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Ecology – Energy Flow, Environments, and Habitats [7th grade]

Alex Wallender
Trinity University, Alexander.Wallender@trinity.edu

UNDERSTANDING BY DESIGN

Unit Cover Page

Unit Title: Ecology – Energy Flow, Environments, and Habitats

Grade Level: 7

Subject/Topic Area(s): Science

Designed By: Alex Wallender

Time Frame: 31 days

School District: Northeast ISD

School: Jackson Middle School

School Address and Phone: 4538 Vance Jackson
San Antonio, TX 78230
210-442-0550

Brief Summary of Unit (Including curricular context and unit goals):

By the end of this unit students will understand that life depends on energy flow through systems. They will recognize the many energy transformations that take place, and focus especially on the transformation of radiant energy to chemical energy in the process of photosynthesis. Students will also understand that as energy is transferred throughout an ecosystem and is used or transformed along the way. They will be able to diagram the flow of energy in a number of manners including: food chains, food webs, and energy pyramids. Lastly, students will leave this unit understanding that organisms and their environments; both living and non-living are interconnected. They will be able to describe various environments and the biodiversity created in those ecosystems. In addition they will be able to describe how an environment and the organisms in it attempt to maintain balance when disrupted. In the end students will be able to take a plot of land and describe the different ecological features of it from biodiversity to energy flow and predict its response to various internal and external factors.

Unit: Ecology: 1) Energy Flow & Transfer, 2) Environments & Habitats
Grade: 7

Stage 1: Desired Results

Established Goals (Standards)

TEKS or Scope & Sequence

7.5. Matter and energy. The student knows that interactions occur between matter and energy. The student is expected to:

(A) Recognize that radiant energy from the Sun is transformed into chemical energy through the process of photosynthesis.

(B) Demonstrate and explain the cycling of matter within living systems **such as** in the decay of biomass in a compost bin;

(C) Diagram the flow of energy through living systems, **including** food chains, food webs, and energy pyramids.

7.10 Organisms and environments. The student knows that there is a relationship between organisms and environment. The student is expected to.

(A) Observe and describe how different environments, **including** microhabitats in schoolyards and biomes, support different varieties of organisms.

(B) Describe how biodiversity contributes to the sustainability of an ecosystem; and

(C) Observe, record, and describe the role of ecological succession **such as** in a microhabitat of a garden with weeds.

7.13 Organisms and environments. The student knows that a living organism must be able to maintain balance in stable internal conditions in response to external and internal stimuli. The student is expected to:

(A) Investigate how organisms respond to external stimuli found in the environment **such as** phototropism and fight or flight

(B) Describe and relate responses in organisms that may result from internal stimuli **such as** wilting in plants and fever or vomiting in animals that allow them to maintain balance

Understandings

Students will understand that…

- Life depends on energy flow within systems.
- An ecosystem transfers (and transforms) matter and energy from one organism to another.
- Organisms (including you) and their environments are interconnected.

Essential Questions

How are matter and energy connected?

How are organisms dependent on one another?

How are organisms shaped by their environment?

Knowledge *Students will know…*	**Skills** *Students will be able to…*
▪ The difference between matter and energy. ▪ The basic energy transformations in the environment. ▪ How the process of photosynthesis occurs. ▪ What microhabitats are in a school yard ▪ How different biomes cause different adaptations for animals. ▪ What biodiversity and sustainability are and how they and interconnected ▪ What succession is and how it occurs in different situations. ▪ What external and internal stimuli are and how organisms responded differently to their environments.	▪ Effectively use science equipment ▪ Accurately gather measurements and other data. ▪ Make quantitative observations. ▪ Make qualitative observations. ▪ Diagram the flow of energy in food chains, food webs, and energy pyramids. ▪ Illustrate and describe the process of photosynthesis. ▪ Compare and contrast internal and external stimuli. ▪ Illustrate the cycling of matter in living systems.

Stage 2: Assessment Evidence

Performance Task:

Students will work in pairs and choose an area of land to study and observe, either at their home/apartment, or here at Jackson. Using that piece of land they will research, observe, and pictorially document a variety of information related to the ecology of their plot (organisms present, organisms classification and trophic levels, food chains present, the plot's stage of succession and level of biodiversity, and basic energy transformations occurring) in addition they will then predict what the impact to and response of the environment would be given four different situations. Students will present their information in the medium of their choice (booklet, power point, poster or video).

Other evidence:

End of Unit Test
Mini-Assessments after each specific TEK

Stage 3: Learning Activities

(Steps taken to get students to answer Stage 1 questions and complete performance task)

Day 1: (Advanced Organizer – Energy Transformations)

- Warm-up: Describe three energy transformations occurring in this room right at this moment.
- Engage: HAIL – Return of the Sun (http://www.youtube.com/watch?v=lFJc4xuFPcc&feature=related)
- Explore: Matching Sort Review, in pairs student will match the forms of energy with their definition and a pictorial example.
    - To wrap up this activity I will have students in their science journal divide their page into four and we'll create a graphic organizer looking at the four main forms of energy we will be focusing on for their unit: radiant, chemical, heat, and mechanical.
- Explain: Defining energy transformation, bring back in student created examples from their warm-up.
- Elaborate: Building energy transformation Graphic Organizer: Gateways 7: pg. 48 (TE36)
- Evaluate: 3-2-1 Exit Slip: 3 – Forms of energy we'll be using in this unit, 2 – energy transformations using those forms of energy, 1 – What do you think the most important form of energy is?

Day 2: (Photosynthesis)

- Warm-Up: What is the function of the sun?
- Engage: Cartoon Animation: Plants (http://www.youtube.com/watch?v=0PEYAOKTqEU&feature=related)
- Photosynthesis Song: (http://www.mrdurand.info/singscience.html) – We will listen through the song once, having students reading along with the lyrics. We will then listen to the song again, but this time the students will highlight/underline things that they hear/read and are unsure what that means.
- Explore: Disocveryeducation.com: "Building a Plant" Exploration – Students will reconstruct the parts of a plant individually through the online exploration. We will then discuss as a class that through plants look very different, for the most part they all have a very similar structure.
- Planting Seeds – We will then plant seeds hanging in a couple of different directions so that we will be able to observe their growth later in the unit.
- Explain: As a class we will then have students look at the "Assembly Plant: Part 1" handout and compare and contrasts the various structure and functions of the three main components of the plant: Leaves, stem, and roots. (This will serve as their exit slip for the day.)

Day 3: (Photosynthesis)

- Warm-Up Question: What do plants need to grow?
- Explain: Oxygen/Sugar Factory: (Adapted from Junior Master Gardeners L1 pg 17): Give students a black and white outline of the leaf. Ask them what color are leaves usually? Have them color the leaf that color. Have them color a green square in the corner of their paper and label it green=chlorophyll=makes the plants food= sugar (glucose). Ask them what plants need to make their food. After they have listed off: sun, water, Carbon dioxide, soil (nutrients) have them stand on their chair and reenacting being the sun radiating down over everything. Then on their diagram have them draw a sun and l several arrows going towards their leaf, have them label one of these sunlight and the rest radiant energy. Have them stand back up on their chairs and act water raining down, and then getting sucked up by the plant. Then on their diagram have them label water coming into the leaf through the steam (xylem). Have them simply stand up (on the floor) and take five deep breaths in and deep breaths out. Ask them what they breathe in and what they breath out then ask them to compare that to what they already know about plants. Have them then draw on their leaf the CO_2 coming in and the 0_2 leaving. Ask them then what is missing from their leaf? Get them to the point of saying the plants food, describe it as sugar (glucose). Then have them drawn the glucose going out of the leaf's steam (phloem). Bellow their leaf have them define photosynthesis and then together right the equation.
- Elaborate: "Stomata & Chlorophyll Mini-Investigation" - Students will then rotate between two sets of microscopes set up around the room. The microscopes will already have prepared slides, one set with Purple Heart (Wandering Jew) to see the plants stomata and the other with Elodea Leaf to look at the individual plant cells with their chlorophyll. They will answer the question on their lab sheets with their lab partner and turn them in as they leave as their exit slip.

Day 4: (Photosynthesis)

- Warm-Up Question: Describe the process of photosynthesis.
- Elaborate -Gizmo: Cell Energy Cycle, students will work individually assisted by their table partners on the simulated investigation examining the overall process of photosynthesis, in addition to how the chloroplasts assist in this process.
- Evaluate: Mini-Assessment over TEK 7.5A

Day 5: (Day before spring break)

- Buffer Day

Day 6: (Environmental Organization)

- Warm-Up Question: Describe what you think of when you hear the worlds: community, population and habitat.
- Engage/Explore: Give students a series of cards with images on them (organism, population, community, ecosystem, habitat, biosphere) with their table partner have them sort and organize

them in whichever way they seem to make sense. Have groups come up with an explanation for their organization, and share out with the class.

- Explain: In their science journals have students draw an inverse pyramid. Starting at the lower level have them right the term organism →population→community→ecosystem→habitat→ biosphere. At each level of their pyramid have them define the term, and give a pictorial representation of it. At the bottom of the pyramid have them define limiting factor and carrying capacity.
- Evaluate: "ID the term" – Going through a PowerPoint of 20 slides composed of various images. Students job will be trying to determine if the image they see is a organism, population, community, ecosystem, habitat, or biosphere. This will be their exit slip out of the door.

Day 7: (Biotic/Abiotic)

- Warm-up: (Engage/Explore) Look at a picture from a natural scene. Using the brief text from GW8 –pg 199 have students develop a list of what they think biotic and abiotic organisms might be in the image.
- Explain: Biotic/Abiotic Similarities &Differences: Have students create a t-chart in their science journal, biotic on the left, abiotic on the right. First have them define each term, after having them define each term have them provide contrasting examples of each. Lastly talk about what the importance of each type of factor. Cap the bottom of t-chart with an inverse pyramid, in this pyramid have them talk about the similarities between the two.
- Provide students with another colored picture from a natural scene. Have them make a t-chart in their science journal with biotic and abiotic factors as the heading. Have them identify as many biotic and abiotic factors as they can in 3 minutes. Have them then pair up with the table partner and revise their lists. After that, give each student a dry erase marker, and do a quick chalk talk listing one factor on either side of the board labeled: biotic and abiotic.
- Elaborate: Discoveryeducation.com: **"**Is it Alive?" Exploration. Have students list factors that help to determine whether an object is biotic or abiotic.
- Evaluate: Exit Slip: Least three examples of biotic and abiotic factors and underneath each describe why they are important.

Day 8: (Ecosystem/Habitat)

- Warm-Up: (Engage) : Eco is the Greek word for home describe either in words or images what you think of when you think of your home.
- Explore: "Oh Deer" Game from Project WILD pg.36-40
- Explain/Evaluate: After the game is over have students write their observations on about the game, what they saw happen, what they would change to improve the game. With the help of their table partner have them create their own definitions of habitat, limiting factor, and carrying capacity.

Day 9: (Organism Classification/Food Chains)

- Warm-Up: What is a food chain?
- Engage: Food Chain Song – youtube:sciencemusicvideos (http://www.youtube.com/watch?v=TE6wqG4nb3M&feature=related)
- Explore: "Putting the Chain Together" – (Adapted from GW 8, pg 200) Give students a set of organisms (that would be in the same food chain as one another) and arrows, with their table partner have them organize the organisms and arrows in an order that they think a food chain would be order.
- Explain: "Energy Flow is Systems" Short Reading and questions.
- Have the students draw a pyramid this time with the widest part at the bottom. Have them write producer and the bottom, then herbivore, carnivore and decomposer. Off to the side of herbivore and carnivore have them write omnivore. For each word have them define and illustrate the term.
- Evaluate: "Food Chain Sort" Activity - Given 8 sets of organisms, students with their table partner, are to put them into the food chain order and identify the producer, herbivore, and decomposer in each set.

Day 10: (Organism Classification/Food Chains)

- Warm-Up Question: What do the arrows in a food chain show?

- Elaborate –"Gizmo: Food Chains", students will work individually assisted by their table partners on the simulated investigation examining food chains and how they would respond given various changes in population sizes.

Day 11: (Food Webs/Energy Pyramids)

- Warm-Up Question: What does the term food web make you think of? What might it mean?
- Engage: Bill Nye Food Web Clip – Short clip from Bill Nye as he attempts to construct a food web.
- Explore: "Building a Food Web" – Given cards with various organisms and what they consume on them students with their table partner will try to use yarn and connect the organisms together.
- Explain: "Texas Ecology: Food Web" handout - Using the Texas parries as a case study we will examine the various components of a food web and their interconnections.

Day 12: (Food Webs/Energy Pyramids)

- Warm-Up Question: What do you notice about the shape of a pyramid?
- Engage: Human Pyramid – Asking five students (preferable kinesthetic learner) the day before to volunteer to build a human pyramid (make sure to prepare the room so they don't injure themselves.) As they construct the pyramid have students describe observations they make.
- Engage: Replay Food Chain Song from Day 9
- Explore: "The Learning Site – Energy Pyramids." Students will work in pairs watching /reading the short walk through video on energy pyramids. As they go through they will answer key questions about each of the four pages of presentations. (http://www.harcourtschool.com/activity/science_up_close/314/deploy/interface.html)
- Explain: "Energy Pyramid Notes" – Using a combination of graphic organizers we as a whole class will go through and talk about the specifics involved in constructing an energy pyramid, energy transfer to the high trophic levels, and which type of organisms goes at which level.
- Energy Pyramid Building Basics – students will be given an energy pyramid that the can construct. They will choose a set of organisms from the food chain sort activity, and will place them in appropriately on the pyramid, identify what type of organism they are, the energy at each level and provide an image.
- Evaluate: Mini- Assessment 7.5B/C

Day 13: (Cycling in Systems)

- Warm-Up Question: What is a cycle?
- Engage: Nitrogen Cycle Song
  Circle of Life Song (http://www.youtube.com/watch?v=vX07j9SDFcc)
- Explore/Explain: "Compost Transformations"(8^{th} grade TAKs review) – Students will tie back in their knowledge of energy transformations as they investigate and describe compost at three difference stages of the process: new material→ breaking down→ compost. Students will also tie in their knowledge of decomposers help in this process.
- "Planting Gardens" – Groups of four students will plant "square foot gardens" (most likely depending on the status of the outdoor classroom, these will be done in 5 gallon buckets). They will get to plant season appropriate seeds of their choice. We will also put in their plot some grass seed, as example of weeds. This will be setting the stage for talking about succession the following week. Each day though students will make observations about what is occurring inside of their garden plot.

Day 14: (Symbiosis)

- Warm-Up Question: Are you dependent on anyone? Is anyone dependent upon you?
- Engage/Explore: "Good Buddies" (Adapted from ProjectWILD pg. 91) – Students will each receive an organism. They will be tasked to move around the room and find their partner organism
- Explain: "Symbiosis Foldable": Students will be given a sheet of paper, turn it horizontal and fold both end into the middle and then cut the two flaps. On each of the four panels they will now label them: symbiosis, commensalism, parasitism, and mutualism. For each term they will provide a definition and then as a class we will talk through examples and provide an image.
- Evaluate: "Symbiosis in Texas" – Students will be given a list of symbiotic relationship amongst

organisms in this region of Texas. With their table partners they are to work on determining what type of symbiotic relationship the organisms have, who benefits and what the impact is on the other organism is (positive, neutral or negative).

Day 15: (Biomes/Climate)

- Warm-Up: Describe the climate of San Antonio.
- Engage: How-Stuff-Works: Earth's Terrestrial Biomes (http://videos.howstuffworks.com/hsw/17800-earths-major-life-zones-terrestrial-biomes-video.htm)
- Explore: Discoveryeducation.com: "A Biome to Call Home" – Students will complete the short online exploration to color in the map locating the various biomes around the world, relating it also to temperature.

Day 16: (Biomes/Climate)

- Warm-Up: What biome would you make like to visit and why?
- Explain: "Earth's Biomes"
- Elaborate: "Energy Pyramid Biomes" – Students will receive a short description of three biomes, describing the interactions and connections among the organisms living in that particular biome. They will use the information provided in the reading to construct an energy pyramid of the particular biome, identifying
- Evaluate: "ID the Biome" – Students will be given specific descriptors of the biomes and they will be charged with trying to match the biome type to the description.
- Evaluate: Mini-Assessment 7.10A

Day 17: (Biodiversity)

- Warm-Up Question: When you hear the word diversity what comes to mind? Define diversity.
- Engage: "What is your Biodiversity IQ" Have students in table pairs try and answer the question in on the biodiversity IQ sheet. Go over the answers then as a group discussing each question along the way. (http://www.fieldmuseum.org/biodiversity/illinois_basics/Activity1-1.pdf)
- Explore: "Move Over Rover' (Adapted from ProjectWILD pg. 144-150) – We will review key biome descriptors from the two previous days. These biomes will be places around the room. Each student will be given an organism card and have to decide which biome to go to. Then as a class we will discuss each students location, talk about why some can go in different regions, and what the variety under each area might mean.
- Explain: Marzano's Boxes on vocabulary: Biodiversity, Sustainability, Niche.

Day 18: (Biodiversity)

- Warm-Up Question: What does the term sustainability mean?
- Explain: "Biodiversity Webquest" using (http://www.biodiversity911.org/biodiversity_basics/biodiversity_main.html)
- Evaluate: Mini-Assessment 7.10B

Day 19: (Biodiversity)

- Warm-up Questions: What's one thing you learned about biodiversity from yesterday's webquest?
- Elaborate/Evaluate: "The Nature of Poetry" (http://www.fieldmuseum.org/biodiversity/illinois_basics/Activity2-1.pdf)

Day 20: (Succession)

- Warm-Up: What does it mean to succeed someone?
- Engage/Explore: Four short clips from "Biologix: Succession and Climax Communities": What Determines, The Stages, Influences, Time (discoveryeducation.com).
- Explain: "Succession Foldable" : Students will be given a sheet of paper, turn it horizontal and fold both end into the middle and then cut the two flaps. On each of the four panels they will now label them: primary succession, secondary succession, pioneer community, and climax community. For each term they will provide a definition and then as a class we will talk through examples and provide an image.
- Explain: "Primary Succession Storyboard:" Using pg. 377 of their textbook as a guide, students

will personify and retell the story of primary succession in a 5 panel story board from the perceptive of the abotic and biotic parts of the ecosystem.

Day 21: (Succession)

- Warm-Up: Can you give other examples of succession not in nature?
- Explain: Finish "Primary Succession Storyboard"
- Elaborate: "Revisiting the garden". Over the last two weeks students have been making daily observations about the growth of their garden plot. Today students will diagram and graph the changes they have observed. In addition they will summarize their observations into broader segments of time. We will then take these summarizations and related them to the process of secondary succession.
- Evaluate: "Mini-Assessment 7.10C

Day 22: (Homeostasis)

- Warm-up: What is one thing inside of you that effects how you feel? One thing outside of you?
- Explore: "Internal vs. External" - Students will view several images and short video clips and try and decide if the event occurring is internal or external to the organism. They will then compare their notes to that of their partner, and then share out and discuss as an entire class.
- Explain: Marzon's Boxes: Students will then complete six Marzano's vocabulary boxes over the terms: Internal stimulus, external stimulus, homeostasis, geotropism, phototropism, and fight or flight.
- Evaluate: "Balanced or unbalanced": Students will receive a sheet with five scenarios. There job will be to determine if an internal or external stimulus if occurring in the situation and then whether or not the system is able to maintain homeostasis.

Day 23: (Homeostasis)

- Warm-up:
- Elaborate: "Gizmo – Prairie Ecosystem" – Students will use this online investigation to examine how ecosystem respond to different stimuli and maintain balance (or collapse).
- Evaluate: Mini-Assessment 7.13A/B

Day 24: (Performance Assessment)

- Students will receive a copy of the performance assessment assignment sheet and rubric. We will go over the instruction and rubric as a class and discuss what resources I can make available to them. We will then talk about target goals for each day, and show them an example of the project I have done.
- Students will get time to begin working on their performance assessment.

Day 25-26: (Performance Assessment)

- Work days on performance assessment.

Day 27-28: (Performance Assessment)

- Students will present their performance assessments to the class. Class members will provide peer review, in addition to "One thing I learned…" slips for each project.

Day 29:

- Buffer Day

Day 30: (Unit Test Review)

- Students will get a traditional paper review which they will have half the class period to work on.
- "Numbered Heads" – Students will then be divided into groups of four and we will play numbered heads to review key points for the exam.

Day 31 (Unit Test)

- Students will take their end of unit test covering material from through the unit.

A Plot of Your Own

The City of San Antonio Zoning and Planning Commission has been inundated by building requests in the Jackson Middle School area. In order to handle the massive volume of requests they are looking for help in doing environmental impact studies. They have divided the area up into parcels and are asking for our help in putting together presentations evaluating the variety of habitats and ecosystems in this area.

Task Overview:
You will work in pairs and choose an area of land to study and observe, either at your home/apartment, here at Jackson or somewhere else in this area. Using that piece of land you will research the needed information bellow and then predict what the impact and response of the environment would be given four different situations. You will present all of this information in a booklet, power point, poster or video.

Needed Information:

Part 1

- Identify the number of following organisms: (Provide images)
    1) Producers: 3
    2) Herbivores: 2
    3) Carnivores: 1
    4) Omnivores: 1
    5) Decomposers: 1
- Construct a food web using these organisms.
- Develop an energy pyramid using four of these organisms.

Part 2

- Describe the level of diversity of organisms in your plot.
- Describe what stage of succession your plot of land is in. (Provide images)
- Identify and describe four energy transformations occurring in your plot.

Part 3

- Predict how your environment would respond to the following situations:
    1) Paving over the land
    2) Drought
    3) Use of pesticides
    4) A sudden increase in bird population

	Excellent	Good	Average	Needs Improvement
Part 1 (40 pts)	**40pts** All of the appropriate organisms are identified correctly. The food chain and energy pyramid clearly and accurately communicate the relationships between organisms and energy	**30pts** 80% of the appropriate organisms are identified correctly. The food chain and energy pyramid communicate the relationships between organisms and energy.	**20pts** 70% of the appropriate organisms are identified correctly. The food chain and energy pyramid roughly present the relationships between organisms and energy.	**10pt** Less than 70% of the appropriate organisms are identified correctly. The food chain and energy pyramid misrepresent the relationships between organisms and energy.
Part 2 (40 pts)	**40pts** The level of diversity has clearly been investigated and described. The level of succession has correctly been identified, and four accurate energy transformations have been described.	**30pts** The level of diversity has been investigated and described. The level of succession has correctly been identified, and three accurate energy transformations have been described.	**20pts** The level of diversity has been investigated and described on a surface level. The level of succession is incorrect, and only two energy transformations have been described.	**10pts** The level of diversity has not been investigated or described. The level of succession is incorrect, and less than two energy transformations have been described.
Part 3 (30 pts)	**30pts** All four predictions have been addressed in a thoughtful and full experienced way, understanding the multiple levels of connection.	**23pts** At least three predictions have been addressed in a thoughtful and full experienced way, understanding the multiple levels of connection.	**15pts** All four predictions have been addressed in a surface level manner.	**8pts**. At least two predictions have been addressed in a surface level manner.
Neatness/Creativity (20pts)	**20pts** The project is neat, well organized, demonstrates a high level of creativity.	**15pts** The project is neat and well organized.	**10pts** The project is neat but the organization is somewhat confusing.	**5pts** Little thought has been put into how the project looks.
Group Effort (25pts)	**25pts** Every member of the group was active, participating, and on task the entire time.	**18pts** Every member of the group was active, participating, and on task the 90% of the time.	**12pts** Every member of the group was active, participating, and on task the 80% of the time.	**6pts** Every member of the group was active, participating, and on task less than 75% of the time.
Final Product (45pts)	**45pt** Every part of the project has been put together in a cohesive and creative manner that effectively communicates the information needed.	**33pts** 80% of the project has been put together in a cohesive and creative manner that effectively communicates the information needed.	**22pts** The project has included every part but with the bare minimum information needed.	**11pts.** The project does not include every part and it is put together in a way that communicates little effort.