**Evaluation and Modification of Vegetation Growth Model for Application in Riverine Systems**

**Project Management Plan**

**April 15, 2020**

**Revised: November 8, 2020**

**1. Objective(s)**: The objectives of this project is to assist in the evaluation and modification of a process-based vegetation growth model using data collected via experimental mesocosms. Controlled experiments will be used to measure growth rates of various native riverine plant species under different environmental stressors (duration of inundation and nutrients) and under different competition scenarios (e.g., native vs. invasive species).

**2. Background Description**: Planning and designing USACE water resource projects requires understanding future conditions that may impact the sustainability of projects. Projects using native plant species in mitigation, ecosystem restoration or engineering with nature need to account for how future conditions will impact the persistence of plant species selected or expected to volunteer into project sites. Future changes to climatic conditions for inland riverine systems are expected to include more frequent and longer flood events, increased nutrient input from agricultural and industrial activities and continuing competition from invasive plant species.

Being able to better predict how future climatic conditions will impact riverine plant communities and being able to plan and design with appropriate native plant species that are expected to be more resilient over time is an important aspect of reducing uncertainty in project outcomes. In addition, more robust predictions of plant growth under invasive species pressures will lead to more efficient choices of native plant species that can effectively compete with invasive species.

**3. Value-Added**: This project will increase our understanding of how native riverine plant species will respond to changing climatic conditions, increasing the likelihood of Districts being able to plan and design with resilient native plant species. The ability to include more resilient species will ultimately reduce the cost of operations and maintenance, thus producing more cost effective projects and a cost savings to the nation.

**3. Project Delivery Team**: Brook Herman, PI (EL), Karen Glennemeier (Private Consultant), Todd Swannack (EL), Gary Ervin (MSU)

**4. Approach**: This project will provide conceptual system models and data to evaluate and modify a vegetation growth model by 1) designing and beta testing a mesocosm study that incorporates changes to hydrology, nutrients and competition and can accomplish non-destructive biomass measurements of above- and below-ground plant structures (Figure 1) , 2) identifying native and non-native plant species to be used in experiment in different combinations, 3) collecting data on vegetative growth under different environmental and competitive scenarios, and 4) providing conceptual and quantification of modules for nutrient uptake, inundation stress and competition effects in model.

**5. Milestones**:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | FY20 |  |  |  |  |  |
| Tasks | Apr | May | Jun | Jul | Aug | Sep |
| CESU agreement |  |  |  |  |  |  |
| Mesocosm design/test |  |  |  |  |  |  |
| Tech Note - study design |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  | FY21 |  |  |  |  |  |
| Tasks | Oct | Nov | Dec | Jan | Feb | Mar |
| 1st yr experiments |  |  |  |  |  |  |
| Conference - study design |  |  |  |  |  |  |
| 2nd yr experiments |  |  |  |  |  |  |
| JA - experimental results |  |  |  |  |  |  |
| TR – Modules’ concept/quantification |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  | FY21 |  |  |  |  |  |
| Tasks | Apr | May | Jun | Jul | Aug | Sep |
| 1st yr experiments |  |  |  |  |  |  |
| 2nd yr experiments |  |  |  |  |  |  |
| JA - experimental results |  |  |  |  |  |  |
| TR - Modules’ concept/quantification |  |  |  |  |  |  |

FY22: apply GenVeg to riverine wetland environment...

**6. Funding**: 100k (FY20), 100k (FY21) ?? (FY22)

**7.a. Products FY20**:

a. Design and beta testing of flume mesocosm systems (Figure 1).

b. Design of non-destructive plant growth data collection.

c. Tech Note: Designing mesocosm experiments for parameter estimation for systems-scale ecological models

7.b. Products outyears

a. Conference presentation – results of study design and testing

b. JA: results of 2 yrs of experimental data collection

c. TR: results of conceptualization and quantification of nutrient uptake, hydrological stress and competition effects modules to be included as components of GenVeg.

d. JA: Application of GenVeg to riverine wetland environment using results from mesocosm tests to parameterize model

