Tidal Creek Ecosystems: Sentinel Habitats for Assessing and Predicting the Consequences of Coastal Development and Climate Change

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and
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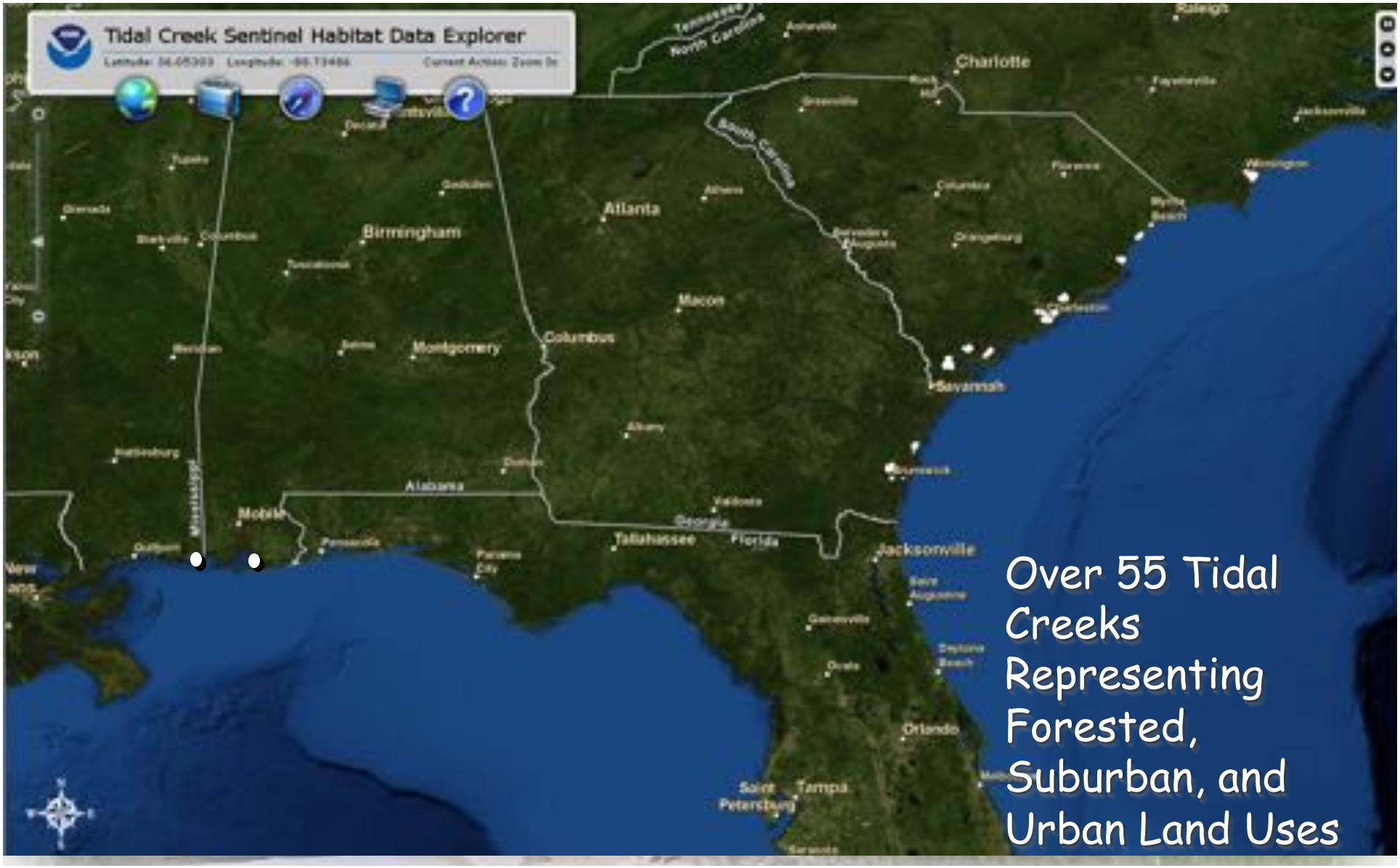
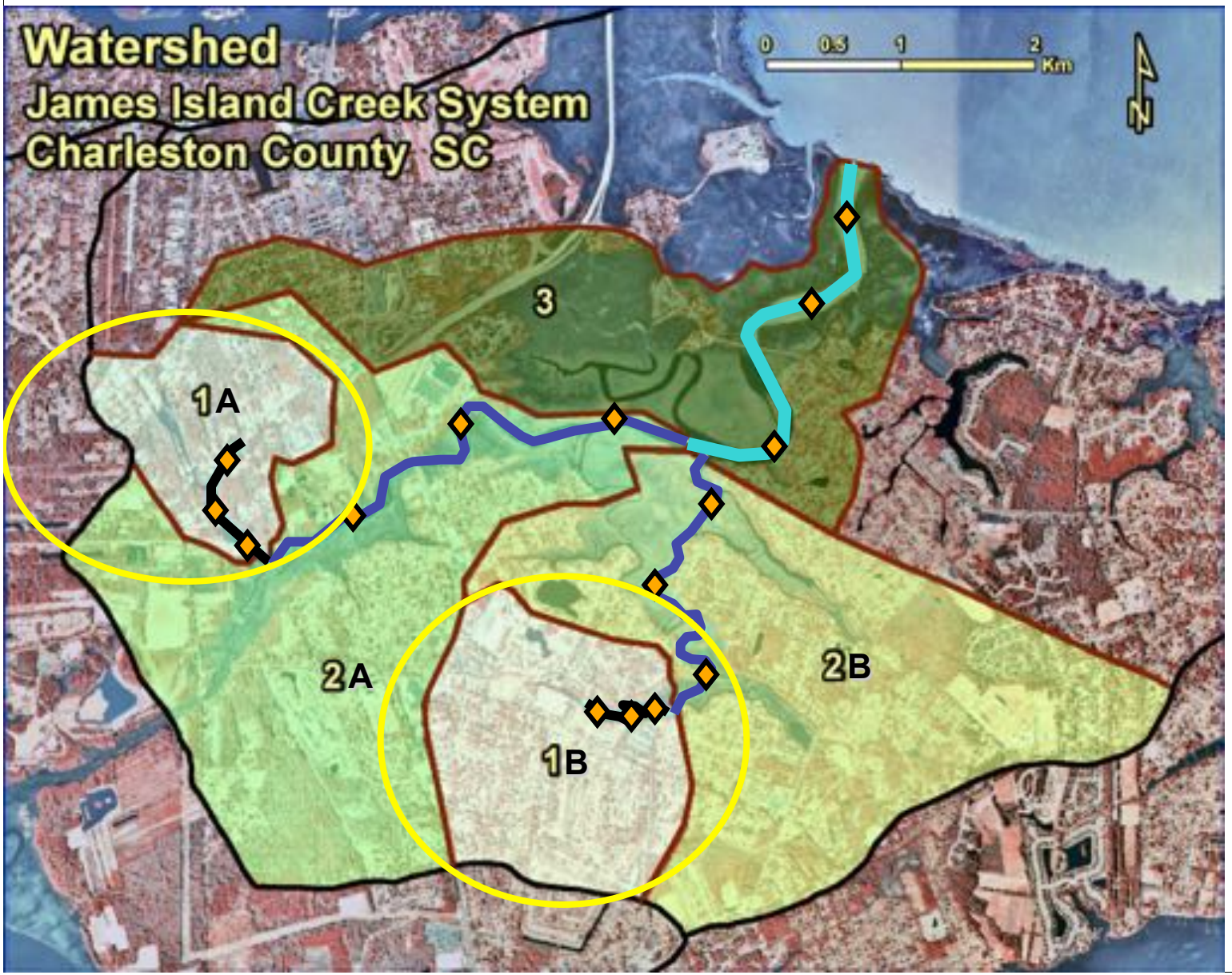
Objectives of Presentation

- Provide a synthesis of the impacts of coastal development on coastal ecosystems and the humans that live in them.
- Provide a case study highlighting a current modeling effort – ultimately predicting the impacts of changes in climate and the level of urbanization.
  - Changes in precipitation and soil saturation

Tidal Creeks Sampled



Creek Continuum



Creek Lengths

1A – 850 m

1B – 850 m

2A – 6400 m

2B – 4600 m

3 – 5800 m

Conceptual Model of Tidal Creek Watershed Linkages

Stressor	Exposure	Biological Response	Societal Response
Coastal Development Activities	**Physical-Chemical Changes**	**Living Resources Impacts**	**Health and Well Being**
Increases population density Alters land cover Increases impervious surface	Alters water quality and hydrography Increases microbial contamination Increases chemical contamination	Reduces biological productivity Alters food webs Impairs animal health	Increases beach and shellfish bed closures Increases flooding Increases public health risk and economic impact

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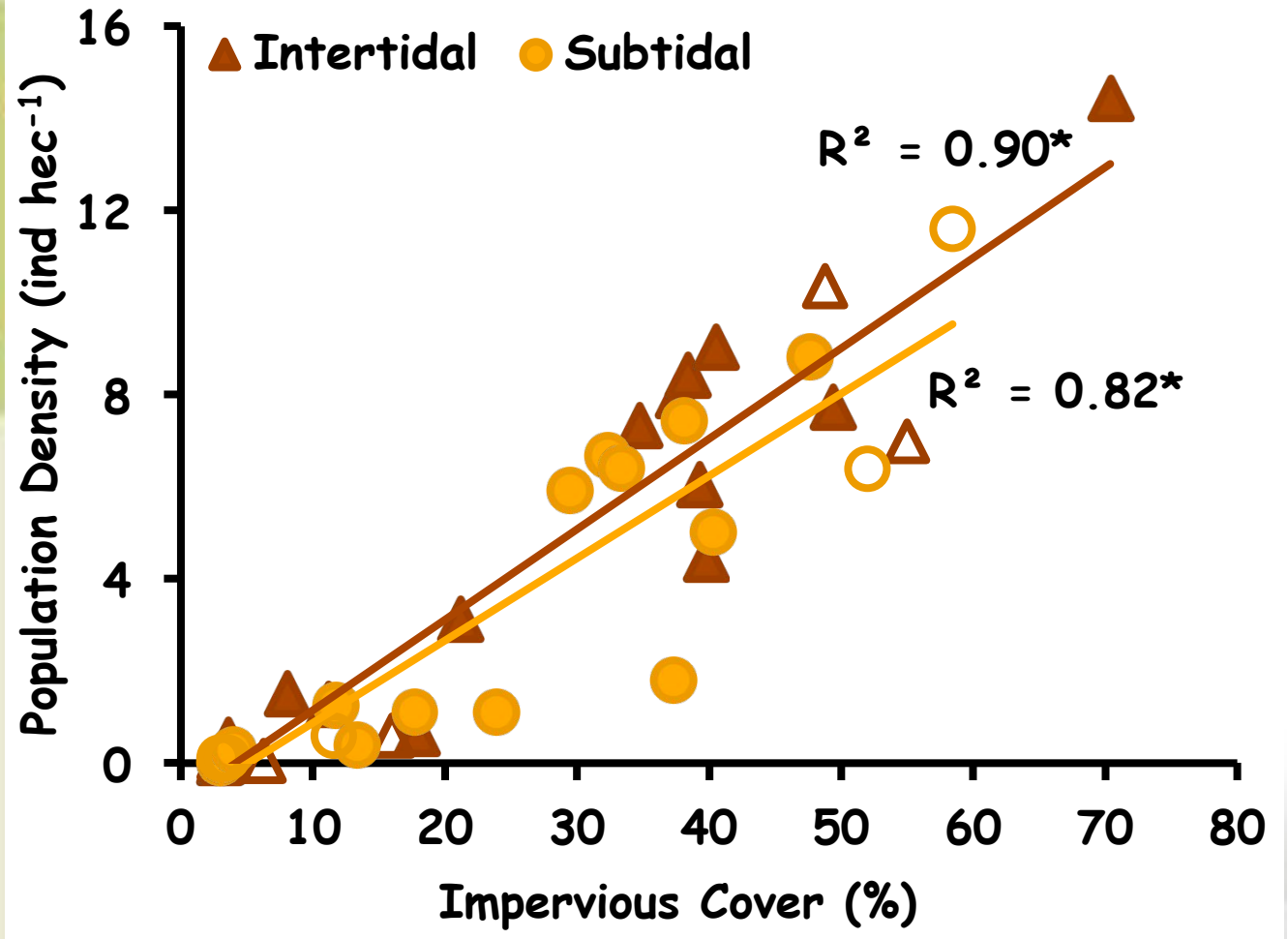
Stressor

Coastal Development Activities

Increases population density

Alters land cover

Increases impervious surface



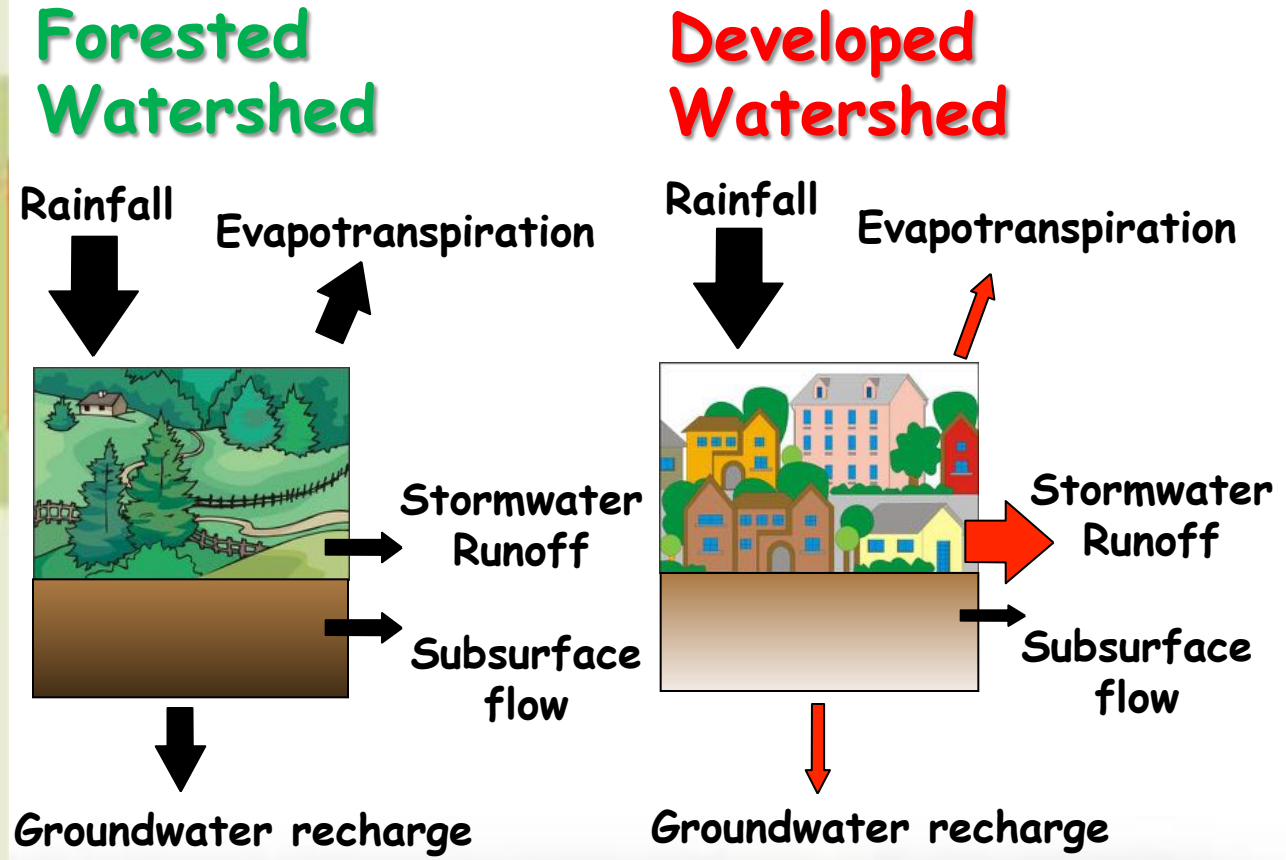
Exposure

Physical-Chemical Changes

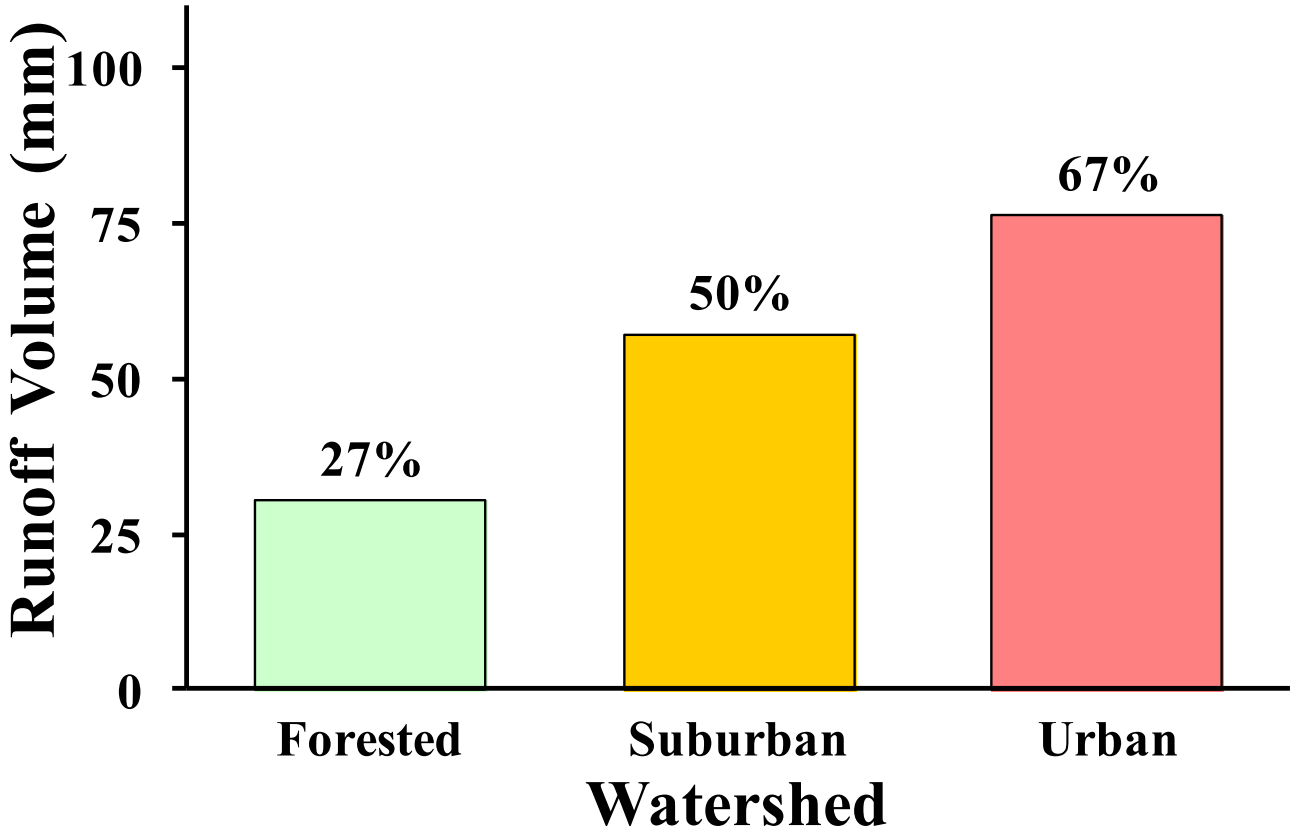
Alters water quality and hydrography

Increases microbial contamination

Increases chemical contamination

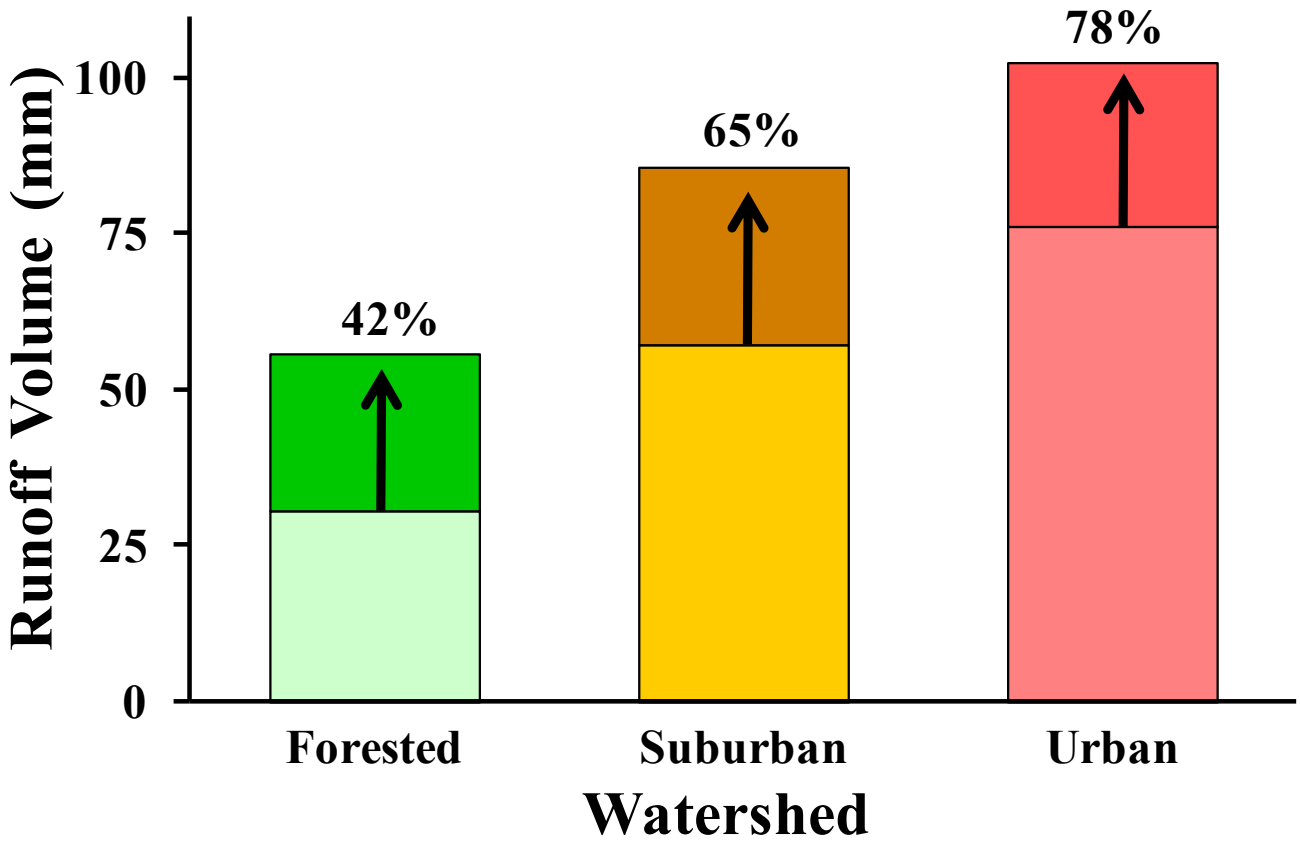


Modeled Runoff Volume



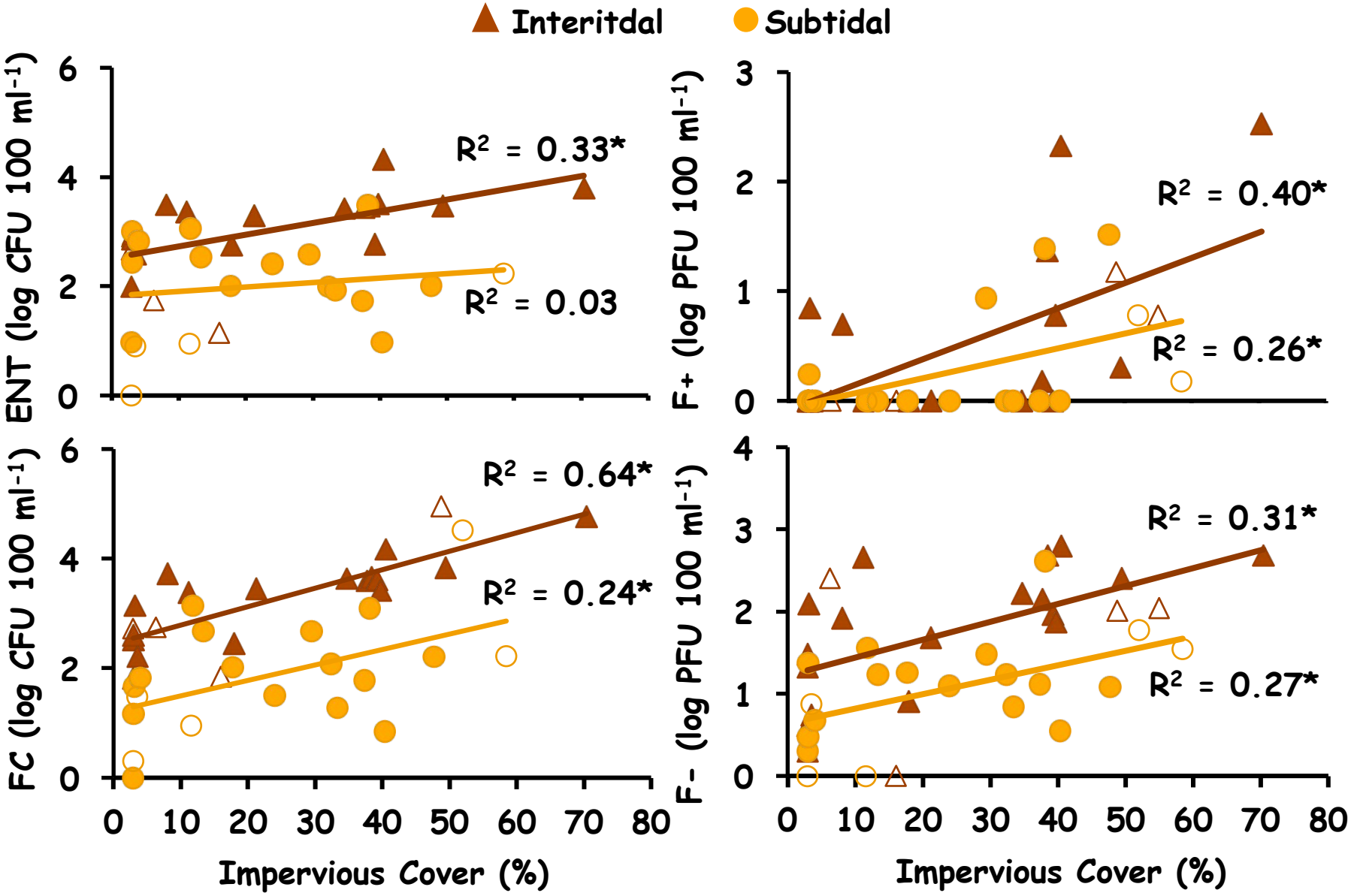
Present scenario – 24-hr 4.5-in storm event, average runoff conditions

Projecting Impact of Climate Change



Present scenario – 24-hr 4.5-in storm event, average runoff conditions
Climate scenario– 12-hr 5.2-in storm event, semi-saturated runoff conditions

Water Pathogens vs Impervious Cover



Biological Response

Living Resources Impacts

Reduces biological productivity

Alters food webs

Impairs animal health

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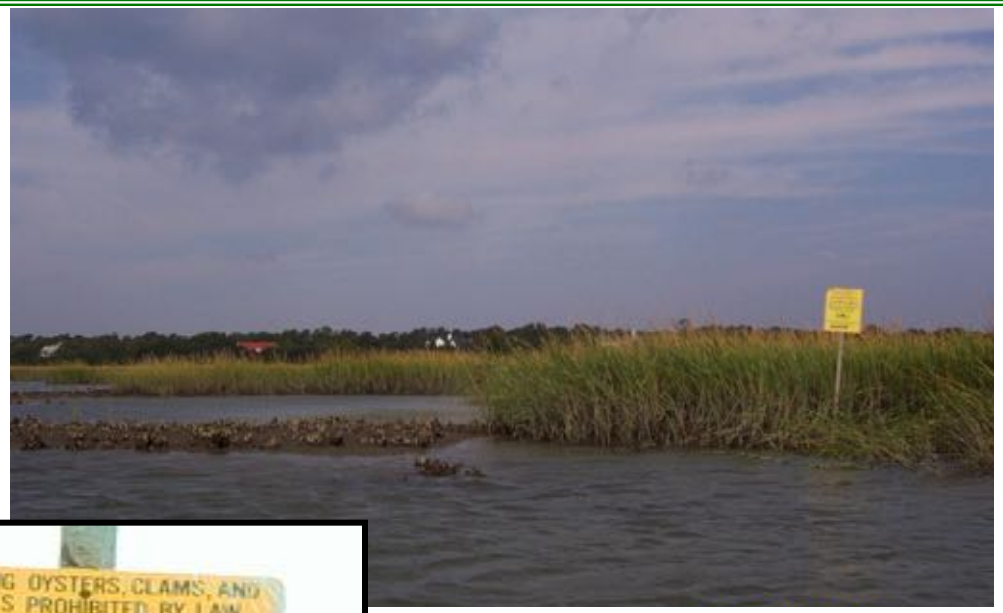
Societal Response

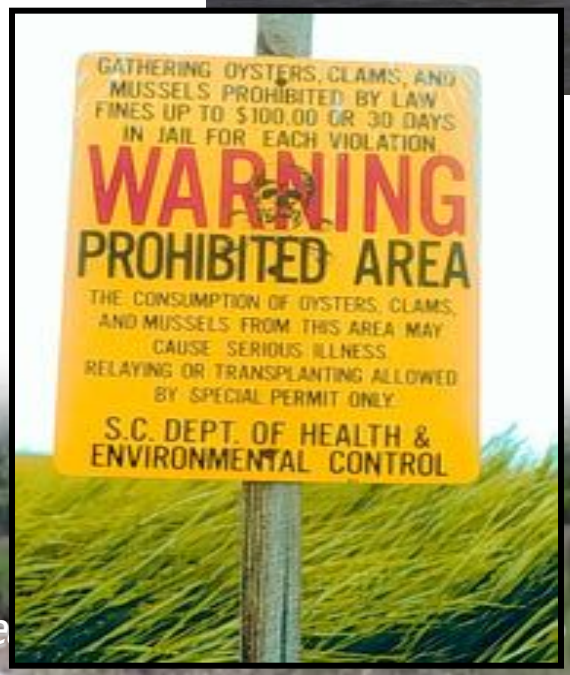
Health and Well Being

Increases beach and shellfish bed closures

Increases flooding

Increases public health risk and economic impact





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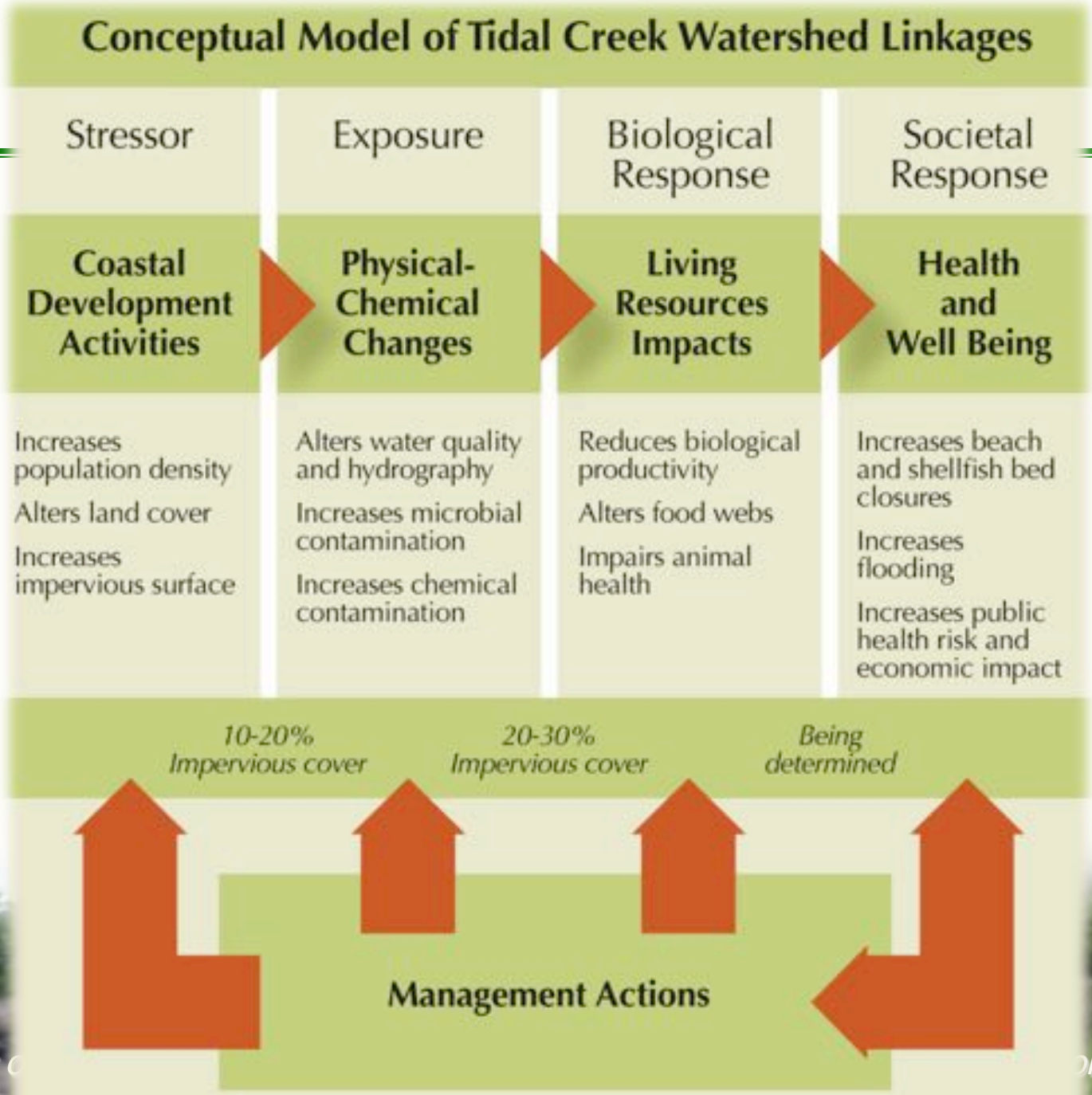
Charleston Flood Prone Areas


Conceptual Model of Tidal Creek Watershed Linkages
Stressor
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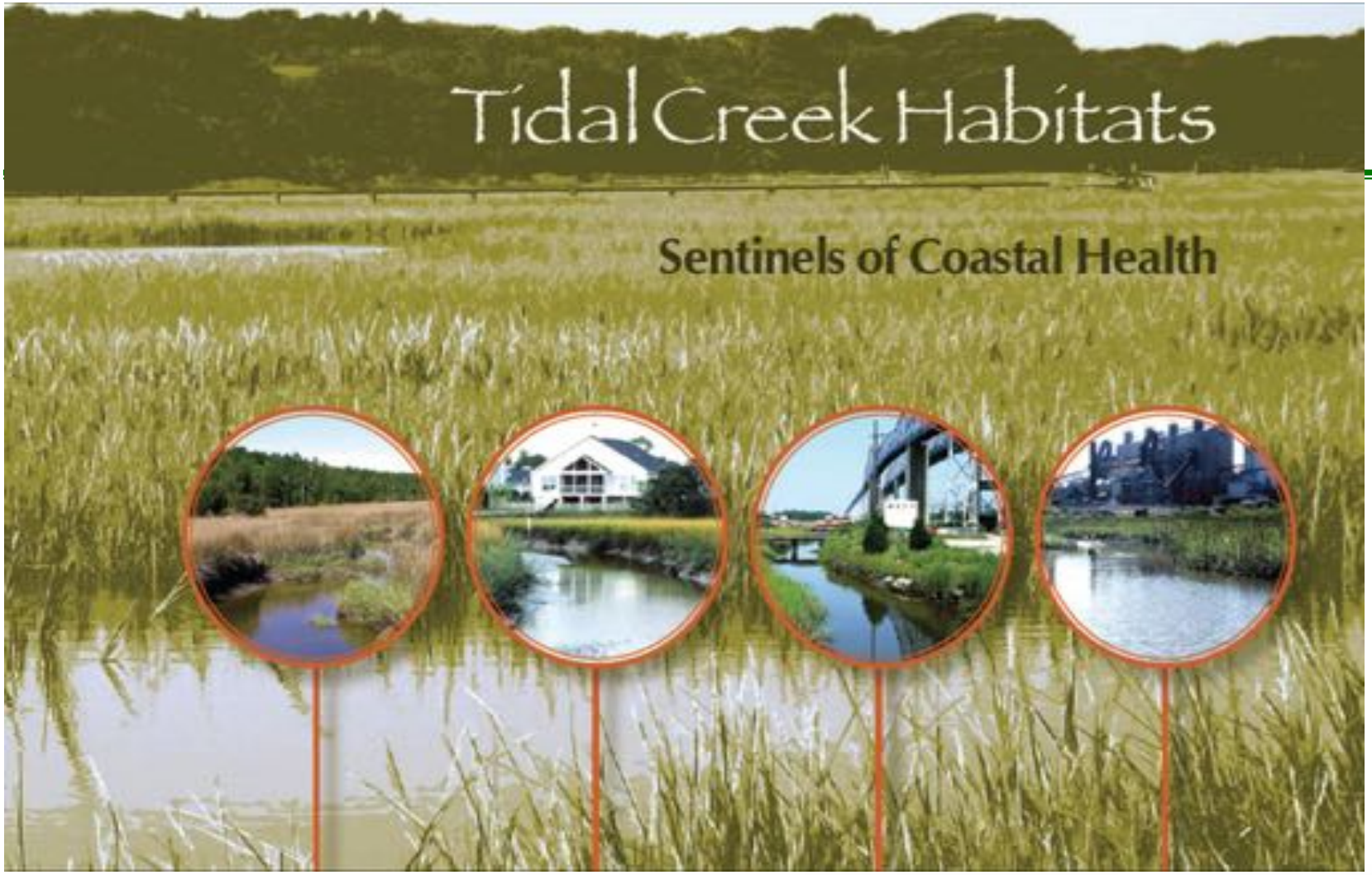
Biological Response
Societal Response
Coastal Development Activities
Physical-Chemical Changes
Living Resources Impacts
Health and Well Being
Increases population density
Alters land cover
Increases impervious surface
Alters water quality and hydrography
Increases microbial contamination
Increases chemical contamination
Reduces biological productivity
Alters food webs
Impairs animal health
Increases beach and shellfish bed closures
Increases flooding
Increases public health risk and economic impact
10-20% Impervious cover
20-30% Impervious cover
Being determined
Management Actions



http://www.scseagrant.org/pdf_files/tidal_creeks_booklet.pdf

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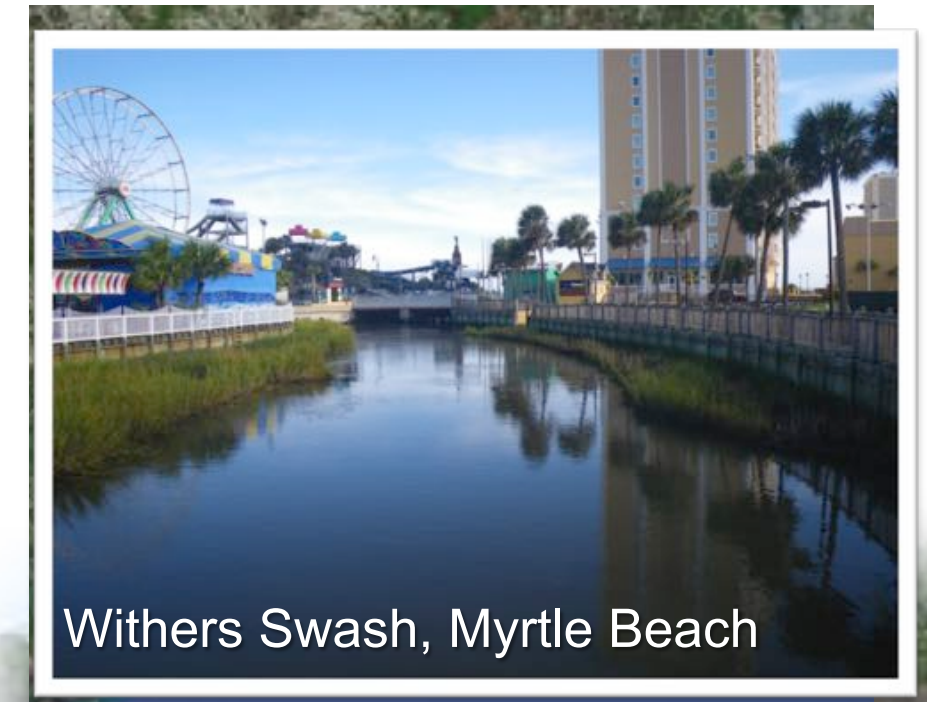
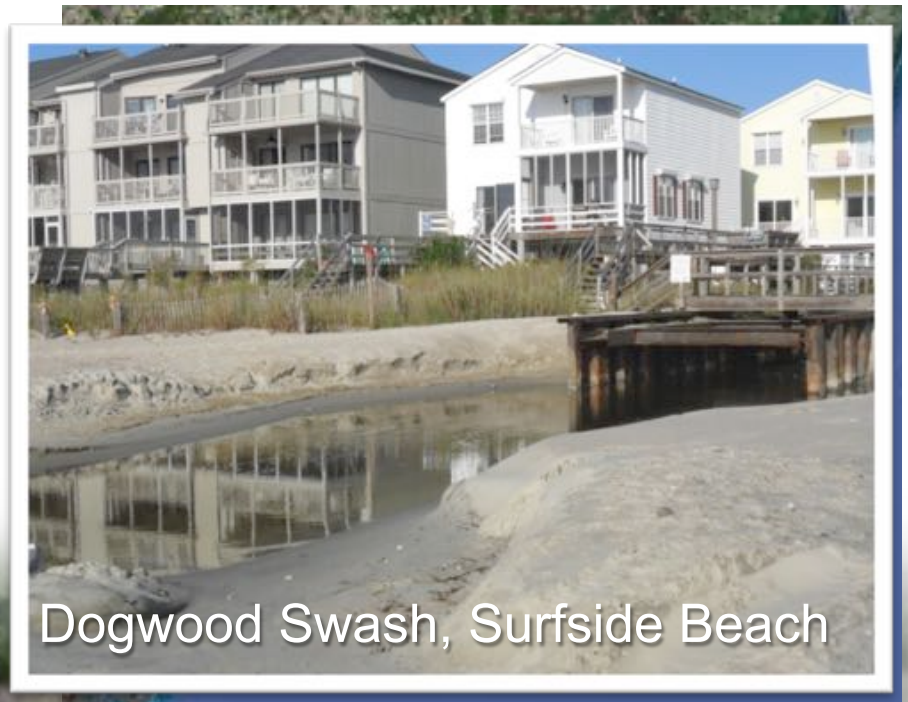
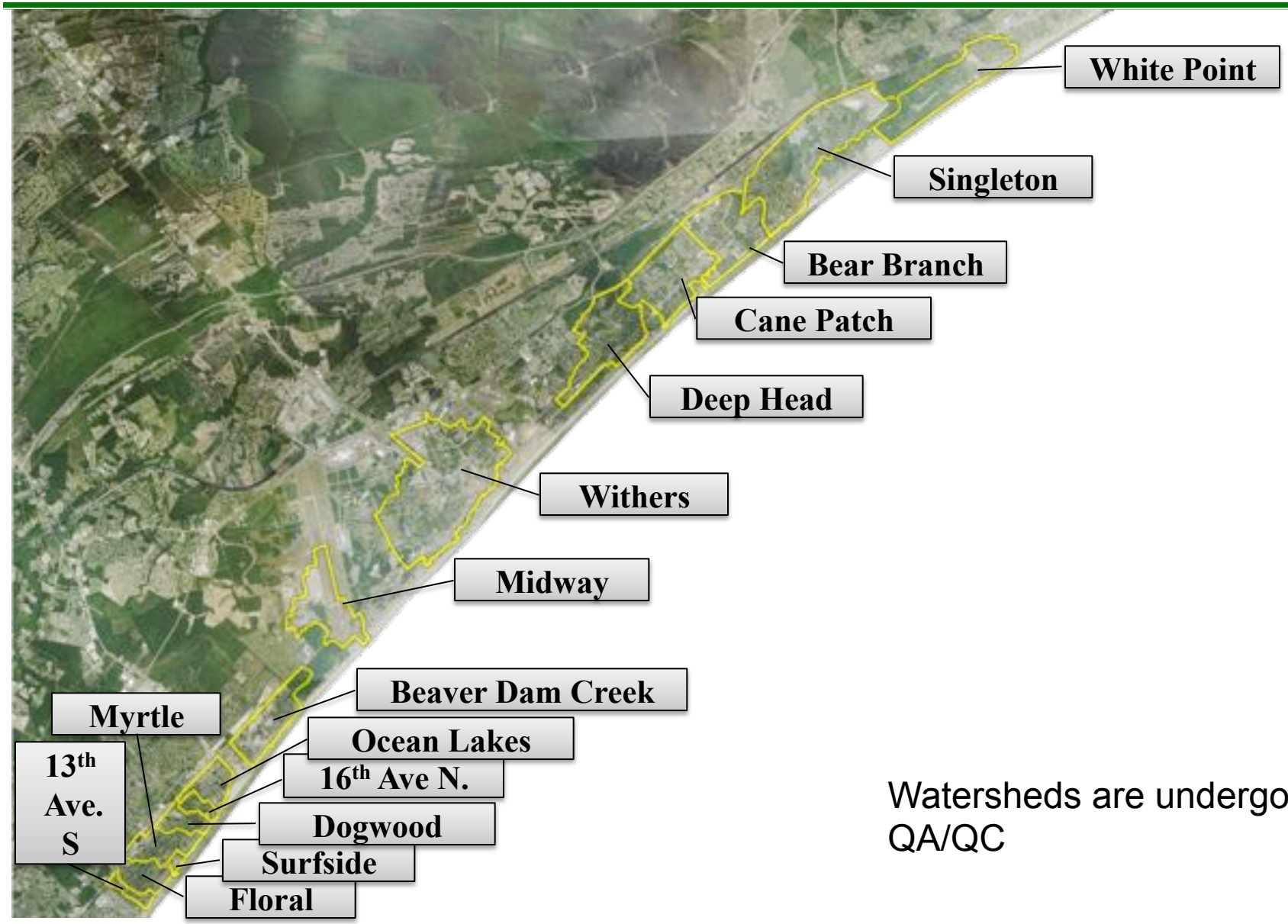
Leveraging a NOAA/UNH Science Collaborative Project – PI Erik Smith

Model the loading of *Enterococci* (indicator bacteria) from surface water discharges along the Grand Strand and relate the findings to the SCDHEC Beach Monitoring Program.


Withers Swash, Myrtle Beach


Dogwood Swash, Surfside Beach

Grand Strand Swashes



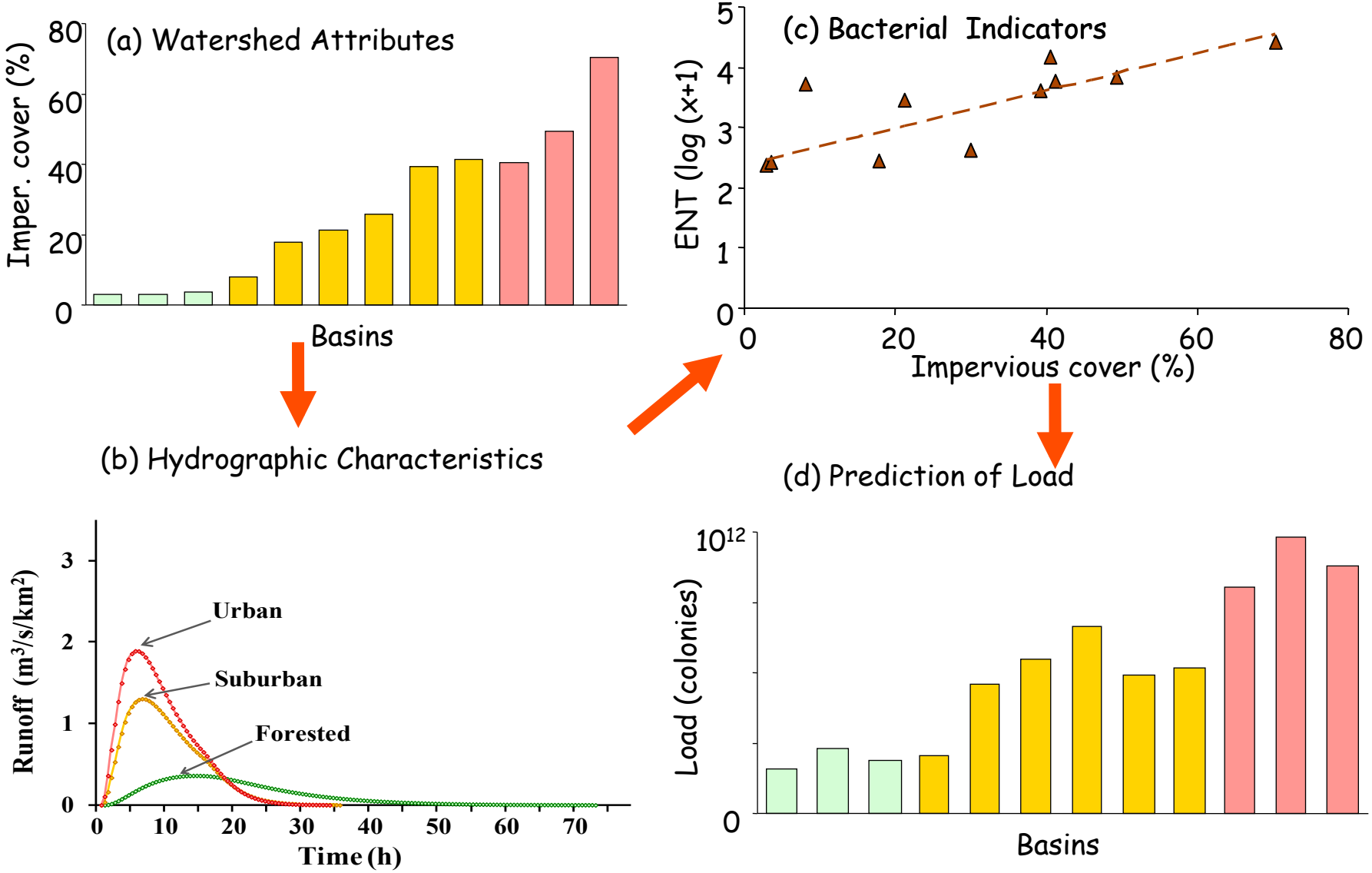
Watersheds are undergoing QA/QC

Dogwood Swash Watershed Tour

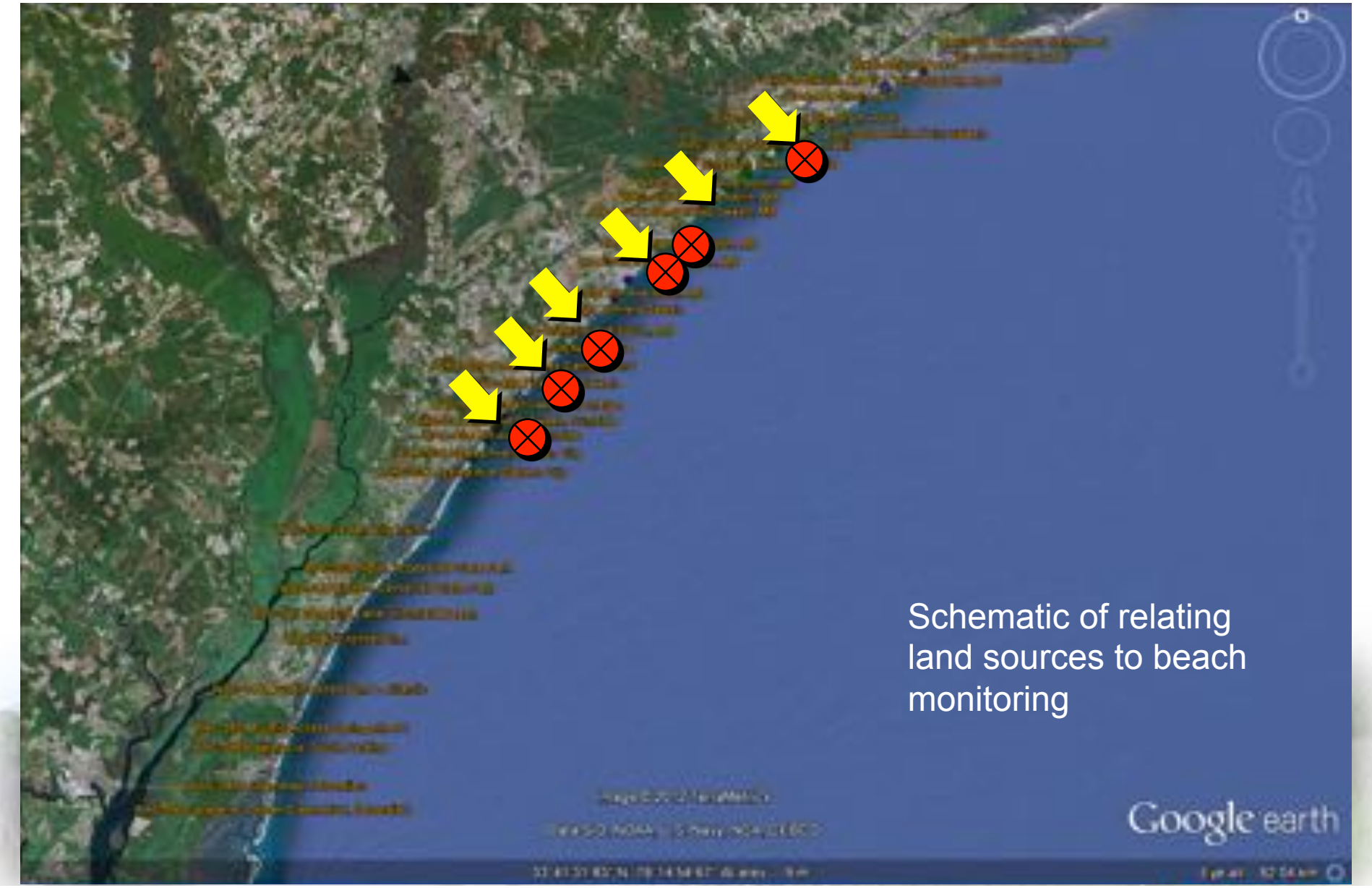
Loading

- Event Load = Concentration * Volume
  - Measure concentration in runoff and instream
    - 2 swashes – 6 runoff and 2 instream
    - Historical data – in runoff and instream
  - Model volume
    - Current land use
    - Potential to add climate and development change scenarios

Prediction Schematic



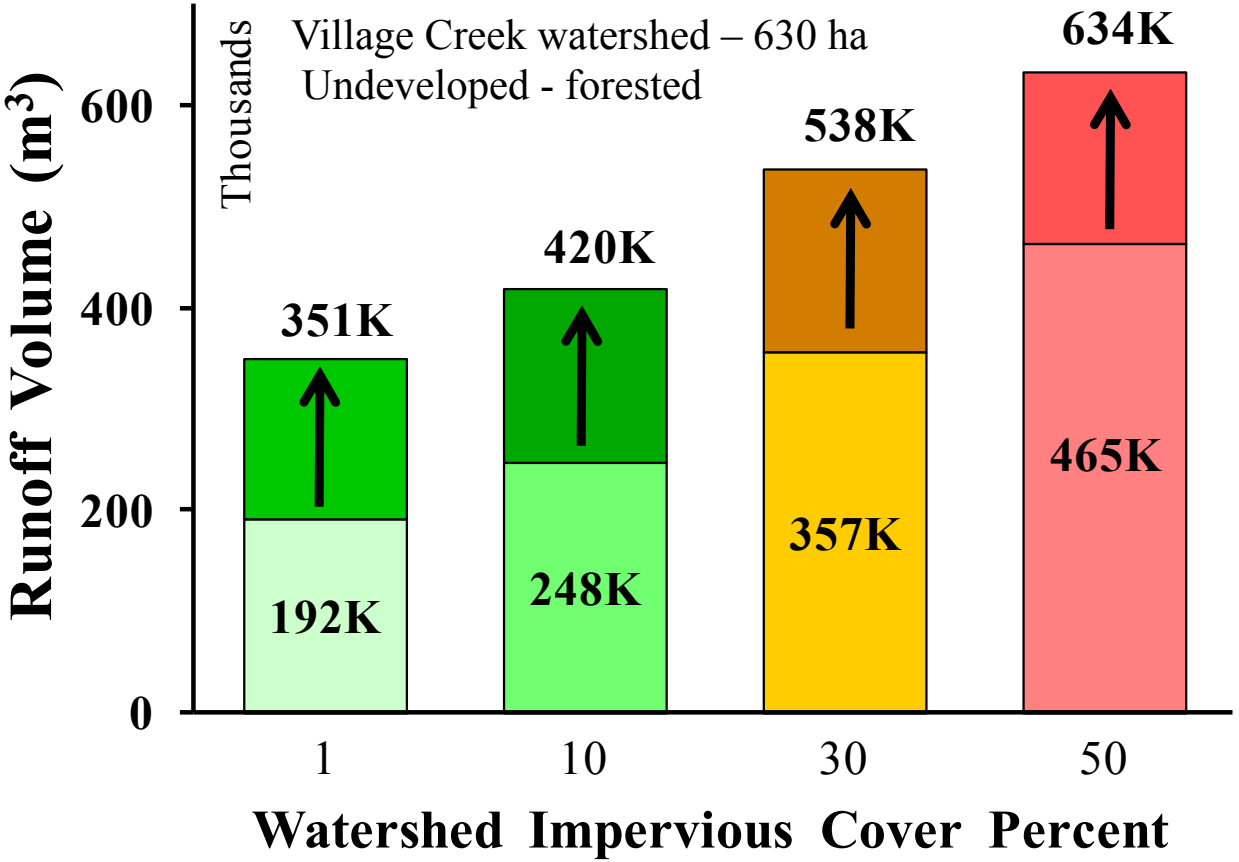
Relating Runoff to Beach Monitoring



Schematic of relating land sources to beach monitoring

Projecting impact of climate change

Modeled climate scenario for current and built development levels shows increases in runoff far exceeding precipitation increase



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Climate scenario– 12-hr 5.2-in storm event, semi-saturated runoff conditions

Interactions/Partnerships

- North Inlet-Winyah Bay NERR – USC
- Local Municipalities Planning and Stormwater
- SCDHEC – EQC (WQ, Beach Monitoring, Watershed Planning)
- SCDHEC – OCRM
- SCDNR

Needs for Addressing Problem

- Good climate scenarios
  - Precipitation patterns
  - Sea level rise and potential impacts on soil saturation
- Assumption that the concentration will stay the same which don't know
- Time to commit to collaboration

Questions

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