CAMP CLASSEN YMCA

TRAIL GUIDE

LAKE CLASSEN

TRAIL

Revised Summer, 2003
Implemented **Fall, 2004**
Trail Cards

Trail Focus: Cycles in Nature

Water cycle, carbon-oxygen cycle, and nitrogen cycle

- Cycles in nature and their relationship to plant and animal communities
- Human impact on nature

Teaching Stations: Lake Classen

Length: Approx. 1 mile

15 Teaching Stations

Color Code: Blue

Note: pH testing of water and/or soil can be done anywhere on this trail.
These testing materials are in the Camp Classes trail backpack

Station Number	Title and focus AND teacher materials needed
1	**Griffith Lodge Photo** – Trail Introduction; Our Changing World 55 gal. of Water
2	**Dedication Rock** – Gases in the Atmosphere Human bar graph Oxygen for a Day
3	**Spillway Bridge** – Human Impact Traveling Tune-Water Cycle
4	**Lake Classen Dam** – Cycles of a Small Lake Ecosystem
5	**Grassy Opening** – Succession
6	**Hardwood Forest** – Carbon-Oxygen Cycle Perc test; Tree id; Transpiration; Keeping your Balance; Moss Study- **Baggies**
7	**Lake Overlook** – Environmental and Human Influences Perc test

Materials listed for each station on the Trail Cards are provided in the backpack.

Note: pH testing of water and/or soil can be done anywhere on this trail.
These testing materials are in the Camp Classes trail backpack

Station Number	Title and focus
8	**Marsh Overlook** – Eutrophication and Layers of the Lake
9	**Forest Opening** – Niche Signs of Wildlife list; Transpiration baggie; Leaf rubbings; **paper, crayons**
10	**First Creek Bed Crossing** – Tributaries and Watersheds Optional perc test
11	**The Rotten Forest** – Decomposition and Recycling ExperiMint; Nitrogen Cycle; Traveling Tune **Mint per student**; **spring balance**
12	**Second Creek Crossing** – Erosion and Sedimentation
13	**Lowland Forest** – Plant Diversity
14	**Classen Falls** – Hydrology Collect Water Samples for Lab; Perc test; Biotic Index
15	**Review** – Completing the Cycle

Materials listed for each station on the Trail Cards are provided in the backpack.

Teaching and Hiking Suggestions

- Before beginning the trail, explain trail rules and what is expected of each student and counselor
- Backpacks should only contain necessary trail items
- Everyone should check for tied shoelaces
- Position counselors at the end of their cabin group
- Be observant of the surroundings and take advantage of “teachable moments”
- At teaching stations, gather students close so that they can hear, attend, and be involved
- Rotate cabin groups during the hike to give everyone a chance to be at the front

Trail Rules

- Stay on trails and walk single file. This reduces erosion and helps maintain habitat for animals. Don’t shortcut the “switchbacks.”
- Don’t litter! Leave no record that you were here, except for footprints. Paper, water bottles, orange peels, piles of rocks, even broken limbs are sad signs of human impact.
- Be prepared. Dress for the weather. Bring water in hot weather. Don’t carry so much that you may tire yourself.
- Stay with your group. This keeps people safe, and allows everyone to share in the learning. Keep one person at the end to “bring up the rear.”
- Use study materials. There are other trail guides, field guides, and other materials available to tell you more.
- Be patient and quiet. Getting there is half the fun. Slow down: noise scares away wildlife, and you will miss the things you came to see. Take time to learn and appreciate beauty.

Griffith Lodge Photo

Trail Introduction; Our Changing World

Movement of Water through its Cycle

We all see water fall as rain, creeks and drainage appear, and puddles dry up. We all know something about the **importance of water for life.** The force of water movement is the result of the **pull of gravity**. Consider the streambeds and what makes water flow downhill. Gravity pulls water toward the lowest point in the terrain. What provides the **energy** for the water to evaporate? It is the **sun - solar energy**- that makes water go upward. **Solar energy and gravity do almost all of the work to move water in its cycle.**

STUDENT ACTIVITIES

1. Look at the photo on the wall, identify various places in camp for comparison; Camp Classen was established.

- Photo was taken in 1941; newspaper article is taken from the Daily Oklahoman newspaper
- Named Camp Classen in honor of the family who gave a major gift to the camp
- From 1950 on, used for YMCA activities, family groups, churches, etc for outdoor activities and events
- In the 1980s, Outdoor School programs began
- Comparisons from photo and today:
  - Hills were bare; today. . .
  - Gravel covered road used to construct the dam; today . . .
  - Number of camp buildings; today . . . Nature Center built in 1990; Activity Center in 1992
  - Notice the type of car in front of the caretaker's house
  - Notice the tower and the dock then; today . . .

"Change is one of the few things you can count on." Humans can make a lot of changes: some positive change (impounding the lake for recreation), some negative change. Nature changes as well: whether that is good or bad is hard to tell (rain falls, trees grow on a prairie and on top of a gravel road). Water truly plays an intricate role in changes of our natural world. Water is the "main ingredient" in all-living things. We will notice on this hike how nature changes, and how humans change nature as well.

2. Discuss how individuals and communities have benefited from recreational programs that stress outdoor living skills.

3. Discuss "ecology" and "environment": camping, outdoor recreation, wildlife conservation and human welfare.

4. 55-Gallons of Water. If all of the water on earth were in this can:

53 gallons in the world's oceans (a bathtub full)
1.75 gallons in the polar icecaps and glaciers (a bucket full)
1.75 gallons ground water (a bucket full)
1 pint, 4.5 ounces in the atmosphere (a soda pop full)
.5 ounces in freshwater lakes (a soda pop lid full)
.34 ounces in salty lakes and inland seas (a medicine dropper full)
.25 ounces in soil moisture and in living things (a few drops)
.01 ounces in rivers (a drop)

5. Review trail rules and hiking practices.

6. While walking, identify where water is: lake, drinking fountain, clouds, tree leaves, grass, our bodies, mud puddles, in the ground.

7. Discuss man's use of water (drinking, irrigation, recreation, industrial/commercial use, etc.).

VOCABULARY WORDS

Cycle: a pattern where something seems to move in a circle.
Dam: a barrier constructed across a waterway to control the flow or raise the level of water.
Ecology: the study of relationships between living and nonliving things in the natural environment.
Environment: all aspects of one's surroundings, especially natural surroundings.
Environmental Awareness: a sense of understanding and care regarding the natural world.
Impound: to confine and accumulate and store (water) in a reservoir.
Recreation: refreshment of one's mind or body after work through activity that amuses or stimulates; play.
Reservoir: a natural or artificial pond or lake used for the storage and regulation of water.
Water Cycle: the various "circular" paths of movement of water on a global scale.

Materials : 20 ft. rope

Dedication Rock and the brass plaque

This rock commemorates the first days of Camp Classen. 1941 was the first summer of camping here. Camp Classen is still open for the purpose of group camping in ways that develop human potential in terms of spirit, mind, and body in an outdoor setting. The names on the brass plaque on this rock are the people who were involved with making this dam.

Lake Classen is a man made lake. Many lakes are designed and built by humans. The only natural in the state of Texas is Caddo Lake in East Texas.

Here at Camp Classen, it was the job of the engineer to design the dam, and figure out how to build it. The contractor's job was to be in charge of actually building the dam.

STUDENT ACTIVITIES

1. Create a **human bar graph** to represent the percentages of the different gases in the atmosphere.
    a. If you have 20 students on the trail the arrangement would be: 78% nitrogen (15 students), 21% oxygen (4 students), and 1% other gases (1 student). The other gases are carbon dioxide, water vapor, carbon monoxide, and ozone.
    b. Have the students stand in three lines parallel to each other. There should be 15 students in the first line, 4 students in the second line and 1 student in the third line.
    c. Ask the students which group of students they think would represent the amount of oxygen in the atmosphere. A common belief is that oxygen is the predominant gas in the atmosphere. Explain to the students that the line with 4 students represents how much oxygen there is (21%). Continue the discussion for nitrogen and the other gases.
2. Review the **Water Cycle**, emphasizing that the Sun provides the energy for the cycle.

3. **Oxygen for a Day** Materials: 25 ft (6m) strings

a. "How much grass it takes to produce enough oxygen for your needs in one day? What is your hypothesis?" Studies have shown that a person needs a minimum of 360 liters of oxygen per day, or the volume equal to 180 two-liter bottles of soda. A 25-square foot plot of grass will produce about that much oxygen in one day.

b. Give each cabin group a 25-foot length of string to measure a 25 sq. ft. plot of grass that represents their individual oxygen needs for a day. To form a 25 square foot plot have the students hold the string and make a square.

-Add that one nearby average tree also produces enough oxygen each day to support one person, while in turn, that person exhales carbon dioxide providing the tree with its supply of carbon dioxide.

c. "What if there are not people around to supply carbon dioxide?(Possible answers: the tree also produces a small amount of carbon dioxide with the oxygen, neighboring trees produce some carbon dioxide, animals living nearby exhale, organisms all over the world produce CO_2)

VOCABULARY

Atmosphere: all of the gases associated with the earth
Condensation: the act or process of water changing from a gas to a liquid
Evaporation: the process whereby a liquid absorbs energy and changes to gas, and rises
Groundwater: water beneath the earth's surface in porous sedimentary rock; supplies wells and springs.
Humidity: moisture in the air
Precipitation: water falling from the atmosphere as rain, snow, sleet or hail
Seep: to pass slowly through small openings or pores; ooze, such as through soil
Solar Energy: energy from the sun
Spring: a place where ground water comes to the surface

SPILLWAY BRIDGE

Human Impact

The Spillway

The structure across the dam opening is called a spillway. This structure was placed here to relieve the overflow from the dam when the water level is too high. The original bridge washed away in a severe storm that occurred in the fall of 1987. The water was high enough that half of the boathouse (across the lake) was underwater. Imagine the force as the muddy, churning water raged over the spillway, carrying entire trees and uprooting a metal bridge! The marsh at the far end of the lake was also created as a result of this storm. A local company, The Kim ray Company, donated money to build a new bridge. The original pylons still remain and were used in the reconstruction of the new bridge.

Standing on the spillway you can see that the far end of the lake is shallower than the area in front of you by the docks. This end of the lake is approximately two telephone poles deep and is the deepest area of the lake. The far end of the lake where Lick Creek empties into the lake continues to deposit sediment significantly decreasing the depth at that end. The far end of the lake is now only deep enough to stand in.

Many years ago when the directors of this camp wanted to lower the level of vegetation in the lake in order to allow sailing as a recreational activity, they introduced a fish, the grass carp, into the lake to eat the vegetation. Twice as many carp were introduced as was needed to reduce the aquatic vegetation. The large number of grass carp placed in the lake reduced the aquatic vegetation so substantially that it was harmful and the lake is only now beginning to recover.

As you leave the spillway notice the small tree to the left where beavers have nearly cut down the tree.

STUDENT ACTIVITIES

1. Discuss with students how they feel about the results of human interference with the lake ecology.
2. Ask students to think of examples at home where human interference has occurred and the results of these actions. Discuss.
3. Look for debris on the creek side of the spillway, which has been carried over during times of flooding (pipes and concrete).

VOCABULARY

Spillway: a channel for an overflow of water, as from a reservoir
Sediment: different sizes of rock pieces and organic matter (plant parts, etc.)

Traveling Tune: The Water Cycle Song (Tune: Coming Around the Mountain)

Water travels in a cycle, yes it does.
Water travels in a cycle, yes it does.
It goes up as evaporation
It forms clouds as condensation

And it falls as precipitation

Yes it does!

LAKE CLASSEN DAM

Cycles of a Small Lake Ecosystem

A New Ecosystem

An ecosystem is an ecological community functioning together with its environment. Lake Classen is a **freshwater lake ecosystem** that formed after the dam was build and the valley filled with water. When the lake filled in the valley, humans changed the area from a **terrestrial (land) ecosystem** to an **aquatic (water) one**. Most animals were moved out of the new water area. Aquatic plants and animals took up life in the lake. People stocked the lake with fish. The aquatic community stabilized, and a complete food web (with plants, plant eaters, predators, scavengers, omnivores, and decomposers) was established. The terrestrial forest ecosystem formed here through natural succession, a change from certain kinds of species to other species living in an area. The oldest tree on the dam is younger than the dam itself.

Carbon/Oxygen Cycle: green plants release oxygen, animals breathe in oxygen, exhale CO_2 used by plants

Nutrient Cycle: living things die, decompose, form detritus, plants grow in this organic matter

Life Cycle: circle of life

Water cycle: thermal cycle-water is warmed in summer, cooled in winter; cold water settles to the bottom; if the water on the top is colder than the bottom water, as in the spring, the water at the bottom moves to the top causing seasonal turnover.

Sewage lagoon: naturally processes all wastewater at Camp Classen and provides habitat for insects, birds, and other wildlife

STUDENT ACTIVITIES

1. Discuss ecosystems and their functions including food chains.
2. Discuss sewage lagoon and its design and function.
3. Look back across the lake towards the Griffith Lodge. Ask the students to compare and contrast the view they see now, from this point on the dam with the view from the picture in the lodge. What changes do they see? How old are the trees on the dam? Does Vesper Mt. look any different? Why? Any new buildings? 13

4. Consider various methods to determine how old various ecosystems are. Methods might include annual rings, the height of a tree, the kinds of plants present, amount of litter and detritus present
5. While walking to the far (north) end of the dam, ask the students to guess when they go from the man made land of the dam to the nature made land. Ask students to list evidence for their judgment. (soft gravelly soil vs. bedrock, straight lines vs. curves and crooked lines, newer vs. older vegetation)
6. Just beyond the end of the dam, there is a large tree over the trail which shows scars from beaver damage. Discuss with the students the impact of this activity. Sometimes trees are not completely destroyed and the tree sprouts new shoots of growth. Imagine how this type of tree would change as it grows.

VOCABULARY

- **Aquatic:** referring to water
- **Carnivore:** a meat or animal eating organism.
- **Ecosystem:** an ecological community together with its environment, functioning as a unit.
- **Extinct:** the death of an entire species, irreplaceable.
- **Food chain:** the process of organisms and animals consuming foods needed for survival in an organized progression
- **Habitat:** the factors necessary for an organism to survive, such as food, water, shelter, and space.
- **Herbivore:** a plant-eating organism.
- **Natural succession:** the orderly process of the kinds of species, which live in a certain place changing over time, resulting in a gradually changing ecosystem.
- **Seasonal turnover:** change in temperature layers of a body of water resulting in movement of water.
- **Species:** a category of organisms, which can interbreed and generate more of the same organisms.
- **Terrestrial:** referring to land.

GRASSY OPENING
Succession

Knowing a Prairie

This is a **remnant prairie**. Grasses, major plants of prairies, once covered vast areas here along with many varieties of wildflowers. Much of the prairie is now covered with Eastern Red cedar. At Camp Classen some of the cedars are cut down or burned as resource management of the prairie and trails. In the past, fire was one way to control the spread of larger trees and allow grasses to regroup continuing the prairie community.

Biodiversity refers to the number of different kinds of species in an area.

Community Competition and Succession All plants and animals are constantly trying to grow as individuals, and expand their range. The plants and animals compete with each other, and other factors influence their success. (factors like soil type, fire, drought, etc)

Abiotic factors Nonliving factors like fire, drought, sunlight, temperature, water, climate, etc

Biotic factors Living factors like grazing animals, humans, other plants and animals, insects

Water is the most important limiting factor.

STUDENT ACTIVITIES

1. Observe the juniper saplings growing beneath the dead tree and discuss seed dispersal in bird droppings as a forest making strategy. Is this a biotic or abiotic factor? Speculate concerning the time required for the juniper saplings to control the biodiversity of this area.
2. Note and/or measure the degree of slope and relate soil depth, water runoff and plant composition as biotic/abiotic factors in the disappearance of the prairie.

3. Identify as many plants as possible. Note that the grasses persist throughout the year while the flowers are seasonal in appearance.
4. Consider the environmental factors of moisture and temperature that affect this site and speculate concerning the season of most abundant growth

VOCABULARY

Abiotic: nonliving or inorganic

Biotic: living or organic

Biodiversity: the number of different species of organisms in a certain area

Climax community: an ecosystem, which maintains essentially the same organisms and functions in a stable manner over long periods of time. The organisms do not change their surroundings to the extent to which they cannot reproduce and live in the same ecosystem.

Competition: the process resulting when several organisms or species simultaneously seek to expand yet needed resources are limited.

Indicator species: organisms which, taken together, identify a particular ecosystem or community.

Remnant prairie: the part of a prairie that remains, though other ecosystems may encroach.

Resource management: the process of making and carrying out effective decisions regarding natural resources, such as plant and animal populations.

Appendix Item Needed-Percolation Test Data Sheet Carbon-Oxygen Cycle

Carbon/Oxygen Cycle Carbon dioxide and oxygen are two vital gases needed by living things. This occurs through photosynthesis, respiration, and breathing.

STUDENT ACTIVITIES

1. Do a percolation test. One thing a percolation test will show is how compact the soil is. Try to find an out of the way place, where few feet have trodden, to do your percolation test. It should go much more quickly if the soil is loose.

PERCOLATION TEST:

Percolation is the process of water moving through a porous medium. A coffee maker uses this principle when water percolates through the coffee grounds. Soil scientists and agriculturists use percolation tests to learn about the quality of the soil. Here are the steps for a percolation test:

a. Dig a hole using a soil auger approximately 2 centimeters (one inch) wide, and 10 centimeters (four inches) deep. Paint on the auger marks the correct depth.

b. Pour a known amount of water into the hole in the ground. We will pour in one- fourth liter (about one cup). Use a water bottle for this procedure.

c. Begin to time as soon as the water is poured in. Stop timing when you can see the mud in the bottom, and no water is left pooled at the bottom.

d. Record the location and percolation time as well as ground characteristics. (Appendix: percolation test data sheet) Pour in the water in a similar manner every time you do the percolation test. The variables (things that can change) in this experiment are the location and the time of percolation. The constants (things that do not change) are the size of the hole, the amount of water, and the method of conducting the test. Fill the hole in with dirt, and try to leave no trace 17

2. **Transpiration**: Pick a fresh green leaf, and place it inside a dry, clean zip lock bag. As you or a student carries it on the rest of the hike, expose it to the sun. The leaf should release water, or "transpire" after a short while indicated by condensation inside the bag.

3. **Tree Identification Activity**: Collect one leaf sample of each tree common to this forest community. Look for a post oak, blackjack oak, hickory, shamed oak, cedar, and elm. Other trees to look for include redbud and dogwood. Allow one student to hold and show the group each leaf. Compare and contrast the leaves with the group. Now allow students to find a sample of each leaf. Ask them to find fallen leaves as much possible. Create crayon rubbings of the various leafs and check with a partner to see if their leaf identification is accurate, using the leaf identification guides (see Appendix). Next create crayon rubbings of the barks of the different trees in the area (see Appendix for bark identification). Match to the leaf crayon rubbings.

4. **Keeping Your Balance Activity**

a. With each arm extended pretend you are a scale or balance. Mark one hand O_2, the other CO_2. Open your right palm to indicate the weight on the balance for carbon. Open your left palm to indicate the weight on the balance for oxygen. When there is an abundance of a material the scale will be weighed down, the hand representing that substance will be lower.

b. The teacher will suggest variable situations that will influence the balance of the carbon cycle in our environment. Ask students to suggest situations after the following examples.

5. **Questions:**

*If the surrounding trees are cut down to make a shopping mall and a parking lot Answer: the scale tilts with more carbon dioxide and less oxygen in the air.

*If 3 times as many trees are planted along this ridge. Answer: the scale tilts with more oxygen and less carbon dioxide.

*If you're personal plot of grass dries up during a drought. Answer: the scale tilts with more carbon dioxide and less oxygen. 18

*What if a fire destroys millions of acres of plants? Students may offer a variety of answers. Prompt students to answer with knowledge of the impact of the carbon cycle.
6. Discuss carbon/oxygen cycle. Food for all green plants is made during the process of photosynthesis. During this process, oxygen is released which plants and animals use to live. During cellular respiration in animals, carbon dioxide and water are given off. Carbon dioxide is needed by green plants and algae for their food-making process of photosynthesis. Carbon dioxide and oxygen are continually recycled in nature. (Remember the Oxygen for a Day activity at the beginning of the trail.) Why is this cycle so important? Are you part of this cycle? What are two waste products produced when we breathe? (Answer: water vapor and carbon dioxide) What is the connection between this cycle and the food chain? (Answer: grass > glucose > plants need glucose and herbivore eats grass > herbivore uses glucose in grass to make their life giving energy >pioneer kills deer for food > pioneer uses glucose in deer meat to make his life giving energy.
7. **North/moss** tree study: It has been said that moss always grows on the north side of a tree. Does it? Ask students to walk into the forest, each choosing a tree, and stands on the side where the most moss grows. Make a "best fit judgment" to determine which direction the moss tends to grow. As a pattern, moss should grow on the north side of trees because shadows stay on that side (the sun is in the southern sky for us, who are north of the tropics).
A nearby hickory tree has been damaged by a storm. Look in the hole at the "micro-habitat" for evidence of wildlife. Discuss the injured hickory tree's recovery relative to the function of the xylem, cambium, phloem, and bark.
2. Appraise the condition of the plants in the shrub layer and speculate concerning those that are bent, dead, and dying condition caused by vines and shading.

3. Locate some oak and hickory seedlings and speculate concerning the factors that will hinder their progress (browsing animals, shade, vines).
4. Discuss how wildlife and small trees benefit when canopy trees die (forest is opened up, sunlight penetrates, and a wider variety of plants grow).

VOCABULARY

By-products: something left over from a process.
Cellular Respiration: process during which all organisms use oxygen to release energy from glucose. Makes up ½ of the carbon-oxygen cycle
Percolation: process of water moving through a porous medium.
Photosynthesis: process during which producers uses solar energy, water, and carbon dioxide to make glucose (food) Makes up ½ of the carbon-oxygen cycle.
Transpiration: to give off vapor containing un-used products, as through animal or plant pores.

LAKE OVERLOOK

Environmental and Human Influences

The Substrate (the Ground)

Compare this area to a parking lot. Where does the rainwater go when it hits a parking lot? Rainwater runs off the parking lot, rather than percolating into the soil. Point out the pile of brush. Why is this necessary? (to slow erosion) Doesn't the ground absorb the water? How quickly is the water absorbed? Let us look at the factors involved in understanding the answers to these questions.

Conduct the second **percolation test**. All students feel the soil sample. There is more clay here than at the first percolation test. The clay soil particles are very small and water cannot get through clay easily- **impermeable**. It can absorb only a small amount of water. **Erosion** begins when the **substrate** (ground) becomes **saturated**. When no more water can percolate down, it flows on the surface. A parking lot is an impermeable surface. Why can't plants grow on a parking lot (water is available; it rains there, too!)? There must be a place for roots to take hold, and minerals must be available. The brush pile on the hill is needed to slow the flow of water on this clay soil. Plants do not grow easily here because plant roots have a difficult time establishing themselves and getting nutrients from the clay soil. If plants were growing on the hill, this would slow the flow of water naturally. The deep, straight gullies indicate that the water flows down this hill with **high energy**, taking many soil particles to the bottom of the hill.

Human Impact and Ethics

A major human impact (**cultural** factor) on the natural environment is the interruption of natural cycles. A parking lot interrupts percolation. An impounded stream (to form Lake Classen) slows the job of drainage the stream does. How does a building interrupt the water cycle? Careful management is important.

STUDENT ACTIVITIES

1. Conduct a second percolation test, using the same procedure used at station #6.
2. Have students rub some of the soil between their fingers to check if the soil is rich in clay. Clay feels greasy in the hands. Be careful as the iron in this soil also stains clothes easily.
3. Identify the structural features of Camp Classen on the opposite shoreline and hillside that differ from the Griffith Lodge photo. (Activity center, dock…)
4. Discuss the questions: Why are parking lots important to human activity? Imagine the erosion and human impact if cars parked all over an expanse of ground.

VOCABULARY WORDS

Cultural: having to do with the activity of humans
Erosion: process of removing and carrying away material from the surface.
Ethics: relating to issues of good and bad, right and wrong
Impermeable: state where liquid cannot penetrate the material.
Permeable: state where liquid can penetrate the material.
Saturate: filling a **permeable** substance to capacity.
Substrate: material immediately below us; the ground, soil, or bedrock
Zone: to designate certain geographic areas.

Eutrophication

The grass-covered islands near the place that Lick Creek enters Lake Classen islands were greatly enlarged in the flood of 1987, the same one that washed out the spillway bridge. A half mile upstream, the high energy of the water in Lick Creek made a deep canyon seen on the Fossil Trail. The sand that was eroded was deposited in the low energy environment of the lake. High energy water carries particles; low energy water drops the particles. Sediments filling a lake and making these islands bigger is called **sedimentation.** Natural succession of the lake collecting sediment and becoming shallower is occurring. Eutrophication is the process whereby plant life, especially algae, grows abundantly, eventually reducing the dissolved oxygen content and often killing off other organisms. As the islands get bigger, the middle of the island becomes drier and water-loving trees grow. More sediment accumulates, and the lake changes to a marsh, then a meadow (small grassland) then a forest. Aquatic ecosystem to terrestrial ecosystem.

The Marsh

A **marsh** is a type of wetland characterized by soft, wet, low-lying land with **herbaceous** vegetation. It differs from a swamp because it doesn't have trees and woody vegetation. The boundaries of a marsh may be hard to determine since wetlands may gradually fade into land at one end, and into a waterway at the other. Here it can be seen where the marsh gives way to the lake. This marsh performs many functions: to help control flooding downstream by acting as a protective natural sponge, capturing, storing and slowly releasing water over a long period of time. Plants in the marsh take up and filter some pollutants.

The Lake Freshwater Ecology Layers of the Lake

A healthy lake has a well-balanced population of plants, plant eaters, predators, scavengers and decomposers that are adapted to live within certain zones in the lake. The **emergent** vegetation and most fish spawning beds are found in shallow water near the shoreline in the **littoral** zone. The **benthic** zone, deep areas of the lake, contain a vast number of aquatic invertebrates and microorganisms in these lake bottom sediments. The limnetic zone, open water area away from the shore, supports the free-floating algae and plankton. A greater variety of plants and animals live here as the lake becomes shallower. 23

To Dredge or Not to Dredge

As a part of the resource management of Camp Classen, a decision must be reached on whether to **dredge** the lake and marsh to halt the eutrophication and filling of the lake.

STUDENT ACTIVITIES

1. Point out and identify the various stages of lake succession as an ecological process (early emergent plants, marsh, meadow, shrubs, woodland).
2. After describing the zones of the lake, discuss the ecological importance of each zone (littoral- food production and nesting, benthic – bottom layer of the lake, limnetic - oxygen and food production)
3. Compare and contrast the plants of the marsh with the plants in the forest.
4. Notice the plants in the marsh area. " Are the plants in the marsh all the same? If not, how many types are there? Are they distributed evenly, randomly, in patterns, or in clumps?"
5. Discuss where the marsh might be experiencing changes by nature, and by humans.

VOCABULARY WORDS

Anaerobic: without oxygen.
Benthic zone: the bottom of lakes, ponds, oceans and tidal zones.
Dredge: to clean, deepen, or widen with a mechanical scoop.
Emergent: rising above a surrounding medium, as in wetland plants protruding above the water level.
Eutrophication: a process affecting waters that are rich in mineral and organic nutrients, whereby plant life (especially algae) proliferates, eventually reducing the dissolved oxygen content and often killing off other organisms.
Herbaceous: green and leaflike in appearance or texture, not woody.
Limnetic zone: the open water area away from the shore of a body of water
Littoral zone: the shallow water near the shoreline of a body of water
Marsh: a wetland characterized by soft, wet, low-lying land, marked by herbaceous vegetation.
Muck: dark, fertile soil containing a high percentage of organic material.
Plant Community: the many plants that share an area characterized by certain conditions. 24

Appendix Item needed-**Stream Food Web Diagram** Niche

Wildlife

Look for wildlife or signs of wildlife. Animals leave behind evidence of their activities. Raccoon, fox, skunk, opossum, armadillo, deer, coyote, beaver, turkey, and bobcat are among the wildlife in this area. **Tracks** are, perhaps, the most obvious signs of wildlife. Each animal leaves a distinct **footprint** as it moves about in search of water, food and shelter. Mud near creek beds and after a rainfall helps to preserve the tracks. While not as obvious as tracks, animals leave behind other marks as well. **Claw marks** on smooth bark might indicate where squirrels, opossums, or raccoons have been climbing. **Narrow trails** may indicate the regular path of deer, or rabbits. Armadillos may leave golf-balled sized holes in the ground as they dig for insects. There are also **beaver-chewed** tree stumps, signs of deer browsing on brush, or golf-ball sized holes in the ground from armadillos digging for insects. The tree stumps with **finely chiseled tooth marks** are evidence that North America's largest rodent, the beaver, is an occasional Lake Classen resident. The trees forming the canopy over this site are burr oaks. Their large, burred acorns are highly favored by the fox squirrel and white tail deer.

While it may be easy to study these animals in isolation, it is clear that each of these mammals fit in a certain **niche** within the lake's food web and possesses certain adaptations, structural and behavioral features that qualify them for their respective roles. Examples of adaptations include: webbed feet of beaver, sharp teeth of a mouse, and the habit of a turkey to scratch in the ground. Take a minute to list a few adaptations of things that live here. The beaver feeds on the cambium and inner bark layers of trees. Every organism here fills a **niche** in the ecology of Lake Classen. Niche means "Place in the ecosystem," or, simply, '**a job in nature**.' Every organism (plants, animals, every living thing) has a niche in nature, and there is only **one** niche for each organism. The concept of niche is very important to understanding ecology. An organism's niche is how we describe its **link to the natural environment**. 25

All of the niches in an ecosystem are complementary to each other and make the system complete. Examine the aquatic **food chain**. A one-celled animal is consumed by zooplankton, which is consumed by snails. Snails are consumed by fish, fish are consumed by birds and birds are consumed bobcats. If a change in the ecosystem occurs, the niches of affected organisms must change, too. When an organism cannot fulfill its niche, the entire ecosystem may change. This is what is meant by "**the balance of nature."**

For example let's look at the different niches with in our trail group.

Student's job: Learning
Parent's job: Cabin counselors to; nurture and help you
Teacher's Job: Trail guide and naturalist

Describe an organism's niche by answering the "W" questions:

1. **Where** does it live?
2. **What** does it eat and need to live? (basic needs)
3. **What** does it do to live?
4. **When** does it do what it does?
5. **Why** does it do what it does?

The Fox Squirrel:

1. Where does it live? In open hardwood lots in the eastern half of North America. Makes nest in cavities in trees, or twig and leaf nest in forks of limbs usually 9 meters higher.
2. What does it eat? Great variety of nuts, seeds, fungi, bird eggs, and even tree cambium.
3. What does it do to live? Spends much time on the ground foraging, will search in open areas. Ranges up to 40 acres. Population of 1 squirrel per 2 acres.
4. When does it do what it does? Active during the day (diurnal).
5. What does it need to live? Hardwood lot, nuts for food, place for nest, access to food.
6. Why does it do what it does? Growth of the individual, reproduction for the species

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Eastern Red Cedar:

1. Where does it live? Rocky soils, especially those rich in lime. Common in old fields and prairies.
2. What does it eat? Lime rich nutrients in well-drained, shallow, rocky soils. Tolerates a range of water.
3. What does it do to live? Grows best in sunny areas, with well-drained, shallow, rocky soils. Deciduous hardwoods usually eventually shade them out; can invade meadows, shading out grasses and herbs.
4. When does it do what it does? Evergreen will grow all year.
5. What does it need to live? Rocky, lime-rich well drained soil, water, sunlight, space. Birds, such as robins and waxwings eat berries and help spread the seeds (with fertilizer!).
6. Why does it do what it does? Growth of the individual, reproduction for the species

Beaver

1. Where does it live? In and near lakes and rivers in North America
2. What does it eat? Eats tree bark, soft vegetation such as grasses, ferns, mushrooms, leaves, stems and roots of water plants.
3. What does it do to live? Spends most of its time in the water, locates its food by smell because of poor vision, builds dams and dens with trees and limbs it has cut down.
4. When does it do what it does? Conducts its activities at night, sleeps during the day (nocturnal)
5. What does it need to live? Water, trees, food supply
6. Why does it do what it does? Growth of the individual, reproduction of the species

STUDENT ACTIVITIES

1. Ask each student to find three different signs of wildlife. Wildlife includes birds, insects, and other "critters!" Discuss how the signs help to answer the "W" questions about an organism's niche.
2. Water is more available in some areas, and less available in others. How does the water cycle relate to concept of niche?
3. Discuss an aquatic food chain using the beaver as a primary consumer.
4. Name some other herbivorous and carnivorous animals, determining their niche through discussion.

5. Discuss the beaver's niche in Lake Classen and list some predators of a beaver.
6. Contrast the forest and the marsh as habitats for organisms in the food chain, and how each ecosystem (the forest and the marsh) support different organisms
7. Look at the green leaf in the baggie for transpiration.
8. Students may do leaf and bark rubbings if they wree not done at #6 .

VOCABULARY WORDS

Adaptation: a part of an organism's anatomy, physiology, or behavior which enables it to function in its environment.
Niche: the function, position or job of an organism or a population within an ecological community

FIRST CREEK BED CROSSING

Tributaries and Watersheds

Where the Water Goes

After a rain, this creek is full of water draining to the lake. Other times, it is dry. This is an **intermittent stream**. Water for this stream is rainfall falling directly into the stream or is moving here by **gravity** from the watershed. The beginning of a stream is its **origin**, and the place it empties out the **mouth.**

Watershed is the entire land area that contributes surface runoff to a drainage system. Think of a raincoat- "shedding water." If water was to land on your shoulder, predict which direction the water would run. The ridge of a watershed is called the **divide**. North America's Continental Divide is in the Rocky Mountains. The divide of your body's watershed is the top of your head and shoulders.

The creek is at the bottom of a valley:

- ♣ Water drains in from the sides as well as from the higher part of the valley
- ♣ Water running down from the watershed to this creek bed forms small streams, which join together into bigger streams, then coming together to form this intermittent stream and flowing into Lake Classen.
- ♣ Smaller streams, which join bigger streams, are called **tributaries**, looking like branches of a tree **Dendritic** refers to this pattern.
- ♣ When a stream hits flat land, it will slow down, and often break into several channels, which weave about, called **braiding**.

The soil here at the mouth of this intermittent stream becomes **saturated** for long periods of time during heavy rainfall. Air and some moisture usually occupy the pore spaces in the soil near the surface of the ground. Water now occupies the spaces once occupied by air. Once those pore spaces are full of water the soil reaches its saturation point and water is perched on top of the soil. Wetlands usually form in areas where the soil is saturated for long periods of time or where the soil is impermeable or poorly drained.

Nature's erosion methods

Stream processes, main land shapers, formed the valleys at Camp Classen, and in most places in the world. Rock and organic material are carried away, and a valley results. Sediment carried by slower moving water drops to the stream bottom as **alluvia**l material. A delta forms when alluvial materials drops into still water.

STUDENT ACTIVITIES optional activity: another perc test

1. Discuss the characteristics of this tributary using the terms intermittent, shallow, saturation and clay.
2. Identify the watershed for this intermittent stream. Discuss what the dendritic pattern might look like during rainfall.
3. Imagine and discuss how the area would change if the mouth of the stream were cleared.
4. Find natural dams in the drainage (tree roots, piled up leaves and brush, litter, man made), and discuss the terms "organic and inorganic" materials as they relate to ground saturation, runoff, and erosion.
5. Note any evidence of cultural influences (bottles, cans, cartons) and discuss its origin (litter, household trash from upstream).
6. Discuss some notable North American landscapes that are being shaped by erosion (Palo Dura Canyon-red River in Texas, Grand Canyon-Colorado River in Arizona, Royal Gorge-Arkansas River in Colorado).
7. Identify three of the largest tributaries in the world (Nile River-North Africa, Amazon-South America, Mississippi River-North America).

VOCABULARY WORDS

Alluvium: sediment deposited by flowing water; alluvial refers to the process of erosion and sedimentation.
Braiding: pattern of many overlapping strands.
Dendritic: treelike pattern.
Intermittent: alternately containing and not containing water.
Mouth: a natural opening, as the part of a stream or river that empties into a larger body of water
Origin: beginning.
Saturation: soil that is soaked to capacity with water.
Tributary: a stream that flows into a larger stream or other body of water.
Watershed: the entire land area that contributes surface runoff to a given drainage system.

THE ROTTEN FOREST

Materials needed: Nitrogen Cycle picture and ExperiMint Materials — Decomposition and Recycling

The Nutrient Cycle

Plants get nutrients from soil; **herbivores** eat plants, **omnivores** and **carnivores** act as **consumers**. Animal waste is decomposed as organic fertilizer. Organisms die, they decompose, and complete the cycle. When forest animals die, their remains are seldom seen, and trees decay slowly, providing evidence of orderly change. "If the dead organisms were freeze dried and sealed, would they still decompose?" No!

Decomposition occurs when decomposing organisms get to the remains. Examples: termites, insect larvae, worms, fungi, bacteria, vultures, bacteria and fungi. accomplish the vast majority of decomposition. A decomposer is any organism that eats organic material, breaks it down through digestion, and leaves waste. Waste matter from decomposers returns nutrients to soil, making them useful for other plants and trees. Look for a **dead oak** tree. Inspect it for signs of decomposers: insects, fungi, pillbugs, woodpeckers, squirrels. Alive, it provided habitat for wildlife. Dead, it falls to the forest floor, becoming decomposer habitat..

The Nitrogen Cycle

Nitrogen in air close to soil is 'grabbed' by bacteria on the nodules of the **legume plants**. (i.e. peas, beans, bluebonnets) Nitrates are released by **nitrogen-fixing bacteria** into the soil for plant use. Herbivores eat plants. These animals die and decompose. **De-nitrifying bacteria** come along in the decomposition process, changing nitrates back into nitrogen and releasing it back into the atmosphere.

STUDENT ACTIVITIES

1. Look under or into a rotting log. Find the decomposers that make their habitat there. Observe their behavior and physical adaptations.
2. Use the Nitrogen Cycle illustration to discuss the Nitrogen Cycle (See Appendix)
3. Name some organisms that promote the decomposition of plant and animal remains (bacteria, **fungi**, molds, insects, and worms). 31

4. Discuss a food chain, establishing the woodpecker as a link in forest ecology (dying tree-insect infestations-woodpecker excavations).
5. **Leaf weighing**: Take about twenty fresh green leaves, and about twenty dried leaves, and use the balance scale to determine which is heavier. The weight of the water in the fresh leaves should make quite a difference. (see Appendix for balance scale instructions)
6. Discuss the effect that the death of this tree will have on the forest ecology (add nutrients to the soil and allow the penetration of sunlight, promoting other plant growth).
7. List other examples of orderliness in nature (seasonal cycles, daytime and nighttime cycles, predator-prey cycles, hydrologic cycles, carbon dioxide-oxygen cycles).
8. Give mint for the "**ExperiMint**" experiment, a tongues-on study of erosion. (see appendix)

Appendix

Nitrogen Cycle picture

VOCABULARY WORDS

Decomposer: an organism that breaks down once living material.

Fungi: a major group of flowerless plants (as molds, mildews, mushrooms) that lack chlorophyll and are parasitic or live on dead or decaying matter

Nitrogen Cycle: process where nitrogen is taken from the air, made into a usable form, used by living things, and released back into the atmosphere.

Nutrient Cycle: process where nutrients move through the soil to plants, primary and secondary consumers, then decomposers, and back to the soil and air.

Traveling Tune: The Decomposer Song (Tune: The Worms Crawl In, The Worms Crawl Out)

The worms crawl in, the worms crawl out,
The worms leave droppings all about.
Bacteria grows, and fungus spreads,
Mo-o-ld sprouts and insects are fed.
To decompose, you need to know, Nutrients come, and nutrients go. 32

SECOND CREEK CROSSING

Erosion and Sedimentation

Cobble Creek

This creek flows with much energy during rainstorms and dries up soon after. The large cobbles in the bed help indicate its high energy. Stream's energy rubs off particles and carries them suspended in the current.

Zone of Erosion

The **soil profile** shows exposed alternating layers of soil and cobble (rocks and boulders). The rocks and boulders could have been eroded from upstream outcroppings or possibly washed down from the adjacent hillside. Look at tree and plant roots in the eroded stream edge.

Water energy

High-energy (fast) streams are straight, and have big rocks in them. Low energy (slow) streams have fine sediments in the streambed, and curve ("meander") a lot. Gravity's pull causes the stream to flow downhill. High-energy streams are able to carry larger particles. Small particles carried in a stream are called suspended sediments. Wherever the stream drops its load, is called the **zone of deposition**.

STUDENT ACTIVITIES

1. What happened to the mint in your mouth? Did it erode? Why? (Saliva, crunching, tongue, etc)
2. Examine the creek bed to see stream energy patterns first hand. Examine the streambeds to determine how much energy they carried, by looking for brush piles and at the size of the sediments and rocks. Can you find a tree that will soon fall over due to stream erosion?
3. Look for "natural dams." These could be exposed tree roots, piles of leaves or brush, or rocks. How do these affect the drainage patterns?

4. Observe soil horizons, which are exposed at the eroded bank of Cobble Creek. Count and measure the layers of soil and rock on the exposed bank of Cobble Creek and discuss their origin.
5. What are the factors in a lowland forest that favors soil building (large amounts of detritus deposited annually, slow water runoff)?
6. How can a lowland forest benefit from temporary flooding (sediments from the watershed increase soil depth)?
7. Compare and contrast the two tributaries studied thus far (Stations 8 &11) has the highest gradient and the most violent energy potential.
8. Identify and discuss any other evidence of fast water energy (brush pile accumulations in and out of the creek bed).
9. How has the forested slope contributed to soil formation in the lowland (most of detritus that falls on the slope eventually washes to low area)?
10. How has Lake Classen interfered with the shaping of downstream landscapes? The lake is a reservoir for the rock and sediments that were destined for the Washita River Valley?

VOCABULARY WORDS

Gradient: the degree of slope.
Sedimentation: process where suspended sediments settle down through a liquid medium.
Soil Profile: cross sectional view exposing various layers of soil.
Zone of Deposition: the place where deposition occurs
Zone of Erosion: the place where erosion occurs

Plant Diversity

Any organism's body and behavior must be adapted to the available resources. The plants you see here must be well adapted to this amount of sunlight. During the growing season the canopy of this hardwood forest captures most of the sun's rays, limiting the survival potential of those trees growing beneath. This is characteristic of a mature forest.

Vines

Moss-require damp environment

Lichen-alga and a fungus growing together

Climax Community

If the next generation of plants can live under the conditions left by the preceding generation, the ecosystem is said to be a climax community. Ecologists believe that a hardwood forest is a climax community. The struggle for life is nowhere greater than in a forest, and the survival of one mature tree can mean the life and death of many others. During these growth periods the competition for space, moisture and sunlight is the measure of success. 100 years or more of plant succession have yielded a mature hardwood forest. Still the competition continues, with seedlings and saplings moving upward through the forest layers towards sunlight.

STUDENT ACTIVITIES

1. Close your eyes and listen: What do you hear?
2. Discuss how wildlife and small trees benefit when canopy trees die (forest is opened up, sunlight penetrates and a wider variety of plants grow)
3. North / moss tree study: It has been said that moss always grows on the north side of a tree. Does it?

-Ask students to spread out on the trail, choose a tree, and stand on the side where the most moss grows. Make a "best fit judgment" to determine which direction the moss tends to grow. As a pattern, moss should grow on the north side of the trees because shadows stay on the north side, because the sun appears in southern sky for us, who are north of the equator.

4. Appraise the condition of the plants in the undergrowth and speculate concerning those that are bent, dead, and dying conditions caused by vines and shading.
5. Locate some oak and hickory seedlings and speculate concerning the factors that will hinder their progress (browsing animals, shade, vines).

VOCABULARY WORDS

Fungi: any of a major group of flowerless plants (as molds, mildews, mushrooms) that lack chlorophyll and are parasitic or live on dead or decaying organic matter

Lichen: any of numerous complex plants made up of an alga and a fungus growing together on a solid surface (as a rock or tree)

Moss: a simple plant in the classification mosci, and, with liverworts, is in the bryophyte grouping.

Vine: a plant growth pattern, characterized by long, slender plant stalks which utilize support from other plants rocks, or other structures

CLASSEN FALLS

Materials needed-water test materials, perc test ; Biotic Index Hydrology

Waterfall Erosion

Gouge pool-pool of water beneath the falls. Energy from the falling water has eroded this pool. Two kinds of erosion have occurred:

- physical, from the water wearing on the rock, and
- chemical, because water is acidic, and the limestone bedrock is alkaline.

Erosion has occurred on the side of the rock face, too, making miniature caves. Water will easily erode limestone. The waxy blue green color to the water is due to lime in the water. This water is relatively clean, and provides a good habitat for fish. For the water to be clean enough to drink, it must be tested (it hasn't, so drinking is not recommended). The water of Lick Creek is heavily laden with calcium carbonate which is deposited on the rocks and hardens into some spectacular travertine formations. The clean brown sand from Confusion Canyon making up most of the ground in this area was deposited as part of the1987 flood.

Stream Ecology

Lick Creek originates as a spring fed stream in the ranch land to the west and meanders for miles through the low lands of Camp Classen, receiving water from several other springs before flowing over Classen Falls. Several kinds of algae live in this pool. Favorable conditions encourage the growth of aquatic invertebrates that provide forage for the fish, reptiles, and amphibians that live in this stream. During high water fish move freely between Lake Classen and Classen Falls. The sycamore, cottonwood, and willow trees dominate this forest canopy. These trees requires a great deal of water for life. They only grow where the water table is high. These trees can be called "Survival trees" as they grow near streams that you can follow to a town. There are several stumps left chewed by beavers here. If you look out towards the lake, at the marshy islands, there is an old beaver lodge. Grass has grown over the top of it (natural succession!), since the sticks trap sediments well, yielding good ground. 37

STUDENT ACTIVITIES

1. Perform the last percolation test here. The water should absorb quickly as it is sandy soil.
2. Find the speed of the water in the pool. Use a leaf or a twig. Sail it on the water. The formula for determining speed is, Speed = $\frac{\text{Distance}}{\text{Time}}$ .Use a stopwatch for timing, estimate distance perhaps using kids approximately 6' apart.
3. Gently search for aquatic organisms at the edge of the Falls pool. Make a list of aquatic organisms found in the riffles and pools below Classen Falls. Use the Biotic Index for identification and water quality indicators. (see Appendix)
4. Do pH tests on Classen Falls water and compare and contrast results with bottled water. See water kit for test tubes and pH strips.
5.. Search for animal tracks around the pool below Classen Falls.
6.. Discuss the reasons for the different tree composition found along Lick Creek. (These trees have a high water requirement, such a sycamores)

VOCABULARY WORDS

Acidic: a chemical condition characterized by an abundance of free hydrogen ions.
Alkaline: a chemical condition characterized by an abundance of free hydroxide
Aquifer: a rock layer capable of holding of water.
Calcium Carbonate: lime, $CaCO_3$
Chemical: relating to chemicals.
Hydro: water.
-ology: Greek; logos, symbol, study.
Physical: relating to matter.
Travertine: a deposit of calcium carbonate looks like tan colored hardened, boxy foam. 38

REVIEW

Completing the Cycle

- Lake Classen was impounded in 1941
- Humans have made many decisions that have affected the landscape and ecosystems
- Identify where water is located
- Review the stages of the Water Cycle.
- The Carbon /Oxygen Cycle-Carbon dioxide and oxygen must be recycled
- The Nutrient Cycle is the process where plants get nutrients from the soil, herbivores eat the plants, then omnivores and carnivores act as consumers. Decomposers are organisms that eat organic material, break it down through digestion, and leave waste. The waste matter from decomposers returns nutrients to the soil, making them available to plants and animals. Decomposition occurs only when decomposing organisms carry it out.
- The Nitrogen Cycle is the process where nitrogen is taken from the air, made into a usable form, used, and released back into the atmosphere.
- Natural succession is the process of certain species that live in a particular place that change over time. Plants change first followed by wildlife.
- Erosion is the process of carrying away rocks or soil. Sediments are indicators of the amount of energy in a streambed. Bigger particles indicate more energy, and straight streams indicate faster flow.
- Niche is a place in the ecosystem or a job in nature. Every living thing has only one niche in nature.
- Biotic and abiotic factors influence ecosystems.
- Comparison of input and output: the water level of the lake is the result of:
  Input: rainfall, creek inflow, ground seepage, springs
  Output: evaporation, creek outflow, ground seepage.

STUDENT ACTIVITIES

1. Let's follow a single drop of water through the entire water cycle. A drop falls on the ground on Vesper Mountain. The drop is absorbed into the groundwater where it travels to a spring that flows into Lick Creek. From Lick Creek it travels into Lake Classen, over the spillway, down Lake Classen to the Waschita River. From here, the drop flows into the Red River and into the Gulf of Mexico. From the Gulf, the drop flows through the Caribbean into the Atlantic Ocean, travels south around the South American Continent into the Pacific Ocean. It evaporates back into the atmosphere in the hot climate of Hawaii, where prevailing winds bring it over Oklahoma, and it rains again on Vesper Mountain.
2. Act out the water cycle with water cycle aerobics. Have volunteers; make up their own appropriate body movements to illustrate a process in of the water cycle. Sequence to reenact the processes into a cycle.