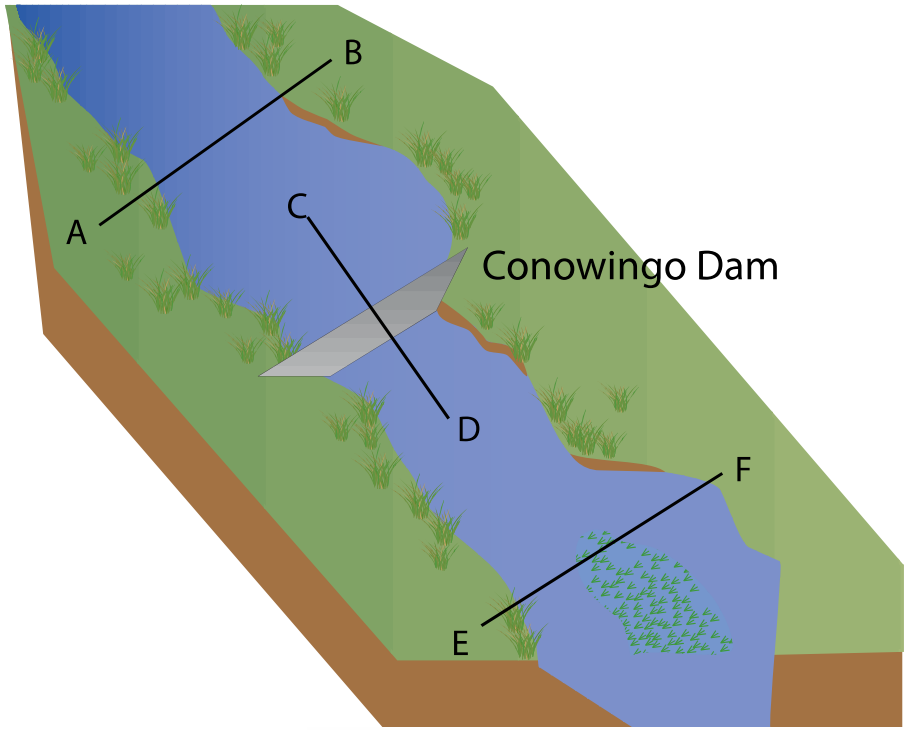
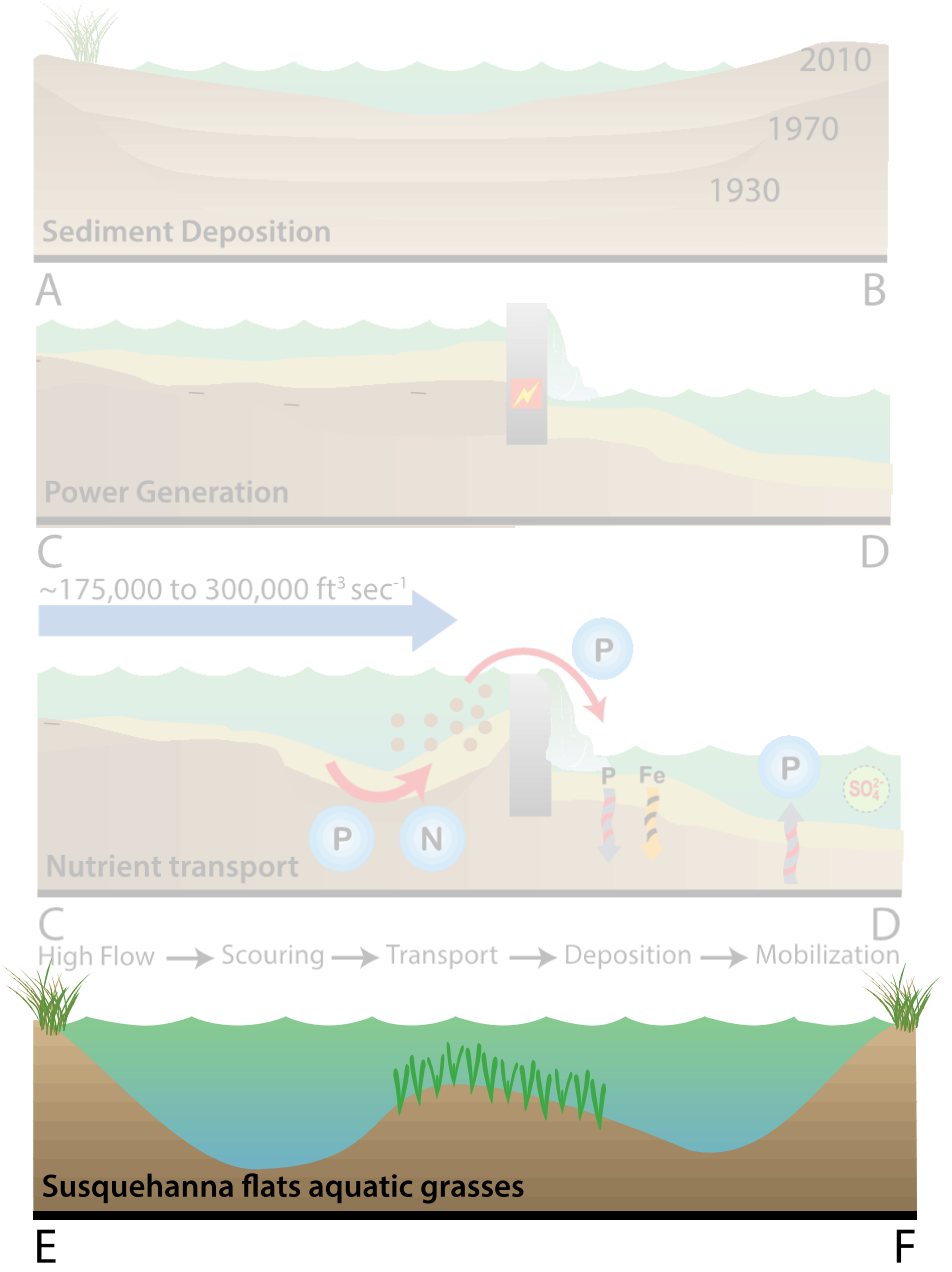
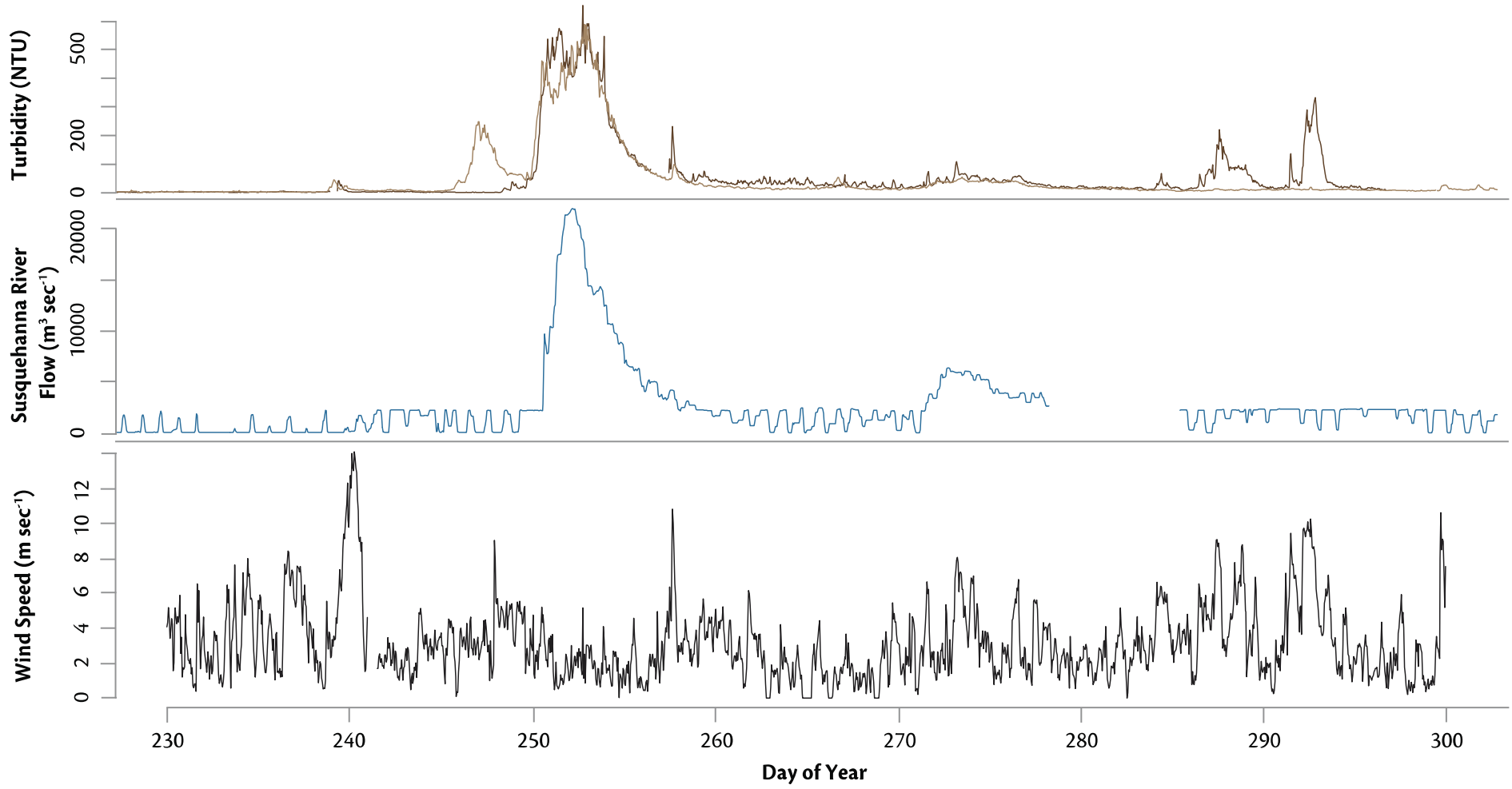




Tropical Storm Lee scoured Conowingo sediments which increased turbidity directly from water flow and indirectly through wind resuspension



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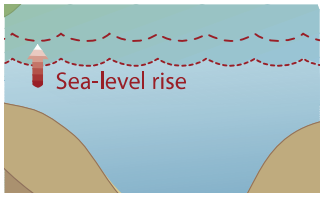
Data from C. Gurbisz

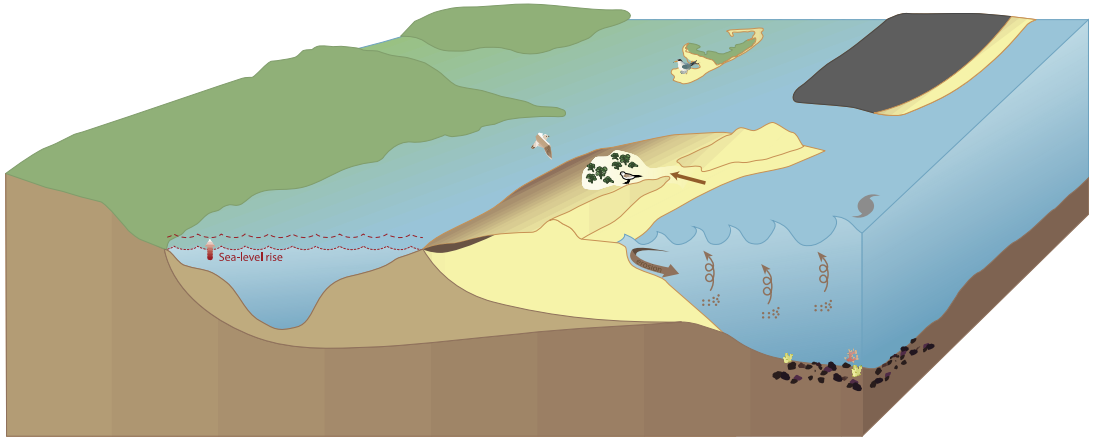
Coastal storm surge not as substantial as experienced in New Jersey and New York

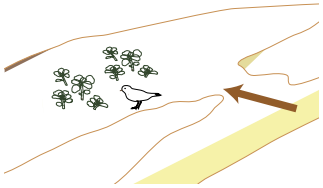
- 4-foot seawater elevation observed
- Assateague Island experienced morphological changes
  - Overwash
  - Beach face steepening

Key physical processes occurring within the Delmarva Coastal Bays



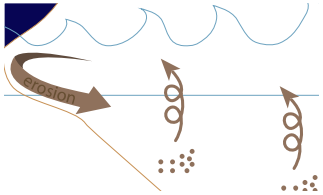
Sea-level rise





Beach overwash

Skimmer Island



Sediment resuspension

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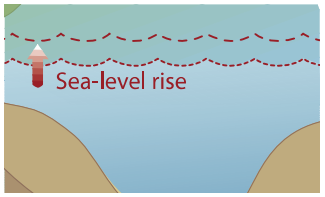

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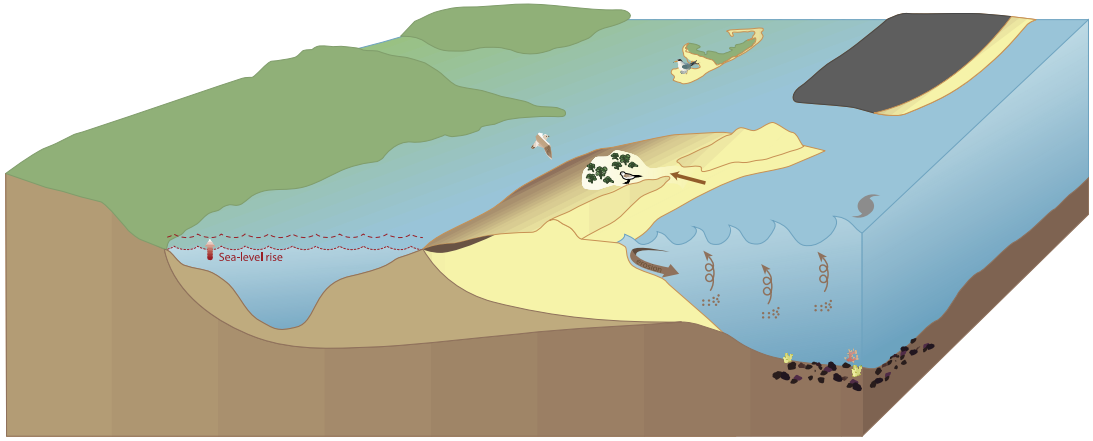

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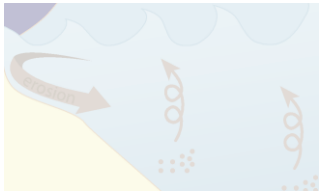

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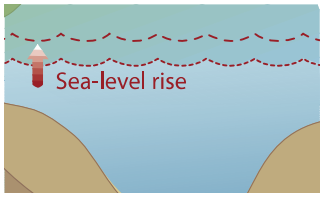

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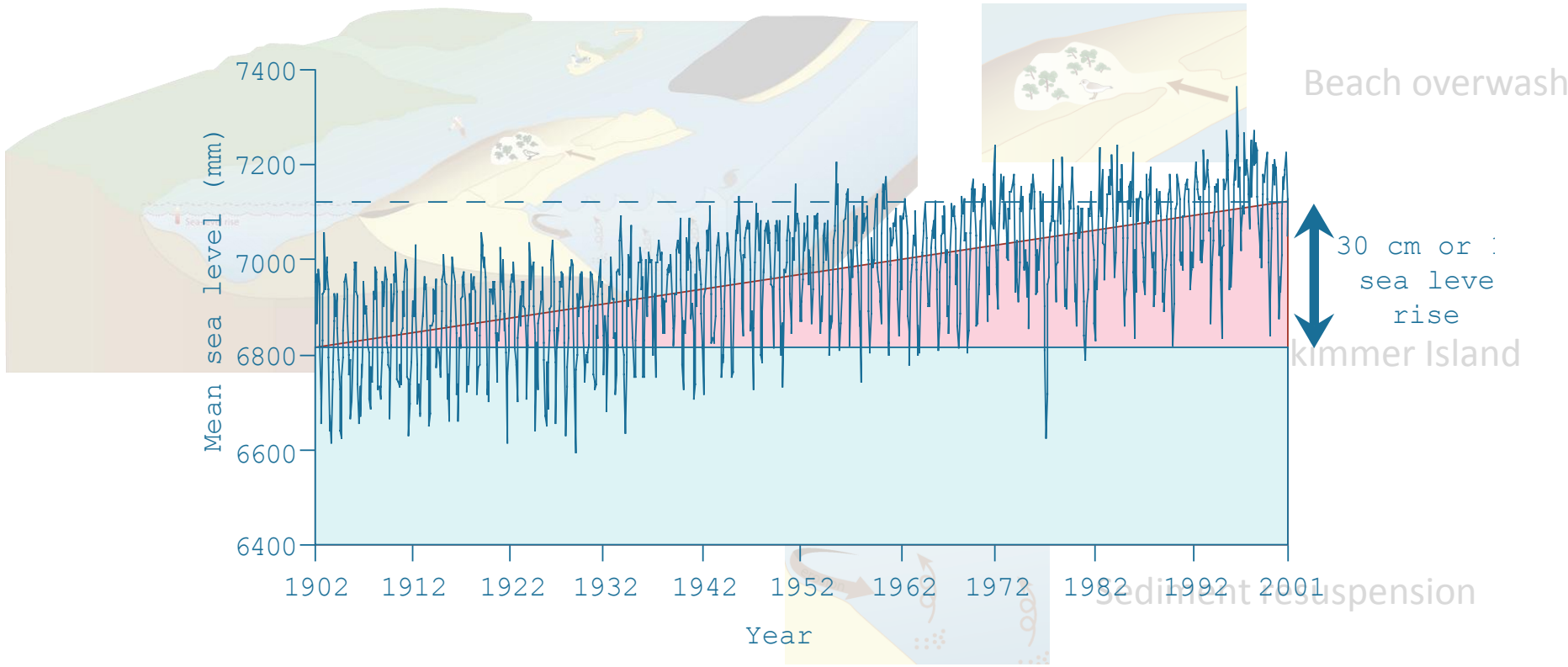

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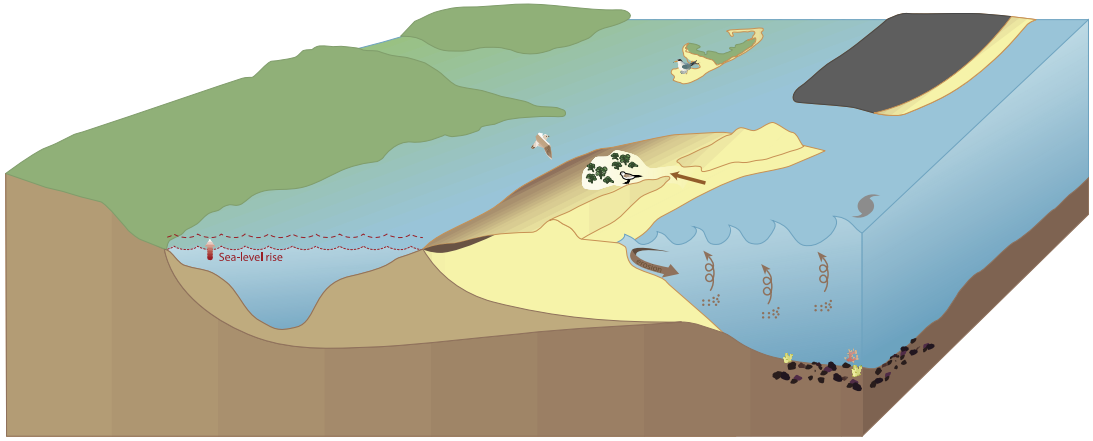

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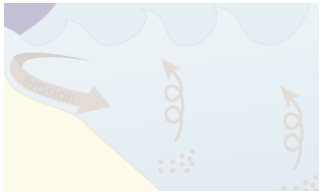

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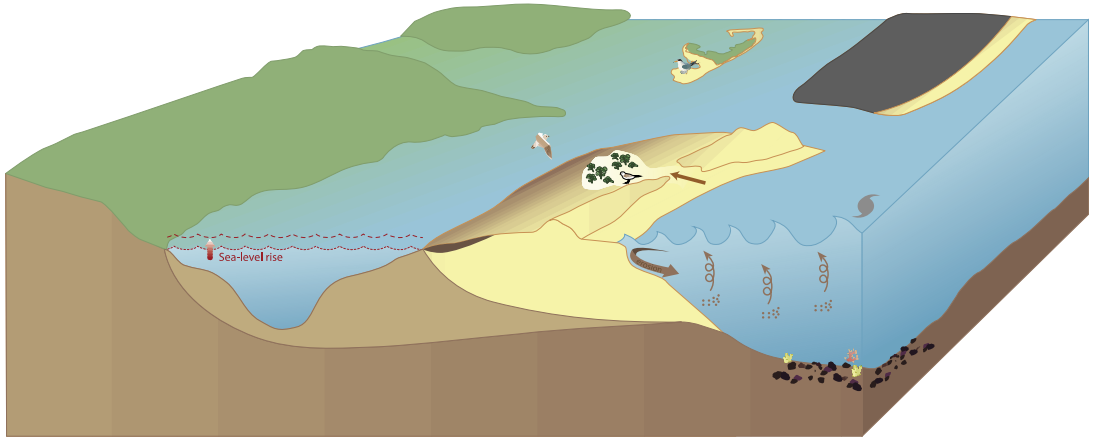


Beach overwash

Overwash is likely to have created new suitable habitat for several rare species

Skimmer Island

Tiger Beetle

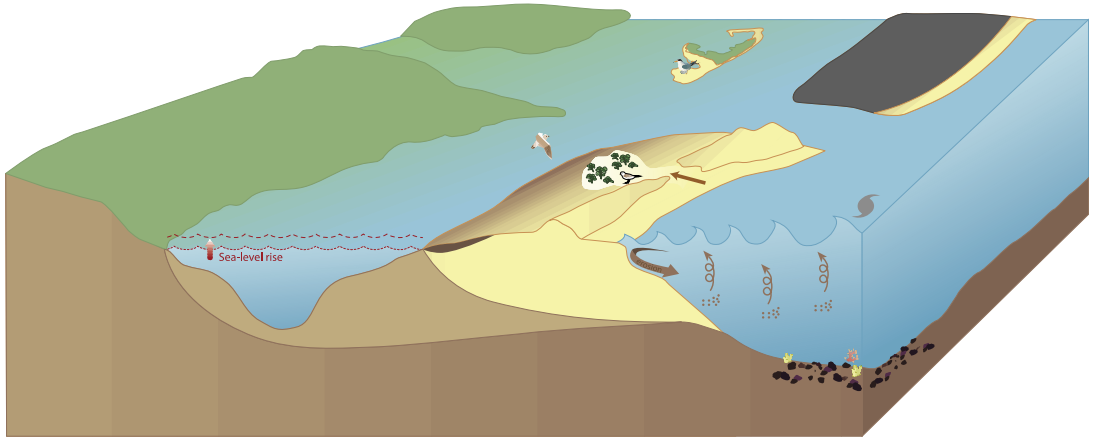
Seabeach Amaranth

Piping Plover

sion

Key physical processes occurring within the Delmarva Coastal Bays

Sea-level rise



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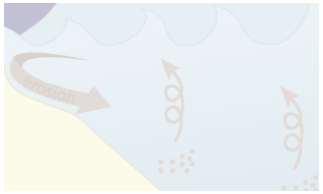

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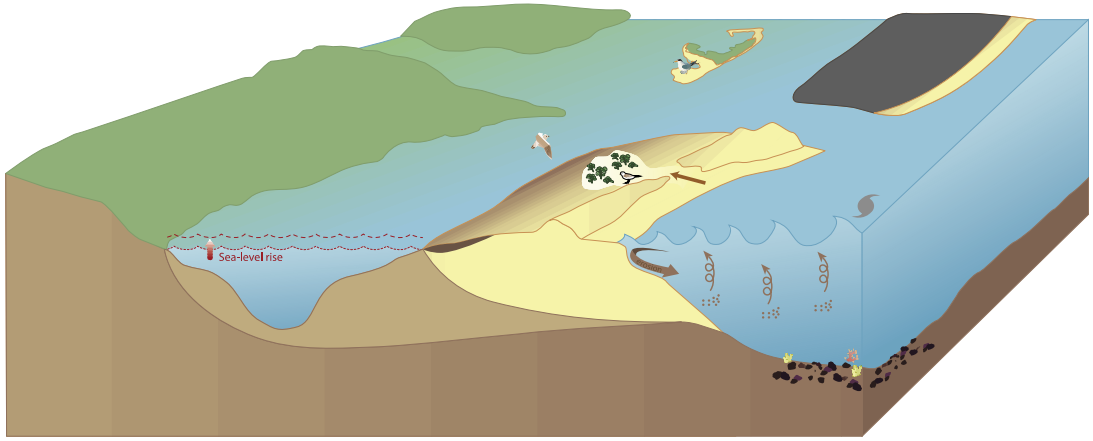

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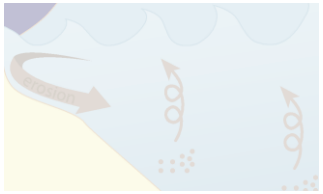

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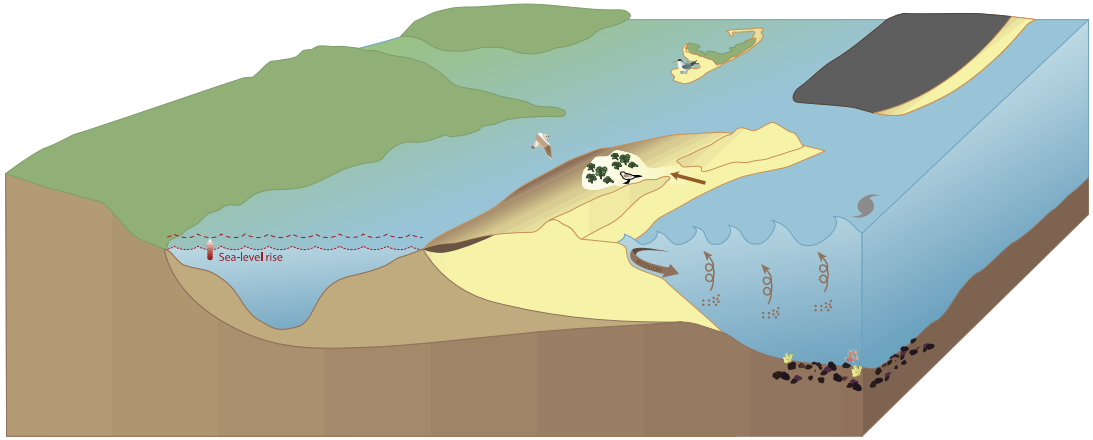

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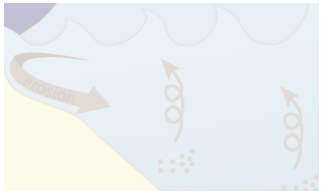

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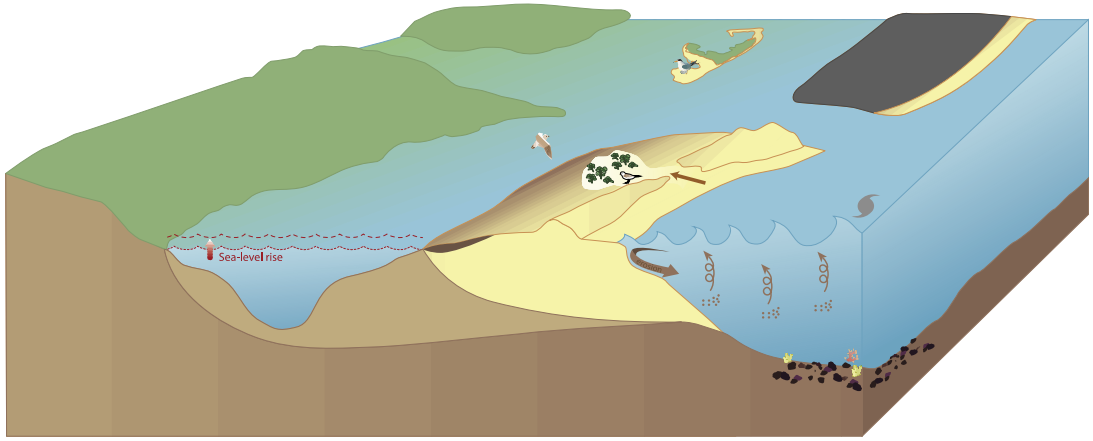

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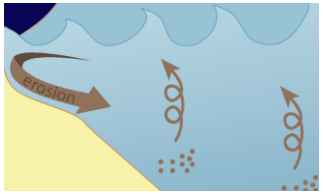

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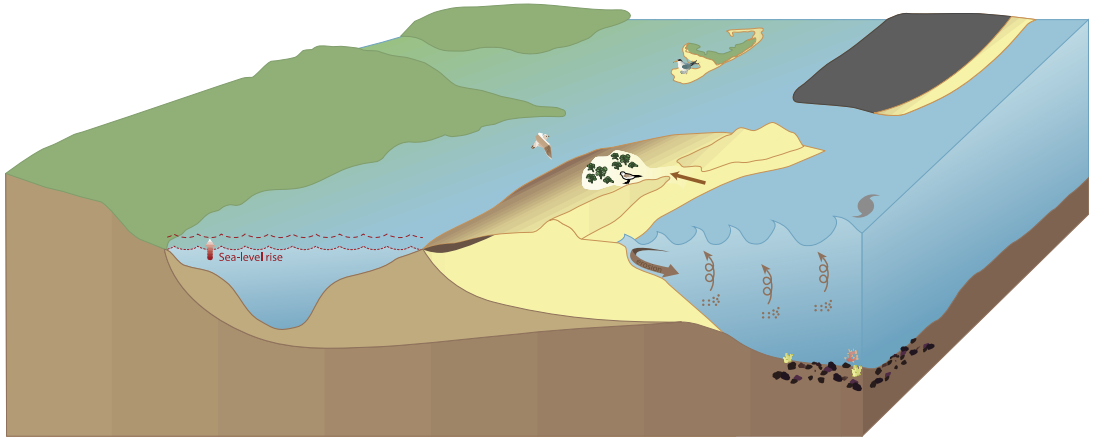

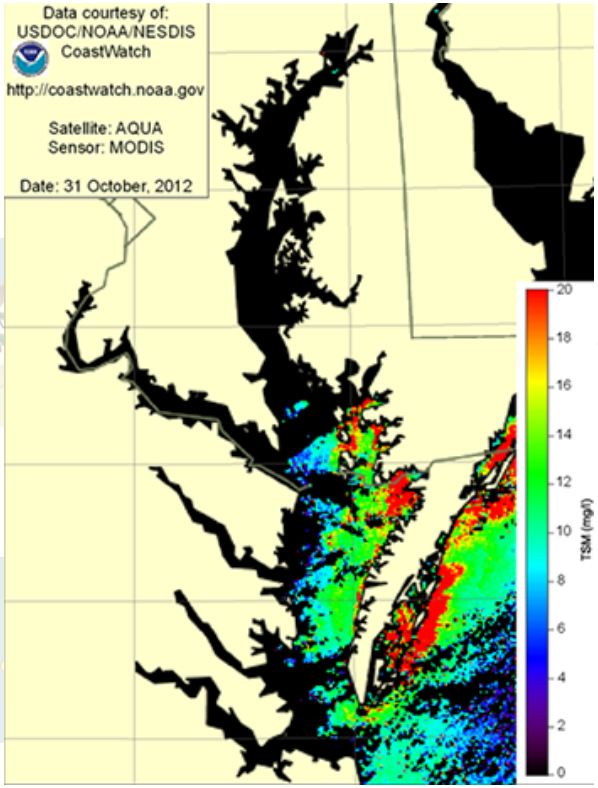

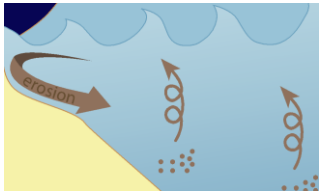

Sediment resuspension

Conclusions and Recommendations: Chesapeake Bay

- **The storm track and timing of Hurricane Sandy in October 2012 ameliorated its impacts on Chesapeake Bay**
  - Just because Chesapeake Bay was spared the devastating impacts of Hurricane Sandy because of its storm track and timing, it is not prudent to become complacent about the potential impacts of future large storm events.
    - Chesapeake Bay Program should conduct an assessment of the robustness of the ecosystem restoration and protection initiatives to large storm events.

Conclusions and Recommendations: Chesapeake Bay

- **The Conowingo Dam reservoir has been losing capacity for sediment trapping since it was constructed in 1928; sediments and phosphorus now largely bypass the dam during flow events. Scouring will occur more frequently during high flow events.**
  - Investigate sediment bypass or dredging options to increase Conowingo Dam capacity for sediment trapping.
    - The Lower Susquehanna River Watershed Assessment is an ongoing multi-agency study, led by the Army Corps of engineers targeting these issues.

Conclusions and Recommendations: Chesapeake Bay

- **Extreme events like Hurricane Sandy are likely to increase based on regional climate predictions**.
  - Survey and map offshore habitats to investigate potential impacts using underwater video, satellite remote sensing and diver observations.
    - The offshore habitats are beyond the administrative boundaries of the National Park Service and US Fish & Wildlife Service who manage Assateague Island (to 0.5 miles offshore), and the Maryland Coastal Bays Program (up to the inlets).

Conclusions and Recommendations: Delmarva Coastal Bays

- **Large waves from the Atlantic Ocean (up to 40 foot waves recorded off New Jersey) affected the nearshore benthic habitats on the seaward side of the barrier islands.**
  - Climate variability needs to be factored into future scenarios regarding Chesapeake Bay restoration.
    - Expand the event response assessment in Recommendation # 1 to include readiness for climate change assessment.

Conclusions and Recommendations: Delmarva Coastal Bays

- **Sandy islands of the Delmarva Coastal Bays, in particular Skimmer Island in Isle of Wight Bay, may have lost increasingly rare habitats due to storm surge and erosion.**
  - Develop a strategic sand dredging plan for the Delmarva Coastal Bays so sand nourishing of critical sand island habitats can occur.
    - A sand dredging strategic plan is being developed by the Army Corps of Engineers and Maryland Coastal Bays Program, and Hurricane Sandy provides an impetus to accelerate this planning effort.

Conclusions and Recommendations: Delmarva Coastal Bays

- **Beach overwash on Assateague Island created new potential habitat for key threatened species of birds, plants, and insects. Potential habitat losses are possible due to overwash into salt marshes and seagrass meadows in the Delmarva Coastal Bays.**
  - Monitor the establishment of threatened and rare species in beach overwash habitats and manage the potential changes in recreational uses accordingly. Monitor the salt marsh and seagrass habitats in the next growing season.
    - Coordinate monitoring efforts by federal and state agencies, academic and research institutions, and non-government organizations to provide an integrated assessment of Hurricane Sandy impacts using the Science & Technical Analysis Committee of the Maryland Coastal Bays Program.

Short- and Long-Term Remediation Projects

Resource	Issues	Habitat Impacted	Species Impacted	Remediation	Partners	Estimated Costs	Name/Agency
Skimmer Island, Isle of Wight Bay	Island lost all sand used to restorm it in 2010 and 2011. It lost a foot of elevation.	Colonial nesting bird island.	Royal terns, black skimmers.	Sand replenishment of island.	MD DNR, MCBP, Private marina owners.	$144,000	Dave Brinker, MD DNR.
Coastal Bays	Island Loss.	Colonial nesting bird islands.	Royal terns, black skimmers, common terns, least terns.	Restoration of lost and degraded islands and a comprehensive dredging plan. Need assessment to implement.	MD DNR, MCBP, Private marina owners.	$550,000	Roman Jesien, MCBP