Amy Mayedo
Mentor: Dr. Jairo Diaz
Alcorn State University, Mississippi River Research Center
Center for Ecology & Natural Resources
1000 ASU Drive #209, Alcorn State, MS 39096
Mentor Profile: Dr. Jairo Diaz

- Director, Mississippi River Research Center, Alcorn State University
- Water Resource Engineer
  - Watershed and hydrological transport modeling
- Universidad Nacional de Colombia (Civil Engineering, B.S.)
- University of Puerto Rico (Civil Engineering, M.S.)
- Mississippi State University (Civil Engineering, Ph.D.)
Outline

• Equipment cataloguing and inventory
• Education for middle and high school student visitors
• Miscellaneous activities
• Field work
• Research
  – Runoff Quantity Assessment
  – Runoff Quality Characterization
Equipment cataloguing

YSI Sonde 6600

Outdated Equipment and Solutions
Outreach

June 20th: AgDISCOVERY Camp Students

July 22nd: U.S. Virgin Islands Students
Additional Activities

June 6th: Ag Field Day in Preston, MS

June 30th: Dissertation defense in Starkville, MS
ASU Land and Water Resources

• Lorman, Mississippi
• 1,700 acre campus
• Low elevation
• ~3,500 student population
• On-site water treatment plant

Image credits: Google Earth, BASINS
Stormwater Management

- Agricultural runoff
  - Crops
  - Cattle
- Urban runoff
  - Impervious surfaces
Mississippi Water Quality Standards
MS Department of Environmental Quality

- Standards for dissolved oxygen concentrations:
  - Daily average at or above 5.0 mg/L
  - Instantaneous measurement at or above 4.0 mg/L

- May – October standards for fecal coliform bacteria concentration
  - Colony maximum at geometric mean of 200 per 100 mL
Field Work Continued
Alcorn Experiment Station Watershed
61,200 sq. ft.

Animal Science Farm Watershed
183,049 sq. ft.
Equations Used

**Turc Method**
- Potential Evapotranspiration (PET)

**Water Balance**
- \( R = P - ET - \Delta S \)

**Root zone water content**
- \( \%VWC \rightarrow mm \)

**Unit Conversions**
- \( F \rightarrow C \rightarrow K \)
- \( \text{wat/m}^2 \rightarrow \text{cal/cm}^2/\text{day} \)
- \( \text{in} \rightarrow \text{cm} \rightarrow \text{mm} \)
- \( \text{sqft} \rightarrow \text{acres} \)

**Averaging between intervals**
- Daily
- Weekly
- Monthly

**Topographic map**
- Area
- Slope

\[
PET = 0.013 \left( \frac{T}{T + 15} \right) (R_s + 50) \left( 1 + \frac{50 - RH}{70} \right)
\]

When RH < 50 percent

When RH > 50 percent

Image credit: Journal of the American Water Resources Association
Data Collection and Analysis
Data Analysis: Potential Evapotranspiration

- Defined as the amount of water that could evaporate and transpire without restriction other than atmospheric demand (Lu, Sun, McNulty, & Amatya, 2005, p. 621)
- Quantification of water lost to the atmosphere
- PET data calculated for high humidity season (March – June)

\[
\begin{align*}
PET & = 0.013 \left( \frac{T}{T + 15} \right) R_s + 50 \left( 1 + \frac{50 - RH}{70} \right) \\
\text{RH} & > 50 \text{ percent}
\end{align*}
\]

where, PET is the daily PET (mm/day); T is the daily mean air temperature (°C); \( R_s \) is the daily solar radiation (ly/day or cal/cm²/d) and RH is the daily mean relative humidity (percent).
Data Analysis: Water balance

• Defined as a calculation of the inputs and outputs of water in a system

• Considers precipitation, PET, and storage changes of water
  • \( R = P - ET - \Delta S \)

• Quantification of runoff
Modeling: Runoff Hydrograph

- Measures the water flow of a precipitation event over time
- Performed with LIDIA (Low Impact Development Assessment)
- Key to understanding relationship between precipitation and runoff
- May 1st – 2nd precipitation event modeled for each watershed
  - 16 hour event
Animal Science Farm Hydrograph
May 1st - 2nd Precipitation Event
RESEARCH
Runoff Quality Characterization
Dissolved Oxygen

• Dissolved molecular oxygen content of water
  – DO concentration is affected by many environmental factors

• Measured using an amperometric instrument
  – Probe with temperature sensor and membrane

• Surface D.O. defined as <5 feet of depth
  – My measurements were taken between 6 – 18 inches of depth
Presence of Coliform

48 Hour Incubation Period

Primary Sedimentation Pond
West Lake
Samples taken July 17, 1:30PM

Northwest Lake
Sample taken July 22, 10:00AM
Research Conclusions

• ASU agricultural operations contribute significant volumes of runoff to wastewater retention bodies.

• A significant amount of dissolved oxygen measurements taken between June 24\textsuperscript{th}– 28\textsuperscript{th} were consistently below MDEQ standards at the time of measurement.

• Fecal coliform was present in the wastewater retention body samples on July 17\textsuperscript{th} and 22\textsuperscript{nd}.

My results suggest a relationship between low quality agricultural runoff and a decline in water quality.
Accomplishments

• Exposure to equipment maintenance and calibration
• Exposure to software and professionals relevant to my field of interest
• First time hands-on experience with GIS and modeling
• First time conducting field work
• Minority youth STEM outreach
Citations


Acknowledgements

MRRC Staff: Dr Jairo Diaz, Ms. Germania Salazar, Ms. Nancy Morehead