2019 version

Faculty Member: __Mindy Faulkner_____ **Faculty ID:** _____10165782_____

Department: __Geology_____ **Faculty Email:** __mgshaw@sfasu.edu_____

Have you previously received a SURE award? __Yes____ **If yes, when?**_2018_____

If yes, how did you disseminate results from previous awards (successfully published a paper or obtained a grant, submitted paper or grant based on results, presented results at external conference, etc.):
Matthew Sailor (2018 recipient) will present his final research presentation at the 2019 Joint Section Meeting of the South Central Geological Society of America March 25-27 in Manhattan, KS, and if accepted, at the 2019 Undergraduate Research Conference at SFA. "Remote Sensing and Field Investigations of Geologic Structures in the Owl Mountain Province, Fort Hood Military Installation, Texas" Abstract ID#326889

Student's Name: ____Melanie Ertons_____ **Student ID:** ___10552250_____

Major: ____Geology_____ **Student Email:** ___ertonsml@jacks.sfasu.edu

Have you previously received a SURE award? ___No_____ **If yes, when?**_____

Proposed SURE Project

Title of proposed SURE project: ___Geochemical Analyses of Base Metals in Sediments and Stream Water, Black Cypress Bayou, Marion County, Texas

Description of proposed project (describe the scope of the project, including specific objectives):
This research project would employ geochemical analyses to characterize the concentration of metals (with an emphasis on copper, lead, and zinc) in sediments and stream water in Black Cypress Bayou near the city of Jefferson, in Marion County, Texas. Black Cypress Bayou has been listed on the Texas Commission of Environmental Quality 303(d) list for copper impairment since 1995 (TCEQ 2014) and recent mercury and metal analyses in adjacent waterbodies revealed elevated copper and zinc concentrations in Marion and Harrison counties.

Specific objectives include:

1. Collection of stream sediment cores and water samples for geochemical analyses.
2. Geochemical analyses of stream sediment cores to determine metal content.
3. Geochemical analyses of stream water samples to determine total and dissolved metal species.
4. Spatial delineation and statistical analyses of metal concentrations in Black Cypress Bayou.

Is this a new project or a continuation of a current project? If a continuation, what new work will be done as part of SURE?

This is a new project, inspired by recent research in the Caddo Lake watershed.

Potential impact or significance of research:
The Caddo Lake watershed includes one of the largest bald cypress ecosystems in the United States and is well known for exceptional wildlife diversity. Black Cypress Bayou is one of the primary tributaries of the Caddo Lake watershed, and functions as a major geochemical contributor to the environment in Caddo Lake. Since 1995, Caddo Lake and some of its tributaries have been listed on the State of Texas Clean Water Act 303(d) list by the Texas Commission on Environmental Quality (TCEQ 2014). This research will provide baseline geochemical data regarding the concentration, mobilization, and transport of metals within Black Cypress Bayou and the potential watershed contribution to impairment of Caddo Lake.

Recent geochemical research in Big Cypress Bayou revealed significant changes in metal concentrations at the confluence of Big Cypress and Black Cypress bayous, and an increase in metal concentrations near the city of Jefferson. This research would help characterize the metal concentrations in Black Cypress Bayou above and below the city of Jefferson, and provide better understanding of potential metal transport in the Caddo Lake watershed.

Research Design (approach/methodology):

A set of eight 15cm sediment cores will be collected from a 20km stretch of Black Cypress Bayou near the city of Jefferson, TX using an AMS core sampler with a plastic sediment core sleeve (see proposed sampling locations on attached map). The cores will be capped, labeled, and transported in an ice chest to the geochemistry laboratory at SFA. In the laboratory, the cores will be placed in a freezer for 48 hours to allow the samples to stablilize. After they have been frozen, each core will be cut into four equal sections measuring 3.5cm with a band saw. The uppermost and lowermost sections will be freeze-dried to remove any remaining water, then transported to the SFA Soil, Plant, and Water Analysis Laboratory for metal analyses. The middle sections of each sediment core will be used to determine particle size analysis by the Bouyoucos method.

Water samples will be collected at each of the core sampling locations (n=8). These samples will be labeled and transported to the SFA Soil, Plant, and Water Analysis Laboratory for cation and anion analyses. Anions will be determined using a Dionex 1000 Ion Chromatograph. Total metals will be determined using a Thermo Scientific iCAP 7400 ICP Analyzer.Total carbonate of the water samples will be determined by titration in the geochemistry laboratory.

Once the laboratory results for the sediment cores, water samples, and particle size distribution have been completed, ArcGIS software will be used to determine the spatial distribution of metals in sediments and water in Black Cypress Bayou. Statistical analyses will be used to determine the relationship between particle size distribution and metal concentrations.

Literature review for project (must provide at least five peer-reviewed sources):

The Caddo Lake watershed drains an area of approximately 4,247 km^2 and has a storage capacity of approximately 0.216 km^3. Major tributaries into Caddo Lake include Big Cypress, Little Cypress, and Black Cypress bayous, accounting for approximately 70% of the total drainage area of Caddo Lake (Albertson and Dunbar 1993). These bayous flow across Eocene-aged lithologies from the Wilcox and Claiborne groups through the Interior Coastal Plains of Texas, characterized by low rolling hills and heavily wooded terrain covered by a mix of pines and hardwoods (Eargle, 1968). The confluence of Black Cypress and Big Cypress bayous occurs approximately 3km ESE of Jefferson, Texas, and the waters continue to flow in an easterly direction and empty into the western arm of Caddo Lake.

Throughout its history, Caddo Lake has served as a major transportation conduit for people and commercial products via steamboat in the 19th century. In the early 1800s, a log jam known as the Red River Logjam or the Great Raft, caused Caddo Lake to become deep and wide enough to accommodate larger steamships. In the early 20th century, Caddo Lake was the initial site for the establishment of overwater oil platforms, the precursor to platform drilling around the world. By 1914, the U.S. Army Corps of Engineers established a water navigation improvement plan to dredge the channels in the watershed to allow boats upriver and constructed an earthen dam to raise the water level in the lake (Winemiller et al., 2005). In 1971, 8,000 acres of Caddo Lake and the watershed were designated as a Wetlands of International Importance by the Ramsar Convention; currently Caddo Lake is one of only 29 sites in the United States serving as an internationally protected wetland and includes one of the largest flooded cypress forests in the United States.

Present day, local and regional industries have affected metal concentrations in the Caddo Lake watershed. The oil industry active in the early 1900s left the area for richer fields in east and west Texas, with little to no remediation of well sites. In 1942, the Longhorn Army Ammunition Plant near Karnack, TX was charged with producing trinitrotoluene (TNT) for World War II efforts and is now a superfund site (EPA, 2004). Sediment samples from streams in the Caddo Lake watershed found elevated levels of copper, lead, zinc, arsenic, and mercury. Lignite mining and incineration of fossil fuels has been cited as one of the largest remaining anthropogenic sources of metals released to the atmosphere (EPA, 2015). Although United States emission levels are decreasing, these decreases may be offset by increasing emissions from Asia. Since 1995, Caddo Lake and the tributaries in the watershed have been listed on the Texas Commission on Environmental Quality 303(d) list for impairment due to mercury content in edible tissue, depressed dissolved oxygen, base metal concentrations, and low pH values (TCEQ, 2014).

Recent research in the Caddo Lake watershed have indicated higher metal concentrations near the confluence of Big Cypress and Black Cypress bayous and near the city of Jefferson (Watkins, 2018). This research would focus on characterizing the metal concentrations found in sediment and surface waters in Black Cypress Bayou above and below the city of Jefferson before its confluence with Big Cypress Bayou.

References

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Watkins, J.D., 2018, Mercury in Big Cypress Bayou and Caddo Lake Watersheds in Marion and Harrison Counties, Texas. [Master's Thesis]: Nacogdoches, Stephen F. Austin State University

Project timeline (activity/task and time to complete):

Week 1:	Sediment core and water sampling on Black Cypress Bayou (1 field day).
	Water samples delivered to SFA Soil, Plant, and Water Analysis Laboratory for processing.
	Freeze sediment cores for stabilization.
	Literature review, first draft of abstract.
Week 2:	Sediment cores prepped for laboratory analyses (cutting, freeze drying).
	Sediment samples are delivered to SFA Soil, Plant, and Water Analysis Laboratory for processing.
	Titration analyses of water samples for total carbonate.
	Literature review, first draft of geologic setting
Week 3:	Particle size analyses of sediment cores using Bouyoucos method.
	Process data and create figures for water sample geochemistry.
	Create figures for particle size analyses.
	Select photos for poster, first draft of methodology.
Week 4:	Process data and create figures for sediment core geochemistry.
	Finalize abstract, geologic setting, and methodology.
	First draft of results and discussion.
Week 5:	Finalize results and discussion.
	Organize final draft of poster.
	Print poster.
	Present!

Description of research and professional skills that the student will develop from the project:

Field research skills: During this research, Melanie will be able to participate in data collection of sediment cores and water samples. She will also be introduced to various instrumentation utilized to record temporal data at the sample sites, and the importance of keeping accurate records for future laboratory analyses. We will also be emphasizing field safety and respecting property boundaries (geoethics).

Laboratory research skills: Melanie will have the opportunity to use various laboratory instruments to process her samples and familiarize herself with a working laboratory. She will be able to walk her samples through the processes at the SFA Soil, Plant, and Water Analysis laboratory and use the auto-titration equipment in our geochemical laboratory. Conducting particle size analyses will help her become familiar with standard practices in the environmental and soil science industries. Since we will be working with an operational saw, laboratory safety will be strongly emphasized.

Other research skills: Once the samples have been processed, characterization of the data to present results will help Melanie hone her research skills by synthesizing the data into figures and graphs that will help her articulate this experience and share with others.

Professional skills: Scientific communication of research results requires professional writing and interesting presentations. This opportunity would provide an avenue for Melanie to practice scientific writing and learn various ways to present data effectively. The poster session will allow Melanie to explain her research results to others, and communicate with the larger scientific community.

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Description of the involvement and activities that the student and mentoring faculty will have in this project:

This project would be conducted together, particularly data collection in the field and laboratory analyses. The first drafts of the written sections of the poster would be authored by the student and edited by the mentoring faculty.

Description of how you will disseminate results from the project:

The results of this research will be disseminated at the SURE presentation at the completion of the project. We will also present a poster at the upcoming 2020 Texas Academy of Science conference hosted by SFA, South Central Geological Society of America, and submit an abstract for the 2020 SFA Undergraduate Research Conference. The results of this project will also support ongoing development of faculty and student led research regarding metal transport in Caddo Lake watershed.

Budget ($0-$500 with justification):

Sediment core and water samples will be processed in the SFA Soil, Plant, and Water Analysis laboratory. Current price sheet is attached to this proposal.

1. Current pricing for sediment (soil) samples is $40.00 per sample. $40.00 x 16 = $640.00
2. Current pricing for water samples is $25.00 per sample. $25.00 x 8 = $200.00
3. Mileage (300 miles @ $0.57 / mile). $0.57 x 300 = $171.00

Total Budget $1,011.00

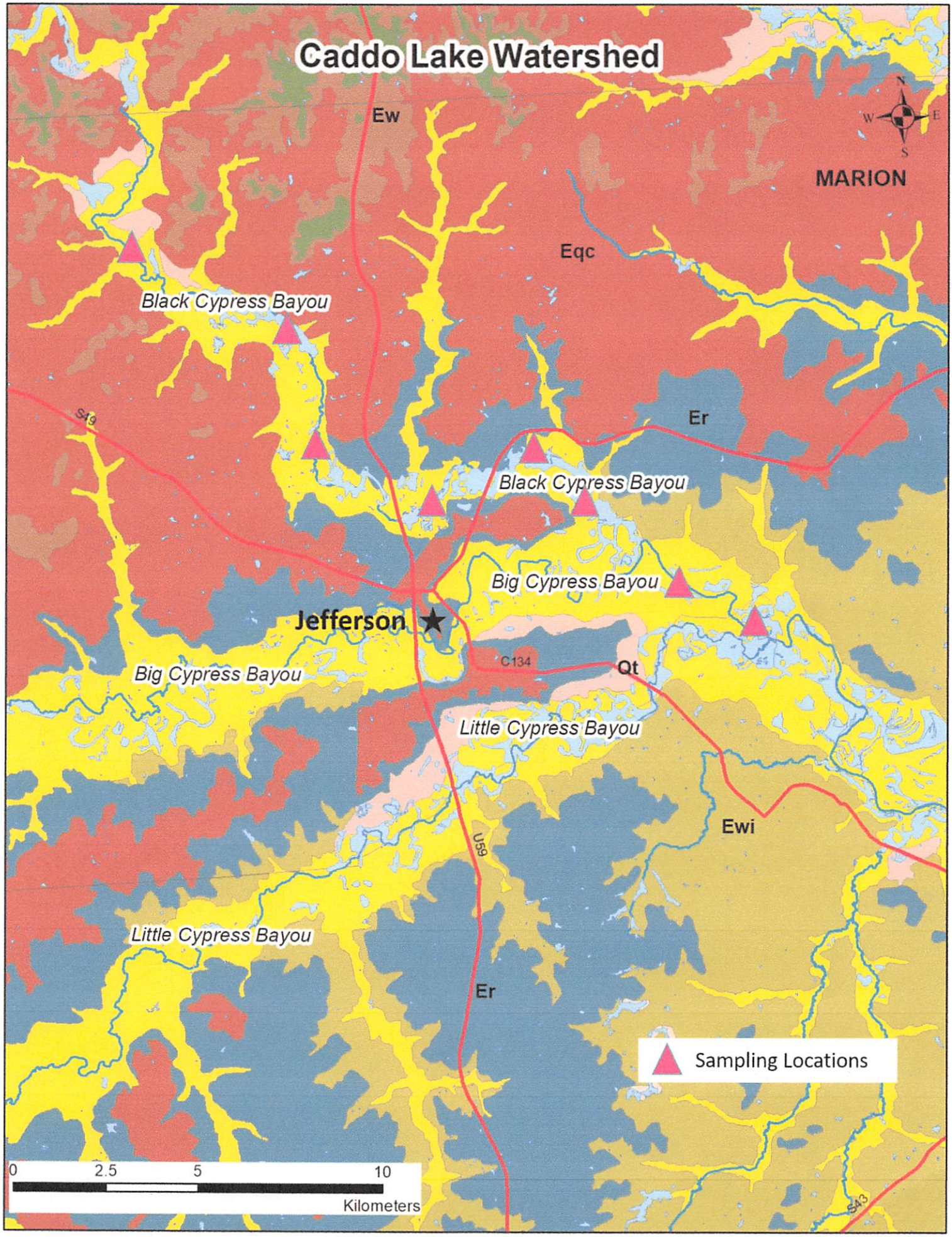
Amount requested for supplies from SURE: $__500.00____
Amount requested for supplies from department: $__511.00____
Amount department will fund faculty stipend: $____0_____
Amount department will fund student stipend: $____0____

Chair approval: _____
Chair Signature

I have reviewed and agree to fulfill the expectations of the SURE award.

_____ _____
Student Signature **Faculty Signature**

For internal purposes only:
Proposal Awarded _____ Proposal not award_____ Amount awarded: _____
Accounts to be used for award:_____


Caddo Lake Watershed
Ew
MARION
Eqc
Black Cypress Bayou
S49
Er
Black Cypress Bayou
Big Cypress Bayou
Jefferson
C134
Qt
Big Cypress Bayou
Little Cypress Bayou
Ewi
US59
Little Cypress Bayou
Er
Sampling Locations
0
2.5
5
10
Kilometers
S43

STEPHEN F. AUSTIN STATE UNIVERSITY
SOIL, PLANT AND WATER ANALYSIS LABORATORY

SOIL	FEE PER SAMPLE
Regular Analysis (pH, buffer pH, electrical conductivity, nitrate-N, P, K, Ca, Mg, S)	$13
Complete Analysis (regular analysis + micronutrients: Fe, Mn, Zn, Cu)	$20
Nitrates Only (nitrate-N)	$7
Hot Water-Soluble Boron	$7
Salinity (saturated extract to determine SAR & electrical conductivity)	$22
Potting Media (soilless potting mix)	$20
Organic Matter Analysis	$10
Soil Texture Analysis	$30
Total Nitrogen	$10
Aluminum (extractable)	$7
pH, Buffer pH, & Electrical Conductivity	$5
Ammonium (ammonium-N)	$10

METALS	
RCRA*: As, Ba, Cd, Cr, Hg, Pb, Se, and Ag	$40
*NOTE: If lower levels of detection are required, an additional $40 per element will be charged.	
Mercury Analysis Only	$25

FORAGES & FEEDS	
Regular Analysis (protein, Acid Detergent Fiber, and estimated Total Digestible Nutrients)	$14
Complete Analysis (regular + minerals: P, K, Ca, Mg, Fe, Mn, Zn, Cu, Na, S)	$26
Protein Only	$10
Minerals Only	$15
Nitrates Only	$7
Moisture Content Only	$5

PLANT TISSUE	
Minerals (N, P, K, Ca, Mg, Na, S, Fe, Mn, Zn, Cu, B, C/N analysis)	$26
Nitrates Only	$7

WATER	
Regular Analysis (pH, conductivity, Na, Ca, Mg, B, K, Fe, carbonate, bicarbonate, sulfate, chloride, fluoride, phosphate, nitrites, and nitrates)	$25
Nitrates (nitrate-N)	$7
E. Coli Coli-form (water only)	$20

LIME & ASH ANAYLSIS	
Particle size distribution, neutralizing value ($CaCO_3$ equivalent), and a fineness efficiency (ECCE), %Ca & %Mg	$40

MANURE	
Nutrient analysis (Total N, moisture, P, K, Ca, Mg, S, Na, Fe, Mn, Zn, Cu)	$26
Lagoon/Waste Water (total N, P, K, Ca, Mg, S, Na, Fe, Mn, Zn, Cu, pH, conductivity, carbonate, bicarbonate, sulfate, chloride, fluoride, phosphate, nitrites, and nitrates	$30

Prices Effective 1/8/2018 Franta Majs