



North Carolina Department of Public Instruction

INSTRUCTIONAL SUPPORT TOOLS

FOR ACHIEVING NEW STANDARDS

This document is designed to assist North Carolina educators in effective instruction of the new Common Core State and/or North Carolina Essential Standards (Standard Course of Study) in order to increase student achievement. NCDPI staff are continually updating and improving instructional tools to better serve teachers. **These Graphic Organizers are in draft form and are undergoing review for feedback.**

Graphic Organizers SAMPLES

What is the purpose of this tool?

These visual representations assist the student in organizing abstract “big picture” information that is new, overwhelming or misunderstood. Research supports the utilization of graphic organizers as a contributing factor in improving student performance. The examples are to model varied organizers and their use in provoking student engagement, organization, and understanding, thus equipping the teacher with the knowledge to develop and use such tools effectively with the new standards. By providing these examples, DPI is creating a foundation for teachers to shift the focus from merely classroom instruction, but also on student learning.

What is in the tool? The instructional tool uses straightforward (clear) models/examples that can be used in the classroom in alignment with the new standards. The tool speaks directly to teachers and holds high expectations for teachers’ ability to understand the use of the tool as a mechanism for differentiating instruction.

How do I send Feedback?

We intend the explanations and examples in this document to be helpful and specific. That said, we believe that as this document is used, teachers and educators will find ways in which the tool can be improved and made even more useful. Please send feedback to us at feedback@dpi.nc.gov and we will use your input to refine our instructional tool. Thank You!

Where are the new Common Core State and North Carolina Essential Standards?

All standards are located at <http://www.ncpublicschools.org/acre/standards/>

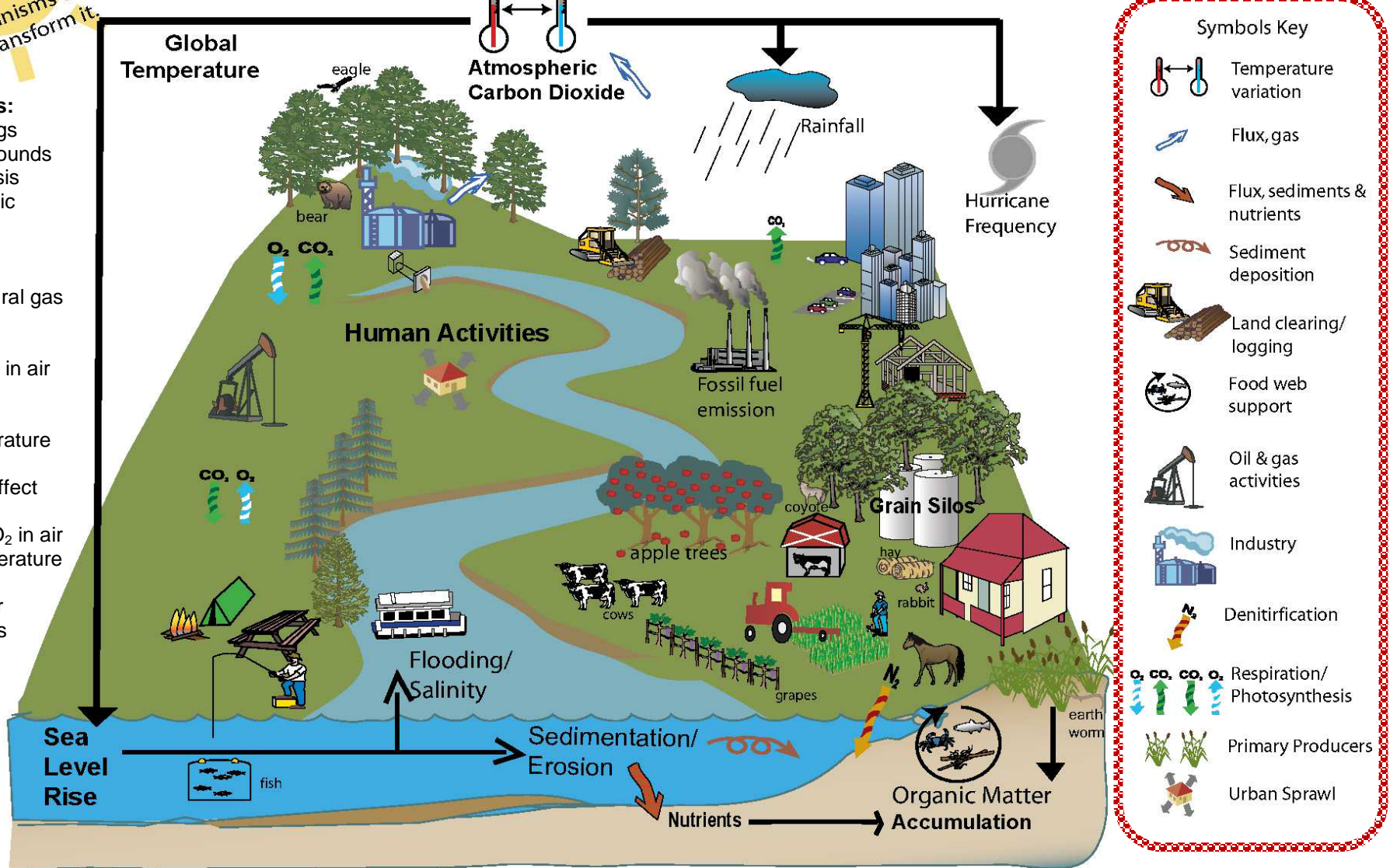
Global Systems Change

Organisms are linked to one another and to their environment by the flow of energy and cycling of matter. Acquisition of resources and population growth can accelerate the rates of natural change in a system.

Energy from the sun flows in one direction through an ecosystem and is conserved as organisms use and transform it.

- Key Terms:**
- All Living Things
 - Carbon Compounds
 - Chemosynthesis
 - Chemosynthetic bacteria
 - CO₂ in air
 - Carnivores
 - Coal, Oil, Natural gas
 - Death
 - Decomposers
 - Decrease CO₂ in air
 - Excretion
 - Fossil Fuels
 - Global Temperature
 - Green Plants
 - Greenhouse effect
 - Herbivores
 - Increase in CO₂ in air
 - Local air temperature
 - Omnivores
 - Organic Matter
 - Photosynthesis
 - Respiration

Figure 1. Mr. Green Gene's Farm



Symbols courtesy of the Integration and Application Network (<http://ian.umces.edu/symbols>), University of Maryland Center for Environmental Science.

Concept Mapping

Designing a concept mapping activity

Concept mapping is one way to organize information that serves as a visual tool for learners. Concept maps may be used to show how science topics and ideas are related; thus, they are vital to effective science teaching and meaningful learning. Maps may be generated to flow from a central concept, topic or process. Lines or arrows are used to show how the different parts of a concept are related flowing from a general to a more specific idea.

Concept maps are excellent formative and summative assessment tools for eliciting evidence of how students organize, connect and synthesize information. Maps generated by students are most effective in affirming evidence of learning; however, differentiation may be accomplished by presenting students with partially completed maps. While there are many ways to construct concept maps (no one way receiving preference to another), students should be given general rules that may serve as success criteria.

The following is an example of how to design a concept map activity. This is an activity that may be used with a unit on human influences on the environment. While it is intended for use in a high school biology class, portions may be adapted for use in middle or upper elementary school. The scope and sequence chart in *figure 2* will assist you in identifying the appropriate NC Science Essential Standards that may be addressed. *Figures 3-8* are examples of concept maps that connect many ideas around carbon cycling, a major factor of climate change. *Figures 9 - 11* are examples to explore student ideas about living and non-living things.

Please refer to the references provided for more information on the use of concept mapping in the science classroom.

Step 1 – Select key terms. Identify the most critical terms related to the concepts in a unit then construct propositions, pairs of connected terms, which indicate what you have determined you want students to know and be able to express at a meaningful level at the end of the learning experience.

Step 2 – Determine where to embed the map. Concept maps may be used as a pre-assessment tool. An important feature of concept maps is the ability to revise as the instruction continues. Thus, concept mapping activities should be planned at critical points to help inform instruction.

Step 3 – Create the activity. Open-ended construct-a-map activities provide the greatest insight into student understanding of a concept. Provide students with the opportunity to create their own map first; then, share ideas in small groups and to the whole class. Once feedback has been provided and instruction proceeds, students should have the opportunity to redraw their concept map to demonstrate changes in their understanding of the concept. When used in this manner, concept maps are both a self-teaching tool and a diagnostic tool.

Sample Activity:

Elicit evidence of prior knowledge.

Figure 1 is a conceptual model of factors affecting Global Systems Change. Human influences on climate change often spark debate among individuals in various arenas of society. Scientists and politicians currently debate the phenomena of climate change and global warming. Not all scientists agree about the prospects of human influences on climate change and global warming nor do all policy makers agree on what to do about it. What do you think about climate change and global warming?

Students’ task: Your task is to examine figure 1 and the associated key terms. Create a concept map about your ideas on human influences on Earth’s climate. Your concept map should show your ideas about the effects of human activities on climate and the Earth as a system.

1. Start with the phrase “all living things” at the top.
2. Use arrows and linking phrases to connect ideas.
3. Use each key idea only once.

Addressing English Language Learners:

To meet the needs of English Language Learners in science classes embed English Language Development Standard 4: English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science. Consider teaching these graphic organizers in parts, adding on more components as students demonstrate comprehensibility.

- Engage ELLs in the use of academic language in all 4 language domains: listening, speaking, reading, and writing through partner and small group activities. Oral academic language development is essential to build reading and writing skills.
- Explicitly teach vocabulary before, during, and after a lesson. Besides key terms listed for figure 1 teach such words as frequency, salinity (saline), accumulation, sea level rise, sedimentation (sediment), deposition, variation (vary), urban sprawl.
 - Orally pre-teach vocabulary using these steps. Activity should take from 2-5 minutes.
 - Teacher says the word/phrase.
 - Students repeat the word 3 times.
 - Teacher uses the word in context from the text/diagram
 - Teacher provides the dictionary definition (students do not find the word in the dictionary)
 - Teacher explains meaning of words with student-friendly definitions
 - Teacher engages students in speaking activities to develop word/concept knowledge
 - Teacher points out grammar, multiple meanings, spelling/pronunciation anomalies associated with word
- Link graphic organizer/reading to students' background knowledge or build background knowledge
- Employ partner reading to build comprehension.
 - Teacher uses "think aloud" to model the partner reading process.
 - Students, in partners, read the graphic organizers/reading passage and summarize what they have read.
 - Students begin partner reading by alternating reading and summarizing sentences.
 - Then partners alternate reading and summarizing paragraphs.
 - Note the students' discourse complexity and their use of key vocabulary in their summarization as a means for ongoing assessment to plan specific interventions to meet individual needs.
- Provide cooperative learning activities during the different stages of the writing process.
 - Student group explains a process
 - Each student in the group copies the prompt on a piece of paper, completes the sentence, and passes to paper to the right.
 - That student reads what was written, writes another sentence, and passes the paper to the right.
 - The process continues with each student reading the previously written sentences and adding another sentence to each paper he/she receives until the teacher calls time.

Connections of NC Science Essential Standards and Common Core State Standards for Literacy in Science

Bio 2.2 Understand the impact of human activities on the environment (one generation affects the next).

Range of Reading and Level of Text Complexity (Grades 9-10) By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Range of Writing (Grades 9-10) Write routinely over extended time frames (time for reflection and revision) and shorter timeframes (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Figure 2.

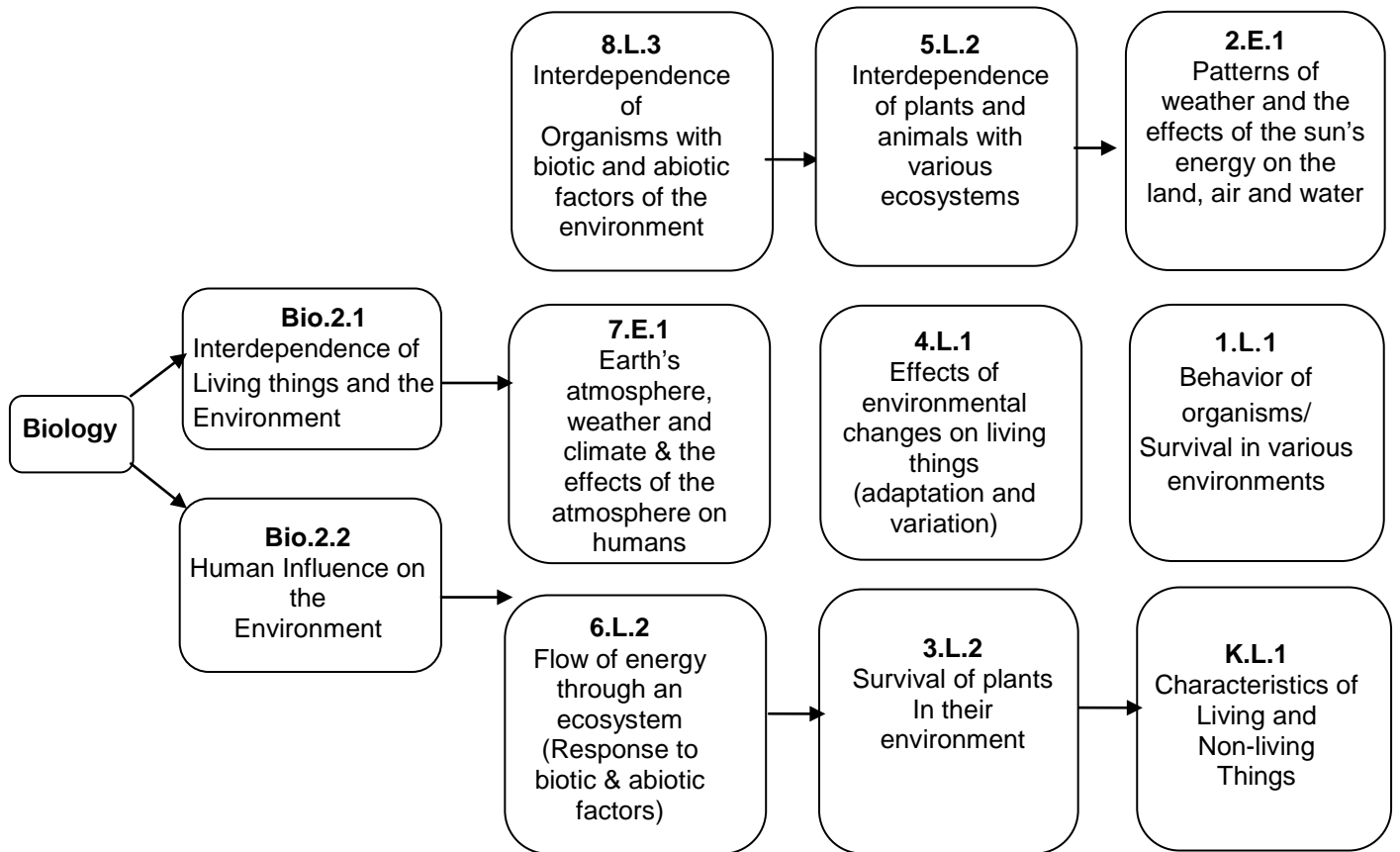


Figure 3. Sample Concept Map of Carbon Cycling

Organisms are linked to one another and to their environment by the flow of energy and cycling of matter. Acquisition of Resources and Population Growth can accelerate the rates of natural change in a system.

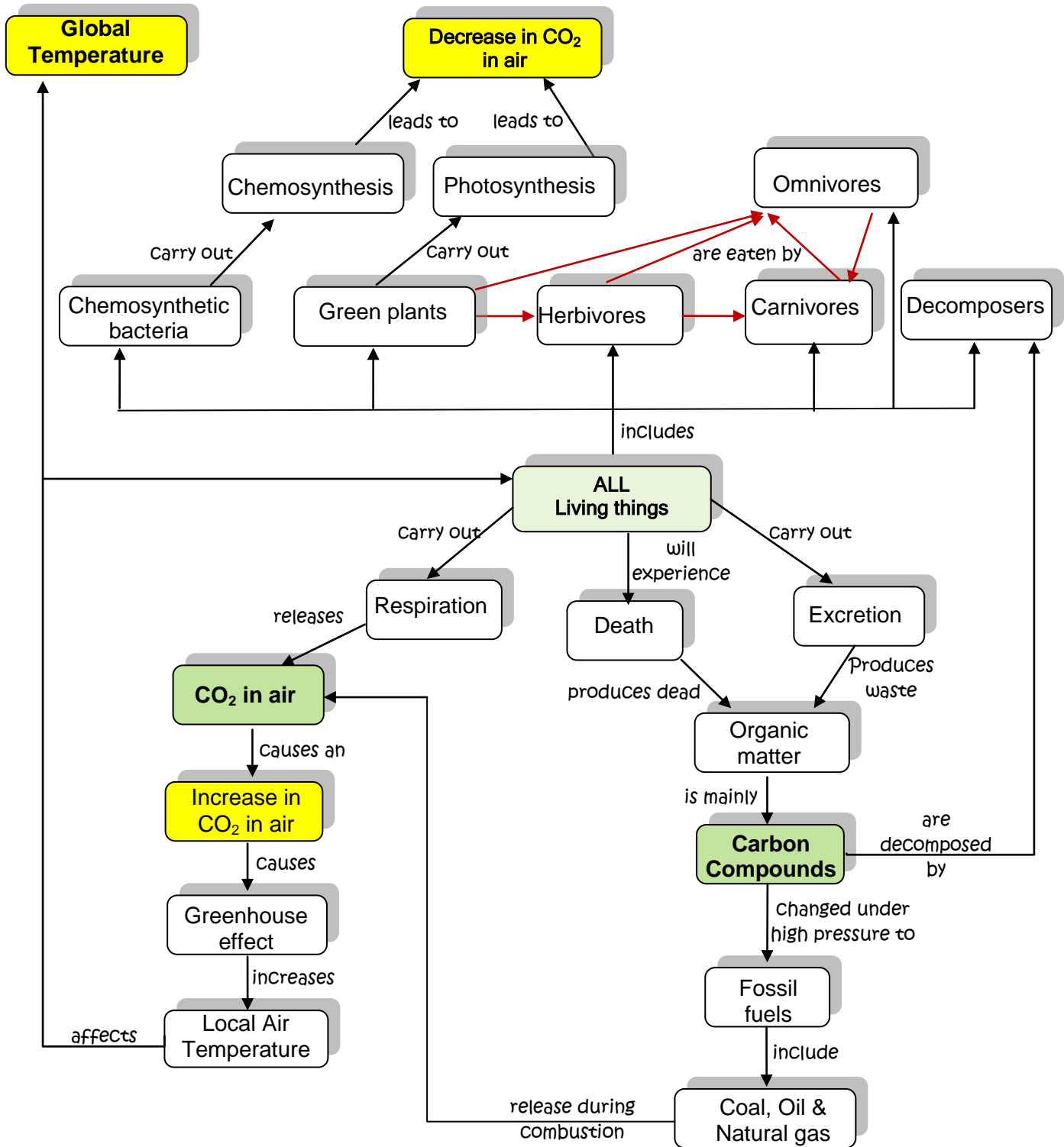
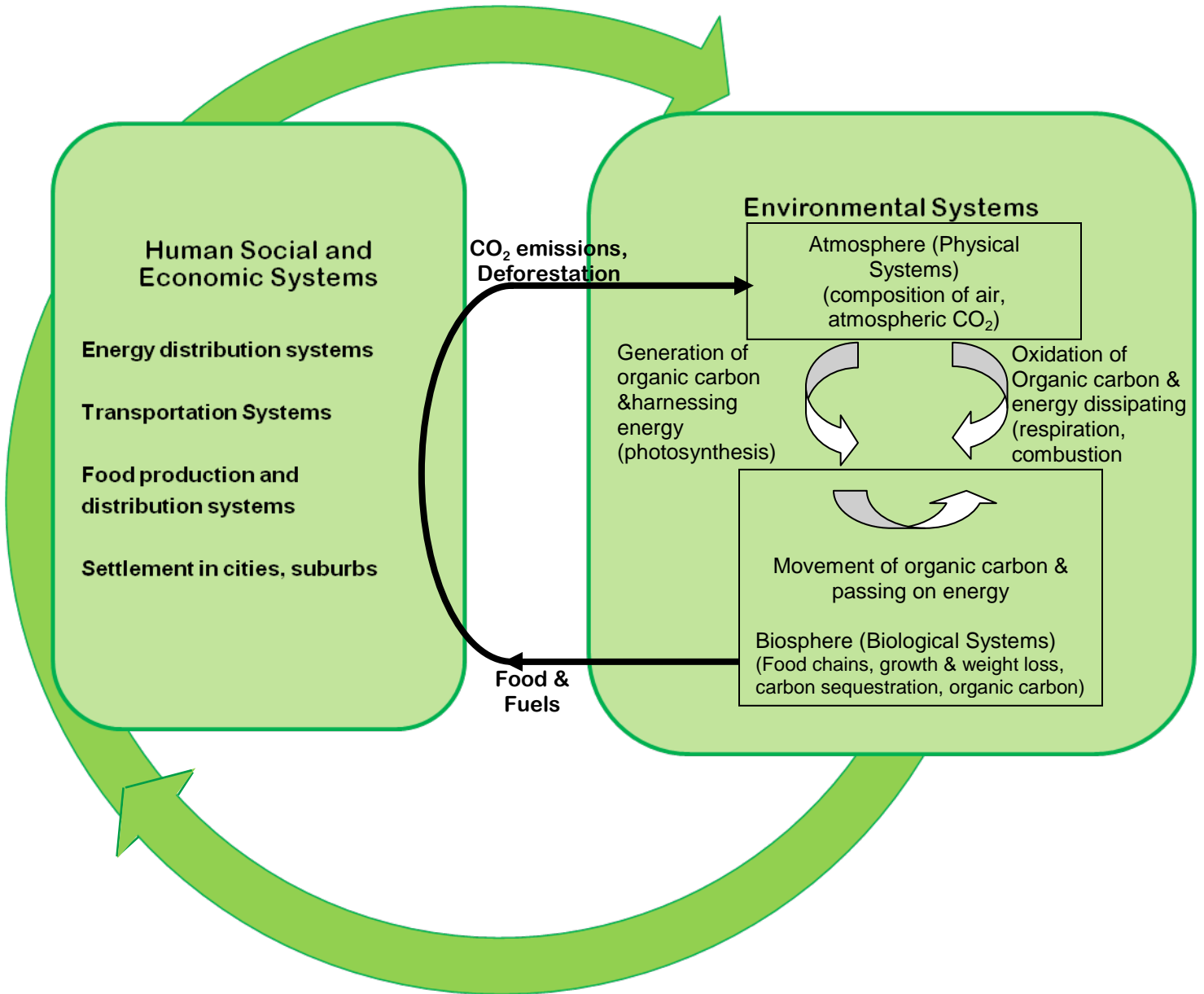


Figure 4. Sample Concept Map of Carbon Cycling in socio-ecological
Enduring Understandings:

Human Impact: Acquisition of resources and population growth can accelerate the rates of natural change in a system.

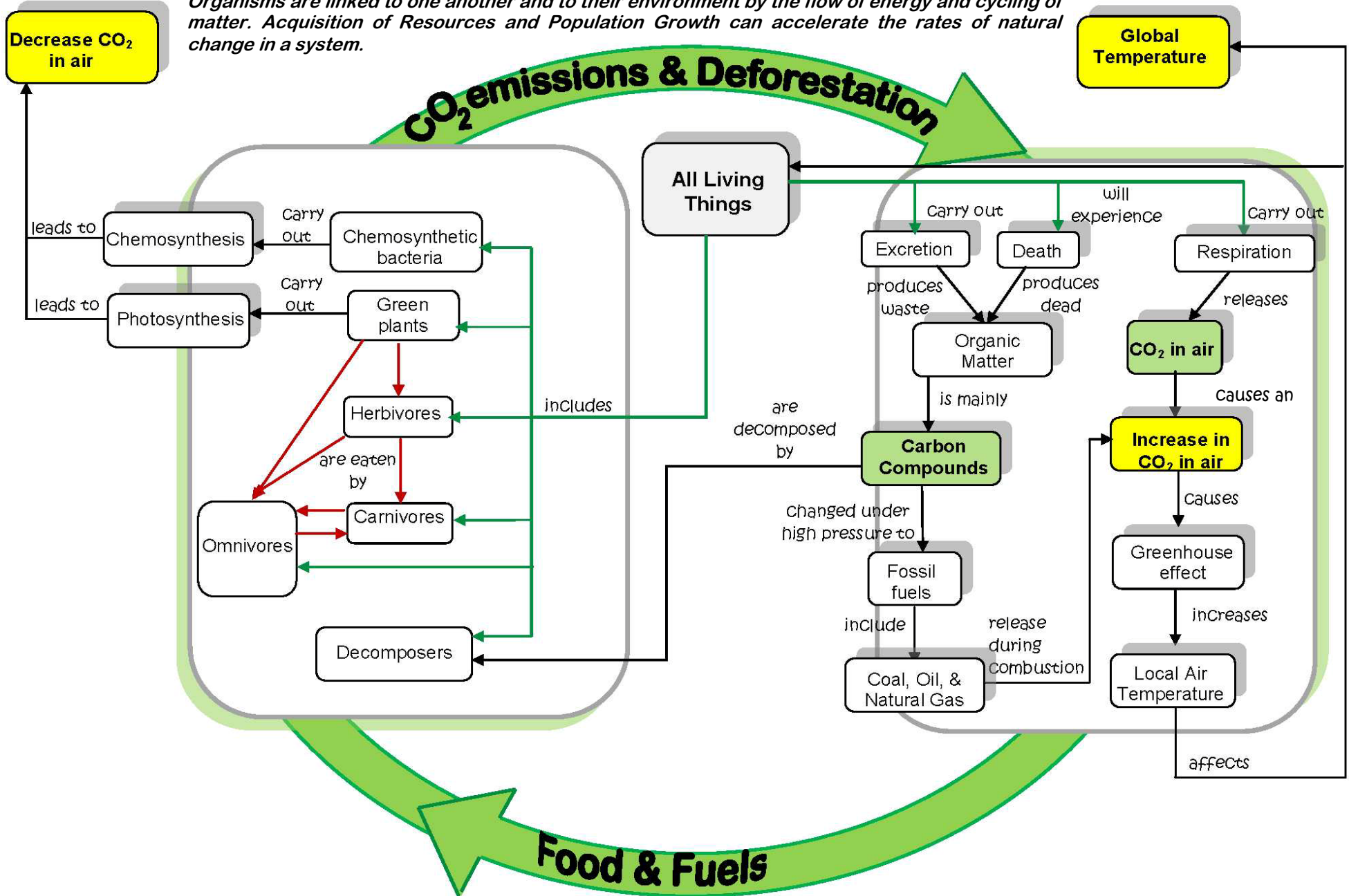


Environmental system services: Organisms are linked to one another and to their environment by the flow of energy and the cycling of matter.

Mohen, Lindsey, Jing Cheng, and Charles W. Anderson. (2007, July). *Developing a K-12 Learning Progression for Carbon Cycling in Socio-Ecological Systems* presented at the Knowledge Sharing Institute of the Center for Curriculum Studies in Science. Washington, D.C.

Figure 5. Sample Concept Map of Carbon Cycling

Organisms are linked to one another and to their environment by the flow of energy and cycling of matter. Acquisition of Resources and Population Growth can accelerate the rates of natural change in a system.



Grade 9-10

By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Reading Assignment:

Analyze a reading passage and determine how human activities might impact the environment.

Essential Question:

How do scientists model and predict the effects of human activities on Earth's climate?

Biology: Analyze a Reading Passage Human Influences on the Environment

Key Ideas and Details

- Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
- Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

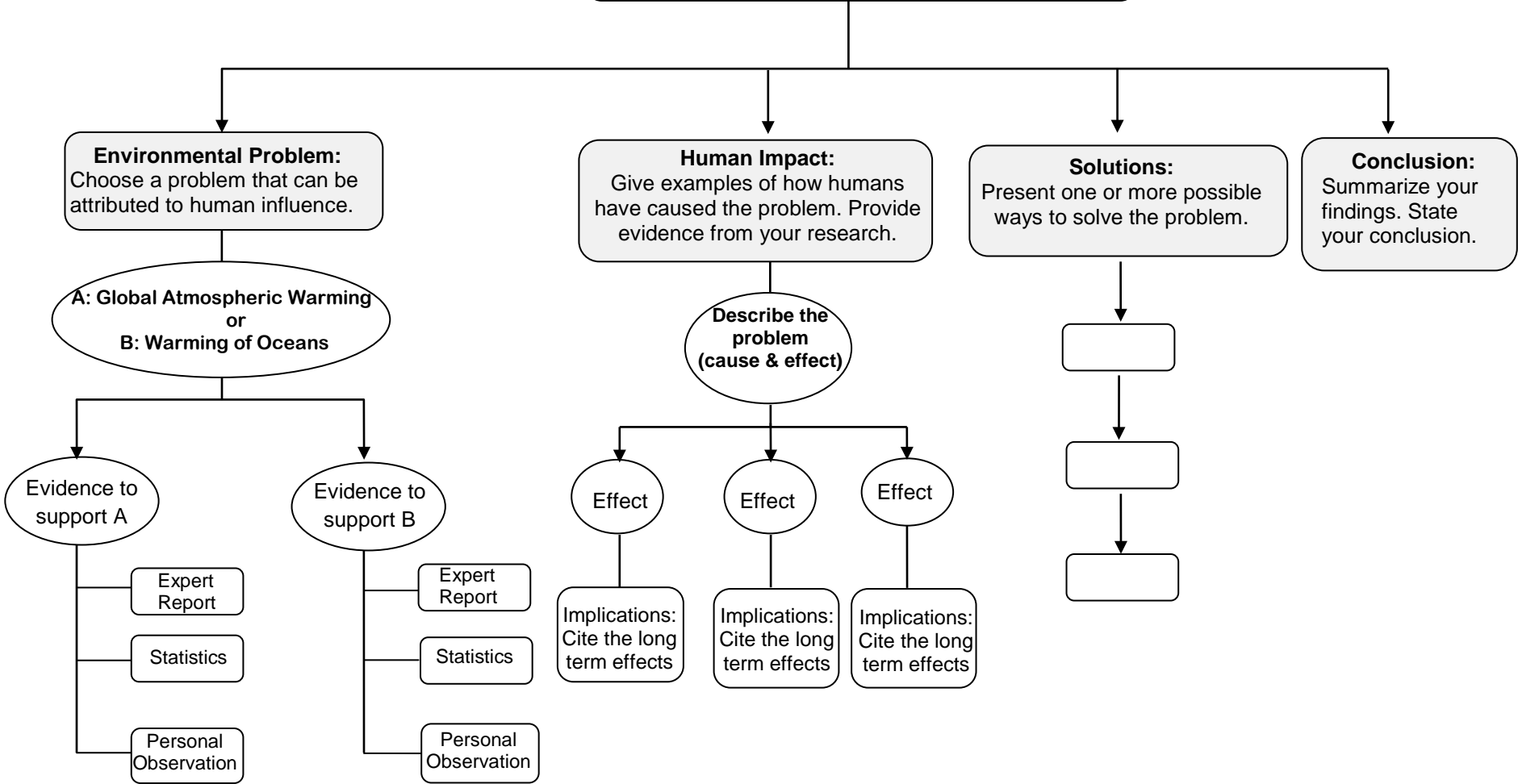
Craft and Structure

- Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*.
- Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).
- Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

Integration of Knowledge and Ideas

- Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
- Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

Bio2.2
Human Influences on the Environment
Long-term Writing Task

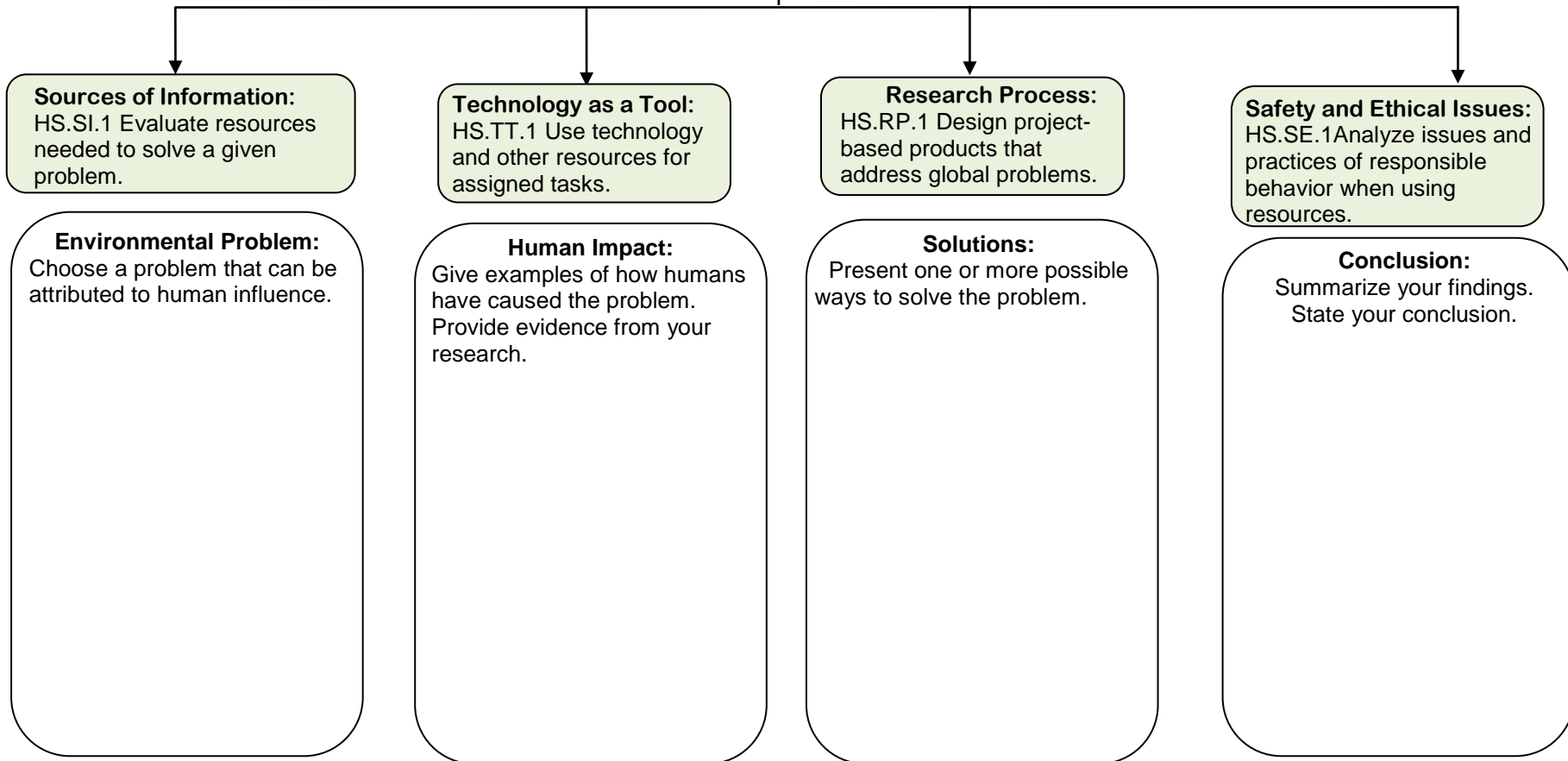


Short-term writing prompt:

a. Argument: Should the acquisition and preservation of undeveloped land be a priority for our state? If so, what could you do personally? If not, why not?

b. Expository: Explain how scientists monitor the environment to detect ecosystem changes and provide reasons why it is difficult to predict how a particular ecosystem might react to a change in climate.

**Bio2.2
Human Influences on the
Environment
(Embed Information &
Technology Standards)**



Teacher's Task: Review the Information and Technology Standards. Brainstorm ideas for embedding the standards into the research assignment.

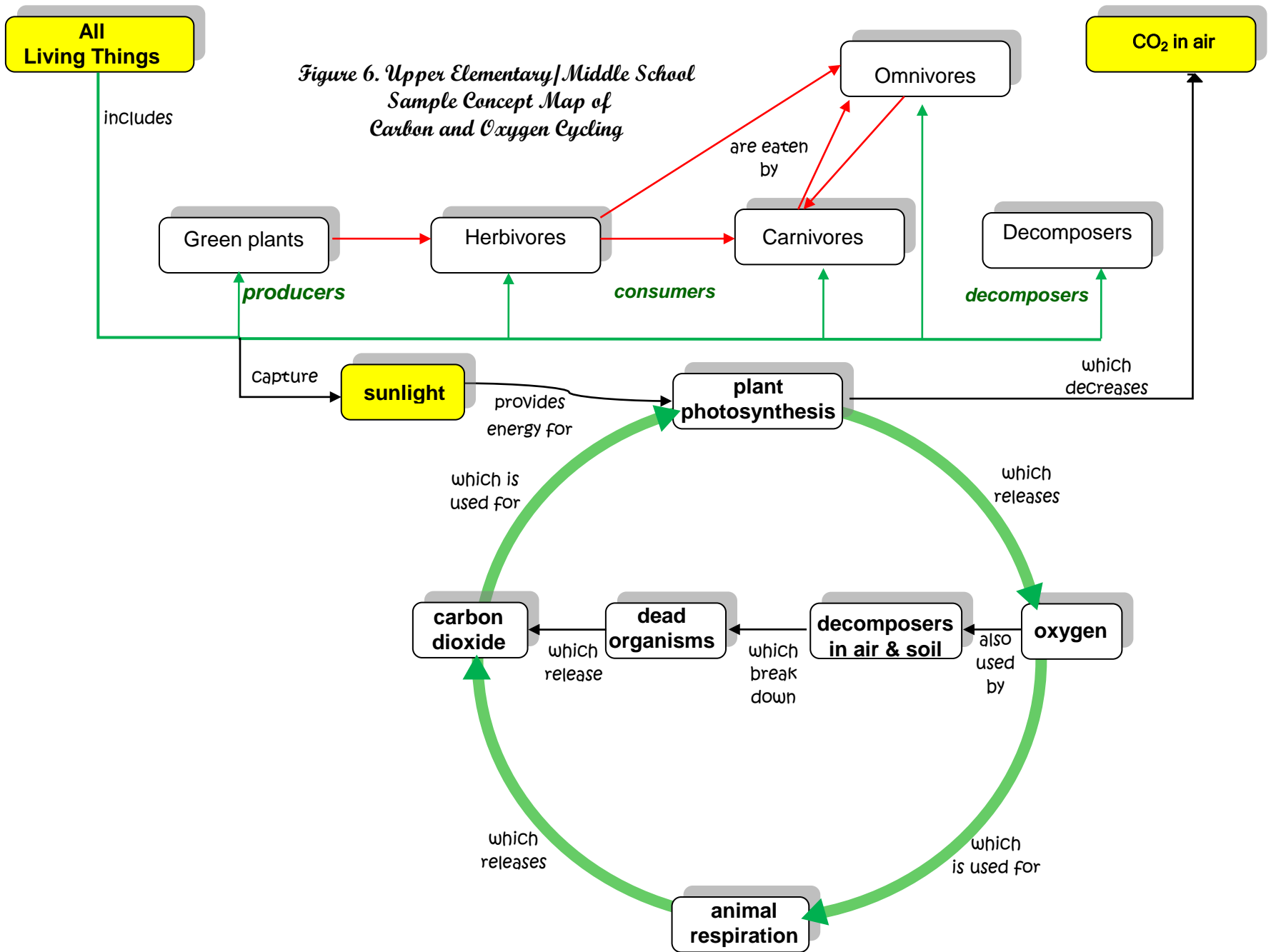
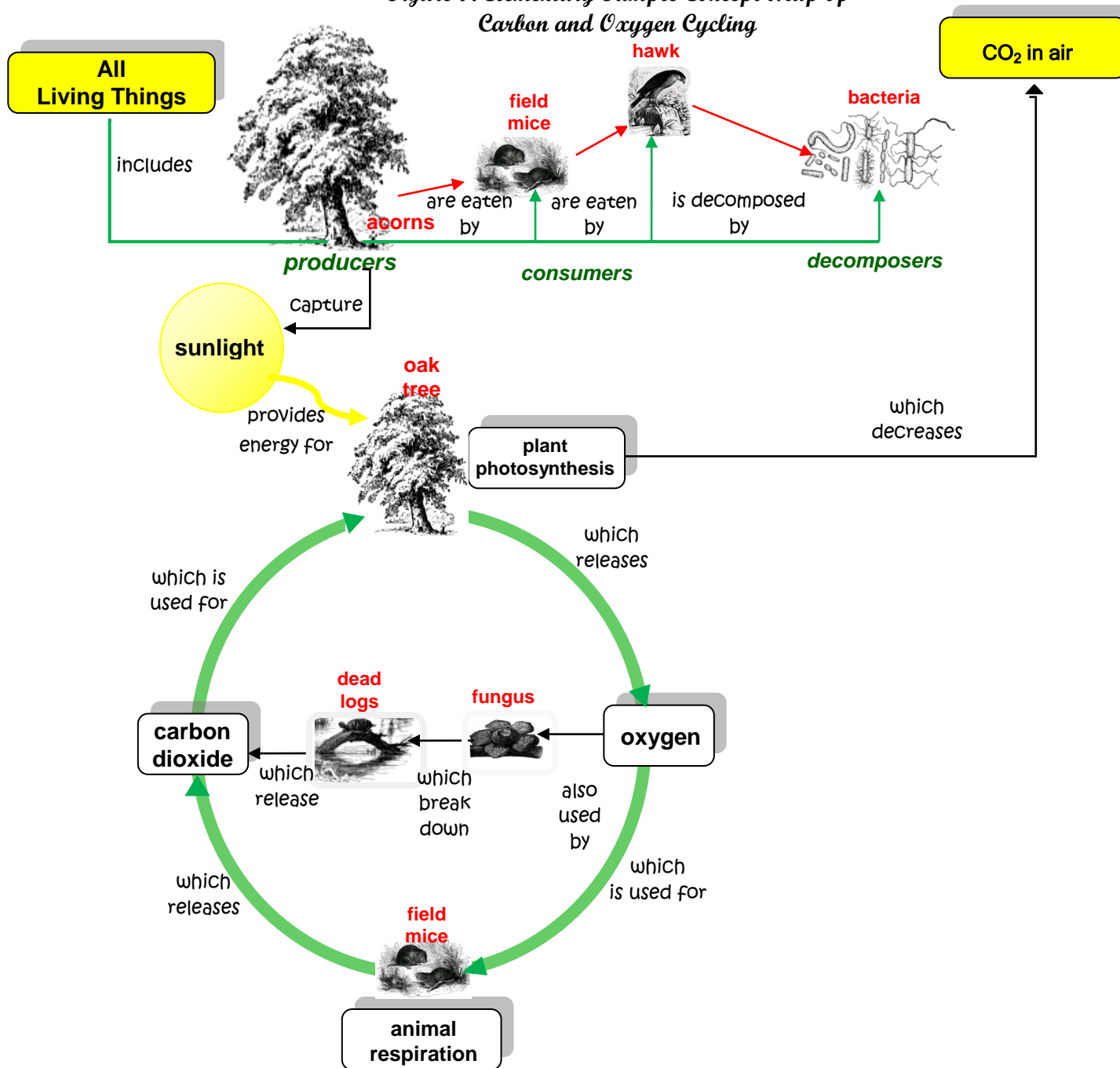
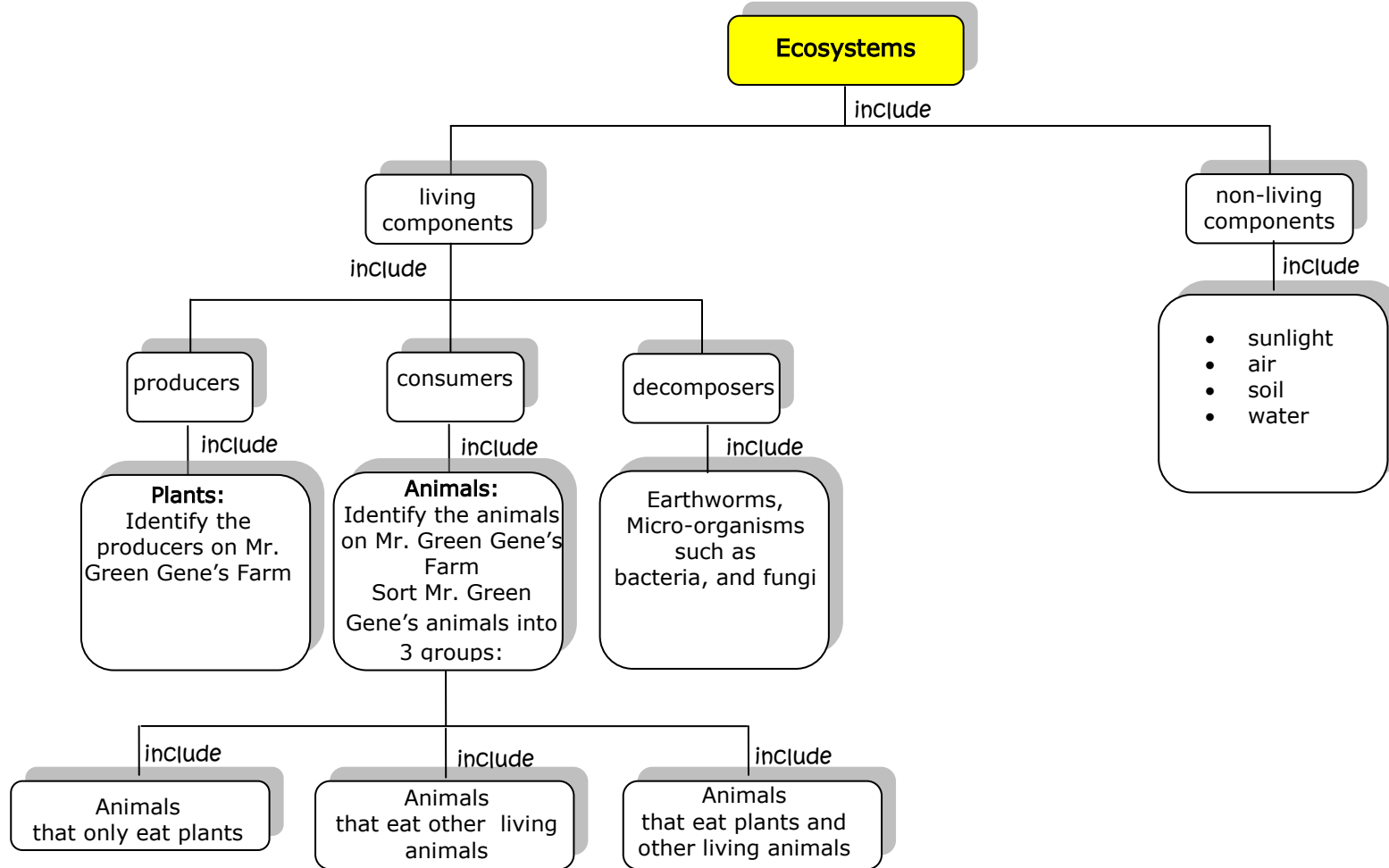


Figure 7. Elementary Sample Concept Map of Carbon and Oxygen Cycling



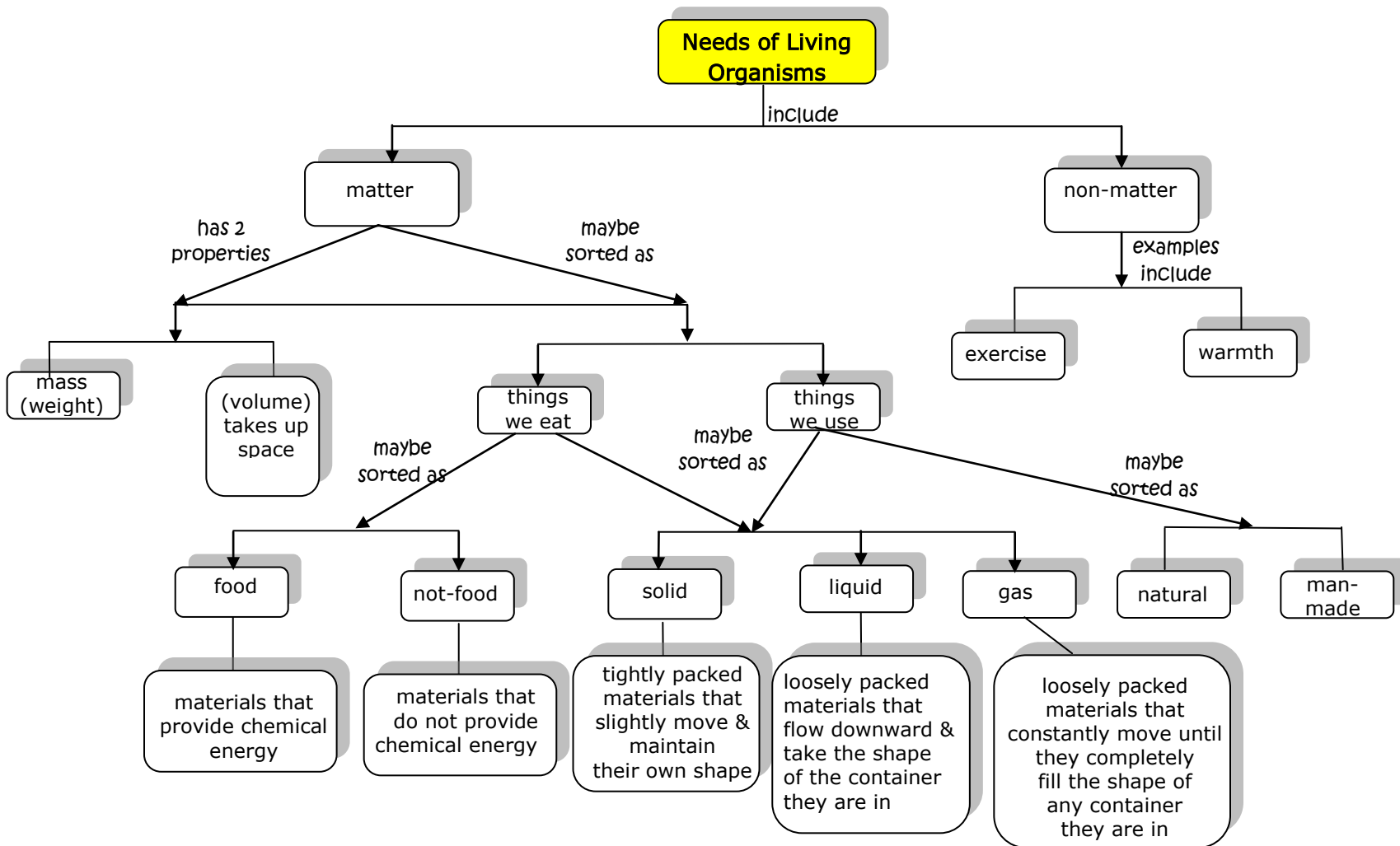
*Figure 8. Grades 5-8 Sample Concept Map
Components of an Ecosystem*

Mr. Green Gene's farm is home to many living and non-living things that are busy interacting every day. Analyze figure 1 and make a concept map that identifies the living and non-living components of Mr. Green Gene's farm. Start with the word ecosystems at the top. After completing your concept map, tell how the non-living things are beneficial to the living things and how the living things are beneficial to each other. Make a diagram of a food web (lower grades: food chain) that includes Mr. Green Gene. Identify the producers, herbivores, carnivores, omnivores, and decomposers for your food web. See Appendix A for animal pictures.



*Figure 9 Grades 3-5
Needs of Living Organisms*

Organisms survive best in environments where their needs are met. All living things need food for energy, growth and repair of the body. Plants and animals depend upon the resources and conditions of their habitats to survive. Mr. Green Gene depends on many of the living and non-living things on his farm to survive. But, is it all food? Analyze figure 1 and make a concept map that demonstrates your ideas about the needs of living organisms. Include your thoughts about food. Start with the phrase “needs of living organisms” at the top and include ways to sort materials that maybe considered food. See Appendix B for card sorting activity.



*Figure 10. K-3 Sample Concept Map
Living vs. Non-living Things*

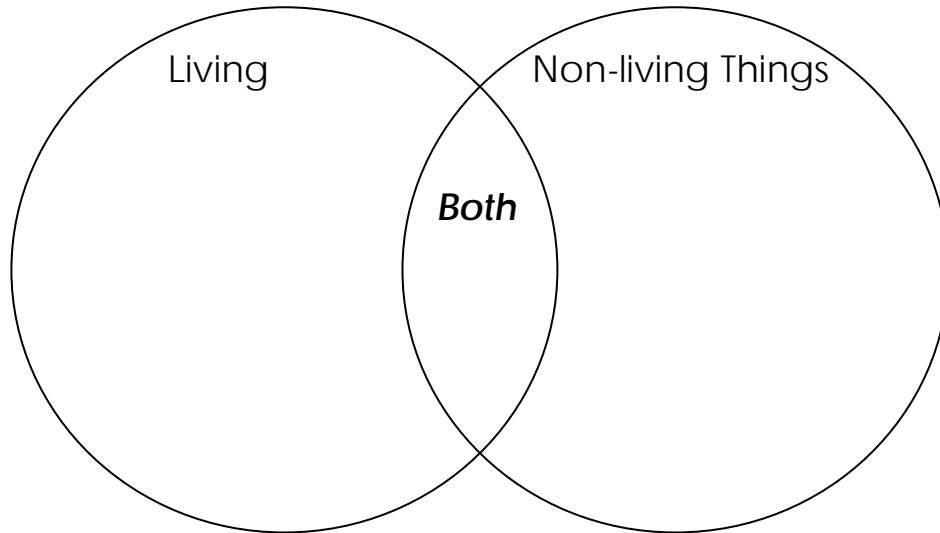
All living things need food for energy, growth and for repair of their bodies. Plants and animals depend upon the resources and conditions of their habitats to survive. Mr. Green Gene depends on many of the living and non-living things on his farm to survive. Identify pictures of things that may be found on Mr. Green Gene's farm. Cut out the pictures and sort them as "living" or "non-living". Explain why you have placed each picture in its group.
(See Appendix C for sample pictures. Combine the animals from Appendix A for greater variety.)

Living Things

Non-living Things

*Figure 11. Grades K-3 Sample Concept Map
Living vs. Non-living Things*

There are some characteristics that all living things share that make them different from non-living things. On the other hand, there are some characteristics that are the same for living and non-living things. For each characteristic listed, tell if it describes living things only, non-living things only or both. Write the number of each characteristic in the appropriate place on the diagram. Explain why you made each choice.



1. Uses energy from the environment
2. Reproduce
3. Grow and develop
4. Show movement
5. Breathe
6. Remove waste
7. Respond to their environment

Interdependence of Living and Non-living Things
Justified Memory Game

Make at least 3 sets of the "Living and Non-living Things" cards. Turn all of the cards face down. Students make pairs of exact matches or of a living or non-living thing and its source of energy. For example, a student may make a pair of two trucks or a truck and gasoline, as gasoline is a source of energy for the truck. Or, a student may pair two rabbits or a rabbit and a carrot. Students must tell why they are matching two cards that are not alike. (Use cards found in appendices A and C.)

Sample Activity Modified:

Pre-scripted Post-it Notes: Pre-scripted post-it notes and pictures may be used to help students with learning disabilities or those who need more assistance with vocabulary. (Appendix D)

Elicit evidence of prior knowledge.

Figure 1 is a conceptual model of factors affecting Global Systems Change. Human influences on climate change often spark debate among individuals in various arenas of society. Scientists and politicians currently debate the phenomena of climate change and global warming. Not all scientists agree about the prospects of human influences on climate change and global warming nor do all policy makers agree on what to do about it. What do you think about climate change and global warming?

Students' task: Your task is to examine figure 1 and the associated key terms. Create a concept map about your ideas on human influences on Earth's climate. Your concept map should show your ideas about the effects of human activities on climate and the Earth as a system.

1. Start with the phrase "all living things" at the top.
2. Use arrows and linking phrases to connect ideas printed on the post-it note.
3. Use each key idea only once.

References:

American Association for the Advancement of Science (AAAS). 1993. *Benchmarks for science literacy*. New York: Oxford Press.

American Association for the Advancement of Science (AAAS). 2001. *Atlas of Science Literacy*. Washington DC: AAAS.

Keeley, Page, F. Eberle, and C. Dorsey. 2008. *Uncovering student ideas in science: Another 25 Formative Assessment Probes* (vol.3). Arlington, VA: NSTA Press.

Mohen, Lindsey, Jing Cheng, and Charles W. Anderson. (2007, July). *Developing a K-12 Learning Progression for Carbon Cycling in Socio-Ecological Systems* presented at the Knowledge Sharing Institute of the Center for Curriculum Studies in Science. Washington, D.C.

Vanides, Jim, Yin Yue, Miki Tomita and Maria Araceli Ruiz-Primo. 2005. Using Concept Maps in the Science Classroom. *Science Scope* 28 (8): 27– 31.

Concept-mapping Resources:

For more examples of grade level concept maps, visit the Science Wiki: <http://www.ncdpi.wikispaces.net>

Software

Inspiration <www.inspiration.com>

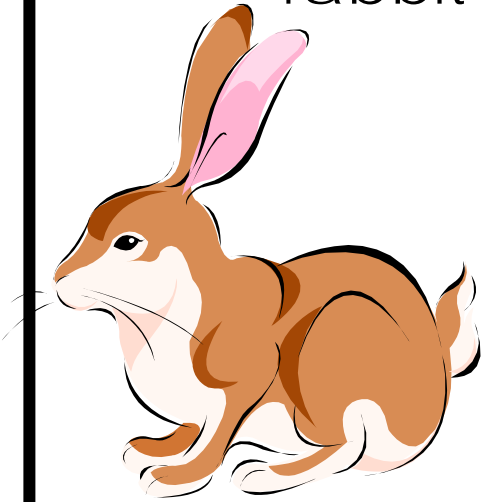
IHMC Concept Map Software <<http://cmpa.coginst.uwf.edu>>

Mind Tools <<http://www.mindtools.com/mindmaps.html>>

Smart Technologies Inc. <<http://www.smarttech.com/Products/smartideas/index.asp>>

Smart Draw <<http://www.smartdraw.com/specials/mindmapping.asp?id=13054>>

rabbit

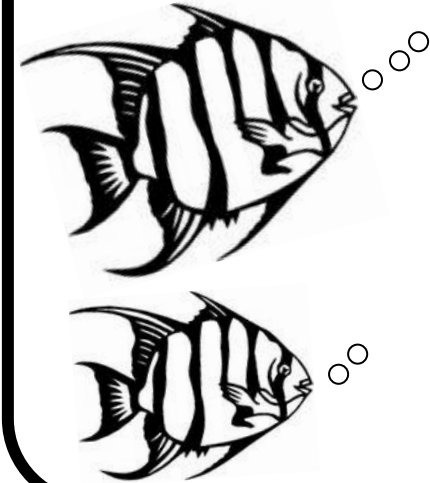


Appendix A

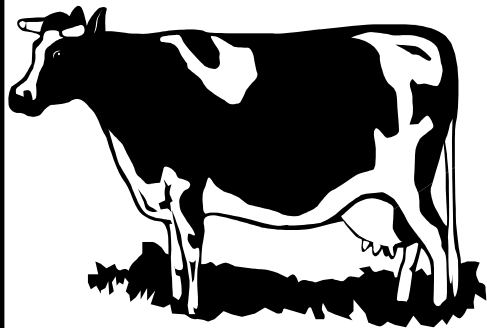
Animal Sort

Sort the animals that live on Mr. Green Gene's farm into 3 groups: animals that only eat plants; animals that eat other living animals; and animals that eat plants and other living animals. Print two sets and play the memory game.

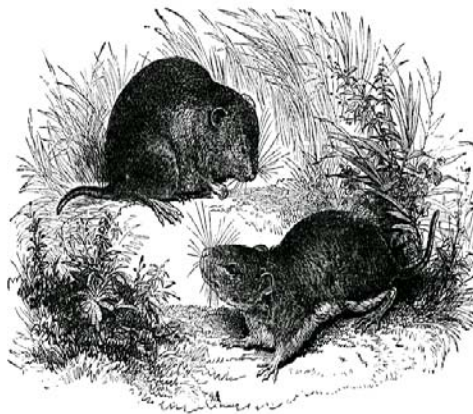
fish



cow



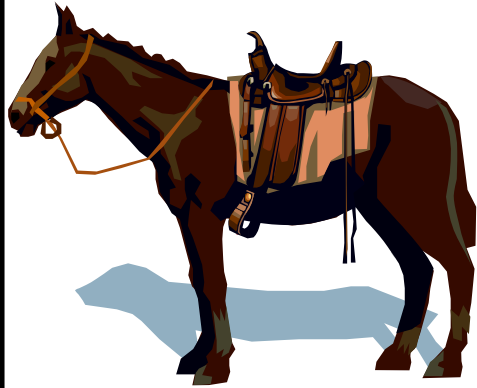
field mice



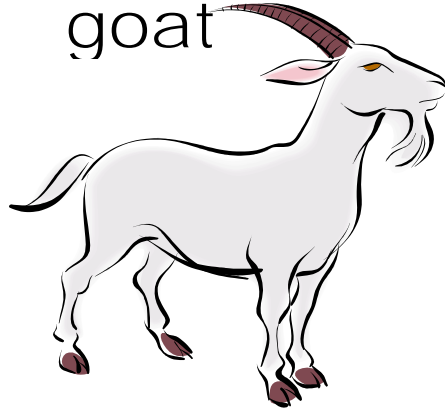
chicke



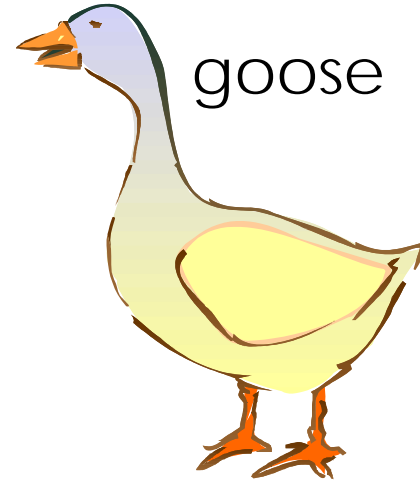
horse



goat



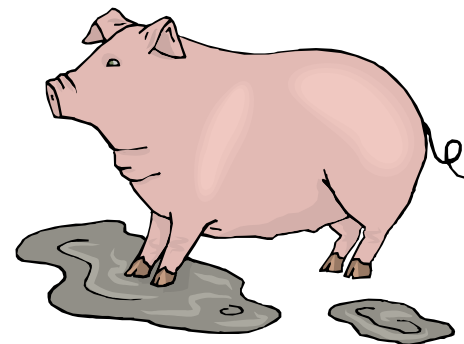
goose



chick



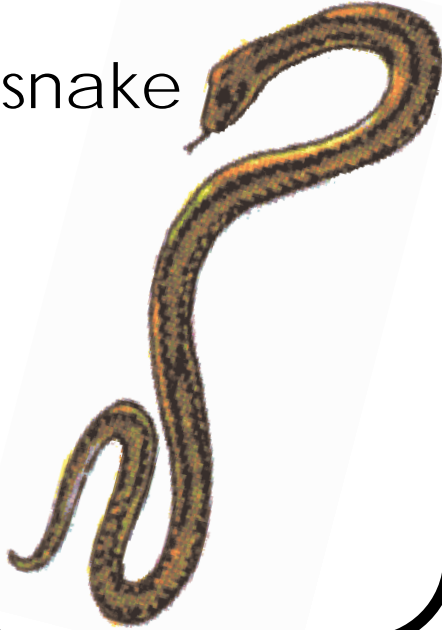
pig



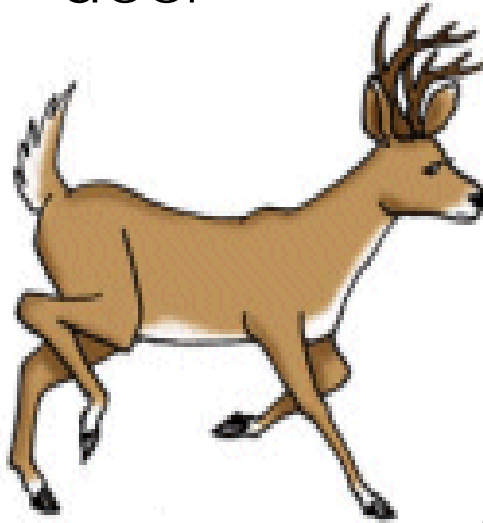
Mr. Green Gene



snake



deer



butterfly



barn



coyote



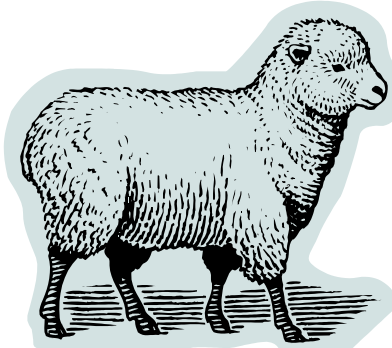
bear



bird
(bee eater)



sheep



mountain



eagl



dog



Appendix B

Needs of Living Organisms

Distribute a packet of cards to each pair or small group. The packet contains the following materials and needs: bread, fruits/veggies, milk, juice, water, air, warmth, exercise, gasoline, sand, rock. Ask students to sort their cards into 2-3 groups however they would like. Students may sort the cards as 1) solids, liquids, and gases, 2) foods and everything that is not food, 3) things people need to live and things that we don't need to live, 4) things that were once alive and things that are not alive, 5) matter and things that are not matter, etc. Students get to choose the way they want to sort their cards. Once groups sort their cards into groups, have each group share how they decided to sort the cards.

Matter

Not Matter

solid

liquid

gas

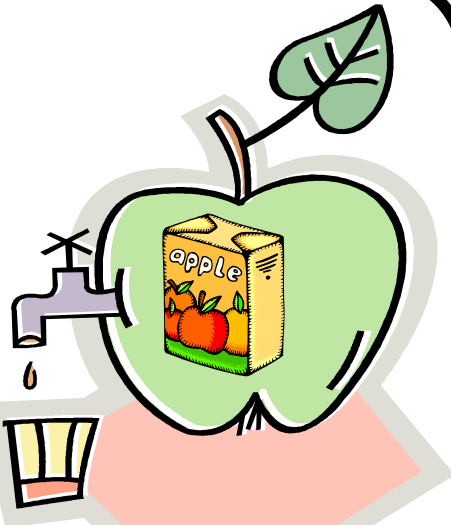
bread



fire:



fruits and
vegetables



juice





rock



AIR:

soil



water



gasoline

AIR: wind

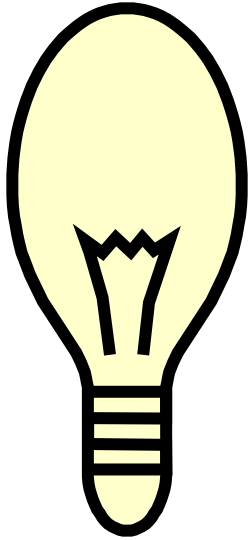


exercise



food

light bulb



Appendix C

Living vs. Non-living Things
All living things need food for energy, growth and for repair of their bodies. Plants and animals depend upon the resources and conditions of their habitats to survive. Mr. Green Gene depends on many of the living and non-living things on his farm to survive. Identify pictures of things that may be found on Mr. Green Gene's farm. Cut out the pictures and sort them as "living" or "non-living". Explain why you have placed each picture in its group.



grapevine

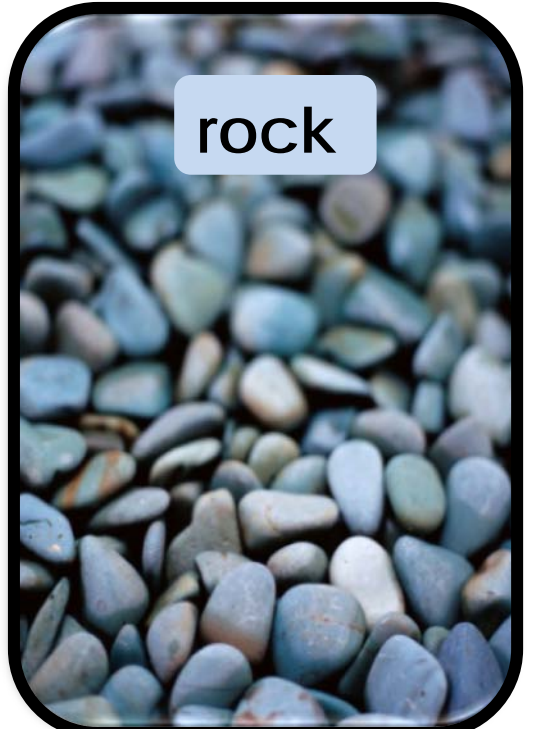
desk



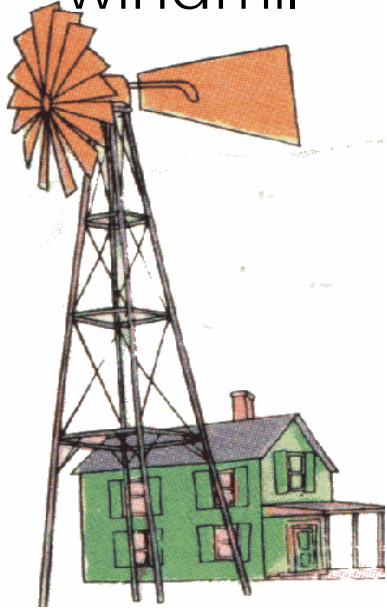
fire:



rock



windmil



Primary Energy Source



Primary Producer
of Food

lawn mower



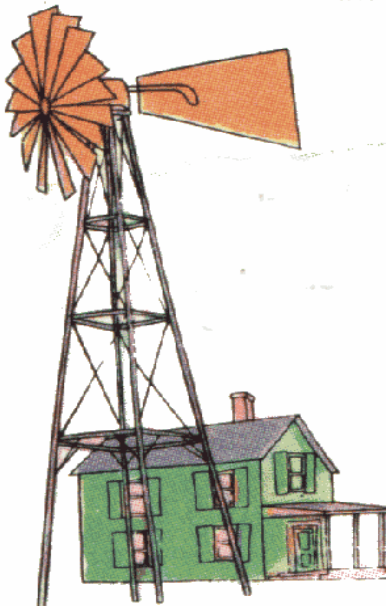
eggs



electricity



windmil..



grapevine



fire



picnic
table



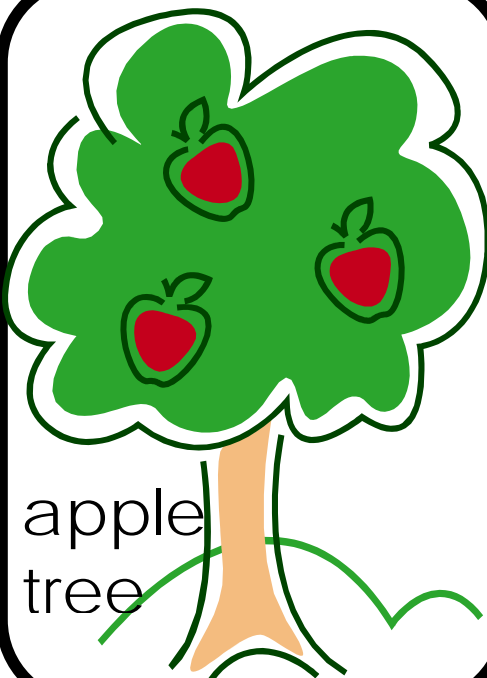
AIR: wind



computer

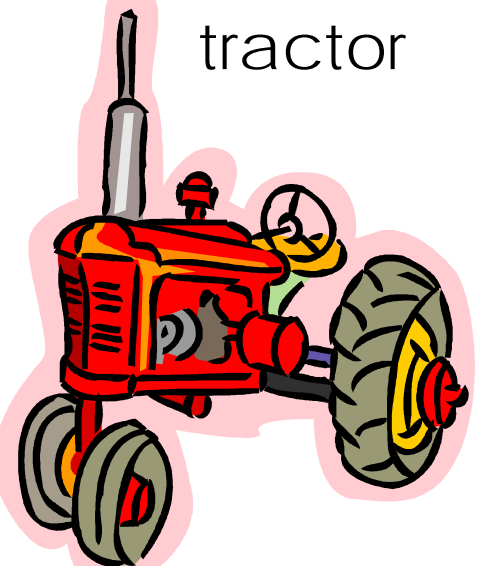


truck

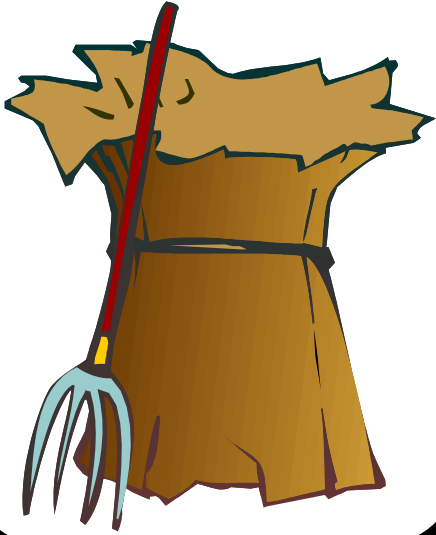


apple
tree

tractor



hay



gasoline



soil

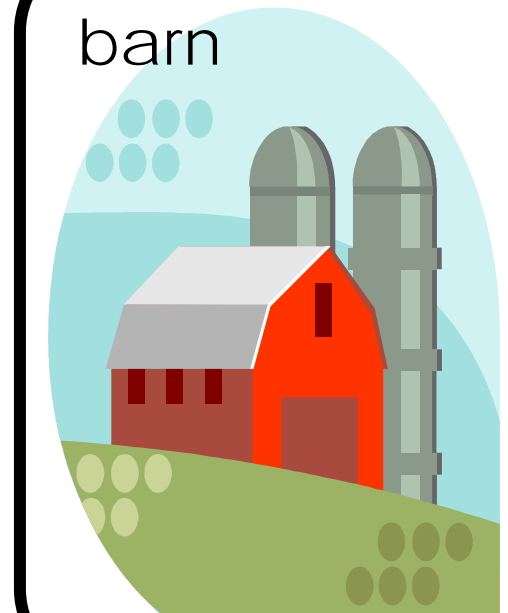


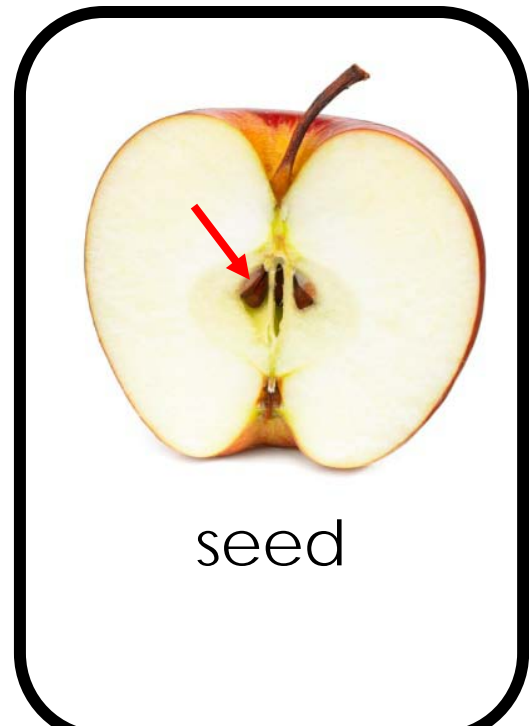
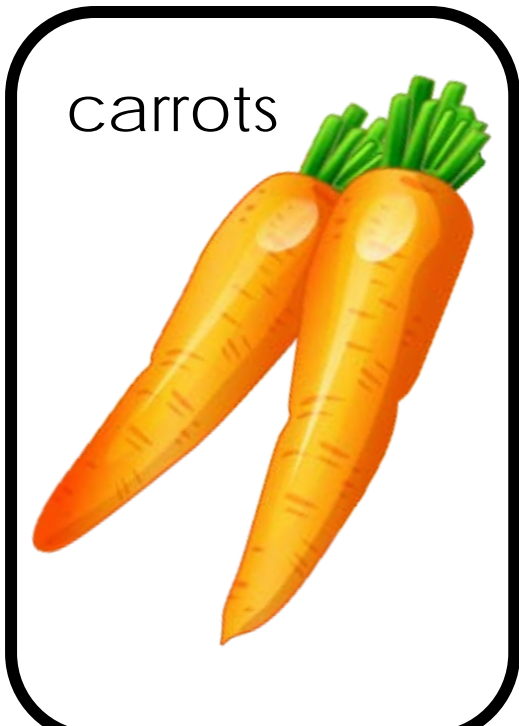
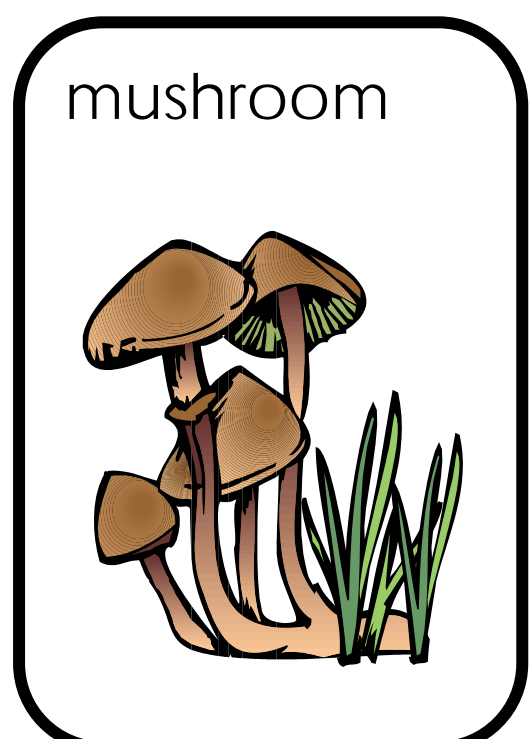
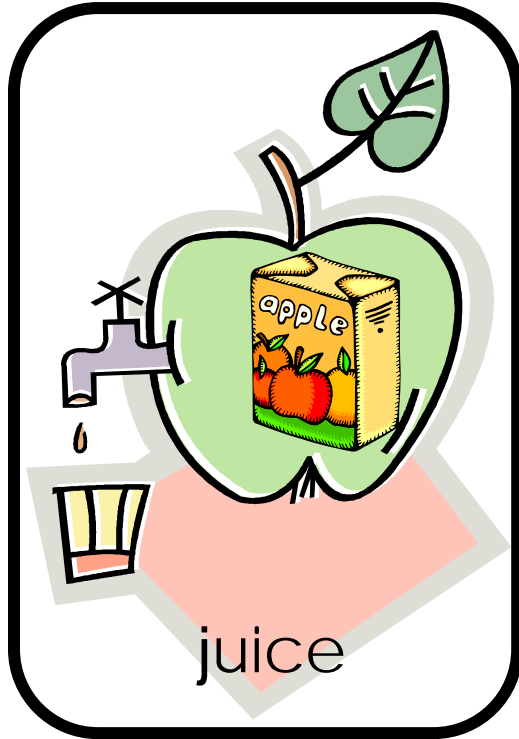
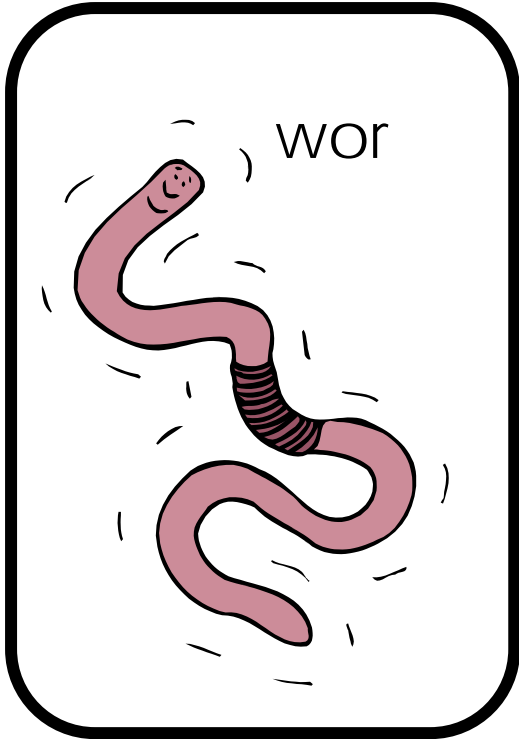
sun

water

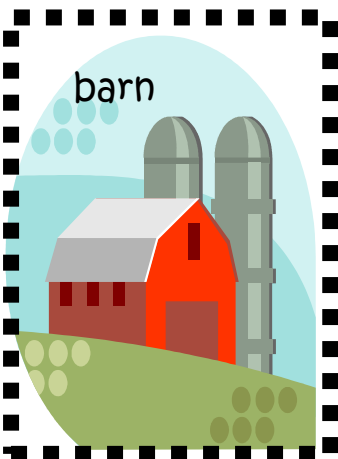
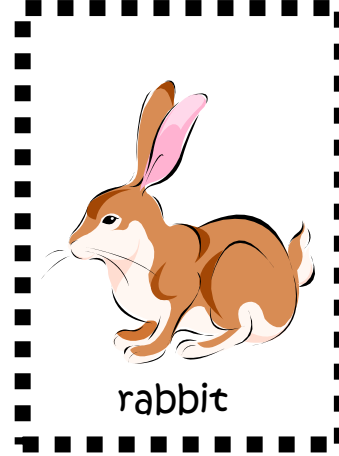
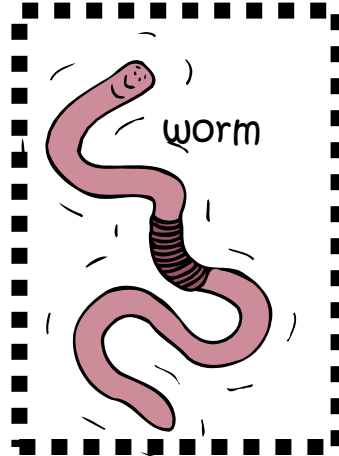
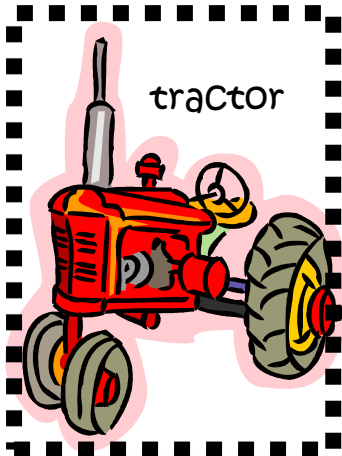
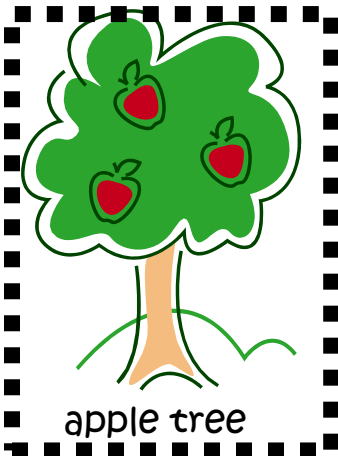


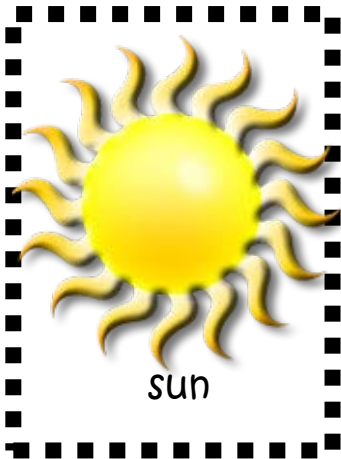
barn





Living and Non-living Things





sun



truck



sheep



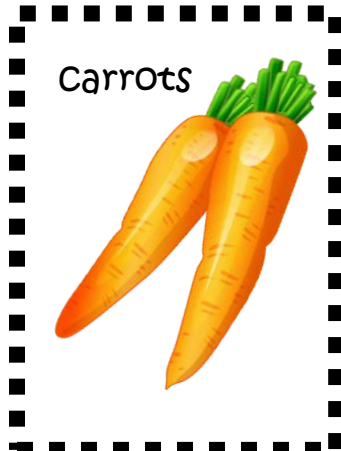
computer



eagle



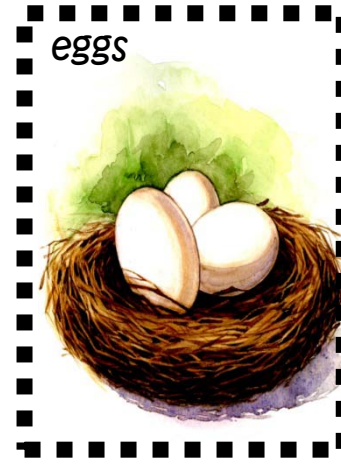
AIR: wind



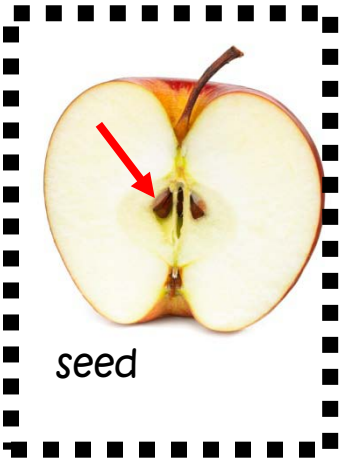
Carrots



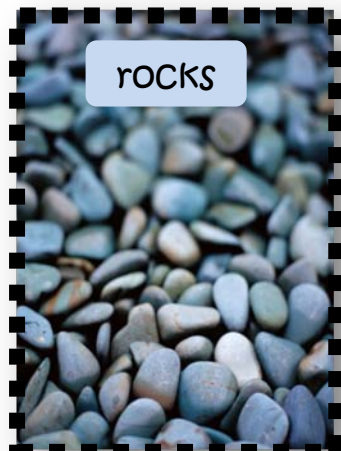
electricity



eggs

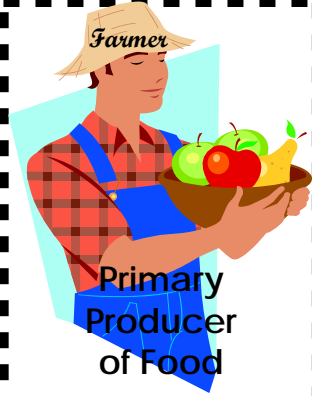


seed



rocks

fire: warmth



Primary
Producer
of Food

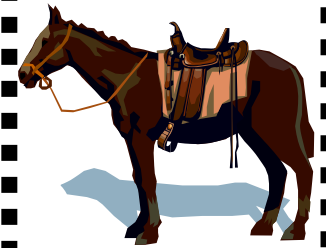
cow



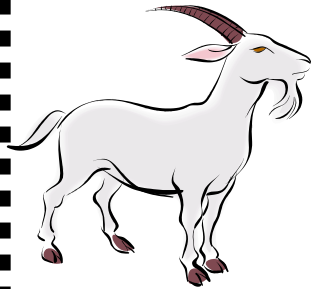
chicken



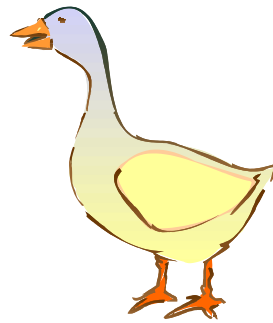
horse



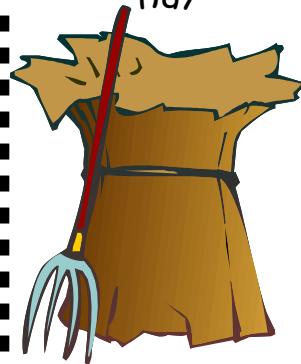
goat



goose



hay

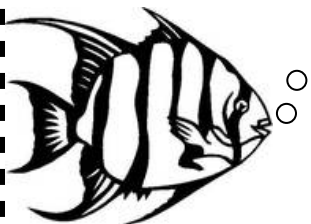


Primary Energy
Source

picnic
table



fish



field mice



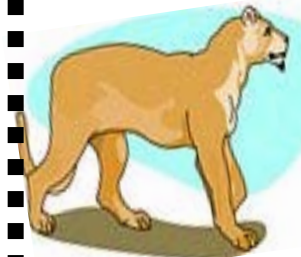
dog



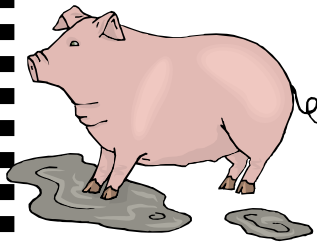
chick



mountain lion



pig



snake



deer



butterfly



bird
(bee eater)



barn owl



coyote



bear



light bulb



desk



lawn mower



windmill



grapevine



juice



MIL

Appendix D: Sample Activity Modified

All
Living Things

Carbon
Compounds

Chemo-
synthesis

Chemo-
synthetic
bacteria

CO₂ in Air

Carnivores

Coal, Oil,
Natural gas

Death

Decomposers

Decrease CO₂
in air

Fossil Fuels

Excretion

Global
Temperature

Green Plants

Greenhouse
effect

Herbivores

Increase in
CO₂ in air

Local Air
Temperature

Omnivores

Organic
Matter

Photosynthesis

Respiration

plant
photosynthesis

oxygen

non-living
things

Decomposers
in air & soil

dead
organisms

carbon
dioxide

Ecosystems

living
things

sunlight

animal
respiration

earth
worm

Mr. Green
Gene

rabbit

cow

coyote

eagle

fish

soil

apple

air

bear

grass/hay

oak tree

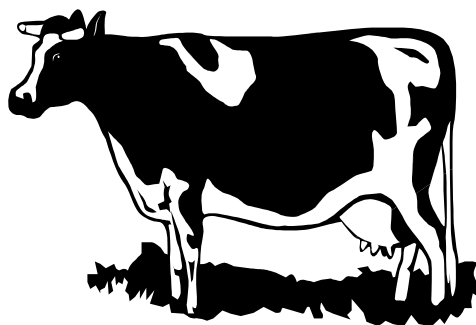
water

Appendix E: Black and White Duplicates

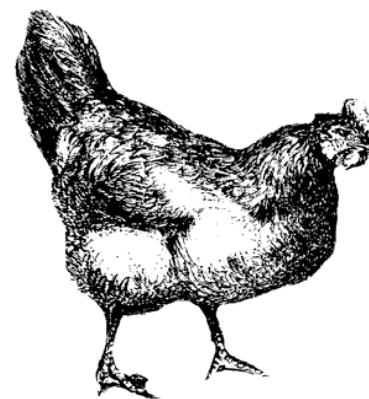
rabbit



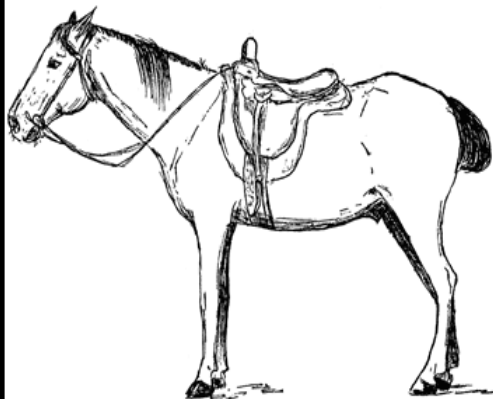
COW



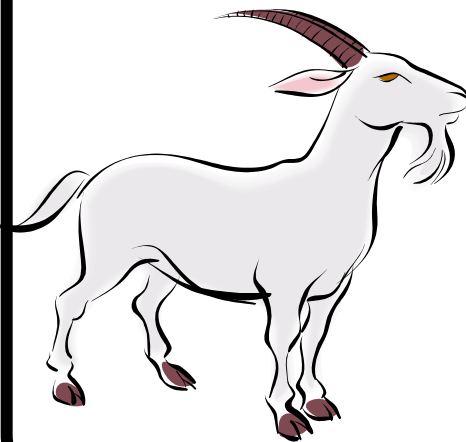
chicke



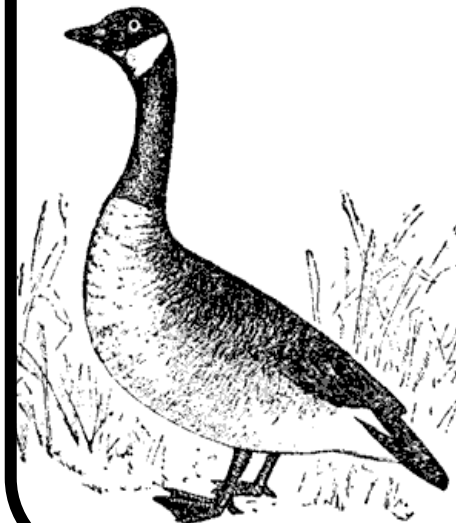
horse



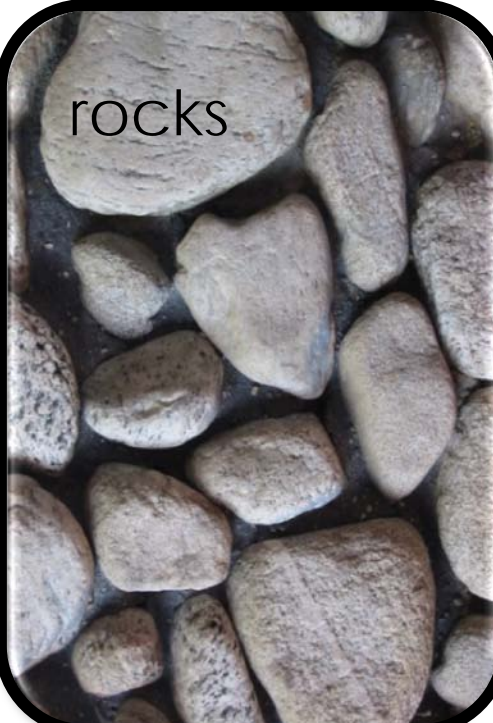
goat



goose



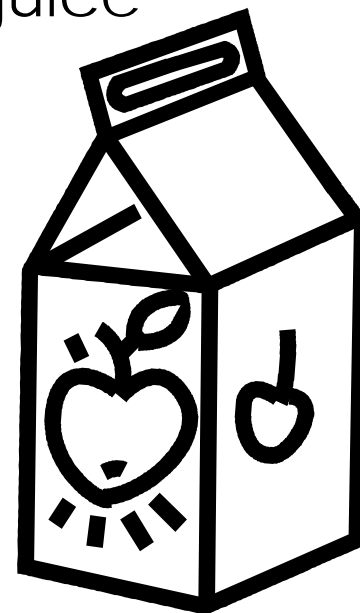
rocks

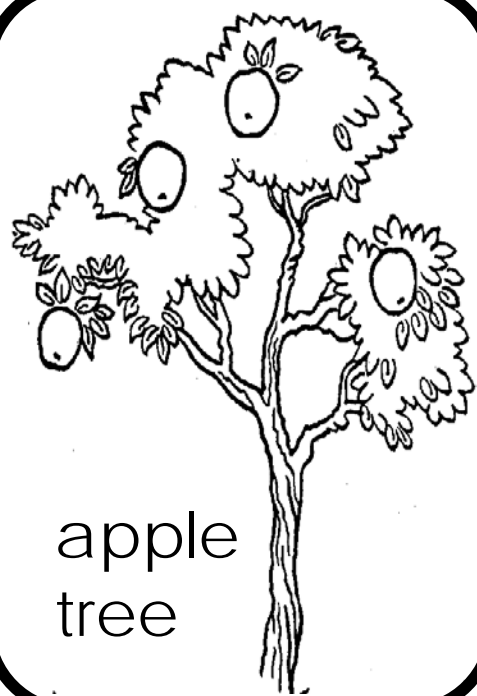


milk



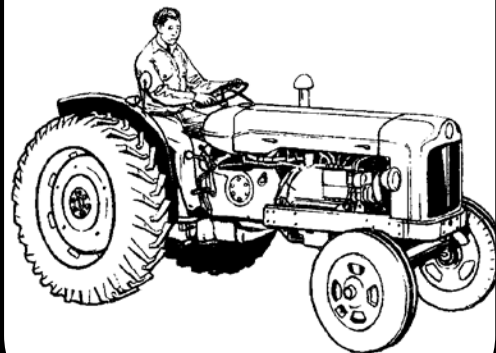
juice



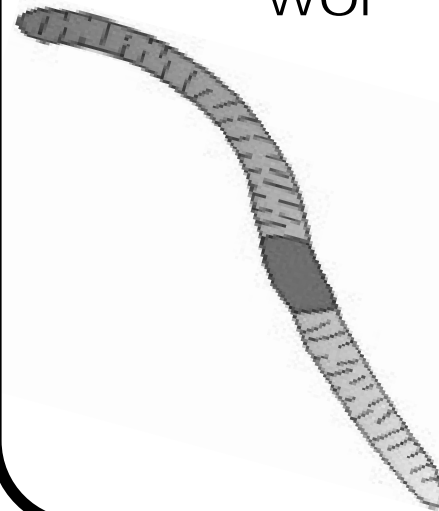


apple
tree

tractor



wor



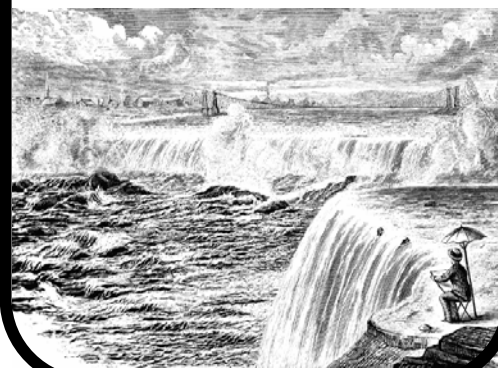
mushroom

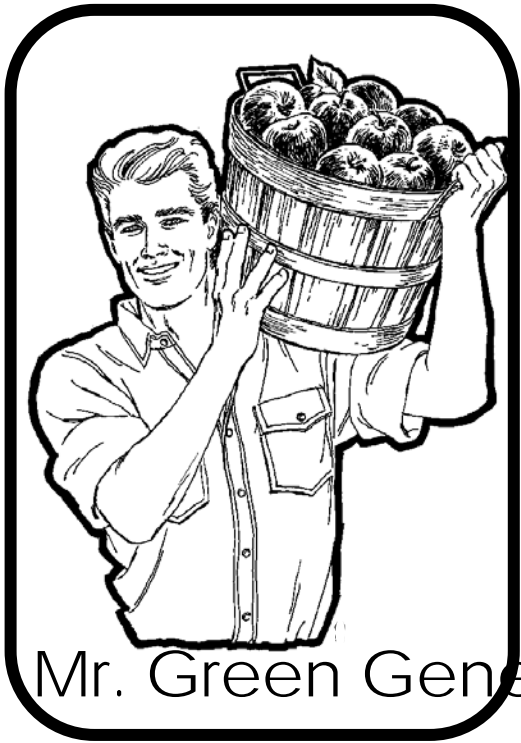


barn

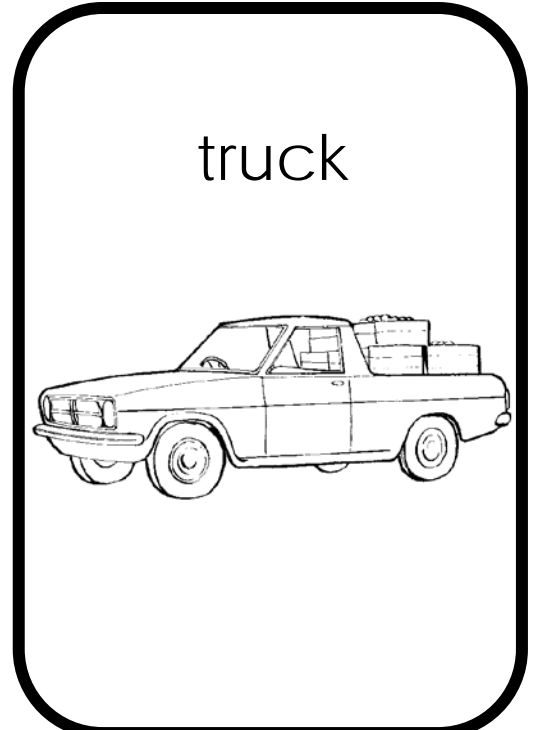
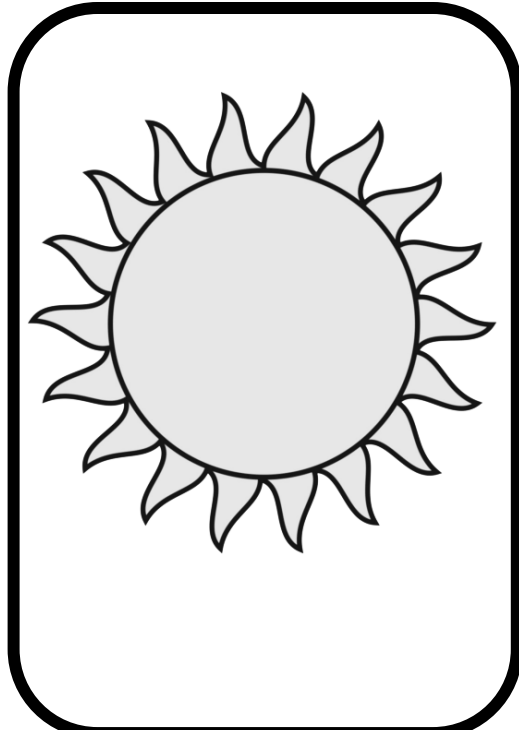
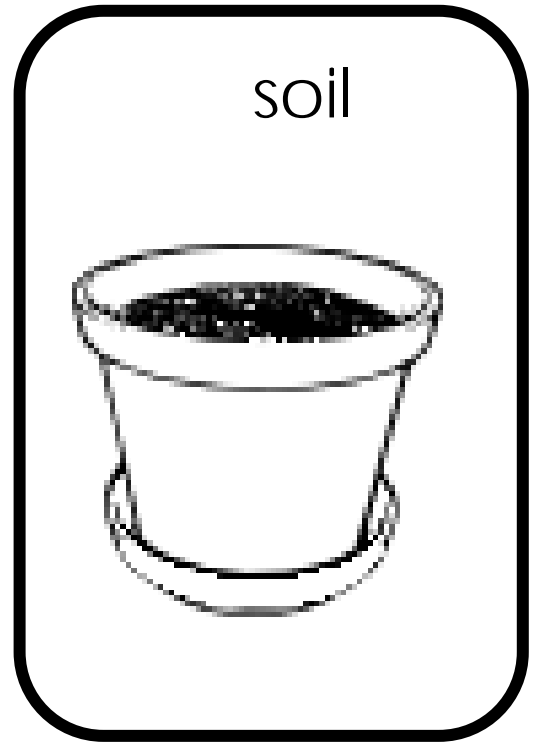
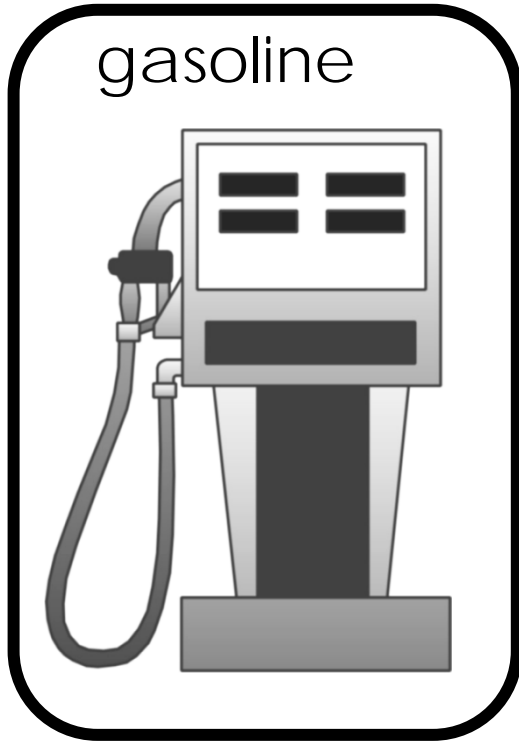


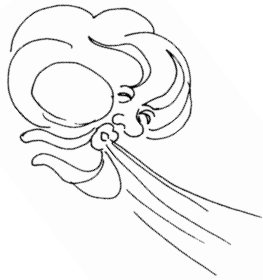
wate





Mr. Green Gene





AIR:
wind



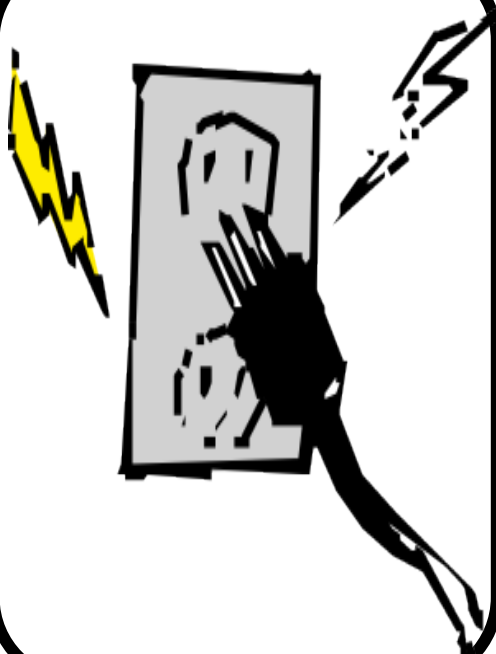
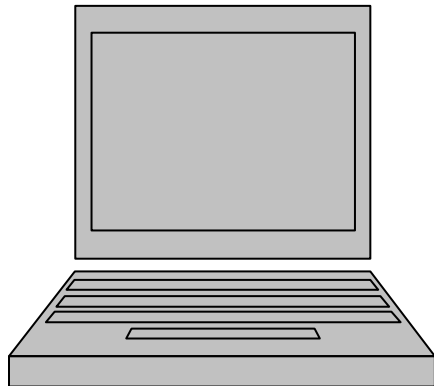
carrots



picnic
table



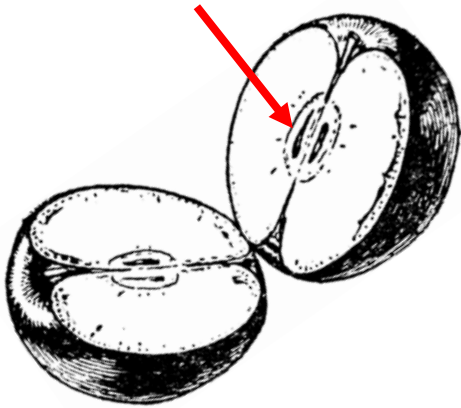
compute



eggs

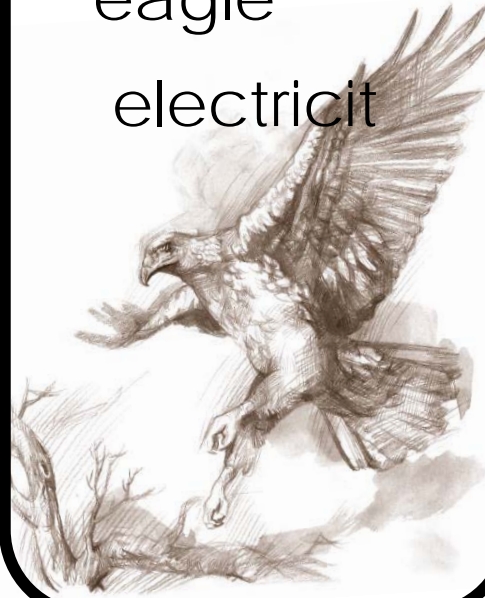


seed

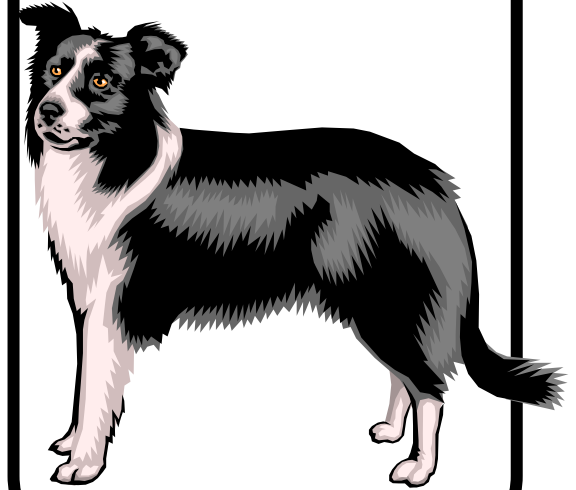


eagle

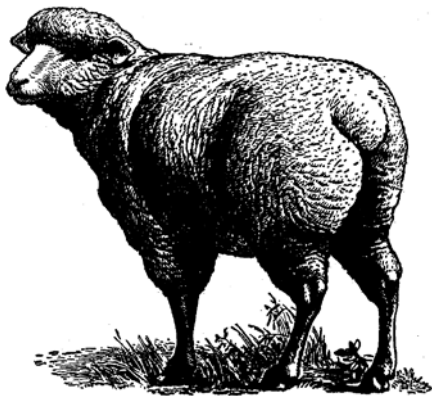
electricit



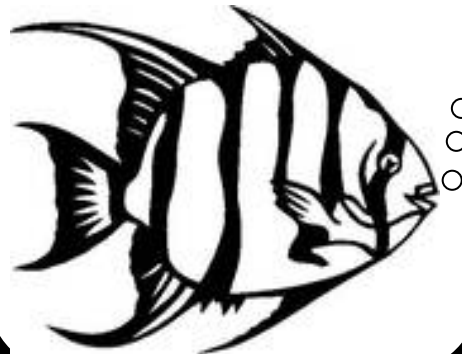
dog



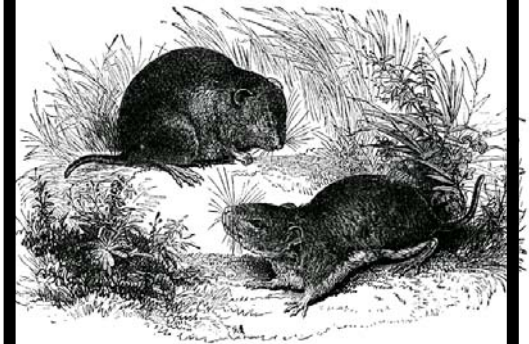
sheep



fish



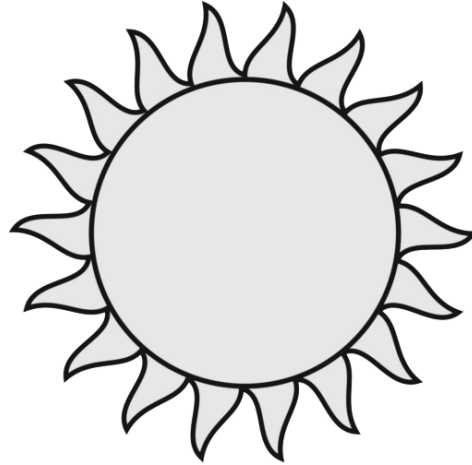
field mice



Primary Producer
of Food



Primary Energy Source



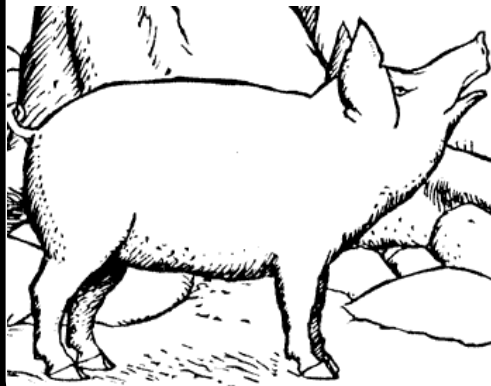
chick



mountain



pig



snake



deer



butterfly



bird
(bee eater)



barn



coyote



bear



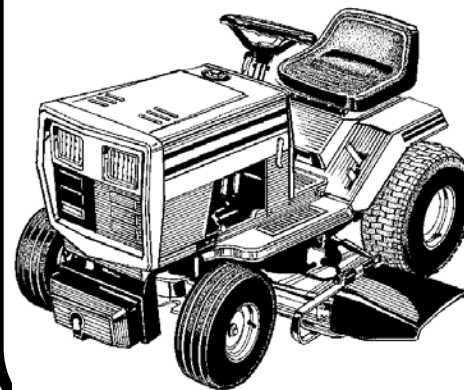
light



desk



lawn mower



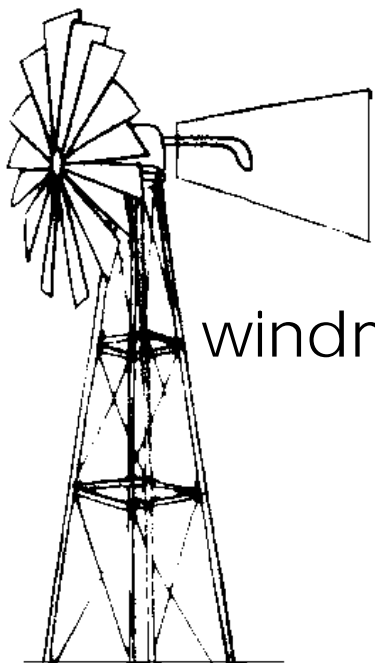
grapevine



fire: warmth



windmill



rabbit



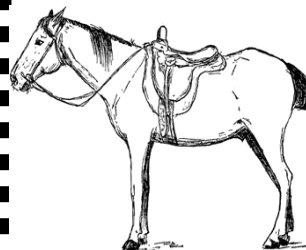
cow



chicken



horse



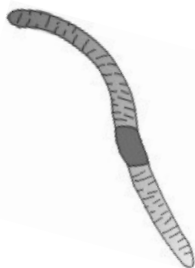
goat



goose



worm



Mr. Green Gene



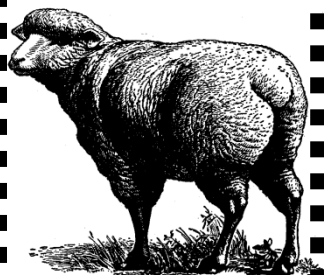
eagle



dog



sheep



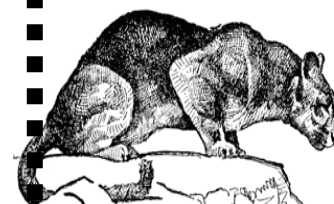
fish



field mice



chick



mountain
lion

pig



snake



deer



fire: warmth



bird
(bee eater)



barn owl



coyote



bear



apple tree



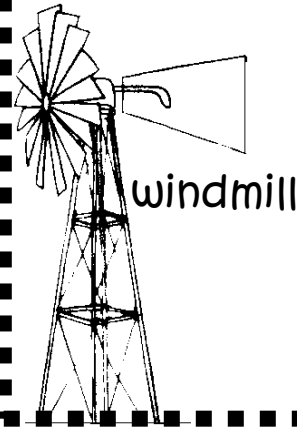
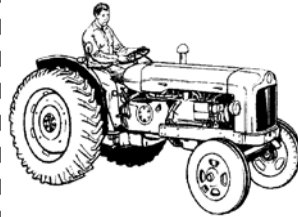
grapevine



butterfly



tractor



windmill

lawn mower



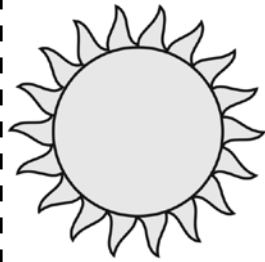
desk



light bulb



sun



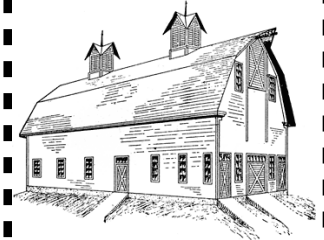
AIR:
wind



mushrooms



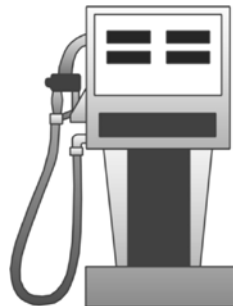
barn



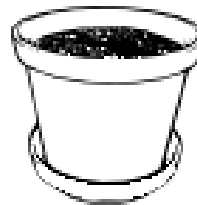
water



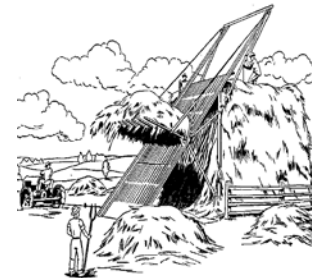
gasoline



soil



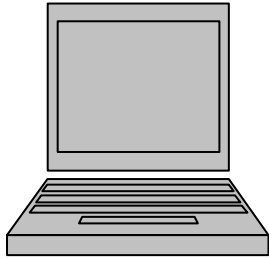
hay



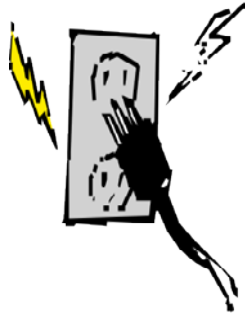
truck



computer



electricity



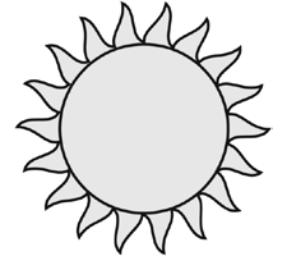
eggs



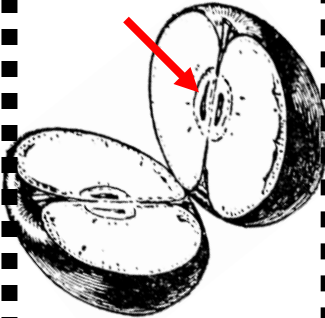
Primary
Producer



Primary
Energy Source



seed



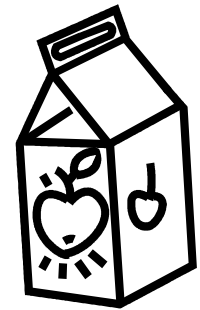
carrots



picnic
table



milk



juice

rocks



