DHS 2017 Summer Research Final Report

A Systems Approach: Developing Cross-Site Multiple Drivers to Understand Climate Change, Sea-level Rise and Coastal Flooding for an African American Community in Portsmouth, VA

By Raisa Barrera

Project Approach

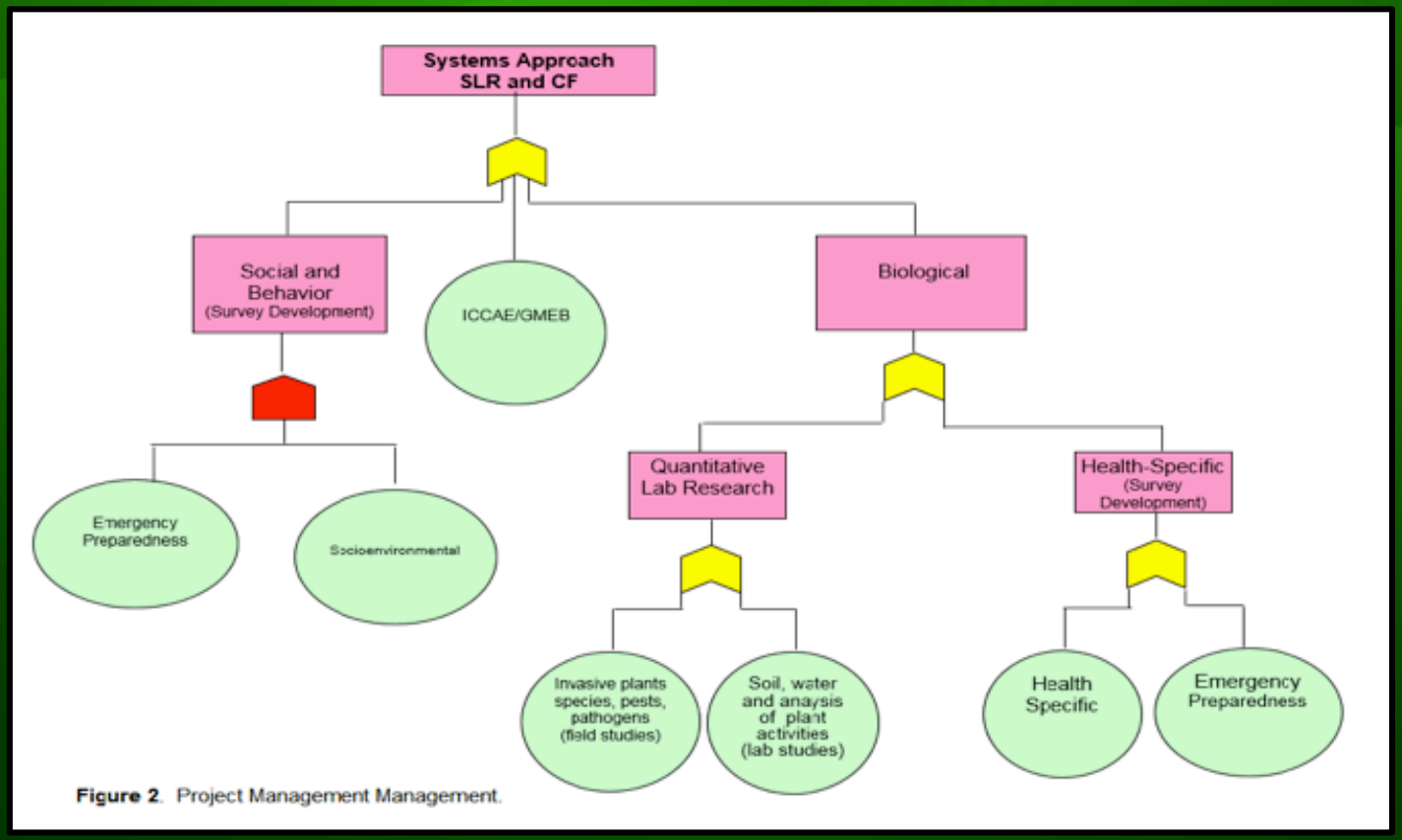


Figure 1 - Flowchart depicting the interdisciplinary systems approach to studying sea-level rise and coastal flooding. This report discusses the biological quantitative lab research conducted over the 2017 DHS Summer Research Program.

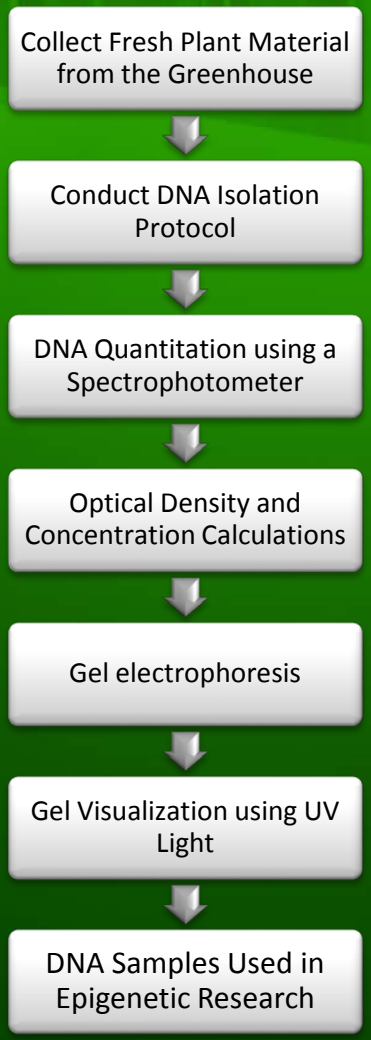
Project Goals

- **Department of Homeland Security Objectives:**
  - Make advances in DHS Research Areas, including but not limited to: **Emergency preparedness & response; human factors; infrastructure protection; natural disasters & related geophysical studies; and social & behavioral sciences**
  - Strengthen the talent pool of scientists and engineers
  - Conduct collaborative research of mutual interest to the Team, the DHS Center and DHS
- **NSU Defense Intelligence Agency - Intelligence Community Centers for Academic Excellence (DIA-ICCAE) program goals:**
  - Target underrepresented groups, women and racial/ethnic minorities, with diverse backgrounds
  - Provide educational and professional development support
- **Coastal Resilience Center of Excellence (CRC) Objectives:**
  - Conduct research and education to enhance the resilience of the nation's people, infrastructure, economies and the natural environment to the impacts of coastal hazards such as floods and hurricanes, including the effects of future climate trends.

Role in Research

- Prepare DNA samples to be used in future epigenetic research
- Isolation, quantitation, and visualization DNA from native grasses, specifically *Spartina alterniflora* or cordgrass
- Literary research
- Greenhouse husbandry

Methodology



Greenhouse Collection and Upkeep

DNA Isolation

- Purpose: to remove and purify DNA from the rest of the cells in plants

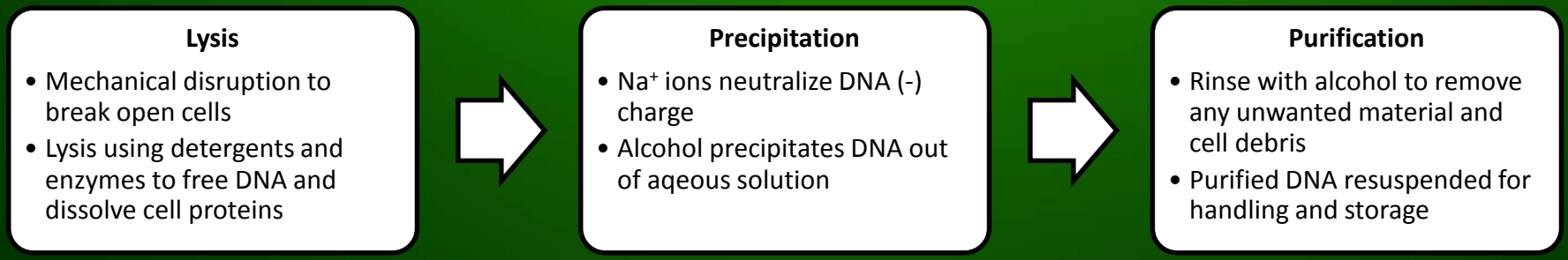


Fig. 3: General steps of DNA Isolation.

DNA Quantitation

- Use of **spectrophotometer**
- **Purpose:** Measures the amount of light of a particular wavelength absorbed by a solution (absorbance)
- Measuring wavelengths of:
  - 260 nm = absorbance of nucleic acids, DNA
  - 280 nm = absorbance of protein
- Results –
  - OD_{260}:OD_{280} ratio values of 1.8 and 2.0 indicate pure preparations of DNA and RNA
  - Readings OD_{260}:OD_{280} <1.8 and 2.0 indicate sample contamination of phenol or protein

Fig. 3: Genesys spectrophotomer model used in lab.

Quantitation Results

Table 1 – Results from quantitation of DNA samples of S. alterniflora and various grass samples.

Key:
SA = Spartina alterniflora
PFG = Purple Fountain Grass
DG = Dallis Grass
MPT = Mexican Ponytail Grass
WPG = White Pampas Grass

DNA Quantitation Results of S. alterniflora and Various Native Coastal Grass Samples

#	Sample ID Date Isolated	Concentration	A260 (Abs)	A280 (Abs)	260/280 Ratio
1	SA 6/1/17	99.8 ng/µl	1.996	0.835	2.39
2	SA 6/9/17	52.1 ng/µl	1.042	0.429	2.43
3	SA 6/13/17	402.5 ng/µl	8.049	3.736	2.15
4	PFG 6/28/17	378.8 ng/µl	7.576	3.498	2.17
5	SA 6/28/17	405.2 ng/µl	8.104	3.783	2.14
6	DG 7/17/17	175.9 ng/µl	3.519	1.557	2.26
7	MPT 7/17/17	399.8 ng/µl	7.996	3.937	2.03
8	PFG 7/17/17	281.9 ng/µl	5.637	2.620	2.15
9	WPG 7/17/17	137.0 ng/µl	2.741	1.121	2.44
10	SA 7/17/17	965.1 ng/µl	19.302	9.691	1.99

Gel electrophoresis

- **Purpose:** technique used to separate DNA fragments according to their size
- General steps:
  1. **Pour** agarose gel cast
  2. **Load** DNA samples & standard into wells
  3. **Run** an applied electric current to pull DNA through gel
- DNA fragments negatively charged, will move towards (+) electrode

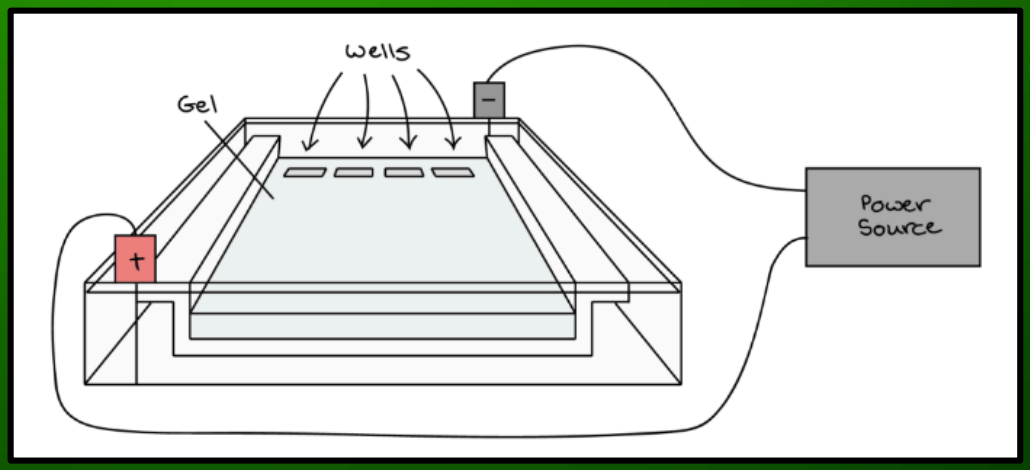


Fig. 4: Visual representation of gel electrophoresis setup.

Visualization: Reading an Agarose Gel Cast

- DNA samples mixed with DNA-binding dye prior to loading into wells
- Ladder loaded into well closest to edge
- Bands can be viewed under UV light
  - Shows DNA present at different locations along the length of the gel
- DNA fragments seen as **bands**
  - Each represent a group of same-sized DNA fragments

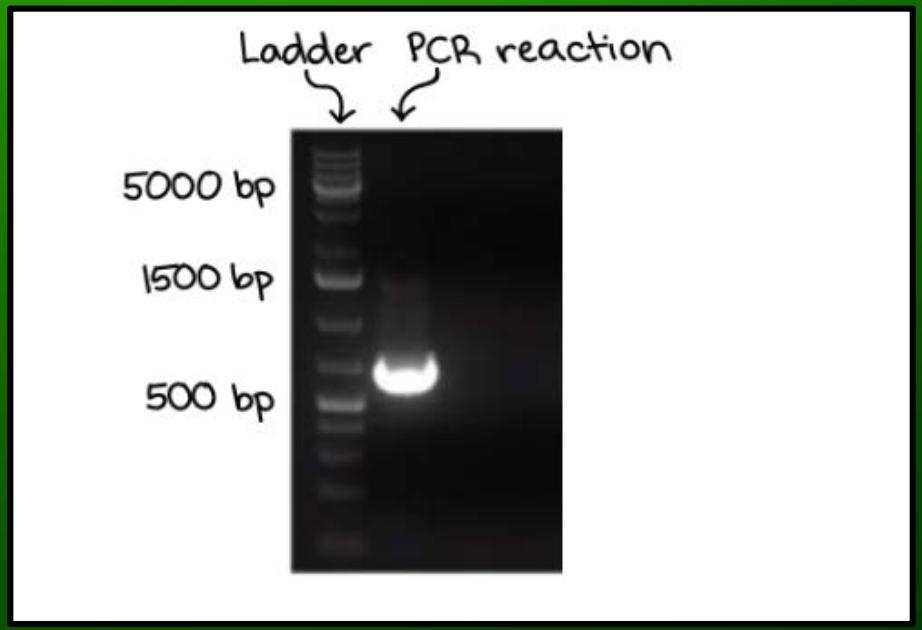
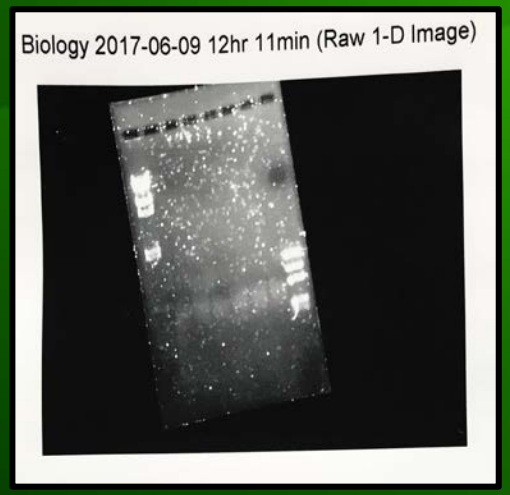
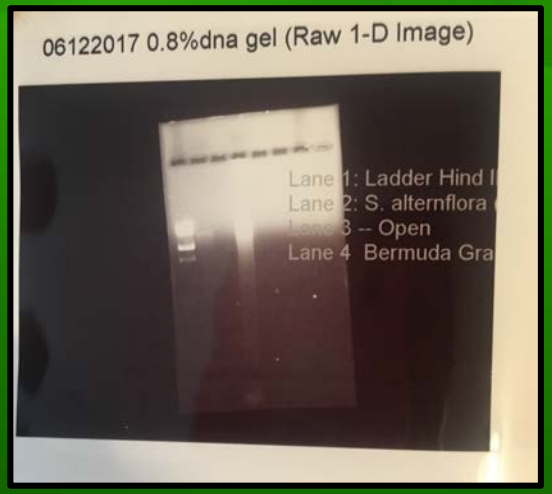
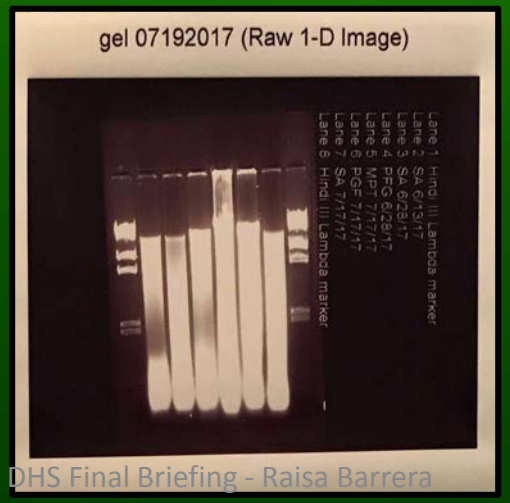


Fig. 5 – Gel cast visualized over a UV light.

Gel Results

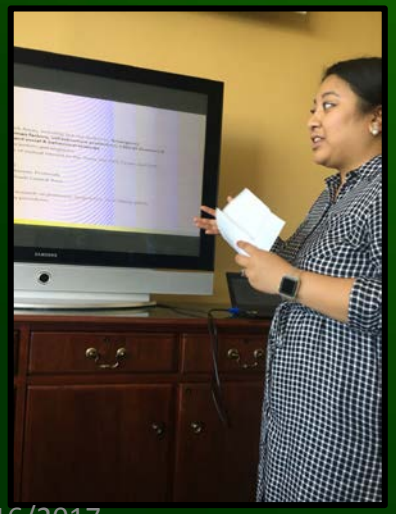


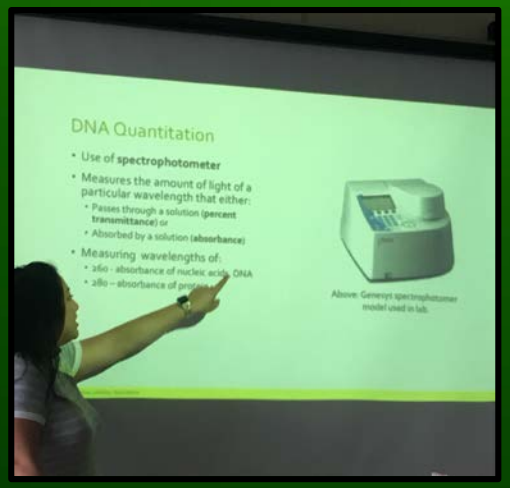




Research Activities

Briefings





Week 3 - Tour of VMASC

- Virginia Modeling, Analysis and Simulation Center (VMASC) at Old Dominion University
- Multi-disciplinary research center dedicated to solving real world problems through the application of modeling and simulation techniques
- Developing new approaches to representing physical, social, and human systems in simulation
- We are one of the world's leading research centers for computer modeling, simulation, and visualization

Right: Me testing the virtual reality programs.

Above: Me playing the Zika virus game

Grad Seminar Take-Aways

- Prepare for Grad School early
  - Resume
  - CV
  - Personal statements
  - Reference letters
- Look into all types of funding possibilities
- Resources
  - IC-CAE/MACCAE website
  - Mentors
  - NSF – fellowships
- GRE
  - Study Aids
    - Magoosh flashcards, Educational word games
  - READ news articles
  - Practice writing prompts
  - Math GRE Study Prep handbook

Week 8 - Grad School Workshop

Week 8 – Elizabeth River Project

- Paradise Nature Creek Park, Portsmouth, VA
- Went out into field to view natural areas of cordgrass
- Network with non-profit for future work and community service for SEEDS

Final Thoughts

- New skills
- Career/academic goals
- Professional development
  - Briefings
  - Professional socialization
  - Resume, CV, personal statements
- Significance of project
- Future work