Course Title – MD Biology

Implement start year – 2016-2017

Revision Committee Members, email, extension –

Sarah Moretti- smoretti@lrhsd.org Ext. 8400
Marc Rohm- mrohm@lrhsd.org Ext. 8996
Lee Timpano- ltimpano@lrhsd.org Ext. 8047

Unit #2– Ecosystems: Interactions, Energy, and Dynamics and Biological Evolution

Transfer Goal –

Students will be able to independently use their learning to recognize their role as a steward of the environment and demonstrate responsibility in protecting their environment.

Stage 1 – Desired Results

HS-LS2 Ecosystems: Interactions, Energy, and Dynamics

LS2.A: Interdependent Relationships in Ecosystems

- Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1),(HS-LS2-2)

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

- Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (HS-LS2-3)
- Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. (HS-LS2-4)
- Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans,

21st Century Themes
(www.21stcenturyskills.org)

_x__ Global Awareness
___Financial, Economic, Business and Entrepreneurial Literacy
_x__Civic Literacy
_x__Health Literacy
_x__Environmental Literacy

21st Century Skills

Learning and Innovation Skills:
_x__Creativity and Innovation
_x__Critical Thinking and Problem Solving
_x__Communication and Collaboration

Information, Media and Technology Skills:
_x__Information Literacy
_x__Media Literacy
_x__ICT (Information, Communications and Technology) Literacy

and geosphere through chemical, physical, geological, and biological processes. (HS-LS2-5)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2),(HS-LS2-6)
- Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (HS-LS2-7)

LS2.D: Social Interactions and Group Behavior

- Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (HS-LS2-8)

LS4.D: Biodiversity and Humans

- Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). *(secondary to HS-LS2-7)*
- Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. *(secondary to HS-LS2-7) (Note: This Disciplinary Core Idea is also addressed by HS-LS4-6.)*

PS3.D: Energy in Chemical Processes

- The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. *(secondary to HS-LS2-5)*

ETS1.B: Developing Possible Solutions

- When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts.*(secondary to HS-LS2-7)*

Life and Career Skills:

_x__Flexibility and Adaptability
_x__Initiative and Self-Direction
_x__Social and Cross-Cultural Skills
_x__Productivity and Accountability
_x__Leadership and Responsibility

Enduring Understandings: *Students will understand that . . .* *EU 1* all organisms transfer energy from one organism to another. *EU 2* ecosystems are resilient, but are impacted greatly by both natural and human influences. *EU 3* evolution of an organism is dependent on group dynamics, adaptation, and natural selection. *EU 4* patterns of evolution have evolved species over time.	**Essential Questions:** *EU 1* • How do organisms in a food chain interact? • How is all life dependent upon plants? *EU 2* • Why do species' interactions influence a food web? • How do limiting factors and carrying capacity together affect populations in an environment? • How do you positively and negatively interact with your environment? *EU 3* • How do organisms avoid competition? • How does the environment dictate favorable traits that are passed on through generations? • Why do organisms with advantageous traits survive, reproduce, and pass those traits to offspring? *EU 4* • Why does evolution affect a species population? • How do we know that evolution has occurred within a species?
Knowledge: *Students will know . . .* *EU 1* • producers convert light energy from the sun into chemical energy stored in food. • predator/prey interactions allow for energy to be transferred between organisms. • food chains show energy flow from producers through consumers *EU 2* • living and nonliving parts of an ecosystem.	**Skills:** *Students will be able to . . .* *EU 1* • describe how food chains, food webs, and energy pyramids work. • discuss how animals get energy to stay alive. *EU 2* • differentiate between human and natural impacts on ecosystems. • design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. HS-LS2-7.

• living and nonliving things interact within an ecosystem. • natural changes and human impacts on an ecosystem. • human attempts to protect an ecosystem. *EU 3* • what natural selection is and its function in an ecosystem. • factors that can cause a species to be threatened, endangered, or extinct. • environmental factors influencing natural selection. • types of symbiotic organism interactions, including parasitic, mutualistic, and commensalism. *EU 4* • the principles of evolution provide a scientific explanation for the history of life on earth. • evolution occurs as a result of reproduction, mutation, resources, and natural selection.	*EU 3* • identify adaptions in species that have enabled their survival. • Construct an explanation based on evidence for how natural selection leads to adaptation of populations. HS-LS4-4 • examine factors that impact a species survival in an ecosystem. • distinguish between symbiotic relationships. • evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species HS-LS4-5 *EU 4* • communicate scientific information that common ancestry and biological evolution are supported by data. HS-LS4-1 • construct an explanation that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) 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. HS-LS4-2

Stage 2 – Assessment Evidence

Recommended Performance Tasks:

You are working for the World Wildlife Federation and you have just been informed that the following animals have been added to the endangered animals list: polar bears, camels, toucans, humpback whales, moose, and buffalo. Your job is to choose one animal and assess the current environmental issues in that animal's ecosystem to determine which issues could be contributing to their endangerment. You will present your findings (i.e. poster, PowerPoint, brochure, etc.) to the Government. Your presentation must include your animal, its specific adaptations, its role in the ecosystem's food web, current environmental issues, and how they impact your animal's survival. (EU 1, EU 2 & EU 3)

You are a tour guide working for Celebrity Cruises. You are tasked with guiding a family around a Galapagos Island and explaining the evolution and natural selection that has shaped the finch population on the Island. You must create tour guide materials, such as a visual aide (chart, poster, graph, timeline, map, flip chart) and speaking points, to explain the heritable variation created by natural selection. You must also have enough knowledge to answer potential questions from the family about human and natural influences on the environment that would affect the future finch population. You will be evaluated on your visual aide, talking points, and answers to questions from the tour guide manager. (EU 3 & 4)

Other RecommendedEvidence:*Tests, Quizzes, Prompts, Self-assessment, Observations, Dialogues, etc.*

- Tests (energy pyramids, components of an ecosystem, symbiotic relationships)
- Quizzes (energy pyramids, components of an ecosystem, symbiotic relationships)
- Alternate Proficiency Assessment (APA)
- Formative assessment
- Reports and Presentations
- Diagrams, flow charts (food chains and food webs)
- Participate in various labs and write lab reports using the scientific method
- Class discussion/teacher observation
- Student reflection
- Multimedia presentations (food chain, food web, ecosystems, symbiotic relationships)

Stage 3 – Learning Plan

Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections:

- Identify components of a food chain, food web, and energy pyramid (A)
- List the abiotic and biotic members of an ecosystem from smallest to largest (A/M)
- Choose an ecosystem and create a food chain including predator, prey, producers, consumers, and decomposers (M/T)
- Draw a diagram of the reproductive cycle of plants (A)
- Journal and reflect on the benefits of plants to humans and animals (A/M/T)
- Compare freezing temperature of salt and fresh water and describe how it may harm or benefit aquamarine life (M)
- Watch The Lorax and reflect on how it relates to human impact in our environment (A/M/T)
- Watch Wolves of Yellowstone and reflect on environmental reaction (A/M/T)
- Provide examples of how structural and behavioral adaptations work together to help an organism survive in its environment (A/M)
- Create a Venn diagram to compare and contrast human and natural impacts on ecosystems (A)
- Create a timeline of an organism that has adapted over many years to its environmental changes (M)
- Research a natural and a human impact on an ecosystem in your area and give possible solutions to each (M/T)
- Model overcrowding in an environment using classroom resources (A/M)
- List examples of symbiotic relationships (A)
- Create a photo collage of symbiotic relationships using the iPad (A/M)
- Make an alphabet book including all of the interactions that occur in an ecosystem (M)
- Create a documentary to show examples of symbiosis in human interactions (T)
- Watch educational videos to identify examples of natural selection and evolution (http://www.neok12.com/Natural-Selection.htm) (A)
- Chart the various locations of Galapagos turtle and explain specific trait variations related to environment (M)
- Complete the candy dish lab using various candies to show different reasons for adaptations (http://www.ucmp.berkeley.edu/education/lessons/candy_dish.html) (M)
- Chart a timeline of the evolution of a specific animal (M/T)

Timeline: 1-2 marking periods