

P R O J E C T D E S I G N : O V E R V I E W

Name of Project: Animal Behavior: Chiricahua Leopard Frog Population Protection		Duration: Approximately 2 weeks
Subject/Course: Honors Biology	Teacher(s): Bertelsen	Grade Level: 10th grade
Other subject areas to be included, if any: math, local history, environmental sciences		

Significant Content
(CCSS and/or others)

NGSS/ Life Sciences

- HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

- HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

- HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

- HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

- HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

- HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

- HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

- HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment .

21st Century Competencies (to be taught and assessed)	Collaboration Students must work in teams to complete project using speaking, listening and online communication skills.		Creativity and Innovation Students will development an implementable plan with a timeline, prediction of environmental impacts, and a storyboard and/or film.	
	Communication Student communication will be ongoing between partners, and with teacher. Students also produce a presentation/storyboard/video and report		Other:	
	Critical Thinking Students should be able to incorporate computer resources like web searches, email/ Google Drive, and Excel.			
Project Summary / SCENARIO / TASK (include student role, issue, problem or challenge, action taken, and purpose/beneficiary)	Deconstructed Scenario: Topic: Protecting the Chiricahua Leopard Frog Population Topic: What causes species to become endangered? Introductory Paragraph – Here in Southwestern United States, particularly Arizona, we have plant and animals that are not found anywhere else in the world. The Chiricahua Leopard Frog is a threatened species that is only found in Arizona and the southwestern part of New Mexico (Federal Register). Scenario: The Federal Department of the Interior considers Pima county critical habitat for these frogs, which require a year-round water source for survival. The sudden growth and development in southern Pima county, especially throughout Sahuarita and Green Valley is increasing the odds that the Chiricahua Leopard Frog will soon reach Endangered status. Scenario: While water consumption is increasing in Sahuarita due to an increasing population as well as industries located in the area, the local water table is a continual concern. Since much			

of the wildlife in the area is dependent on seasonal and annual water sources, we need to consider how our buildings and infrastructure are affecting their ability to access water.
Paragraph 1 – Introduce facts, comparing it to other data. Make it more urgent. (2 sentences)

GREEN VALLEY, ARIZONA (023668)

Period of Record Monthly Climate Summary

Period of Record : 05/01/1988 to 01/20/2015

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Total Precipitation (in.)	0.73	0.87	0.71	0.31	0.21	0.32	3.23	3.01	1.43	1.12	0.57	0.90	13.42

<http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?az3668>

June 1st through November 30th is considered active hurricane season and accounts for much of the monsoonal moisture in Arizona. [NOAA](#) () is predicting above-normal hurricane and tropical storm activity during the 2015 hurricane season resulting in an more active monsoon season here in Arizona. How are local businesses and parks where Chiricahua Leopard Frogs are located going to manage them and will this increase in ground water cause the frogs to relocate to ultimately less desirable living conditions, farther threatening their survival?

Paragraph 2 –

This question is relevant because there is a know population of Chiricahua Leopard Frogs living on Freeport McMoran’s Sierrita mining property, just west of Green Valley. This mine employs over 1,200 local workers and if the movement of wildlife encroaches too close to mining operations then the Federal Government has the right to mandate a halt to mining in order to protect local threatened and endangered wildlife, regardless of local economic implications. While these native species are crucial in maintaining our local habitats and ecology there is also a great need to care for and manage them in a way that will insure that a balance between human business and functions and proper care for other species in the area.

How will we manage this balancing act?

“It has been said that amphibians are an indicator species; that what happens to them could be an indicator for the remaining species on the planet. If we lose them, what does this mean for all the other species on planet Earth?”

Task:

(Role) You are a leading biological researcher in a local Threatened and Endangered species-

	<p>monitoring group that is advising Freeport McMoran on the continued impact of their operations and status the Chiricahua Leopard Frog. <i>(Goal)</i>To propose a sustainable management program that will ensure the opportunity for the frog population group on the property without compromising production and local job security. <i>(Audience)</i> The Environmental team at Sierrita mine and the contracting biological monitoring group. <i>(Product)</i>A proposed and implementable short and long-term management plan for the property including any foreseeable challenges.</p>	
<p>Driving Question /s (essential questions)</p>	<p>What leads to speciation? How does natural selection impact the traits present in a population? Why should we protect populations of organisms? How do we protect a given population?</p>	
<p>Entry Event</p>	<p>Bring in Tim or Tamara from Sierrita Operations to talk to kids about the frogs and what measures they are currently taking.</p> <p>https://www.youtube.com/watch?v=Dm1AYKa5JLw</p>	
<p>Products</p>	<p>Teams:</p> <p>Students will produce each of the following:</p> <ol style="list-style-type: none"> 1. Formal progress/update reports 2. Formal protection plan and presentation including: <ul style="list-style-type: none"> • Points addressing each part of the scientific method • Addresses environmental pressures that effect species survival and evolution • Mathematical predictions of population or traits within a population based on gathered data • Model of mathematic calculations • Specific and implementable means of protecting the species 	<p>Specific content and competencies to be assessed:</p> <p>The project provided the occasion to assess diagnostic and research skills, report and research paper writing, and communication through a written report. We discuss several of these areas below.</p> <p><u>Use of library time</u> Students will create a list of environmental pressures to research and a check list to ensure they researched the material they said they would. If the student was unable to find enough information to fill out the form, then he/she has to choose another focus for their research.</p> <p><u>Group Discussions</u></p>

	<ul style="list-style-type: none"> • Appropriate images and/or multimedia 	<p>Group members will participate in online discussion of materials and research on their project.</p> <p><u>Research Reports</u> These reports will be summarize student work, findings and any difficulties they may be encountering. Reports will be assessed according the rubric.</p> <p><u>Presentation</u> Students will create a project proposal with their groups to present. This will include graphics/ multimedia, mathematical models, and a description of their processes and research. Rubrics will be provided.</p>
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P R O J E C T D E S I G N : O V E R V I E W

Public Audience (Experts, audiences, or product users students will engage with during/at end of project)	Environmental team at Freeport Mcmoran, Sierrita Mine site and the student’s respective class.		
Resources Needed	<p>On-site people, facilities:</p> <ul style="list-style-type: none"> • Biology surveyors (contractors) <p>Equipment:</p> <ul style="list-style-type: none"> • Computers • Topographic map of property • Environmental diagnostic tools (such as LabQuests) <p>Materials:</p> <ul style="list-style-type: none"> • Topographic map of property <p>Community Resources: Survey biologist, environmental team at the mine, UofA</p>		
Reflection Methods (Individual, Team, and/or Whole Class)	All students will be placed in a focus group/ team to complete this project.		Each student planning team will turn in a weekly Progress Report outlining their findings, ideas and general progression through the project.
	Students will participate in online discussion on prompts provided about each driving question. Students will need to research the prompt and share their findings with their team and/or class.		Socratic Discussion on a driving question during class.

	Survey Pre/Post for the Individual		Other:	
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Notes:

PROJECT DESIGN: STUDENT LEARNING GUIDE

Project: Animal Behavior: Chiricahua Leopard Frog Population Protection

Driving Question: How do we protect a population?

Final Product(s) Presentations, Performances, Products and/or Services	Learning Outcomes/Targets content & 21st century competencies needed by students to successfully complete products	Checkpoints/Formative Assessments to check for learning and ensure students are on track	Instructional Strategies for All Learners provided by teacher, other staff, experts; includes scaffolds, materials, lessons aligned to learning outcomes and formative assessments
Protection Plan & Pre/ Post Survey	Students will understand: How the survival of a population is dependent on cycles and energy flow within an ecosystem. HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.	AP Investigation 10: Energy Dynamics Lab Mini-poster on a chosen cycle (carbon, water, nitrogen, phosphorus, etc.)	Local biologist or mine employee to explain environmental conditions on the property Lesson & Activity topics: <ul style="list-style-type: none"> • Free energy • Energy loss in a system • Gas and nutrient cycles Provide students with: <ul style="list-style-type: none"> - Rubrics for all graded assignments - Essential questions and learning objectives - Lab supplies
	Students will be able to predict: How natural selection impacts the prevalence of traits in a population and the how those traits may (positively or negatively) affect the population under differing circumstances. HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) mutations caused by environmental factors.	AP Investigation 11: Animal Behavior Lab including student designed lab on animal behavior Online discussion of pH and concentration gradients based off of Garland Science videos and reading. Calculate standard deviation, interpret significance based on standard error of the mean in models (practice questions and data sets) AP Investigation : Natural Selection Lab (if the supplies are in on time, otherwise the online simulation on PhET)	Lesson & Activity topics: <ul style="list-style-type: none"> • Natural selection vs. Artificial selection • Selective pressures • Fitness • Determining statistical significance Provide students with: <ul style="list-style-type: none"> - Rubrics for all graded assignments - Essential questions and learning objectives - Lab supplies

	<p>HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.</p>		
	<p>Students will be able to support and defend:</p> <p>A species protection plan</p> <p>HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.</p>	<p>Student projects</p>	<p>Provide students with:</p> <ul style="list-style-type: none"> - Rubrics for all graded assignments - Essential questions and learning objectives <p>As needed the teacher will aid in:</p> <ul style="list-style-type: none"> Use of Office products and online software, like Prezi, needed to complete the protection plan Citations Presentation strategies

Project Narrative

1. How does the environment affect life (natural selection) within an ecosystem? How can we prove/ show a relationship between an environment and it's affect on local populations?
 - Energy Dynamics Lab
2. What environmental factors are present?
 - Choose a cycle and create a mini-poster on it to present to the class.
3. How are cycles and energy related? How do specific cycles and energy availability affect survival (natural selection)?
 - Natural Selection Lab
4. What specific pressure cause speciation in an ecosystem?
 - Student research and data collection
5. How would you protect an endangered species in an ecosystem?
 - Students design protection plan and present them