Rising Tide Charter Public School **Designer:** Kate Shara
Don Schoener

UNIT PLAN

Unit Topic: What Makes Up Our Environment? Unit 4

Subject Area Essential Question(s):
What drives the interconnected nature of the world and its living things?
What makes an effective observer?
How do we recognize patterns?
What is a system and how do systems interact?
What does it mean to be alive?
How are matter and energy related?
How do forces affect the natural world?
How do we appropriately use technology to address global challenges?
How do we classify the world around us?

Unit Level Essential Question(s):
How do living systems on Earth interact and balance with each other?
How do matter and energy flow through ecosystems?
How are the various fields of science interrelated?

What important questions are raised by this topic? What questions will guide inquiry into it?

Goals

A: Skills (Students will be able to – ACTIONS)

RTCS COM:Rec
- Interpret graphs, tables, or other data of populations to infer what events could be taking place within that population

RTCS COM: Exp
- Identify relationships between two organisms (ex: Predator-Prey; different types of symbioses)
- Uses scientific language with fluency
- Diagram the flow of energy and nutrients through ecosystems

RTCS INV:Inq:
- Identifies the validity/credibility of a source of scientific information.
- Classify species by taxonomy.
- Classify species by trophic level position

RTCS INV:Inn:
- Employs creativity in sharing information about an organism and its role in its ecosystem.

RTCS SDL: SAw
- Recognizes that personal beliefs influence people's thinking, and maintains an objective and scientific point of view
- Recognizes how their behavior relates to community norms.
- Engages in class discussion.

RTCS SDL: Rsp
- Identifies and tracks new vocabulary relating to ecology
- Manages class time and own time to efficiently

RTCS CST: AwO
- Identifies the effects of humans on the environment, and comprehends the experimental evidence to support that claim
- Appreciates the interdependencies that humans and the rest of the planet share, and can identify why humans need the other living things on Earth, and why Earth needs humans to be responsible stewards.
- Relates to the experiences of others (nutrient cycle/farmers/fishermen activity)
- Recognizes their impact on others

RTCS CST: Clb
- Contributes to class activities and demonstrations by participating in a variety of roles
- Works as a team (when in groups) to solve problems in a way that involves all team members.

*What specific skills, related to this topic, are stated or implied in the **MA Curriculum Framework**? In our **Schoolwide Objectives and Benchmark Skills**? Are there any other specific skills that should be introduced or practiced in this unit?*

B: Content Knowledge (Students will know – FACTS, FIGURES, DEFINITIONS)

- The organizational structure of classifying living things
- The flow of energy through food chains/webs, trophic levels
- The purpose and role of producers and consumers
- Symbiotic relationships
- The cycles of water, oxygen, carbon, nitrogen, phosphorus
- Population growth and limits
- Types of biomes
- Human population growth
- Human effects on environments
- Ways to increase sustainability

'06 MA Frameworks: 6.1, 6.2, 6.3, 6.4, 5.2, 1.1
'16 MA Frameworks: HS-LS2-1, HS-LS4-2, HS-LS4-4, HS-LS4-5, HS-LS4-6, HS-LS4-7, HS-LS1-5

*What factual knowledge must students acquire to fully explore the topic? What content standards from the **MA Curriculum Framework** connect to this topic?*

C: Understandings (Students will GENERALIZE [UNDERLYING CONCEPTS], INTERNALIZE, FIND EVIDENCE, EXPLAIN, REPRESENT IN NEW WAYS, TRANSFER)

RTCS INV: Inq
- Transfer knowledge from chemistry to biology to understand the links between the disciplines
- Explain how energy and matter flow through the system and are recycled naturally
    - Transfer knowledge about predator-prey/consumer-producer relationships to their knowledge about cycles of matter and energy flow in order to understand the balance of living things

RTCS CST: AwO

- Generalize the interconnectedness of all living things, including humans
- Find evidence of humans' effects on each other
    - Relates to the experiences of others
    - Recognizes others differences and others perspectives
- Find evidence of humans' effects on earth
    - Internalize the importance of sustainability
    - Internalize the importance of all living things to the balance of earth

What should students come to understand as they explore this topic, practice these skills, and grapple with these essential questions?

Evidence of Students' Reaching Goals: (Ways to assess the demonstration of understanding skills, knowledge and understandings) [Challenge/Problem] - Climate change labs, hurricane inquiry [Group work/challenge] - Mass GIS local maps and changing landscapes activity [Performance Task - Group work] Group inquiry packet on nutrient cycles [Presentation] Ecology project on an organism and its role in the ecosystem (with choice of organism) [Challenge/Experiment] Winogradsky column of microbial ecosystems - creation and weekly observation [Verbal response] Daily, during class instruction and when students are working in small groups or independently [Written response] in-class essay on "100 Ecological Questions" *How will students demonstrate that they have achieved the goals of this unit? What real-world tasks, challenges, or transfer performances will reveal students' understanding and proficiency?*	In Class Independent Work Group Work Discrete Skill Integrated Skills Verbal Response Discussion Presentation Written Response Paper Quiz/Test Performance Task Challenge/Problem

Inquiry – and Skill-Based Teaching and Learning Ideas: [Entry Points] - Short reading/headlines/photos of current events involving Ecology [Kinesthetic] - Field work (hands-on outside investigations) to introduce the idea of Ecology/Ecosystem and work on observation skills [Visual/Synthesis] - Mini-assignment, food web construction of Plymouth's ecosystem(s) [Inquiry] - Prior to covering nutrient cycles, ask students to write a one-paragraph narrative from the point of view of a carbon atom, explaining	Entry Points Clear Information Model Skills Skill Instruction Practice Skills Ongoing Feedback Inquiries Investigations Assignments Challenges For Individuals For Small Groups For Whole Class Multiple Modes

how the same carbon could have once been in a dinosaur and is now part of them. [Kinesthetic/Whole class] - Build a living food web using the students as representatives of various species. Use twine to connect to each other. [Small Groups/Challenge/Investigation] - Read a scientific article on a symbiotic relationship and present the information to the class [Small Groups/Challenge/Investigation] - Scaffolded inquiry packet on nutrient cycles (work in small groups), includes local topic on overabundance of phosphorus and algal blooms. [Choice/Multiple Modes] - Choose a biome and make a commercial inviting species to live in that habitat [Investigation - independent work] Plymouth ecological community drawings - how has the local landscape changed over time, considering human development of land? [Inquiry] - Create, maintain and observe a Winogradsky column. *What lessons and assignments will help students acquire the knowledge and skills, make meaning of the important ideas, and transfer their learning to new situations? What **connections** can be made to our **local region**?*	Verbal Visual Kinesthetic Pacing Choices Flexible Groupings Varied Assignments

Key Texts and Resources:

Tuoti, G., *Toxic Algae Poses Risk in Some Massachusetts Ponds*. Plymouth's Wicked Local and the Old Colony Memorial. 2017 August 11. http://plymouth.wickedlocal.com/news/20170811/toxic-algae-poses-risk-in-some-massachusetts-ponds

IsleRoyaleWolf.org

Miller & Levine, Biology, Macaw edition

Various primary literature sources on symbioses

McFall-Ngai, M., Divinging the Essence of Symbiosis. PLoS Biol. 2014 Feb; 12(2) http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3913551/

Garcia, K. and Zimmermann, S., The role of mycorrhizal associations in plant potassium nutrition Front Plant Sci. 2014; 5:337 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4101882/

Siepielski, A. and Benkman, C., A seed predator drives the evolution of a seed dispersal mutalism. Proc Biol Sci 2008 Aug 22; 275(1645). http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2593931/

Hojo, M., Lycaenid Caterpillar Secretions Manipulate Attendant Ant Behavior. Cell. Volume 25 p 2260-2264 http://www.cell.com/current-biology/abstract/S0960-9822(15)00819-2?_returnURL=http%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS0960982215008192%3Fshowall%3Dtrue

Rochman, C., et al, Anthropogenic debris in seafood. Scientific Reports 5, article number: 14340 (2015) http://www.nature.com/articles/srep14340