Central High School  
DC—Angelo State University  
Biology 2406—Environmental Science—Fall 2017/Spring 2018

Instructor: Shamone Minzenmayer  
Office Location: Central High School, Tucker 117  
Office phone: 325-659-3434 ext 269  
Office hours: Daily 7am-4:30pm  
Email: sminzenmayer@saisd.org  
Prerequisites: Chemistry 1  
Class Meeting Times/Dates: 2:40-3:30 Daily

I. Course Description  
Biology 2406: Human interaction with and effect upon plant and animal communities. Conservation, pollution, energy and other contemporary ecological problems.

II. Instructional Materials:  
Required Text:  
Wright & Boorse, Environmental Science: Toward a Sustainable Future, ISBN10: 0133102785  
Recommended Text: NA  
Other: NA

III. Course Requirements  
Each student’s six-week’s grade will be based on the following:  
Exams, Labs and Quizzes 65%  
Classwork and Homework 35%

Textbook Reading, Note-taking and Study Guides:  
• You will be expected to read and take notes on each chapter. These notes will be turned in for a grade and oftentimes may be used on a chapter quiz. I am providing you information on how to effectively take notes from a textbook with a method called SQR3. Please use this method when preparing your notes.  
• You may also be given specific study guide questions to answer for some chapters. Study Guides are designed to help you have a framework for studying.  
• It is okay if you work in study groups, but ALL ANSWERS AND ALL NOTES MUST BE YOUR OWN!  
• These assignments must be turned in on time (i.e. at the beginning of your class on the due date). Late assignments will receive half credit, if they are completed before the Unit Exam. After the Unit Exam, no credit can be earned for these assignments.  
• Since you will know the due dates in advance, you are expected to turn in your work the day you return from an absence.  
• You will be given a calendar at least one six weeks ahead of time and will not be given verbal reminders of when work is due.

Lab Assignments:  
• This class has several major lab activities. We will complete these and additional labs throughout the year.  
• You will be required to complete a pre-lab in a bound composition notebook before being allowed to begin these labs.  
• Data, data analysis, conclusions and discussion questions answers will also be recorded in your bound composition notebook. I will provide you specific directions on the format when we do our first lab.  
• These assignments must be turned in on time (i.e. at the beginning of your class on the due date).  
• Late assignments will receive half credit, if they are completed before the Unit Exam. After the Unit Exam, no credit can be earned for these assignments. Pre-labs are not accepted late for any reason and will result in your inability to participate in the lab!!  
• Since you will know the due dates in advance, you are expected to turn in your work the day you return from an absence.
• Some lab activities cannot be made up because the materials will not keep very long, but you are still responsible for completing the lab questions or write up. If you are absent on a lab day, you are expected to get lab data from someone in class in order to complete the lab.

Quizzes
• Most quizzes are announced ahead of time (on your calendar) and will cover material you should have read, work we have done in class or something that we worked on in lab.
• Some quizzes will not be announced ahead of time and may be used to assess whether you have mastered important concepts that we have been working on in class. Consequently, it is important to try to manage your time and not get behind.
• Quizzes may be short answer, multiple choice or a free response question from a previous AP Exam.
• If you are absent, you are expected to make-up the quiz outside of our class time within two days. Please make arrangements with me ahead of time.

Unit Exams:
• Exams are composed of multiple choice questions and essay questions.
• Exams will sometimes take two periods and time will be limited.
• Exam questions will be based on class notes, assignments, labs and your textbook.
• All exams will be corrected when they are returned. Directions for correcting are at the end of this information packet.
• Corrections are usually due one week after tests are returned.
• Exam corrections will be a SEPARATE GRADE and you will keep your original exam grade!
• Corrections are an important learning tool and will help you figure out what concepts you misunderstood or need extra help with.
• If you are absent on the day of an exam, you are expected to make up the exam within two class days outside of our class time. Please make arrangements with me ahead of time.

IV. Learning Objectives
A. Program Outcomes
• Critical Thinking Skills-to include creative thinking, innovation, inquiry, analysis, evaluation and synthesis of information
• Communication Skills-to include effective development, interpretation, and expression of ideas through written, oral, and visual communication
• Empirical and Quantitative Skills-to include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions
• Teamwork-to include the ability to consider different points of view and to work effectively with others to support a shared purpose or goal

B. Student Learning Outcomes
Upon successful completion of this course, students will:
1. Explain the structure and impact of biogeochemical cycles.
2. Describe energy transformations across trophic levels.
3. Illustrate abiotic/biotic interactions and symbiotic relationships.
4. Identify various types of natural resources, human impact on these resources, and common resource management practices.
5. Quantify and analyze the impact of lifestyle on the environment.
6. Depict evolutionary trends and adaptations to environmental changes.
7. Describe environmental hazards and risks and the social and economic ramifications.
8. Describe ecological and statistical techniques and approaches used in the study of environmental biology.
9. Apply scientific reasoning to investigate questions and utilize scientific tools such as microscopes and laboratory equipment to collect and analyze data.
10. Use critical thinking and scientific problem-solving to make informed decisions in the laboratory.
11. Communicate effectively the results of scientific investigations.
V. **Attendance Policy/Makeup Work**
Students are expected to be in class on a daily basis. If a student is absent, they are allowed to have the number of days they are absent plus one to turn in their assignments. If assignments are already given and due dates are found on the course calendar, they are due when the student returns to class. Late assignments will receive half credit, if they are completed before the Unit Exam. After the Unit Exam, no credit can be earned for these assignments.

VI. **Class Assessment/Grading**
Exams, Labs and Quizzes 65%
Classwork and Homework 35%

VII. **Course Content:** See Learning Objectives listed above.

VIII. **ADA Statement:**
Any student who requires special accommodations due to a documented disability under the provisions of the American with Disabilities Act should contact the District Coordinator the first week of class.

IX. **Course Calendar**
Students will collect and evaluate current environmental issues in the news each six weeks. The articles collected will be used to begin classroom discussions on how environmental issues are intertwined with societal issues and politics.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Duration</th>
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<tbody>
<tr>
<td><strong>Science Process and Nature of Science</strong></td>
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<tr>
<td>• Experimental Design—developing and conducting</td>
<td>1 week</td>
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<td>• Presenting, Analyzing and Interpreting Data</td>
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<td>• Dimensional Analysis</td>
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<td>• Analytical Thinking</td>
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<td>• Solving Environmental Problems</td>
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<td>• Math Skills</td>
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<tr>
<td><strong>Terrestrial Ecology</strong></td>
<td>4 weeks</td>
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<td>• Population dynamics</td>
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<td>• Communities and niches</td>
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<td>• Terrestrial biomes</td>
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<td>• Seasons</td>
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<td>• Solar intensity and latitude</td>
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<td>• ENSO</td>
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<td>• Weather and climate</td>
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<td>• Atmospheric circulation and the Coriolis Effect</td>
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<td>• Energy flow and pyramids</td>
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<tr>
<td>• Biogeochemical cycles</td>
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<td>• Energy concepts</td>
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<td><strong>Human Populations</strong></td>
<td>3 weeks</td>
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<td>• Human population sizes &amp; distribution</td>
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<td>• Distribution and fertility rates</td>
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<td>• Growth rate and doubling times</td>
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<td>• Demographic transitions</td>
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<td>• Age structure diagrams</td>
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<tr>
<td><strong>Aquatic Ecology</strong></td>
<td>4 weeks</td>
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<tr>
<td>• Eutrophication</td>
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<td>• Freshwater biomes</td>
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<td>• Surface and groundwater issues</td>
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<td>• Conservation</td>
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<td>• Saltwater Biomes</td>
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</table>
- Ocean circulation
- Global problems
- Fishing techniques
- Overfishing
- Relevant laws and treaties

**Biodiversity and Endangered Species**
- Species diversity
- Preservation, remediation, mitigation, restoration
- Habitat loss
- Exotic species
- Endangered and extinct species
- Deforestation
- Economic impacts and decisions

**Earth Systems, Resources and Energy**
- Geologic time scale
- Plate tectonics
- Earthquakes & volcanoes
- Rock cycle
- Energy forms, units and conversions
- History and global energy use
- Mining
- Fossil fuel resources and use
- Earth Resources
- Nuclear energy
- Renewable energy
- Energy conservation
- Economic impacts and decisions

**Soil**
- Formation and composition
- Physical and chemical properties
- Soil types
- Erosion and other soil problems
- Conservation
- Forestry and Rangeland

**Pesticides, Toxicity and Human Health**
- Types of pesticides
- Cost and benefits of pesticide use
- Bioaccumulation and Biomagnification
- Biological poisons
- Integrated Pest Management
- Relevant Laws

**Waste Management**
- Solid waste disposal and reduction
- Hazard chemicals and wastes

**Air**
- Air pollution
- Smog
- Acid deposition
- Indoor air pollutants
- Clean Air Act and other laws
- Human health risks
- Stratospheric ozone and ozone depletion
- Global warming
- Economic impacts

**Water**
- Pollution
Labs, Activities, Field Trips and Videos:
Students will spend 25-40% of their class time engaged in labs, field trips or activities to reinforce learning. Many of the labs will require students to collect data and apply mathematical analysis of that data. Additionally, students will be required to design and conduct long and short term laboratory experiments using appropriate scientific processes. Many long term projects will require students to identify environmental problems and propose solutions for solving these problems.

Nature of Science and Science Processes
- Critiquing Scientific Studies
- Presenting and Analyzing Scientific Data
- Seed Germination Experimental Design
- Effects of Radiation on Seed Germination and Growth (data will be statistically analyzed)
- Using Chi Square Statistics

Terrestrial Ecology (includes climate and weather)
- Tragedy of the Commons
- Carbon Budget
  - calculations involved
- Environmental pH
- EcoBottle Long Term Lab
- Estimating Population Size
  - using Lincoln Index
- Mark Recapture Lab
  - using Petersen Method
- Community Structure
  - students will calculate density, frequency, relative density and relative frequency of species within a terrestrial community
- Calculating Energy Flow in Trophic Levels Lab
- Owl Pellet Lab
- Carrying Capacity Lab
  - Students analyze data to calculate carrying capacity of an oak forest.
- Decay and Renewal Labs from Cornell Inquiry Series
- Which gets hotter land or water lab
- Creating and Understanding Climatograms from Internet
- Terrestrial Ecology Field Study
- Video: *The Lorax*
- Video: *Strange Days on Planet Earth--Predators*

Populations
- Duckweed Population Lab
- Population Sampling Lab
  - Hayden and Zippen’s Methods
- World Population Lab
  - Interpreting data from internet
- Population Growth Lab
  - Calculate and graph population growth using different population models
- Building Age Structure Diagrams Lab
- Power of the Pyramids Histogram Lab
- Effects of overcrowding on plant development Lab
- **Field Trip**: Cemetery Population Study
- Comparing the populations in China and India Activity
- Video: *The People Bomb*
- Video: *World in the Balance*

**Aquatic Ecology**
- Continuation of EcoBottle Long Term Lab
  - Students investigate nitrogen cycle
  - Students investigate relationship between oxygen and carbon dioxide in a closed ecosystem
- Estimating populations of Daphnia
- Watershed Dynamics Labs from Cornell Inquiry Series
- **Field Study of Concho River System**
  - Students will investigate how the Concho River System changes from the headwaters South of San Angelo as it flows through the City of San Angelo. Students will observe and measure dissolved oxygen, carbon dioxide, nitrates, ammonia, pH, sediment load, macroinvertebrates, stream flow etc… Students will observe the effects of runoff from agriculture and city sources on the river system and propose solutions for these problems.
- Water, water everywhere
- Video: *Strange Days on Planet Earth—Dangerous Catch*
- Video Series: *Blue Planet*

**Biodiversity and Endangered Species**
- Field Trip: Abilene Zoo
- Parking Lot Ecology Lab
- Biodiversity in Leaf Litter
  - Shannon-Weiner Diversity Index
- Biodiversity Hotspots Research Activity
- Invasive Ecology Labs from Cornell Inquiry Series
- Research Activity on Endangered and/or Endemic Species of West Texas
- **Field Trip**: Natural History Collection at Angelo State University
- Video: *Cane Toads*
- Video: *Strange Days on Planet Earth—Invaders*
- Video Series: *Planet Earth*
- Video Series: *Evolution*

**Earth Systems, Resources and Energy**
- Solar panel lab
- Cookie Mining Lab
- Energy Conversions Calculations Activity
- Effectiveness of Insulation Lab
  - “Watts” the Cost?
- Renewable Energy poster assignment
  - Identify alternatives to nonrenewable resources
- Research on nuclear energy
- Fossil Fuel/Personal Energy Audit Lab
  - Calculating personal energy use
- Virtual Earthquake activity
- Rock cycle and formation activity
- Volcano Activity
- Virtual Lab on Plate Tectonics
- Half life problems/calculations
- **Field trip** to recycling center
- **Field trip** to wind farm
- Video: *A crude Awakening*
- Video: *Who killed the Electric Car?*

**Soil**
- Soil texture lab
- Soil permeability lab
- Soil chemical lab
- Soil bulk density and structure lab
- Student designed lab on Effect of Seed Germination with Various soil parameters

**Pesticides, Toxicity and Human Health**
- Assessing Toxic Risk Labs
  - Cornell Scientific Inquiry Series—Supplement published by NSTA
- Pesticide label lab
- Toxicity of herbicides lab
- Daphnia LD50 lab
- Earthworm and pesticide lab
- Video: *Chernobyl Heart*

**Waste Management**
- Landfill and composting research
- Making Paper Activity
- **Field trip** to the landfill
- Video: *Trashed*

**Air and Air Pollution**
- Air Quality Analysis
- Effects of Sulfur and Nitrogen Dioxides on Seed Germination
- Measuring Automobile Pollutants Lab
- Testing For Ozone Lab
- Effects of Solar UV Radiation on Cells
- Virtual Lab: Ozone Hole, El Nino Prediction
- Data Analysis Lab: Carbon Dioxide Levels and Global Temperature Trends
- Video: *An Inconvenient Truth*
- Video: *Strange Days on Planet Earth—The One Degree Factor*
- Video: *Six Degrees Could Change the Earth*

**Water and Water Pollution**
- Organic waste and its effect on dissolved oxygen
- Fish lab- Nuclear energy and its effect on the environment
- Aquatic Primary Productivity Lab
- Guest Speaker from TCEQ (Texas Commission on Environmental Quality)
- Sewage treatment lab
- **Field trip** to sewage treatment plant
- Video: *Strange Days on Planet Earth—Troubled Waters*
- Video: *China’s Mega Dam*