

Model of Synergy for Science and Science Education Research: Transfer of Geoscience Field Research at Laguna Atascosa National Wildlife Refuge into the Science Classroom



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Research Outline:

With the call for increased use of inquiry-based learning in K-16 classrooms, STEM reform has reached graduate programs leading to candidates possessing a strong commitment to and understanding of research and teaching in both STEM and science education. My PhD is being modeled after this need by focusing my research on complex systems in environmental biogeochemical systems and science education.

- Modeling ecosystem sensitivity through ecosystem indicators, salinity bioindicators, and weather patterns.
- Investigating students' mental model development of complex earth systems through the use of a hierarchical virtual field site based on my scientific research at LANWR.
- Investigating novice science teachers barriers to design & implementation of inquiry in the classrooms through the 4 dimensions of inquiry: community-, student-, assessment-, & knowledge-centeredness.

Laguna Atascosa National Wildlife Refuge

Location: 25 mi north of Brownsville, TX in lower Rio Grande Valley
Size: ~45,000 acres of natural habitat
Established: 1946 as a National Wildlife Refuge to preserve natural diversity & abundance of native species

Exclusive complex system and the largest protected area in the Lower Rio Grande valley in South Texas is located in a coastal margin region where multiple habitats interface & interact. Common and unique flora & fauna thrive where temperate, tropical, maritime, & arid habitats co-exist among acres of marshes, tidal & wetlands, coastal prairies, upland brush, Savannah, grasslands, fallow crop lands, & open water within the refuge.

The development of management plans are dependent on adequate knowledge of the interrelationship between ecosystem functioning and water in the region.

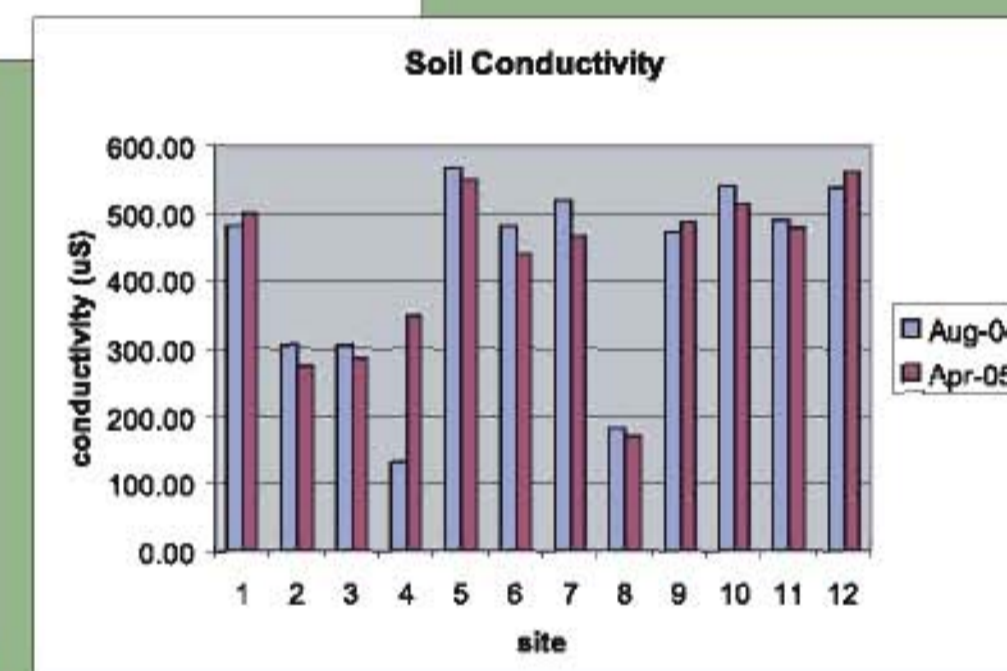
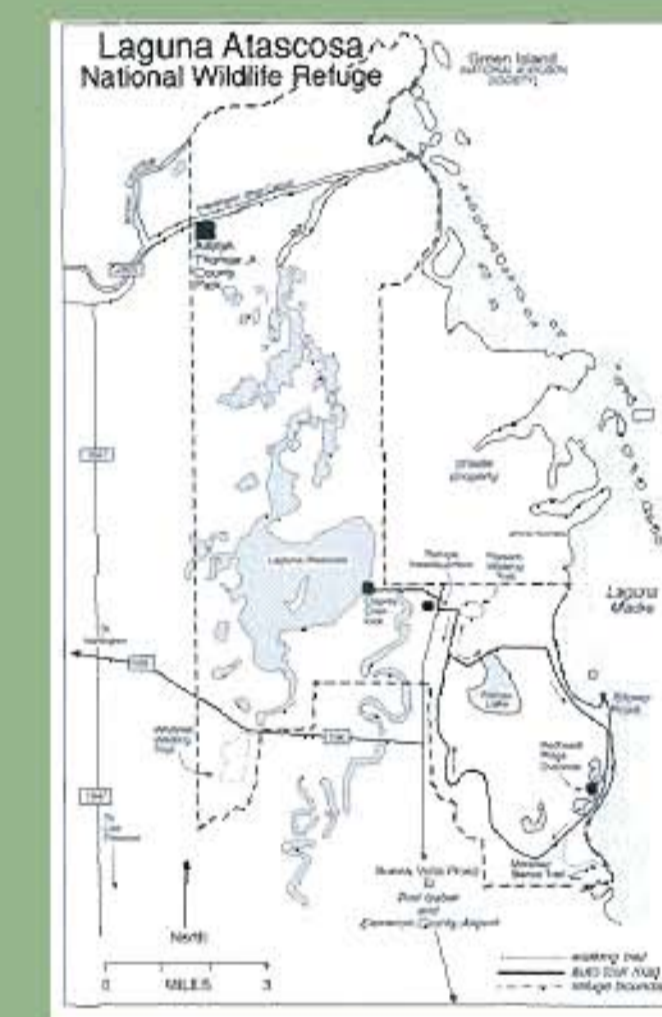
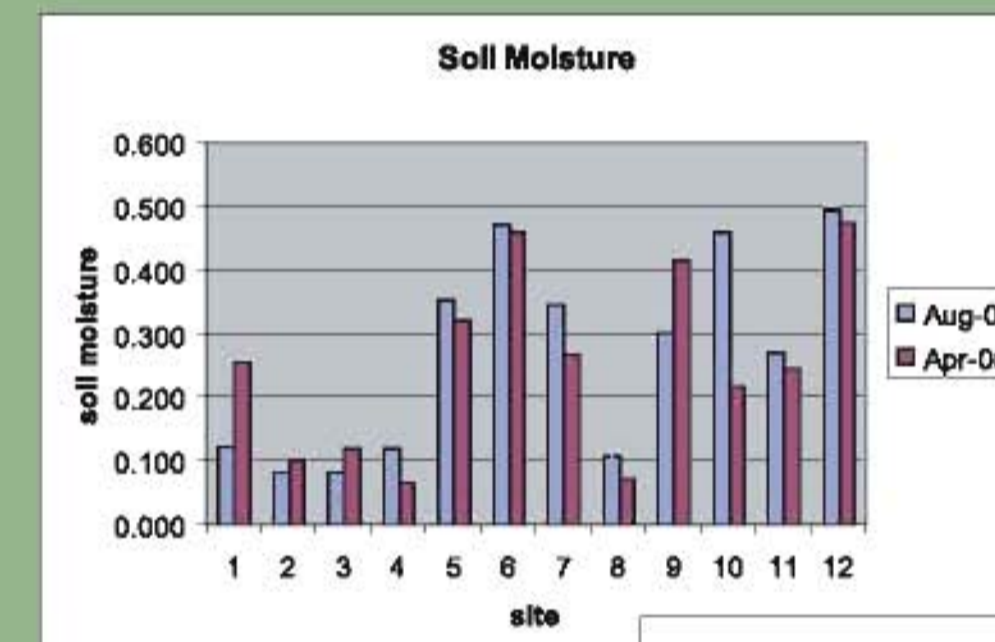
Location for wintering birds & a migratory stop for 5 flyway zones in N. America & Mexico with 411 different species calling LANWR home at different times throughout the year.



LANWR Ecosystem Research

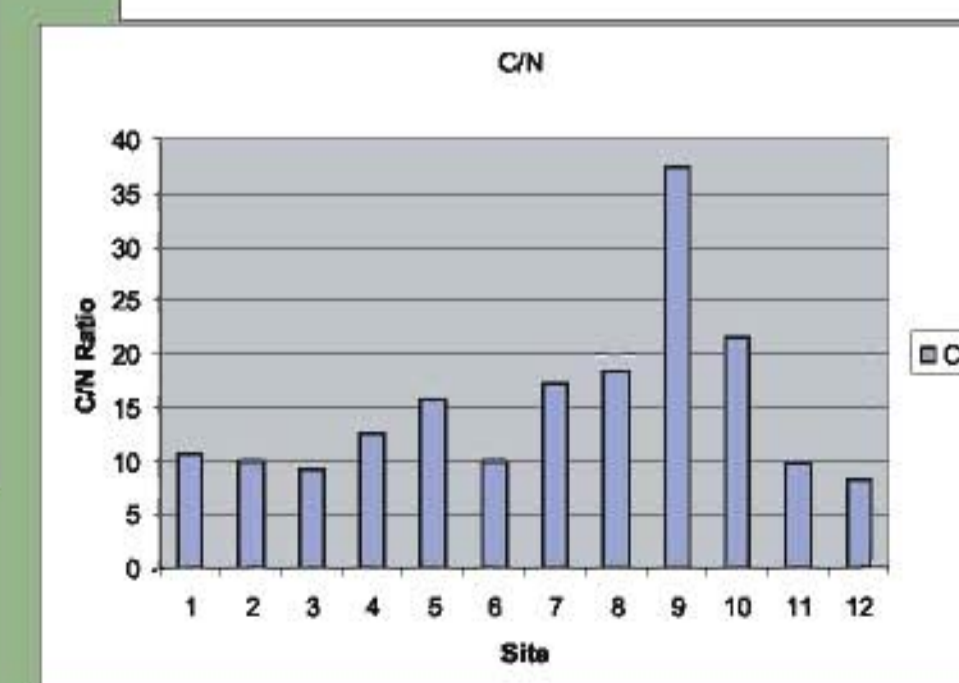
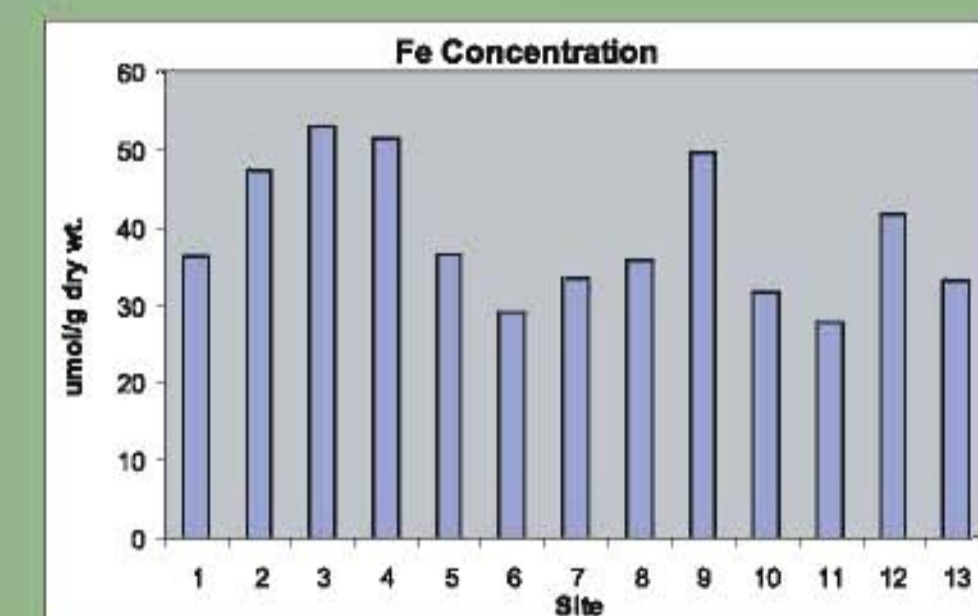
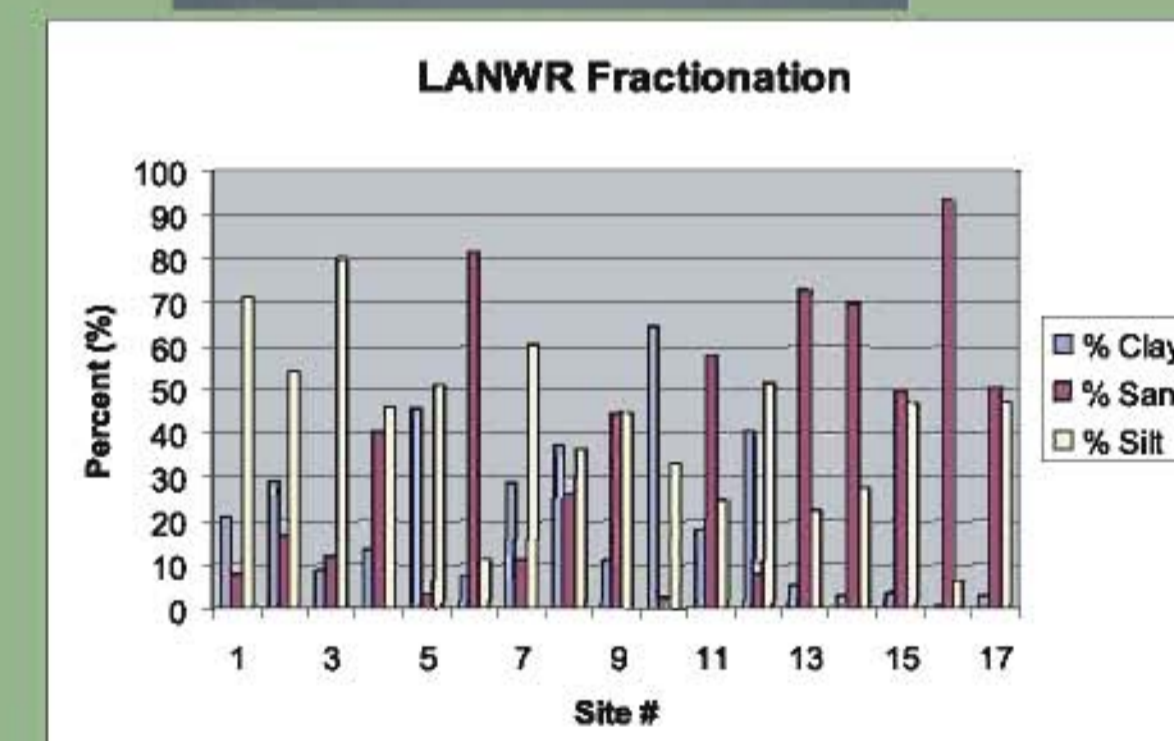
Field Data:

- salinity observations of refuge water bodies
- soil data collection from 12 sites
GPS coordinates
site description
soil color, moisture, & conductivity
surface soil sample for lab analysis
- soil core collection from 3 sites for bioindicator analysis



Lab Analysis:

- soil fractionation
- reactive Fe
- XRD analysis
- CNS analysis



Soil Core Analysis:

- Ostracods used as bioindicators to assess environmental impacts on water quality due to natural & anthropogenic causes within the refuge
- Palynology/ostracods used to help deduce historical ecosystems & changes

Development of Virtual Field Site

Large data sets obtained through field research can be used to develop or improve secondary science students' mental models of complex systems, conceptual & procedural knowledge of scientific investigations, content knowledge, & problem solving skills.

Virtual Field Site - Continuum of Inquiry:

Exploration-Based Knowledge-Based Inquiry-Based Abstraction-Based



Each module will contain:

- National & Texas State Education Standards
- Learning Objectives for each module
- Embedded content & process questions
- Continuum of inquiry activities through module progression
- Scaffolded hierarchal design
- Science research data available for student use:

Historical/current weather data
Historical/current water salinity data
Historical ecology/refuge uses
GIS maps
Photos, site videos, scientist's data logs
Collected data from each site
Soil core data & profiles



Barriers to Inquiry

Novice teachers' development & implementation of inquiry comes with multiplicative barriers to overcome. The support of scientists can help diminish these barriers & support successful inquiry.

Common reported barriers to inquiry implementation:

- inadequate space, equipment & technology, insufficient time to prepare, large class size, personal doubts about inquiry being appropriate to attain learning goals, lack of confidence about personal understanding of the topic, & personal computer skills

Scientist trained in Science Education can help novice teachers overcome barriers:

- time, through use of technology (internet/website development)
- use of technology
- content knowledge
- help with preparation time through use of scientific data

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