Panel

Maritime Transportation Resilience in Hampton Roads: **Sea Level Rise and Flood Risk Mitigation**

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Virginia Tech

VIRGINIA TECH

CENTER FOR COASTAL STUDIES

Context
Decisions
Portfolio of Options
Future Change
Extreme Flooding

- **VA General Assembly / VASEM 2021 report on The Impact of Climate Change on Virginia's Coastal Areas**
- Virginia Coastal Resilience Master Plan (2021)

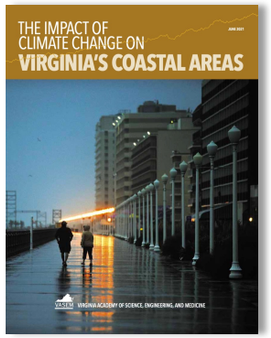
Projected Future Impacts in Virginia

Flooding disproportionately affects disadvantaged populations

Public health crises emerge as septic systems fail and groundwater is contaminated by saltwater

Regional economy shrinks by $611 million within a year of a 1% annual-exceedance flood

Waterfront businesses risk failure as existing zoning classifications inhibit relocation



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From The Impact of Climate Change on Virginia's Coastal Areas (2021) Figures from Virginia Coastal Resilience Master Plan (2021)

- VA General Assembly / VASEM 2021 report on The Impact of Climate Change on Virginia's Coastal Areas
- **Virginia Coastal Resilience Master Plan (2021)**

Projected Future Impacts in Virginia (cont.) – By 2080:

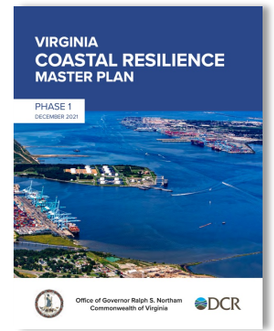
160% increase in residents exposed to major flooding

$6 billion in annualized damage to buildings (930% increase)

2,800 miles of roadways chronically flood (460% increase)

170,000 acres of tidal wetlands lost (89%)

3,800 acres of dunes & beaches lost (38%)



From Virginia Coastal Resilience Master Plan (2021)

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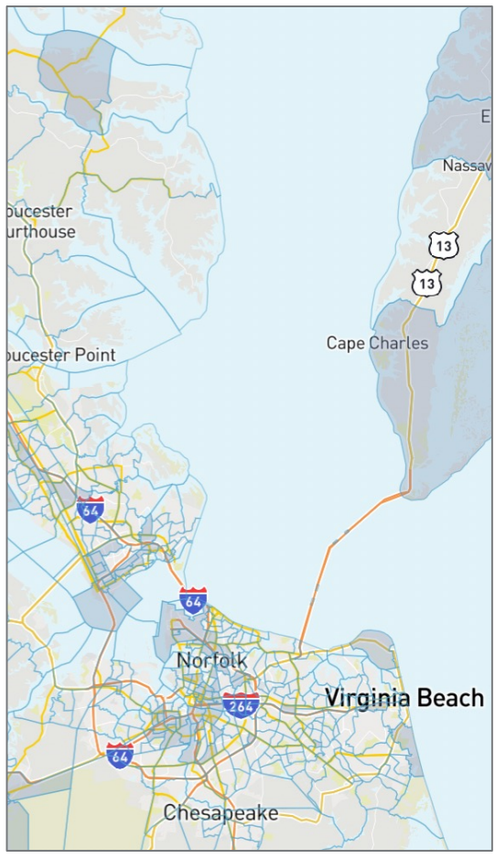
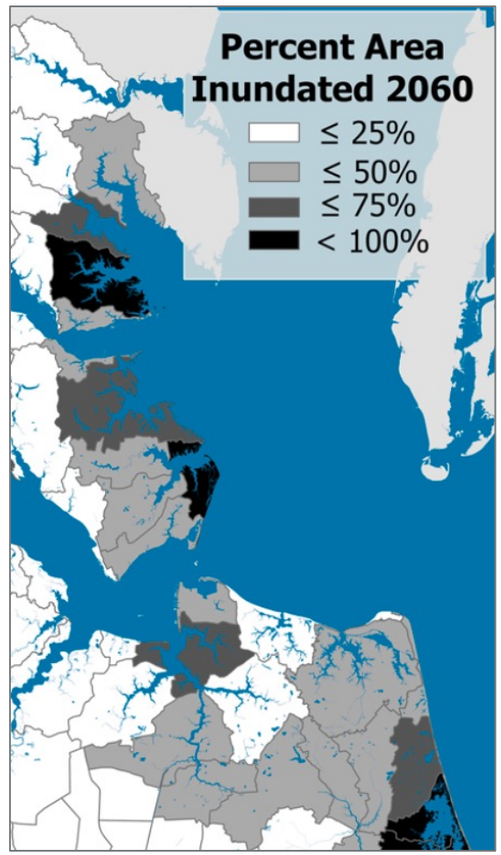
- **Environmental equity**
- Quality of life
- "Certainty"

Equity





= Disadvantaged

2% flood event

- **Advance understanding** of negative consequences of positive feedback loops
- **Establish policy** that incentivizes and enables just decisions

Left figure: From screeningtool.geoplatform.gov. Right figure: Modified from Mitchell et al. (2022) *Environmental Management*

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- Environmental equity
- **Quality of life**
- "Certainty"

Quality of Life

- ***When will workforce leave?*** **Advance understanding** of community capacity to manage lost work-days, school closures, inhibited access to healthcare facilities, etc.

- **Establish decision tools and policy** that enable consideration of quality-of-life factors

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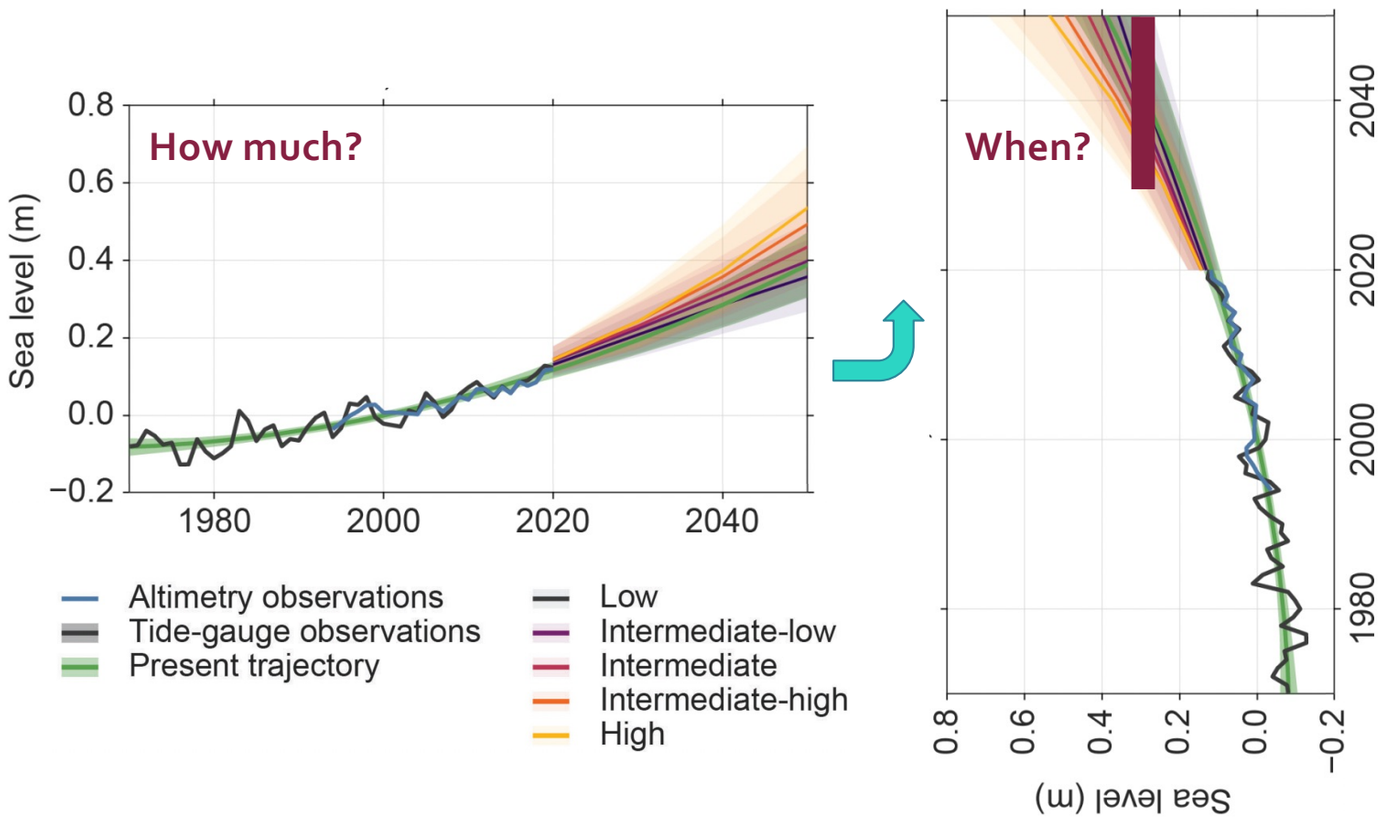
- Environmental equity
- Quality of life
- **"Certainty"**

"Certainty" (Moving Forward with Uncertainty)

Certain will happen no later than 2050



- **Develop strategies to communicate** what we are certain about in a way that matters to decision makers (and those that vote for them)

Figures modified from Sweet et al. (2022)

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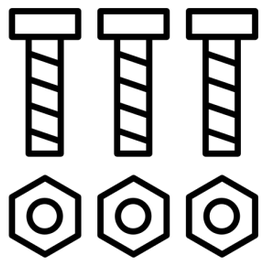
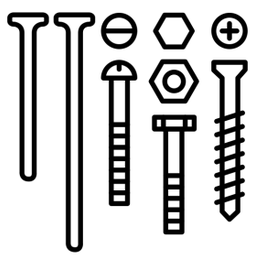
- **Co-development**
- Gray-to-green infrastructure
- Relocation as an option

Co-Development with Communities





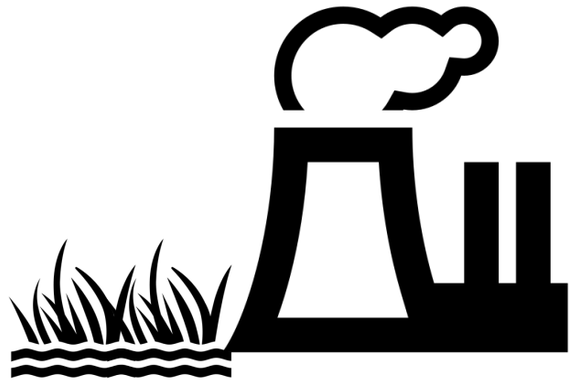

- **Tighten connections and build trust** with communities and local decision makers

Graphics from The Noun Project (M.G. Brown, Draftphic, Jino)

- Co-development
- **Gray-to-green infrastructure**
- Relocation as an option

Gray-Hybrid-Green Infrastructure

- **Advance understanding** of natural & nature-based infrastructure performance
- **Responsibly communicate** pros & cons of gray-to-green infrastructure



Left top: Photo from Galveston.com ((CC BY-NC-ND 2.0). Left bottom: Photo by O. Aburto/ILCP.
Right bottom: Graphics from The Noun Project (D.Z. Aczél, L. Prado) .

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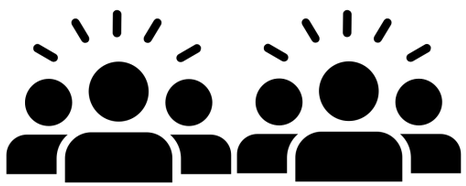
- Co-development
- Gray-to-green infrastructure
- **Relocation as an option**

Relocation as a Planned Option

- **Establish policy** that incentivizes proactive (not reactive) relocation within the region



Graphics from The Noun Project (N. Kozen, Juicy Fish, A. Ahmed

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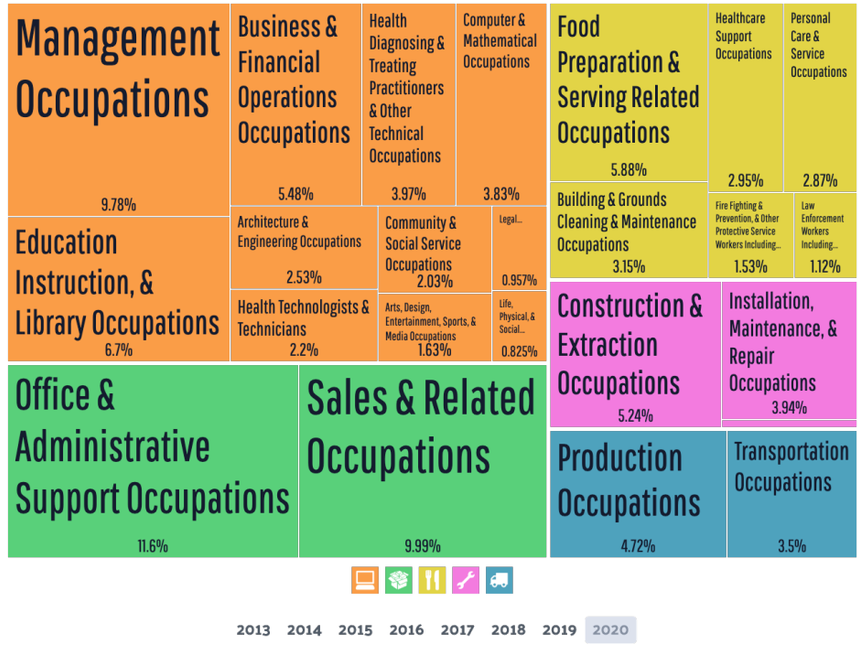
- **Anthropogenic change**
- "Natural" change

Anthropogenic Change

Projected SLR-induced population change (hot=loss, cool=gain)



Hampton Roads workforce by occupation

- **Advance understanding** of impact of flooding on population dynamics
- **Advance understanding** of population change on local economy, workforce, etc.

Left figure: Modified from Hauer et al. (2022). Right figure: From datausa.io

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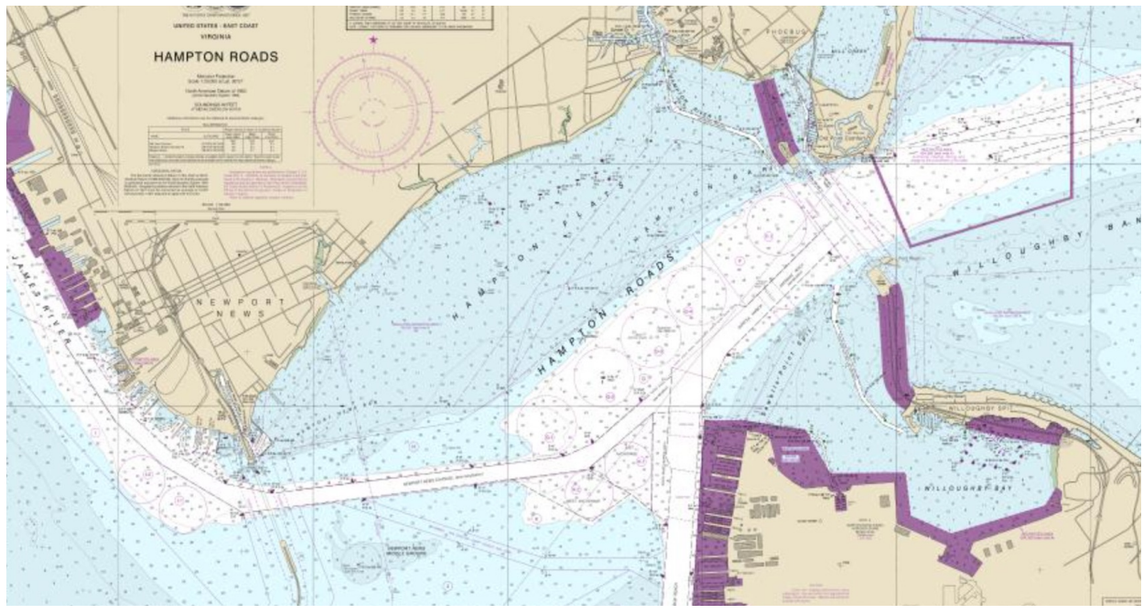
- Anthropogenic change
- **"Natural" change**

"Natural" Change: Morphological Change



- **Advance understanding** of long-term morphological change, including response to sea-level-rise:
  - Impact on dredging needs?
  - Impact on wave, tide, and current conditions?
  - Impact on land loss?

Figure from NOAA

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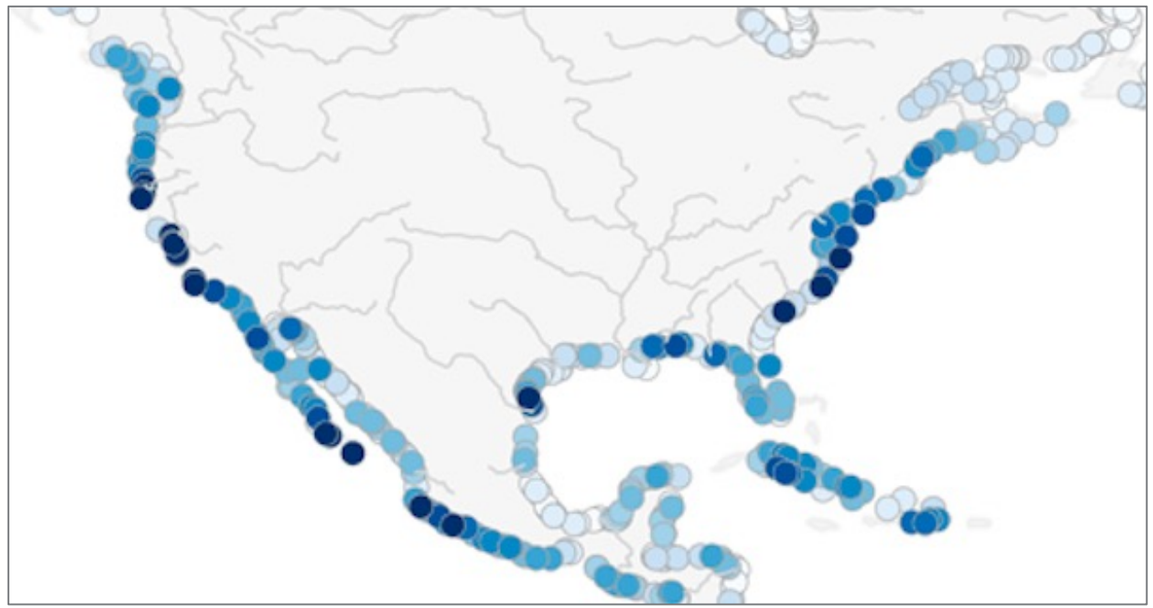
- **Compound flooding**
- Hybrid tropical-extratropical storms

Compound Flooding



Dark blue = More compound flood events

- **Advance understanding** of compound flooding
- **Unify characterization** of inland-to-coastal probabilistic flood hazard

Figure modified from Couasnon et al. (2020)

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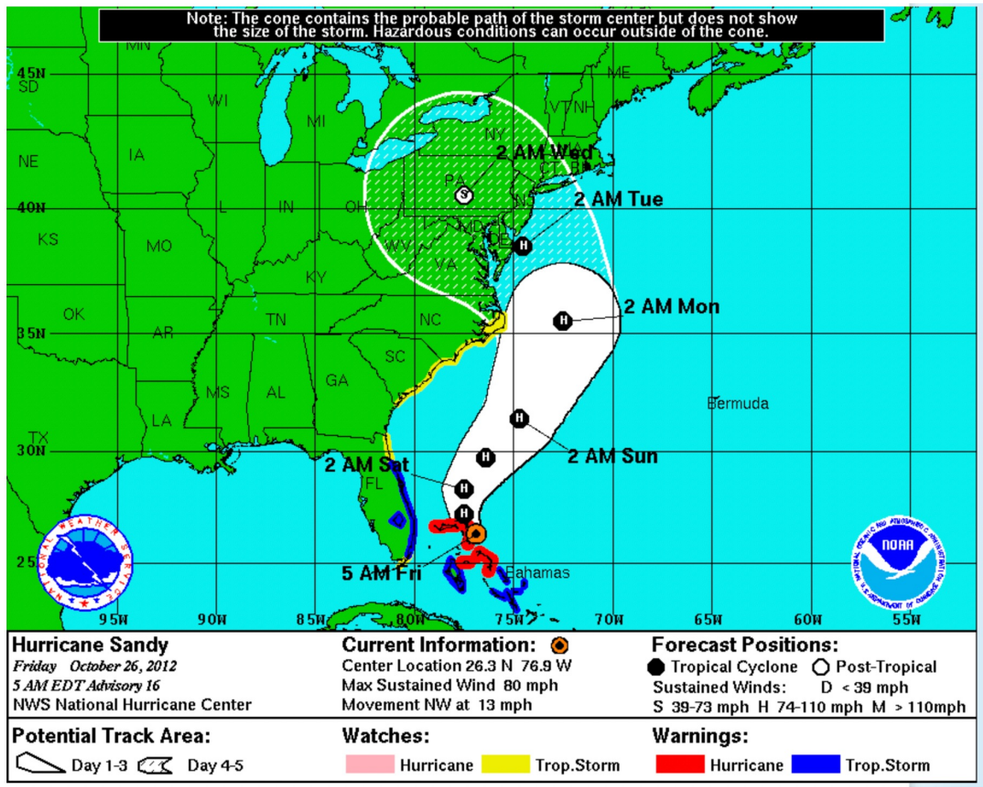
- Compound flooding
- **Hybrid tropical-extratropical storms**

Hybrid Tropical-Extratropical Storms



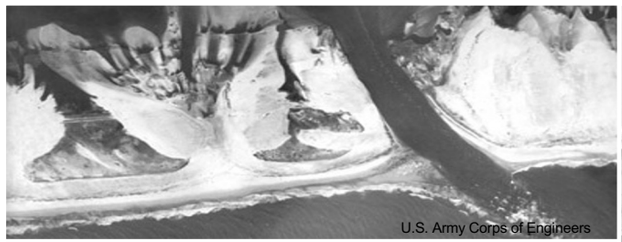
- **Advance understanding** of hybrid tropical-extratropical storms
  - When will extreme, widespread flooding occur?

Figure from NOAA

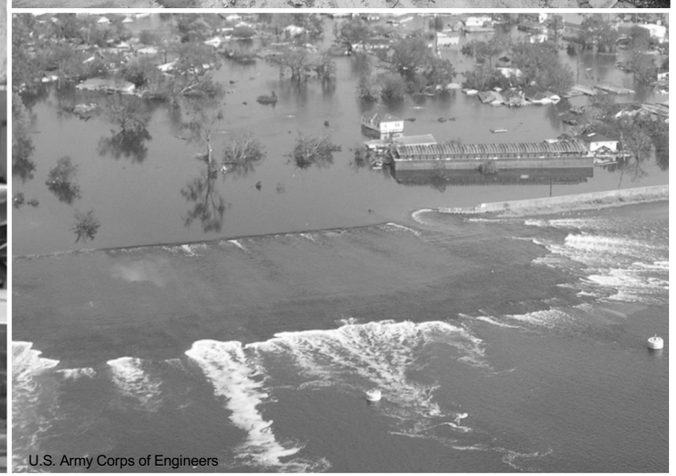
Learn More

Virginia Tech's
Center for Coastal Studies:

Questions?


U.S. Army Corps of Engineers


Courtesy ASCE


U.S. Army Corps of Engineers