## Develop coastal wetland vegetation module

**1. Objective(s)**: Adapt an existing photosynthesis-based vegetation model developed for freshwater aquatic, dune, and crop vegetation communities for use in coastal wetlands

**2. Background and Problem Description:** Coastal wetlands are critical elements of natural infrastructure that provide a host of benefits including habitat provisioning, carbon sequestration, flood risk management, and recreation, among others. However, these ecosystems are increasingly subject to coastal changes including sea level change and development pressure. At the same time, increasing interest in the flood risk management function of coastal wetlands has led to increased efforts to restore and in some cases, expand the footprint of coastal wetlands. However, the persistence and evolution of coastal wetlands, especially wetlands that are heavily manipulated, is not well understood and few tools exist to holistically predict coastal wetland response to predicted environmental changes such as rising sea levels and increases in salinity levels. Rises in global temperatures may affect the historical ranges of marsh and mangrove species. Additionally, many potential interventions designed to address coastal wetland degradation may affect species composition, allowing invasive species such as *Phragmites australis* in the eastern US and *Spartina alterniflora* in the western US to outcompete native species in the short term. Adapting proven vegetation models to coastal wetland ecosystems will allow USACE to better understand future with and without project conditions and monitoring and maintenance requirements for proposed coastal wetland projects associated not only with ecosystem restoration studies but also flood and coastal storm risk management studies and projects utilizing navigational dredged material as a sediment resource for coastal wetlands.

**3. Project Delivery Team:** Piercy, Swannack, Herman, Russ, Tritinger, M. Bryant

**4. Value:** Improved modeling of coastal wetland systems will allow USACE to better manage coastal wetlands, which will improve coastal wetland restoration, enable their use as part coastal and flood risk management, and facilitate sustainable navigational dredged material management in and around coastal wetland systems.

**5. Approach:** To develop a deliver a coastal wetland vegetation module, the following tasks are required:

* Task 1: Literature search and gap analysis – Determine what relevant environmental drivers and processes are required to incorporate into existing vegetation module. Determine controlling factors driving completion between common native and invasive coastal wetland species for both east, Gulf, and west coast wetlands. Determine what additional data requirements to adapt existing model. Identify outstanding data needs and requirements for Task 2.
* Task 2: Targeted data collection – Collect data required to develop relationships between coastal wetland production, environmental drivers, and interspecies competition
* Task 3: Adapt existing coastal wetland accretion module – Incorporate existing coastal wetland accretion algorithms into photosynthesis vegetation model
* Task 4: Develop coastal wetland environmental driver modules – Adapt existing disturbance and mortality modules in the vegetation model for relevant coastal wetland environmental drivers
* Task 5: Develop coastal wetland species competition modules – Adapt existing freshwater SAV competition modules for coastal wetland species to include completion from invasive wetland species such as *Phragmites austalis* and *Spartina alterniflora* well as other endemic and native species.
* Task 6: Model testing – Apply model to a selected set of coastal wetland sites with history of data collection and coastal change to calibrate and validate model
* Task 7: Case study – Apply model results to existing CSRM or navigation operations site to determine efficacy in determining maintenance requirements for wetlands. Possible locations include New Jersey back bays, Texas coast, Mobile Harbor, or Jamaica Bay.

**5. Milestones:**

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| Task | FY20 | | | | FY21 | | | | FY22 | | | | FY23 | | | |
| Literature search and gap analysis |  | X | X | X | X |  |  |  |  |  |  |  |  |  |  |  |
| Targeted data collection |  |  |  |  | X | X | X | X | X | X |  |  |  |  |  |  |
| Coastal wetland accretion module |  |  | X | X | X | X | X | X |  |  |  |  |  |  |  |  |
| Coastal wetland environmental driver module |  |  |  |  | X | X | X | X | X | X | X |  |  |  |  |  |
| Coastal wetland species competition module |  |  |  |  | X | X | X | X | X | X | X | X |  |  |  |  |
| Model testing |  |  |  |  |  |  |  |  | X | X | X | X | X | X |  |  |
| Case study development |  |  |  |  |  |  |  |  |  |  | X | X | X | X |  |  |

**6. Funding:** Year 1: $145K

**7. Products:**

* TN: literature review on environmental change processes for coastal wetlands relevant for management (FY 20-21) – will be delayed into Q1 FY21 due to COVID-19 hiring delay
* JA: data collection and analysis report (exact topics will depend on gap analysis results) (expected Q2 FY22)
* Model: Coastal wetland accretion module, coastal wetland environmental driver module, and coastal wetland species competition module (expected Q4 FY22)
* JA: Coastal wetland vegetation model development (expected Q4 FY22)
* JA: Application of coastal wetland model to proposed wetland NNBF site with focus on realistic application to future conditions (expected Q2 FY23)

**8. Potential COVID-19 impacts:**

Task1 is delayed by 1 quarter due to contractor hiring delays associated with COVID19. Task 2 has been deferred to FY21 due to likely travel restrictions and resulting backlog of field work caused by COVID19.