

Quantifying the effect of changes in land use and land cover on the carbon balance of coastal wetlands in the Mississippi River Delta

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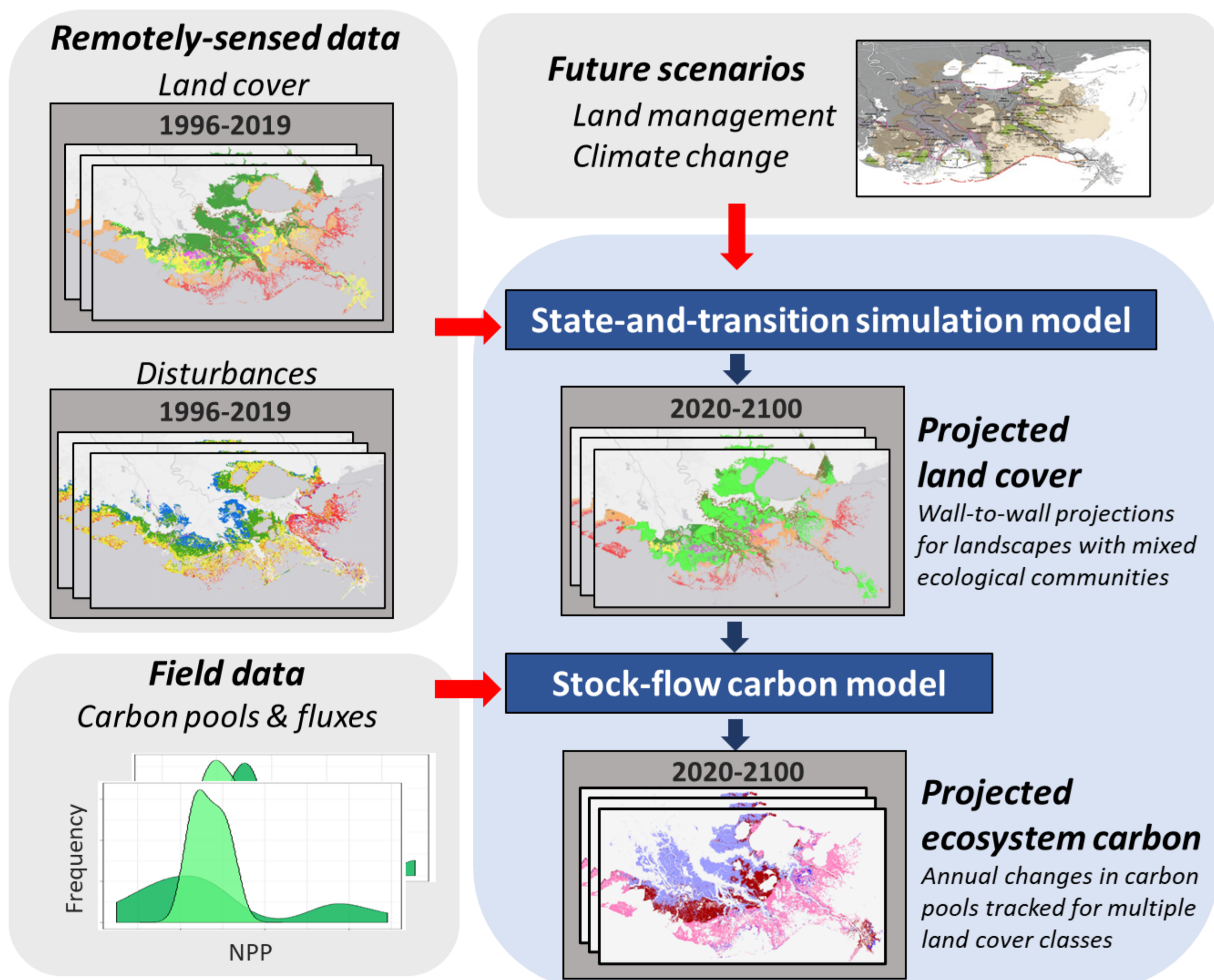
Modeling approach

Overview

Integrated models of land use/land cover (LULC) change and ecosystem carbon dynamics are required in order to **forecast** the effects of future **land management on greenhouse gas emissions**.

We have developed a **state-and-transition simulation modeling** approach that incorporates **continuous stocks and flows** to generate integrated projections of LULC change and ecosystem carbon.

For details, see *Daniel et al. (2018) Methods in Ecology & Evolution*.



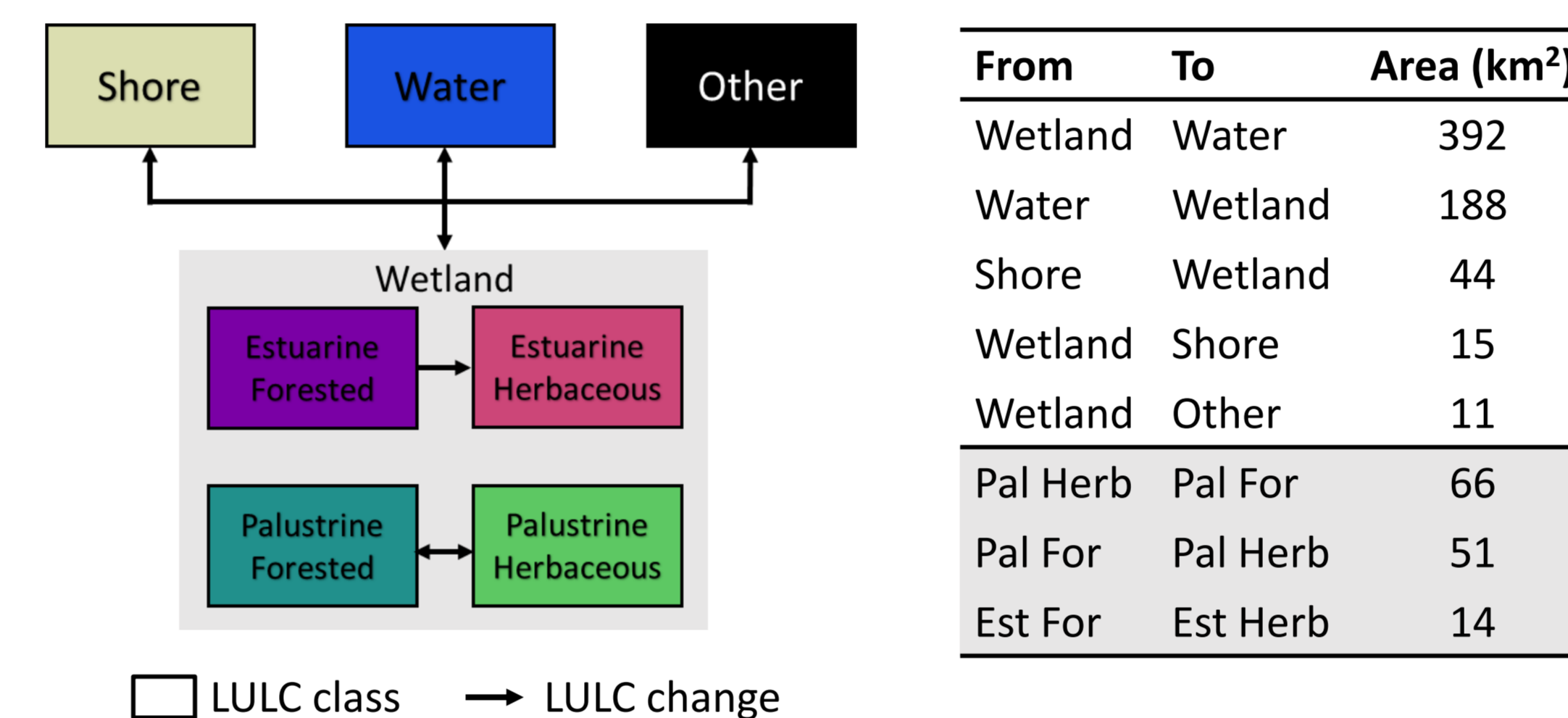
Mississippi River Delta model

Objective

Examine the impact of historical **LULC change** on the **ecosystem carbon balance** of tidal **wetlands**.

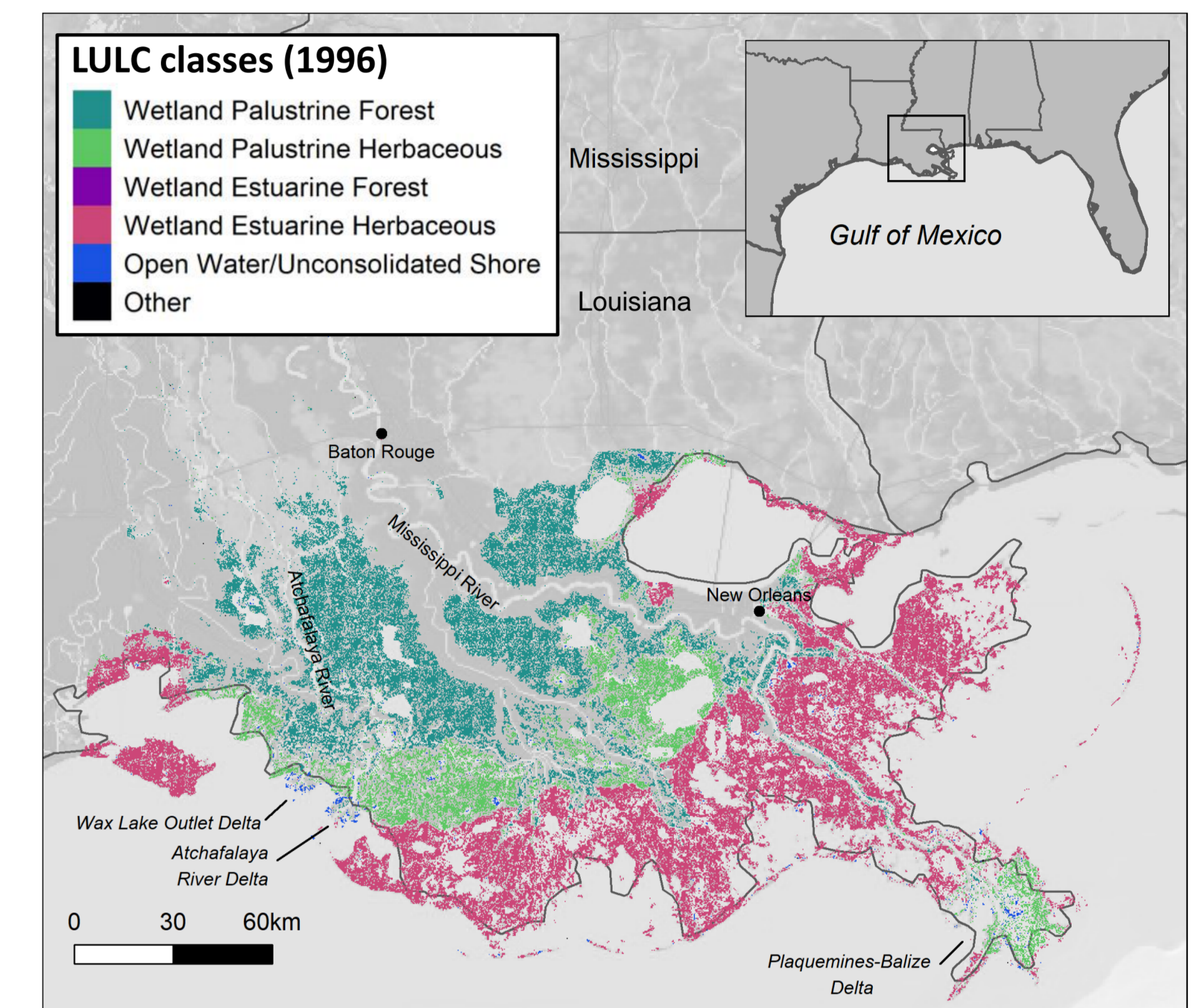
State-and-transition simulation model

LULC change between 1996 and 2016 based on NOAA C-CAP regional land cover and change data.



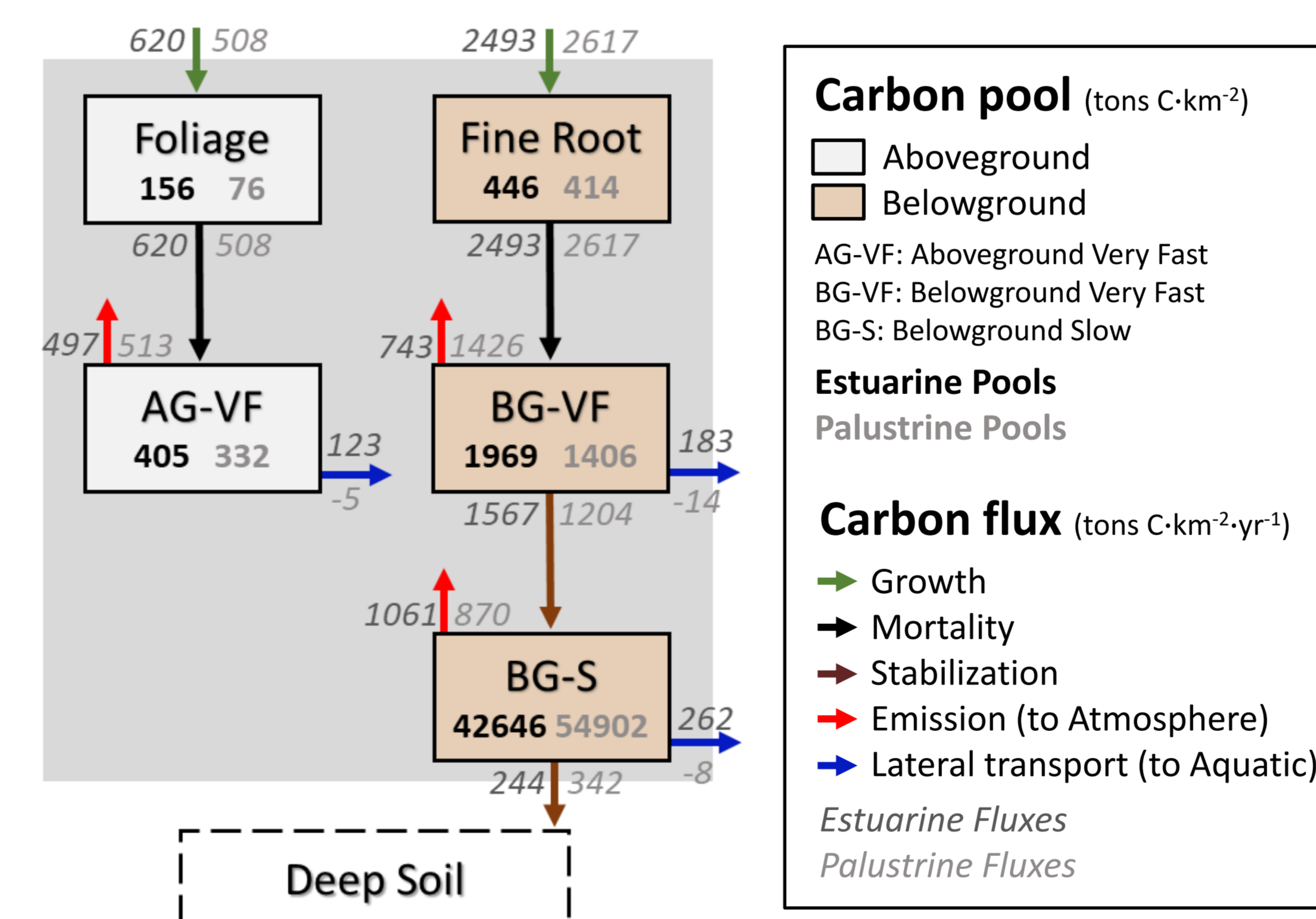
Study area

Tidal zone covers 12,794 km² representing **40% of CONUS coastal wetlands** (300m resolution).



Stock-flow carbon model

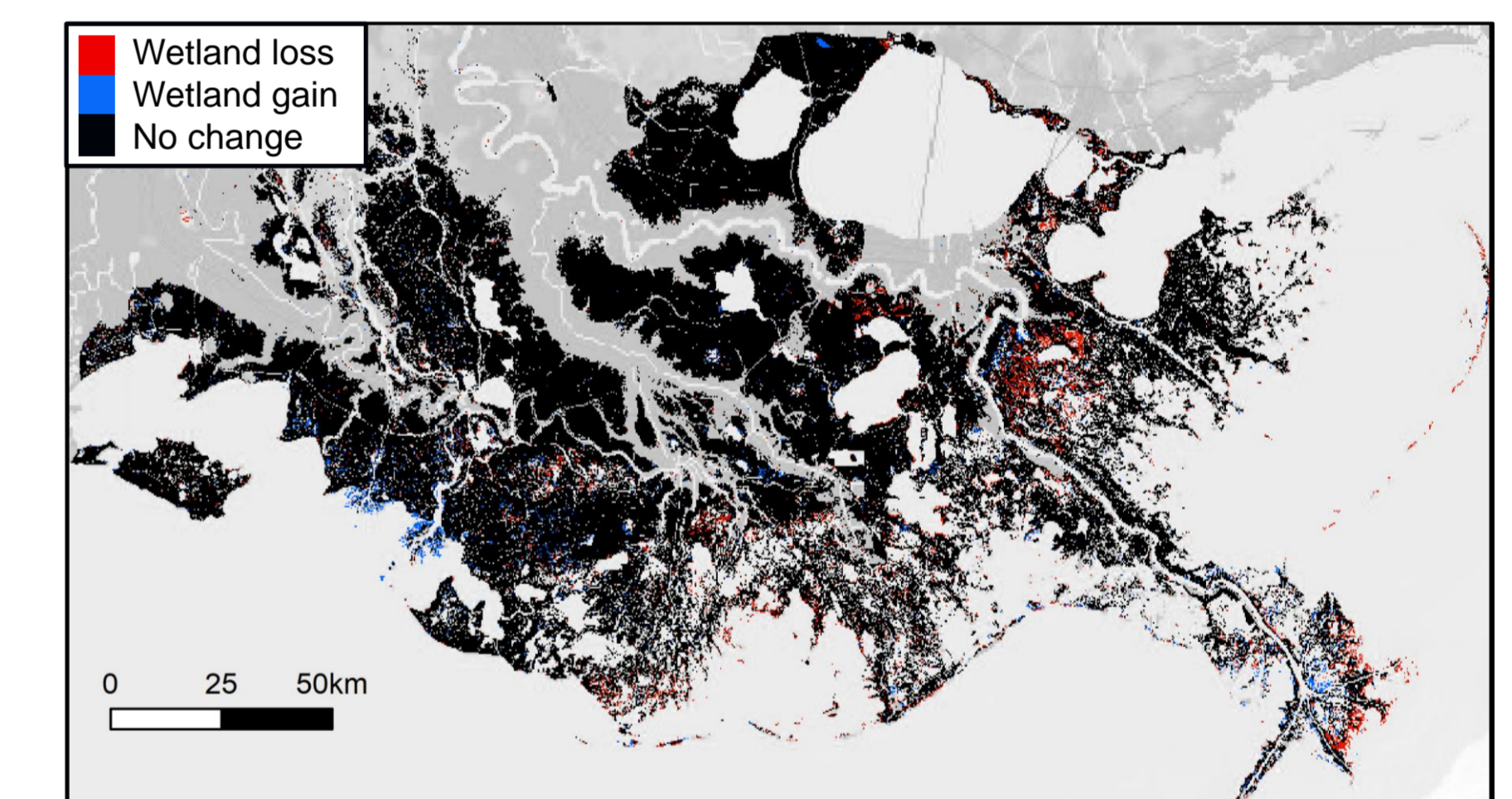
Carbon flux diagram for herbaceous wetlands based on USGS field measurements.



- Carbon flux diagram for **forested wetlands** (*not shown*) based on IPCC Tier 3 CBM-CFS3 carbon budget model.
- Some fluxes triggered by LULC changes.

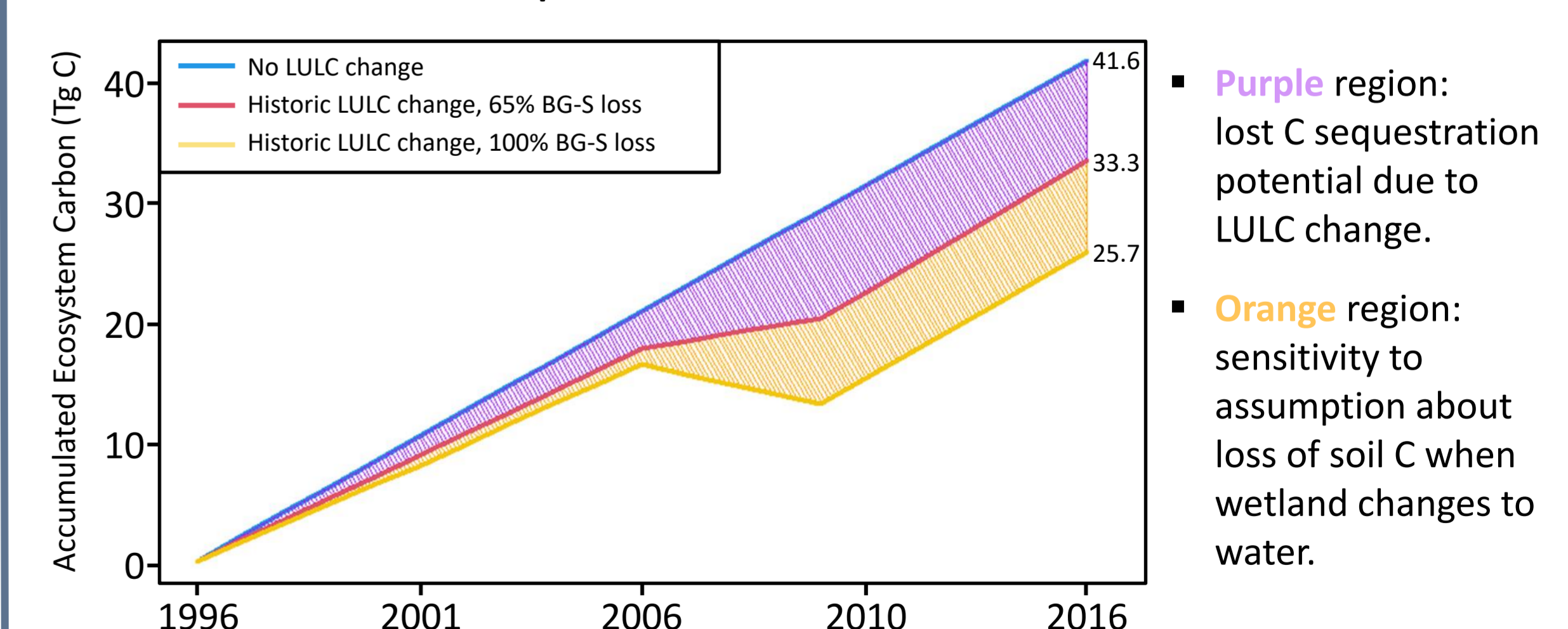
LULC change

Wetland area gains and losses between 1996 and 2016.



Ecosystem carbon change

Reduced carbon sequestration due to loss of tidal wetlands.



Tools

- SyncroSim** is a platform for geospatial forecasting.
- ST-Sim** is an open-source **SyncroSim** package for creating state-and-transition simulation models with stocks and flows.
- 30+ peer reviewed publications (apexrms.com/stsm).
- rsyncrosim** and **pysyncrosim** provide R and Python interfaces (syncrosim.com).

SyncroSim

Learn more

For additional information on our approach and tools, see: apexrms.com/landcarbon

Supported by: **USGS** science for a changing world and **APEX RMS** Apex Resource Management Solutions



Next steps

- Incorporate more field data to improve the **post-LULC change carbon dynamics**.
- Add **future scenarios** of climate, sea-level rise, and land management.
- Extend to **all tidal wetlands** in CONUS and increase resolution to 30m.