Application Due December 8, 2014

Coastal Science Assistantship Program Application

(Enter requested information in the gray boxes; they will expand as is necessary)

Name: Jay X. Wang

Address: 600 Dan Reneau Dr., Ruston, LA 71272

Institution: Louisiana Tech University

E-mail address: xwang@latech.edu

Student's graduate degree major (please attach degree requirements): Civil Engineering

Anticipated date of acceptance of student: June 01, 2015

Anticipated date of graduation: May 31, 2018

****Note* – Louisiana Sea Grant requires that overhead (F and A) charges be waived for this funding.**

Proposal narrative

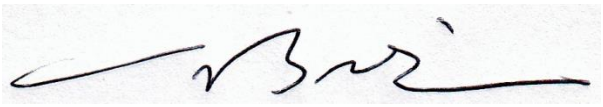
- Provide a brief (two page maximum) description of the research that would be conducted as part of the recruit's Master's degree at your institution. This does not have to be exact as we anticipate the student will play a role in developing specific research objectives as part of this learning experience. Explain how this research is of interest to the Coastal Protection and Restoration Authority (CPRA) and how it fits within the 2012 CPRA Master Plan (see: THE MASTER PLAN - Coastal Protection and Restoration Authority of Louisiana).

- Outline the anticipated curriculum for the student including the classes that the student might take.

- Provide a description of current or anticipated funding sources that will be applied to support the research activities proposed for your student. This must include full disclosure of any employment, agency or other contractual and/or funding agreements to which the applicant, or anyone else participating in their research, are bound or intend to become bound involving any party to the litigation pending before the United States District Court for the Eastern District of Louisiana captioned "In re: Oil Spill by the Oil Rig 'Deepwater Horizon' in the Gulf of Mexico on April 20, 2010", MDL No. 2179 ("Oil Spill Litigation"). Applicants must establish that no conflict of interest exists regarding any existing or anticipated contractual and/or funding agreements and the receipt of research funding from CPRA under the CSAP program. The applicants selected for funding also agree to make CPRA aware of, and obtain CPRA's prior written approval, before (i) accepting any funds from any party to the Oil Spill Litigation, (ii) providing any services or conducting any research that is in any way oil spill related, or (iii) becoming involved in any other work, research and/or projects that could potentially affect the State of Louisiana's claim for natural resource damages in the Oil Spill Litigation[1].

[1] The following is a list of the parties to the Oil Spill Litigation to which conflicts may apply for purposes of a student's receipt of CSAP funding: (i) the Defendants include: BP Exploration & Production, Inc., BP Corporation North America, Inc., BP America, Inc., BP America Production

Note: A condition of this award is completion of an internship of 240 hours at a CPRA office during the period of the CSAP funding.



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Submit Applications to:
CPRA Coastal Science Assistantship Program
C/O Louisiana Sea Grant College Program
232 Sea Grant Building
Louisiana State University
Baton Rouge, La 70803-7507
Or via email to Katie Lea at klea@lsu.edu

Company, BP p.l.c., Anadarko Exploration & Production LP, Anadarko Petroleum Corporation, Transocean Holdings LLC, Triton Asset Leasing GmbH, Transocean Deepwater, Inc., Transocean Offshore Deepwater Drilling, Inc., Transocean Ltd., Halliburton Energy Services, Inc., and (ii) the non-Louisiana plaintiffs include: the United States of America (including the following federal agencies: the Department of Justice; the Department of Commerce National Oceanic and Atmospheric Administration; the Department of Interior Fish and Wildlife Service, National Park Service, Bureau of Land Management; the Environmental and Protection Agency; the Department of Agriculture; and the Department of Defense), the Alabama Department of Conservation and Natural Resources, the Geological Survey of Alabama, the Mississippi Department of Environmental Quality, the Florida Department of Environmental Protection, the Florida Fish and Wildlife Conservation Commission, the Texas Parks and Wildlife Department, the Texas General Land Office, the Texas Commission on Environmental Quality.

Coastal Science Assistantship Program Application

Name: Jay X. Wang

Soil binding ability of natural vegetation *Spartina alterniflora* established on dredged soils in Louisiana coastal area

Introduction

Coastal wetland loss in Louisiana is a very complex issue. Major natural problems in the wetland protection and restoration activities include: low survival rate of the vegetative plantings, severe shoreline erosions, and large settlement and potential failure of the shoreline protection structures, etc. The Coastal Protection and Restoration Authority of Louisiana (CPRA) has been implementing coastal wetland restoration projects by finding an effective way from biological, ecological and geo-sciences through practices in coastal and geotechnical engineering, as human efforts against the natural process of wetland loss. The proposed research is to deal with the issues in the on-going CPRA projects. It will focus on the evaluation of soil binding ability of the native vegetation and development of an appropriate erosion model. Its success will reduce uncertainty and advance the ability to accurately assess coastal protection and restoration alternatives.

Wetland in Gulf area is subjected to the continuous erosion force due to the tidal flow and wave action. The shearing resistance of soils and the wave energy diffusion effect of natural vegetation, such as *Spartina alterniflora* (smooth cordgrass) and *Avicennia germinans* (black mangrove), keep the sheer balance against nature's erosion force. Salt marsh *Spartina alterniflora* flourishing on Louisiana coastline, plays a very important role for shoreline protection and tidal marsh restoration in southern Louisiana because of its aggressive spreading habit and tolerance to salinity (Louisiana Wetland Loss Panel 1987, Mendelssohn et al. 2003, Ryan 2003**)**.

How this research is of interest to the Coastal Protection and Restoration Authority (CPRA) and how it fits within the 2012 CPRA Master Plan?

In the proposed research, a new sustainability analysis tool would be developed for the marsh creation projects that are being operated under the 2012 CPRA Master Plan. The research might be integrated in the CPRA-run project "Sabine Refuge Marsh Creation (CS-28)". Field investigation and vegetated soil sampling work will be guided by officials at CPRA/Office of Coastal Protection and Restoration in the completed cycle 1 three 3, located in the Calcasieu- Sabine Basin on the Chenier Plain.

Objectives

The proposed research is to formulate the anti-erosion mechanism of vegetated soils, to develop an erosion prediction methodology to effectively analyze the shoreline protection structures by accurately and reliably considering the interaction between wave, vegetation, and dredged soils. The suggested research is of fundamental and original nature, incorporating biological, ecological and geo-sciences in the coastal and geotechnical engineering. The research might lead to important findings in predicting the erosion risks of vegetated soils, and evaluating the sustainability of the marsh creation projects.

The proposed research will help adaptively manage the on-going and in-planning coastal restoration projects to ensure their successes. The enhanced ability to better interpret the erosion and soil-binding mechanism will reduce uncertainty and advance the quantitative analysis ability to assess the sustainability of the coastal protection and restoration alternatives.

Approaches

The proposed research will deal with the coastal wetland restoration research ecologically and mechanically. It will be integrated in the CPRA-run project **"Operations, Maintenance, and Monitoring of Sabine Refuge Marsh Creation (CS-28)"** (Miller 2014). Field testing and lab testing will

be conducted. Measurements of biomasses above and below ground, bulk densities, and aggregate stabilities, etc., of the rooted soils will be performed. The research will focus on the study of binding ability and anti-erosion mechanism of the native vegetation established on the dredged soils and development of an appropriate erosion prediction model. The research activities are outlined below:

- Perform field investigation, in-situ tests (vane shear and penetrometer tests) and laboratory tests to measure strength and deformation properties of the rooted vs. plain soils, and collect data for development of the erosion prediction model. Our goal is to establish a relation between shoreline erosion and contribution of different types of vegetation. Available project data on erosion rate at different times will help us study the contribution of existing vegetation of that particular project.
- Measure below-ground biomasses at sites. The biomasses will be measured with special attention on the live roots and rhizome biomass. Below-ground plant tissues at different depths will be sampled. Field observation of growth performance of vegetation will provide records of mean grass height, root diameter, root depth and below-ground root biomass, respectively. Cylindrical soil cores using a soil coring machine will be taken from the field to determine the root length density and soil water content. The root length density in segmented soils will be measured using a leaf area instrument, which is an image analyzer for a specific soil volume. Root volume will be measured for selected plants.
- Perform soil stability analysis by taking wave and current actions as washing forces to study the erosion potentials of the rooted soils. The developed Anchor Reinforcement Method will be used to take those individual roots as independent anchor reinforcements. Soil stability analyses are to be performed to evaluate the grass soil-binding capability following the Smeared Method (SM) and the Anchor Reinforcement Method (ARM).
- Develop soil erosion prediction model -- the erodibility index method. Soil erosion on the shoreline is basically the migration of soil particles due to wave action. A rational correlation is to establish between rate of energy dissipation of flowing water and an erodibility classification of the soils. An erodibility index K_h is defined to characterize the ability of rooted soils' erosion resistance. A critical threshold to initiate soil erosion can be predicted for any given set of hydraulic conditions. Following Annandale (1995, 2006), the erodibility index K is employed as a measure of the shoreline soil resistance against erosion. In the proposed research, various in-situ measurements and field vane shear or penetrometer tests will be performed to get the indices of the constituent parameters by following Kristen (1982, 1988).

Deliverable

After completion of the project, Deliverables include a methodology to predict erosions of rooted soils in the on-going or completed marsh creation projects, conference presentations, peer-reviewed journal articles, and datasets of field and laboratory testing results available to scientific communities. In the course of research, data will be created through laboratory and in-situ field tests, and computational analyses. The gathered data will be entered into electronic Excel and MS Word files along with all relevant notes recorded in the accompanying notebooks. The electronic data will be preserved in multiple on-site backups in the form of DVDs and external hard drive storage, and made deliverable to CPRA.

Expertise

Dr. Wang is a Louisiana registered civil engineer with 25-year extensive experiences in soils, slope stability and foundation engineering. Since year 2010, Dr. Wang has been working on the collaborative research with CPRA.

Current and Pending Support

Project Title	**Development of an Innovative Model for Analyzing Current (Wave)-Dike-Vegetated Soil Interaction and its Application in Louisiana Coastal Restoration Projects**
Funding Agency	Louisiana Board of Regents
Investigator's Role (PI, co-PI, Investigator, etc.)	PI
Funding Period	10/01/2014 - 09/30/2015
Total Direct & Indirect Costs	$10,000.00
Support Type	Current

Project Title	**Erosion resistance evaluation of the dredged soils on which *Spartina alterniflora* was established by performing field vane shear tests**
Funding Agency	Louisiana Sea grant – UROP
Investigator's Role (PI, co-PI, Investigator, etc.)	PI
Funding Period	03/01/2015 - 12/31/2015
Total Direct & Indirect Costs	$2,500
Support Type	Pending

The anticipated curriculum for the Master's graduate student

Activities	Academic year 2015-18 (starting from June 01, 2015)											
	Quarters											
	1	2	3	4	5	6	7	8	9	10	11	12
Make research preparation: literature review	■											
Contact the CPRA for information for the on-going projects such as Sabine Refuge Marsh Creation (state project CS-28), etc.		■	■	■								
Take classes.		■	■	■								
Make detailed research and 3-week internship plans, and send it over to the CPRA office for review, suggestion and comment. Improve the research plan after feedback is obtained.				■								
Perform internship for three weeks advised by the CPRA. If possible, perform field observation and soil field testing, with attention focused on the soil-binding, anti-erosion and sediment accretion capabilities of native vegetation such as *Spartina alterniflora* and *Aviccenia germinans*.					■							
Take classes. Setup lab equipment for lab experiment, and perform fundamental soil tests for geotechnical properties of hydraulically dredged sediments used for march creation.						■	■					
Perform numerical modeling by developing a model to analyze the anti-erosion capacity of dredged soils with *Spartina alterniflora* established on.							■	■	■	■	■	
Evaluate the erosion risks of the rooted soils and the effectiveness of the native marsh creation project based on the research achievement.											■	
Prepare and submit the M.S. thesis to the CPRA, and give final presentation. Write and submit one journal and/or conference paper; Prepare one or two proposals to submit to NSF and NOAA, etc.											■	■

Courses the Master's student might take

Course Number	Course Title	Department offered	College
BISC 313	Ecology	School of Biological Sciences	Applied and Natural Science
CVEN 440	Foundation Engineering	Civil Engineering	Engineering and Science
CVEN 510	Advanced Soil Mechanics	Civil Engineering	Engineering and Science
ENGR 541	Mathematical Methods for Engineering	Mathematics	Engineering and Science
FOR 306	Forest Measurement (I)	School of Forestry	Applied and Natural Science
FOR 428	Wetland Ecology	School of Forestry	Applied and Natural Science
FOR 528	Advanced Wetland Ecology	School of Forestry	Applied and Natural Science
MEMT 508	Finite Element Method	Civil/Mechanical Engineering	Engineering and Science
Note: There will be three members in the academic committee for the Master's student. One of the members will be selected from School of Forestry in College of Applied and Natural Science.			

Master of Science in Engineering

Degree Codes: ES MSE ENGR **Concentration:** Civil Engineering **Contact:** Nazimuddin Wasiuddin

SCH Requirements: Thesis option: 30 SCH; Practicum option: 36 SCH; Coursework-only option: 36 SCH
Thesis Option: Research & Thesis SCH toward degree: 6
Practicum Option: Practicum SCH toward degree: 3
Coursework-only Option: As described below.

Course Category	Number	Course Name	SCH	SCH needed
Core Courses	*Take **ENGR 501** and another course from this list*			**6**
	ENGR 501	Engineering Research Methods	3	
	ENGR 541	Mathematical Methods for Engineering	3	
	ENGR 592	Engineering Computational Methods	3	
Concentration Courses	*Five of the following courses (Civil Engineering + Engineering Mechanics) are required for students earning a concentration in Civil Engineering with the practicum or coursework-only option. Four courses are required for the thesis option.*			
	Civil Engineering			**12~15**
	CVEN 427	Design of Highway Pavements	3	
	CVEN 440	Foundation Engineering	3	
	CVEN 459	Introduction to Infrastructure Management	3	
	CVEN 503	Urban Hydrosystems Engineering	3	
	CVEN 504	Pollution Control and Residuals Management	3	
	CVEN 505	Buried Structures-Rehabilitation and Management	3	
	CVEN 506	Above-ground Structures: Assessment and Rehabilitation	3	
	CVEN 510	Advanced Soil Mechanics	3	
	CVEN 514	Bituminous Mixture Design	3	
	CVEN 515	Advanced Cementitious Materials	3	
	CVEN 557$^{\Delta}$	Introduction to Non-Destructive Testing Methods for Civil Engineers	3	
	CVEN 580	Trenchless Technology	3	
	Engineering Mechanics			
	MEMT 577	Advanced Mechanics of Materials	3	
	MEMT 588	Inelastic Deformation	3	

Δ It would be changed to an IPC-approved course number.

Beyond this point, follow one of the three options below. A Plan of Study showing the option selected is due <u>at the end of the first quarter of enrollment</u>. Approval of the graduate advisor will be required to switch options or advisors at a later date.

COURSEWORK-ONLY OPTION

Electives	*3 courses approved by the Advisory Committee**	9
MATH/STAT	One MATH and one STAT course	6
	TOTAL	**36**

THESIS OPTION				**PRACTICUM OPTION**		
Course Category	**Number**	**Course Name**	SCH	**Number**	**Course Name**	SCH
Other courses	*2 courses approved by the Advisory Committee**		6	*4 courses approved by the Advisory Committee**		12
Thesis or Practicum	CVEN 551	Research & Thesis in Civil Engr.	6	CVEN 555	Practicum in Civil Engr.	3
		TOTAL	**30**		**TOTAL**	**36**

* The maximum number of variable credit Independent Study courses that can be applied towards the degree is 6 SCH.