

Healthy Chickens, Healthy Pastures: Making Connections at Drumlin Farm and Beyond



Curriculum Guide

Companion “Healthy Chickens, Healthy Pastures” Playkit available through the Creative Learning Exchange (www.clexchange.org)

Created by:



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ABSTRACT

This *Making Connections* curriculum guide has been created to help students think deliberately about living systems in a farm setting and to give students a mental framework to take home and apply in other contexts. Through the discussions, system mapping activities, and games in this unit, students will explore the hidden interconnections and dynamics surrounding the “Egg Mobile,” a sustainable chicken farming operation at Drumlin Farm in Lincoln, MA. Concepts such as feedback loops, time horizon, and stocks/flows are illustrated through a study of the relationships between elements of a farm pasture: chickens, cows, soil, plants, manure, etc. Students will answer the question: “What’s the connection between the Egg Mobile and a healthy pasture?” The unit can include outdoor exploration if you have access to Drumlin Farm or another local farm that raises chickens, or you can bring the farm into your classroom using photos, videos and the Internet. Use this unit to encourage your students to see the people, land and wildlife in and around farms, not as a set of interesting but disconnected parts, but as a components of vibrant, living systems.

CURRICULUM OVERVIEW

Grade Level: PreK-K, 1-2, 3-5 (*can be extended to grades 6-8*)

Essential Question: *How does an Egg Mobile help to develop healthy pastures?*

Time: 1 – 8 hours, depending on level of outdoor observation/interaction and the number of activities included

Materials:

- *Making Connections* playkit with cards and Wikki Stix (optional, available for purchase)
- Egg Mobile observation sheet
- Paper, clipboard, colored pencils
- Butcher paper, markers/crayons/yarn (for murals)

Vocabulary (see appendix):

- Interconnections, system, feedback, Waste=Food, stock/flows

Methods:

- Observation/exploration, inquiry, “curious conversations,” creating visual maps and graphs

Learning Outcomes:

- Children will practice “**systems thinking**” by exploring such questions as: “How is this connected to that?”, “How does this influence that?”, “What makes the amount (stock) of healthy soil grow?”
- Children will develop a broader understanding of the **relationships in a healthy pasture.**
- Children will understand soil as a living system that takes in **waste and turns it into food.**
- Children will understand that some connections are causal, for instance, that one type of causal connection – **reinforcing feedback** – plays a role in generating healthy soil.

Indicators/Assessment:

- Children will be able to create visual maps that show their understanding of soil as an interconnected, living system that takes in waste (and other matter) and turns it into “food for soil,” enabling plants and other species to thrive.
- Children will understand that there is a connection between living things (chickens, cows, insects, people) and the soil.

Program Outline:

1. Introduction/Observation: Find out what an Egg Mobile is and think about what it’s like to be a chicken (can be modified for classes not taking place at Drumlin Farm).
2. Initial Group Discussion: Lead a “Curious Conversation” about the Egg Mobile.
3. Individual Processing (Grades 1-5 only): Students sketch a simple picture of what they see and think is happening, then work with a partner to think about possible interconnections in the healthy pasture system.
4. Group Activity/Processing: Group discussion of interconnection, using the optional “Making Connections” playkit (available for purchase) or a group mural to map the connections/feedback
5. Stock/Flow Lesson: Collaborative exercise in stock/flow mapping
6. Wrap Up: Develop ways to take these ideas home.

INTRODUCTION: WHAT IS AN EGG MOBILE?

Drumlin Farm is Mass Audubon's flagship sanctuary, containing nearly 250 acres of fields, forests, and ponds. The property features a sustainable working farm, a display of native wildlife, and educational programming that reaches nearly 100,000 adults and children each year. We welcome you to visit the farm in Lincoln, MA to see the Egg Mobile and chickens up close, but here's an inside look for those of you who can't make the trip in person.

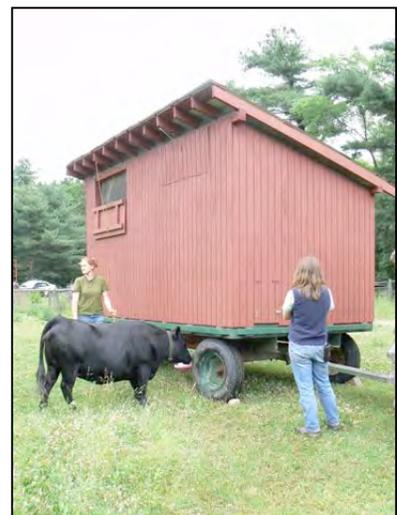
Drumlin Farm built the "Egg Mobile" in 2009 to increase egg production using sustainable, eco-friendly farming practices. The Egg Mobile is a mobile chicken coop that moves from field to field to give the free range chickens a steady supply of fresh bugs, seeds, and grasses to eat. This healthy diet allows them to produce superior quality eggs while their manure fertilizes the fields. The portable coop provides night-time shelter for up to 100 birds. Roosting perches and nest boxes inside provide a safe and comfortable indoor resting place. The chickens go outside in all weather, even during the winter, and are protected from predators by an electric fence. Once the chickens have completely "farmed" this area, a tractor is used to move the coop to a fresh pasture.

Drumlin Farm raises several breeds of chickens in the Egg Mobile, including Wyandotte, Leghorn, Rhode Island Red, Ancona, and Black Australorp. These varieties are selected for their strong egg laying capabilities, as well as their dual use for meat.

A Virtual Tour of the Egg Mobile (photos courtesy of Drumlin Farm):



The Egg Mobile is located in a grassy pasture, surrounded by an electric fence to keep out predators. The Egg Mobile is on wheels, so it can be easily pulled from location to location using a tractor. Cows share the pasture with the chickens.





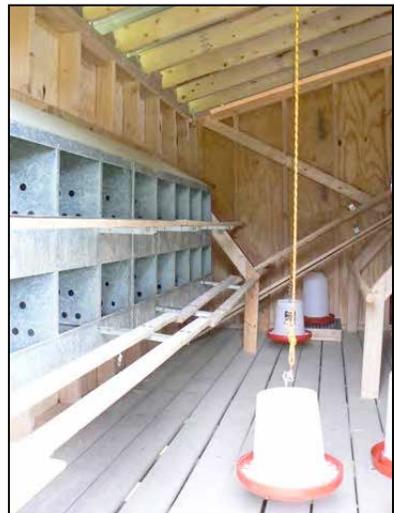
A ramp allows the chickens to move in and out of the Egg Mobile at will during the day. The farmer gently leads the chickens inside at night and closes the door.



Inside the Egg Mobile, there is room for over 100 chickens. Metal boxes along one side provide an enclosed space for egg laying. Hens typically lay one egg each day.



Chickens roost (perch to rest or sleep) on the bars on the other side. Grain feeders hang down from the ceiling for the chickens to eat from during the night or in cold or snowy weather. Water is available from containers on the floor.





The chickens go outside during the day, even during the winter. They scratch and peck at the soil as they look for grass and bugs to eat.



The Egg Mobile typically houses just one rooster to alert the flock to any danger. The rest of the chickens are hens (females). Can you find the rooster in this winter photo?



A variety of chicken breeds live in the Egg Mobile, selected for their strong egg production as well as use for meat. Dark-feathered varieties are often selected since their color offers them some camouflage from predators flying overhead (like hawks).

Chickens produce manure. The farmer scrapes out the manure inside the Egg Mobile from time to time to keep it clean. Outside, the chicken manure slowly decomposes in the pasture grass.

DETAILED PROGRAM GUIDELINES

1. Introduction/Observation

a. IF PROGRAM TAKES PLACE AT DRUMLIN FARM:

- i. Take a walk to the Egg Mobile (possibly after seeing the chickens in the Poultry House). When possible, enter the pasture to get a closer view but don't enter the electric fence (must be arranged in advance with livestock manager).
- ii. Ask the children to take 1-2 minutes quietly looking at what's around them – Where are they? What do they see? What do they smell?
- iii. If time: Ask the children to select one animal they see (chicken, cow, insect, etc.) and complete an "Observation Sheet" that records what they see happening in and around the Egg Mobile and surrounding pasture (see *Appendix: Egg Mobile Observation Sheet*). They should focus in on specific activity and behavior – i.e., what *one* particular chicken is doing, not *all* chickens in general.

b. IF PROGRAM TAKES PLACE IN A CLASSROOM SETTING:

- i. Show the photos of the Egg Mobile and read aloud the accompanying description. You can also search online for videos or pictures of chickens moving, eating, scratching, and interacting with each other and their environment. [Searching on the phrase "pastured chickens video" in your web browser will result in some good choices. Michael Pollen's book, *The Omnivore's Dilemma* (Penguin Press, 2006), contains a great description of the Polyface Farm "Eggmobile" in Chapter 11. The National Sustainable Agriculture Information Service also has a very detailed description of various sustainable chicken-farming methods (<http://attra.ncat.org/attra-pub/poultryoverview.html>).]
- ii. Create a moment for students to stop and reflect individually, using observation sheets or journals to capture their thoughts on "What is it like to be a chicken in an Egg Mobile?"

2. Initial Discussion: Lead a **Curious Conversation** about the Egg Mobile

Ask children to sit in a circle, and use guiding questions to engage them in a *Curious Conversation* about the Egg Mobile. A *Curious Conversation* (source: Louise Cadwell, *The Cadwell Collaborative*, 2008) is an exploratory conversation aimed to spark interesting connections between how children think about the natural world and our relationship to it. In order for a *Curious Conversation* to reveal the wealth of knowledge and emotional connection that children already have for ideas, and to make visible a child's schema, world-view, about a subject, teachers assume a tone of curiosity, authentic wondering, respect and attentive listening to children.

- *What do you think lives in an Egg Mobile?*
- *How does the Egg Mobile work?*
- *What is the Egg Mobile good for?*
- *How could the Egg Mobile be helpful to the Farm?*
- *Why would a farmer build an Egg Mobile?*

- *Is there any connection between the Egg Mobile and us (people)? What do we give the chickens? What do they give us?*
 - *Does the Egg Mobile relate to the soil? Does having an Egg Mobile change the soil in any way?*
3. Individual Processing (*Grades 1-5 only*):
- a. **Identifying Parts of a System:** Either outside, or after returning to an indoor space, ask students to make a quick sketch of what they think are the important parts of the pasture “system” and identify connections between parts by drawing lines or arrows between them.
 - b. **Sharing Ideas (if time):** Ask students to work with a partner to share their sketches and talk about the possible connections between the chickens, other animals, soil, grasses, and other parts of the farm.
4. Group Activity/Processing (choose the activities that are appropriate for your age group, setting, and time available):
- a. **Mural (PreK-5):** On-site or back in the classroom, have the children, as a group, use large paper and markers/crayons to draw a simple mural that shows the main components of the healthy pasture system (Egg Mobile, chickens, eggs, bugs, cows, grasses, soil, manure, people, etc.). Encourage students to look for connections between the elements of the drawing and to draw lines, or tape on yarn, between elements in the picture that are connected in some way. Use guiding questions to ask children to explain those connections:
 - *What about the soil/dirt around the Egg Mobile? What’s in it?*
 - *How does the Egg Mobile help other animals on the farm?*
 - *How are people a part of our picture?*
 - *Was the sun out today? Was it rainy? What does the weather “do” for the chickens and pasture?*
 - b. **Pasture Stamp Collage (PreK-K):** As an alternative to hand-drawing a mural, very young students could use stamps in the form of a barn, cow, chicken, tractor, etc., to create their own version of the pasture on a large piece of butcher block paper. The teacher can use the same guiding questions as in the mural exercise as the children work. If more guidance is needed, the teacher can draw a simple picture of the Egg Mobile and add stamps of a chicken (drawing in dirt at its feet) and the cow (with a bit of manure). Stamping and talking at the same time may help to keep the attention of four-year-olds more successfully than a pure discussion.
 - c. **Make Connections (Grades 1-5):** Sit in a circle and ask kids to share what components of the Egg Mobile system they thought were important. As components are mentioned, write the names or draw a picture for each on the blackboard (chickens, eggs, bugs, soil, grass, chicken manure, cow manure, cows, people, etc.).
As elements emerge, talk about the connection between the Egg Mobile approach and the health of the soil. Once enough items are on the blackboard, ask students to “connect the dots” to link elements where a relationship exists. See the *Appendix: Pasture Health Connections* for a sample of a diagram the

group might come up with. NOTE: A *Making Connections Playkit* for this unit is available for purchase through the Creative Learning Exchange. The kit includes a set of playing cards and connectors to create a visual map of the interrelationships between elements in the pasture. Visit <http://www.clexchange.org/> for information.

- d. **Big Ideas (Grades 1-5):** As connections emerge, highlight the Big Ideas:
 - i. **Feedback Loops:** Identify loops that emerge in the links between cards. In particular, what connections go into and out of the soil that influence its health? Is there positive feedback at work with the Egg Mobile? See if the students can focus in on different types of feedback at work – *Soil Health*, *Chicken Health*, and *Cow Health* – which together make up the overall *Pasture Health* (see the *Appendix: Feedback Diagrams* for examples).
 - ii. **WASTE = FOOD:** Sometimes we “throw away” our waste. Waste of cows and chickens is “thrown away” and so becomes a source of pollution. At Drumlin Farm, the waste of one (for example, the cow manure and parasites), becomes food for another (the chickens). Ask for other examples: Chicken manure becomes “food” for the soil. Compost (waste) also becomes “food” for the soil. If we do as nature does, we can find ways to use our waste; the waste of one can become food for another. Q: *Where do you see this idea in action on a farm?*
 - iii. **Stock/flows:** Ask students to think about “healthy soil” as a stock that can be depleted or replenished. What can make soil health decrease or increase? See the lesson below for a structured way to approach mapping the Egg Mobile as a series of connection stocks and flows. The Soil Health Game (below) is also a nice physical way to represent the flows that can add or deplete the stock of “soil health.”
 - iv. **System Disruptors:** How is this system in balance? What could push it out of balance? For example, chickens in a cage environment do not contribute their manure to soil health (waste stays waste and does not equal food). Their eggs aren’t as healthy for us to eat (we don’t get the input benefits from the chickens’ insect diet). There are more flies in the pasture, etc. Using pesticides to control insects inside of chickens, we introduce toxins in our food supply and reduce the availability of natural foods for the chickens to eat. Manually erase the link between elements so children see the out-of-balance system.
- e. **Visit to the Poultry House** (preschool-grade 5, *for programs taking place at Drumlin Farm or another local farm*): If time allows, consider a visit to the Poultry House to compare the chickens there versus in the pasture/Egg Mobile. What’s different about where and how they live, what they eat, how much time they spend outside? How might this impact their egg-laying ability or the quality of the eggs? Does this depend on time of year? Where would you rather live if you were a chicken? (Compare their pen to having 20 kids live in one bedroom.)

- f. **Egg-Tasting (Grades 1-5):** If time and program goals allow, compare pastured or free-range eggs with commercial eggs from the grocery store. Crack them open into different bowls to compare the color, shape, consistency, etc. Ask the children to hypothesize what might account for the differences. What do they think might influence the nutritional value of the two varieties? Scramble the eggs and eat them to compare any taste differences. (See *Appendix: Egg Nutrition.*)
- g. **Soil Health Game (Grades 1-5):** If time allows, play the Soil Health Game (15-20 minutes): Draw a circle on the ground large enough for the group to gather in. Have the children count off by 4's. Number ones start off the game representing "soil nutrients" and should gather within the circle ("pasture"). Count the number of soil nutrients at the start of the game. The other children are given roles according to their numbers:
- Number twos: Plants (Students can choose to be crop vegetables or hay/grasses.)
 - Number threes: Animals (Students can choose to be chickens or cows.)
 - Number fours: Water (Students can choose to be gentle rain or thunderstorms.)

The children who are not in the pasture should mix themselves up randomly and then line up in a row. As each child approaches the circle, they call out their role and what impact they think it will have on the pasture, for example:

- "I'm a rainstorm, and my runoff washes nutrients out of the soil."
- "I'm a carrot, and as I grow I absorb nutrients from the soil,"
- "I'm a chicken, and my scratching mixes compost into the soil to add nutrients."
- "I'm a cow, and my poop adds nutrients to the soil."
- "I'm a gentle rain that moistens the soil without causing erosion."

If the child's card adds nutrients to the soil, they enter the pasture circle and transform into a soil nutrient. If their card depletes the soil, they choose one child from the circle to step OUT of the pasture and then both students re-join the back of the line. It may help young children to first draw a picture of their role on a card that hangs around their neck with yarn. Make extra soil/pasture cards to give to students entering the circle.

After the game has gone through a few rounds, stop for a process check: When did the pasture have the most nutrients? When did it have the least?

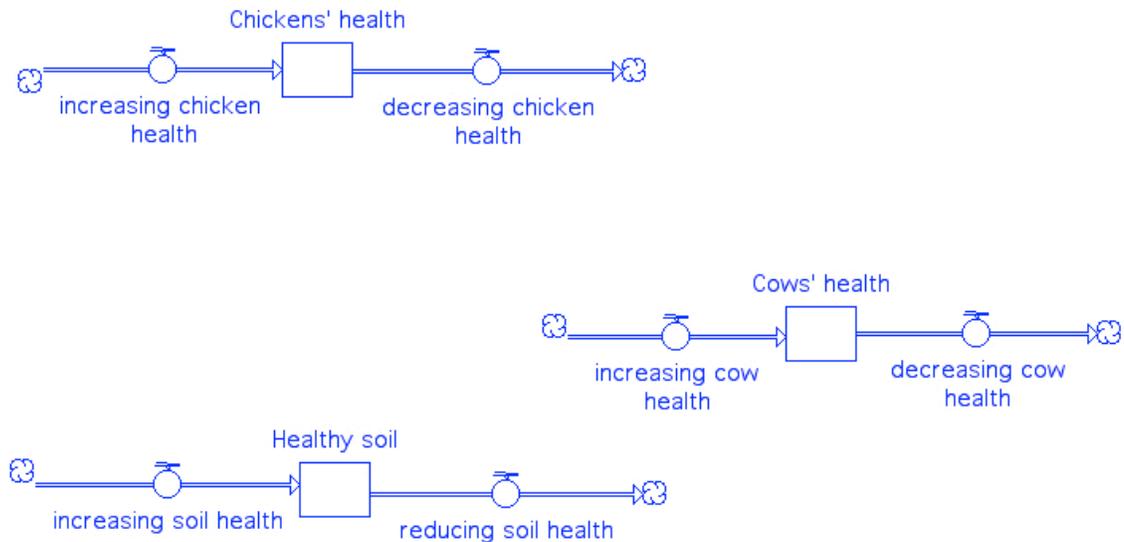
If there is time/interest to play again, start over, but this time lead the children through seasons of activity – spring rains, summer grazing, fall harvest, winter decomposition – so that the teacher determines the order in which different cards are played. At the end of this round, stop to process again: What was different this

time? Were there cycles of higher and then lower soil health? What factors had the biggest impact on changing soil health?

5. Stock/Flow Lesson (*with credit and much thanks to Alan Ticotsky*):

- **Bold font indicates directions or a pedagogical note.**
- “Quotation marks indicate a teacher script. I do not suggest teachers have to follow it verbatim, but only as a guide.”
- *Italics indicate answers or possible student responses.*

a. **Show Diagram 1 (stocks and flows only):**



“Here’s another way to draw the connections in the pasture. The boxes are called ‘stocks,’ and they represent the amount of things we want to watch as they change. Other things in the pasture change also, but in this diagram we’re choosing the health of chickens, cows, and soil as our stocks.

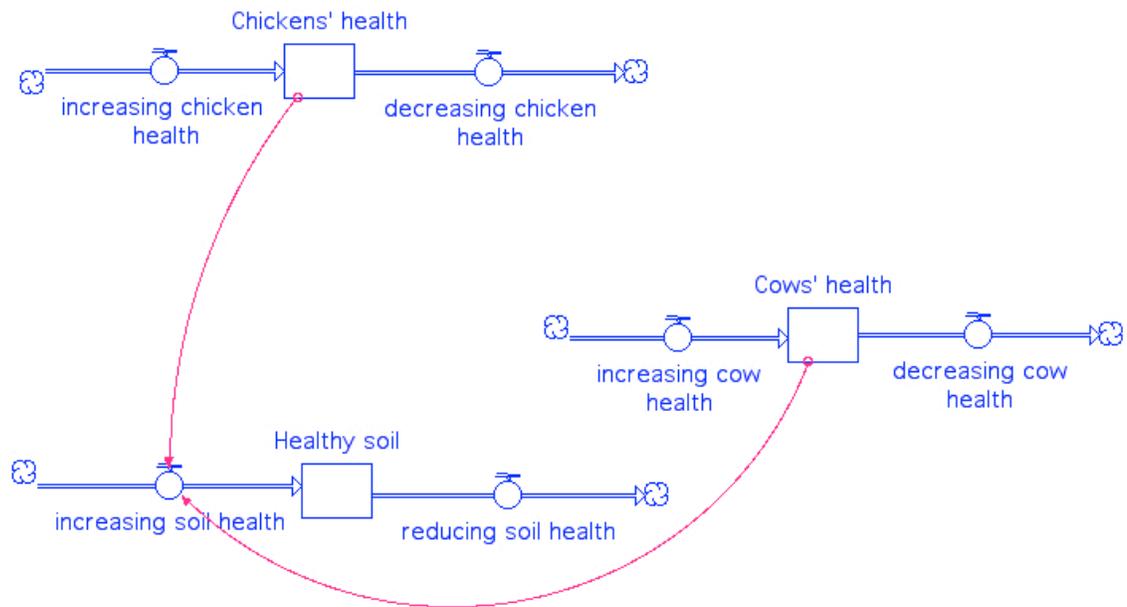
“The stocks change because of ‘flows’ that either increase or decrease them. If you made a different diagram about a bathtub, and you chose ‘Amount of water in a bathtub’ as your stock, what do you think the flows would be?”

Water filling the tub from the faucet and water leaving down the drain.

“In this stock and flow diagram, the flows look like pipes that either ‘fill’ the health of chickens, cows, and soil, or ‘drain’ it away. What’s missing from this diagram?”

Lots of things are missing, and students will have a lot to suggest – insects, manure, decaying plants, ... They may also say that the stocks are not connected to each other.

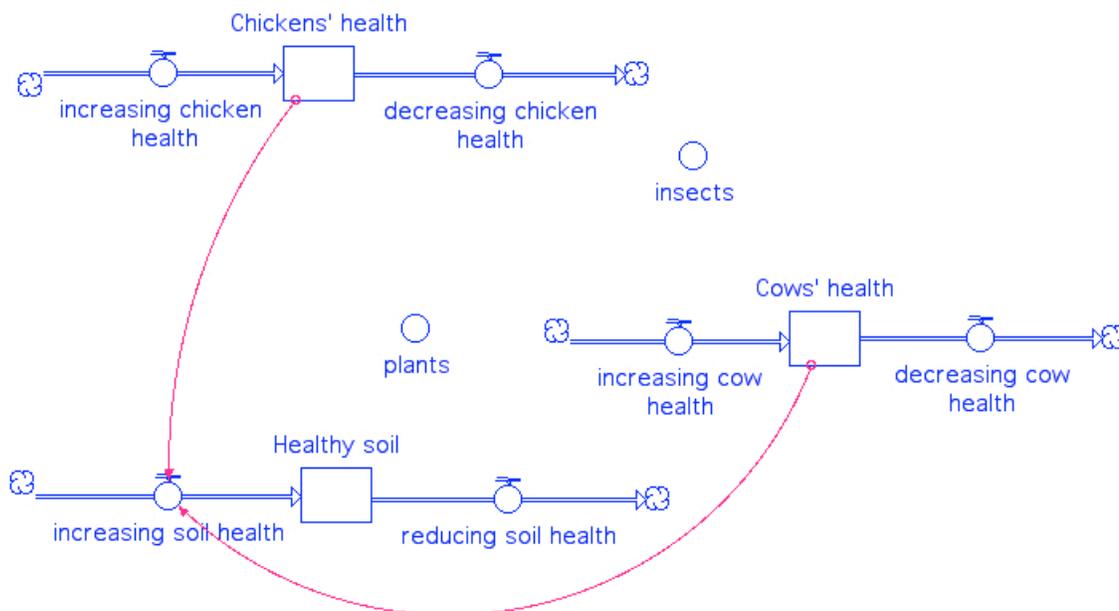
b. Show diagram 2 (beginning to connect):



“OK, our diagram has to show more connections. Remember we learned that the chickens living in the Egg Mobile are usually healthier than those crowded in a coop. This diagram adds two connectors, one from the chickens’ health and one from the cows’ health, both going to the flow increasing the health of the soil. In a stock and flow diagram, connecting arrows start at the cause and point at the effect. So the arrows here mean that the healthy chickens and cows affect the soil. Explain how the healthy chickens and cows make the soil healthier.”

Both chickens and cows produce manure that adds nutrients to the soil. Chickens scratching for food aerate the soil and help incorporate nutrients.

c. Show diagram 3 (adding converters):

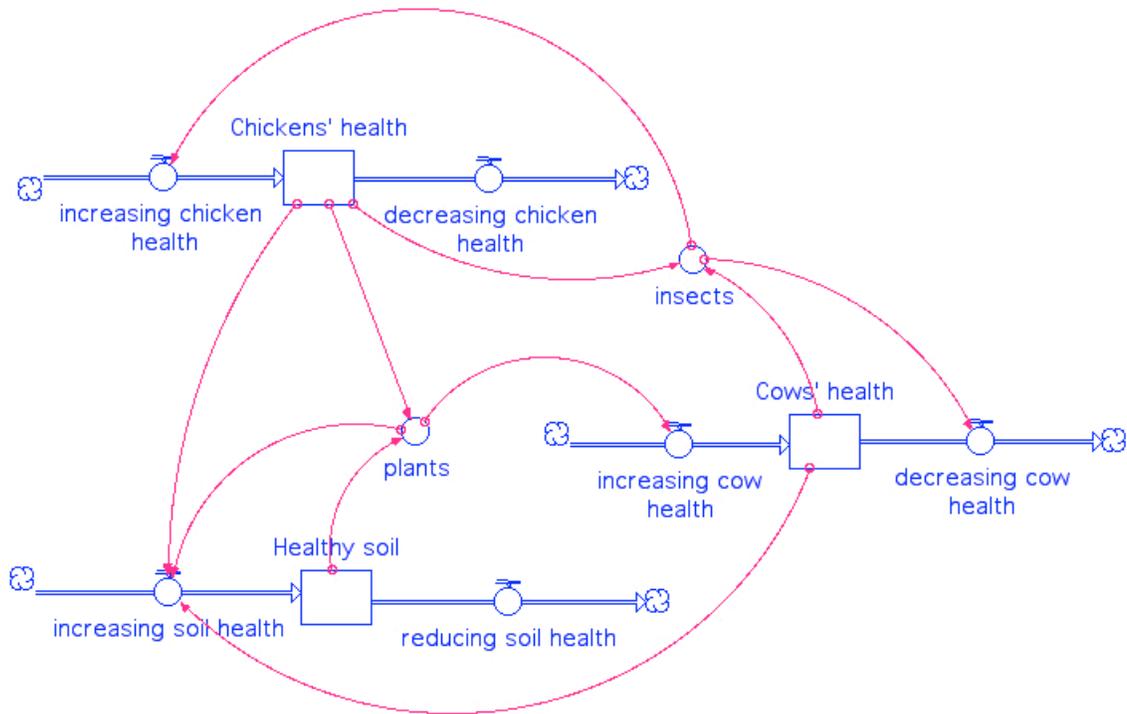


“In this diagram, there are two circles added. One represents insects and one represents plants. We could draw insects and plants as stocks, because the amount of each in a pasture changes over time. But to keep things simple, let’s say that a healthy pasture has insects and plants and draw them as circles without flows connected.”

“Another way the diagram is simplified is that manure is left out. The animals produce manure and that’s important to the pasture. But let’s assume that as long as we have animals in the pasture, they’ll produce manure.”

- d. **Advanced lesson (people and pastures):** At this point, the lesson can go in different directions, depending on the facilitator. A person experienced in systems modeling can work from diagram 3 and draw in connections with the students to move to diagram 4 as an exercise in group model building. The STELLA model for this exercise is available for download from the CLE website. For the majority of teachers, at this point it is most constructive to show diagram 4 and have students work in teams to explain the causal connections. If the connections are numbered, kids can refer to them with less confusion. The following paragraph suggests a way to get students started.

Show Diagram 4 (advanced connections map):



“This diagram has lots of connections. Because there are so many and it looks complicated, let’s put a number on each one.”

Number each red arrow, or replace the unnumbered diagram with a numbered one prepared beforehand. Start with one or two examples and let the students work in teams to describe the rest. An example follows:

“Look at the arrows going in and out of the circle named ‘insects.’ Explain why ‘insects’ is connected to another part of the diagram.”

Among possible answers:

Chickens eat insects, which are a healthy food for chickens.

That improves the health of cows because having too many insects disturbs the cows and makes them less healthy.

The manure from the chickens and cows provides nutrients for insects.

“Number your papers and explain how each connecting arrow works in a pasture. Work as a team – you can divide up the connectors among the team and then share your thinking when you finish.”

Teachers can assign different numbers to teams and have them present their explanations. Younger students can draw the relationship if their writing skills are just emerging. Here are some explanations they may share:

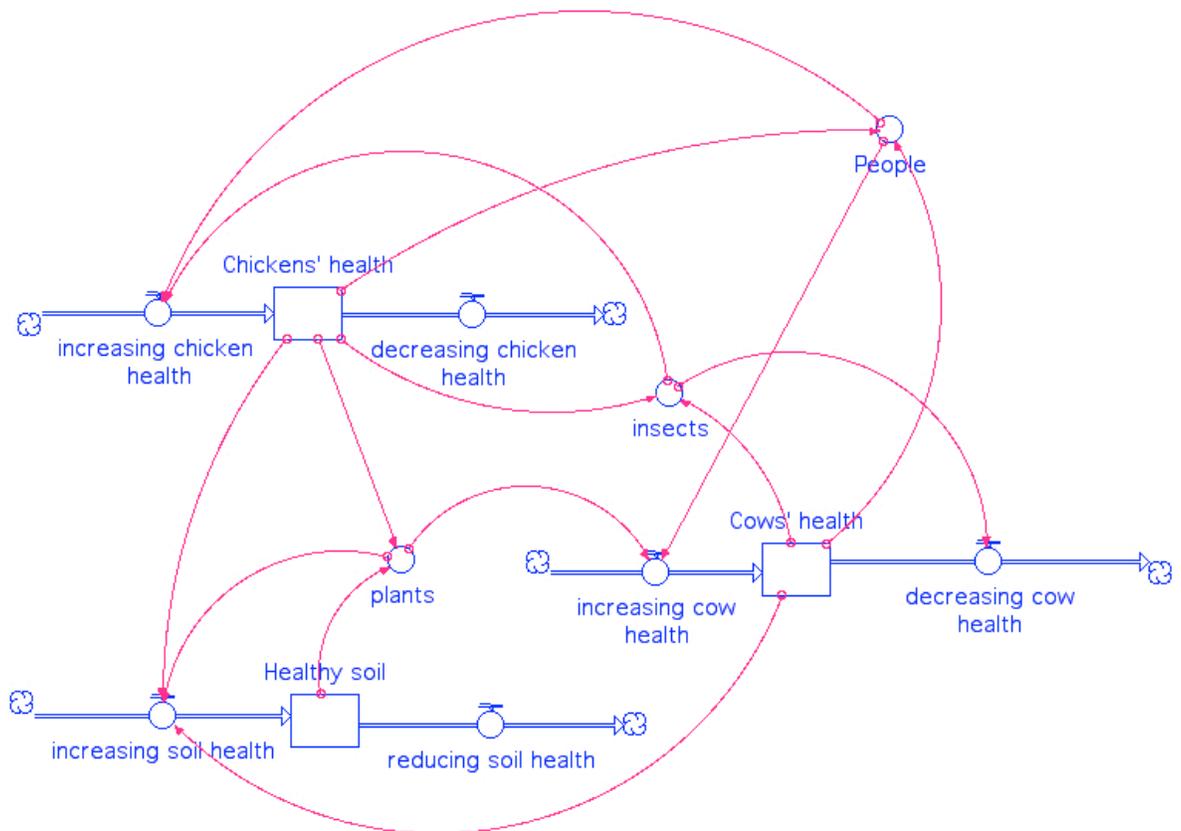
Healthy chickens help plants because their manure provides nutrients and their scratching in the soil aerates the space around the plants' roots.
 Plants help the soil become healthier when they decay and return nutrients.
 The healthier the soil, the better the environment is for plants.
 The plants feed cows.

Presentations may be written, verbal, drawn, acted, or expressed in other creative ways.

“Do we have all the parts of our pasture community accounted for? Why do we care about this?”

Students will identify choices that are poor management options for chickens and cows in terms of the health of the ecosystem and the quality of produce. People are missing from the diagram.

Show diagram 5 (bringing people into the picture):



“Let’s add people to the diagram. Show the connections between people and the pasture.”

Add 'people' as a circle (converter), again to avoid the complication of flows. Like insects and plants, the population of people certainly varies and could be represented as a stock, but let's keep it simple.

People always want healthy livestock like chickens and cows, so connecting arrows go from each stock to 'people.' To produce healthy chickens and cows, people must practice prudent environmental stewardship, so connecting arrows travel from 'people' to 'increasing chickens' health' and 'increasing cows' health.'

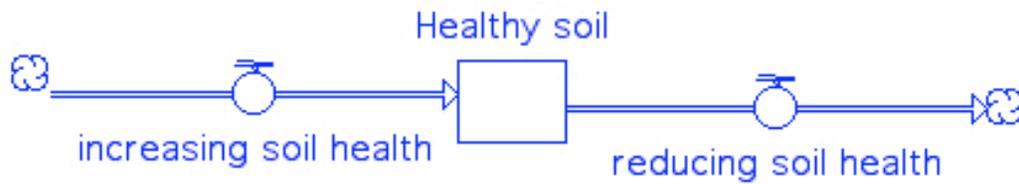
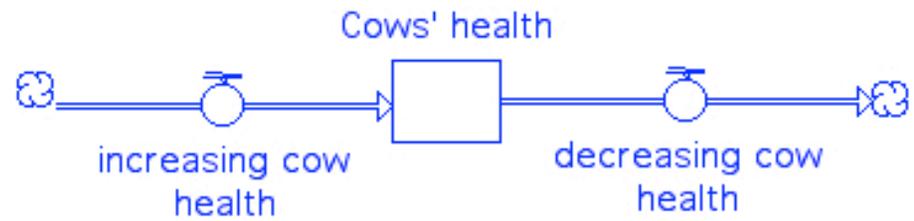
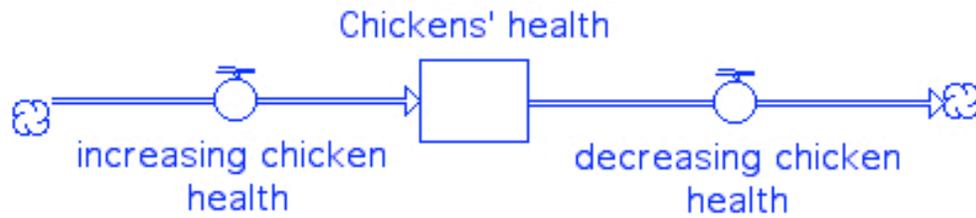
“What may happen when humans don't connect to the flows of increasing animal health?”

The stocks of chicken health and cow health do not grow and eventually will decline. Because of all the interconnected relationships, the soil health will also decline. The quality of produce will suffer when the health of the pasture ecosystem deteriorates. But when humans do our part, with systems like the Egg Mobile, the pasture can flourish.

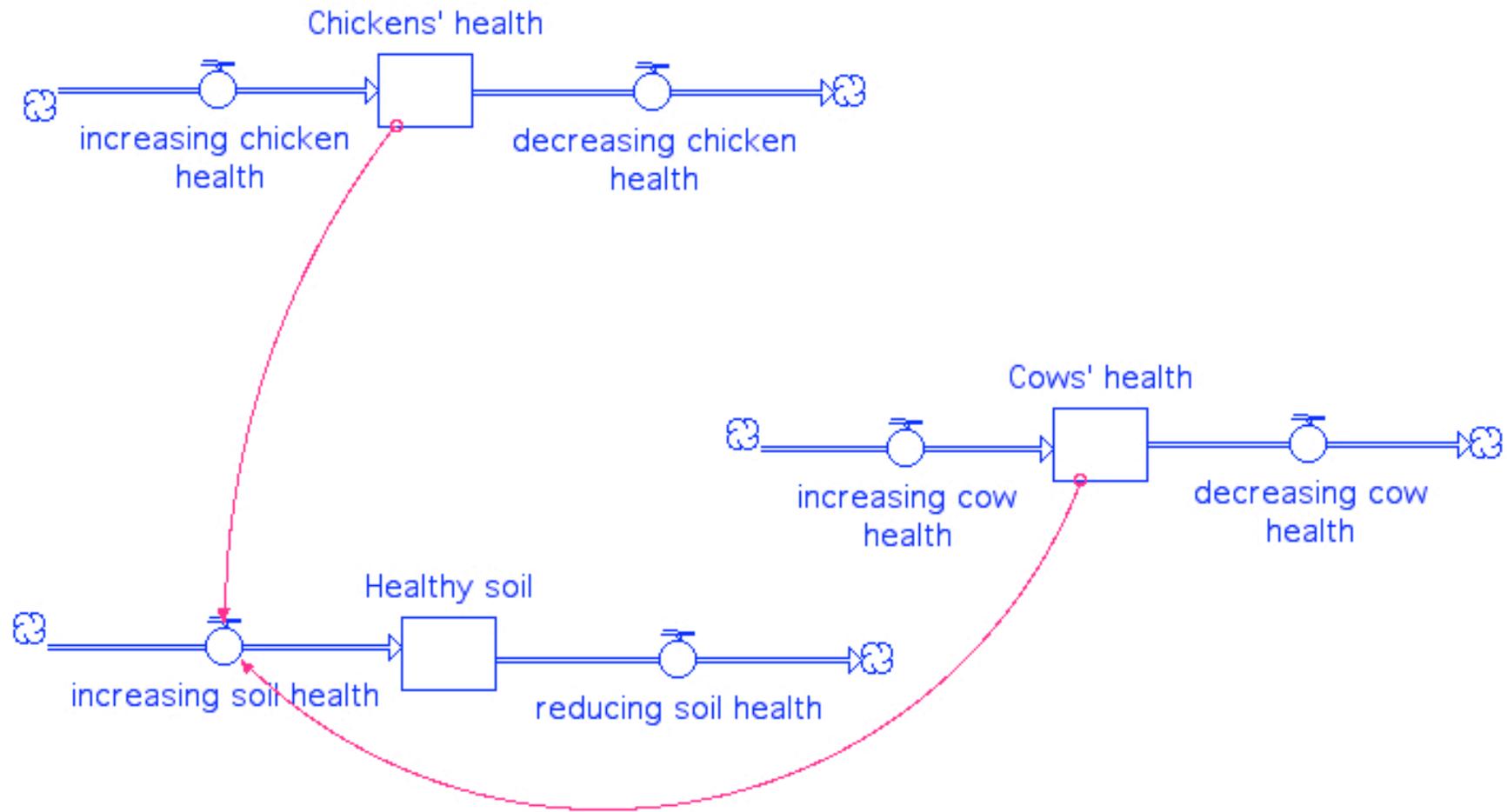
6. Wrap Up:

- a. **Pasture Symphony** (Preschool-grade 2): End the session with the Pasture Symphony: Have the kids make up a sound that describes each part of the pasture: chicken clucking, cows mooing, insects chirping, grasses waving (“swoosh”), soil growing plants (“mmmmm”). Practice each movement/sound together and make up new ones for other ideas. Then ask each child to close their eyes and think of what part of the pasture they enjoyed learning about the most: chickens, cows, soil, grasses. Have them open their eyes, and on the count of three, make their own sound. Watch and enjoy the Pasture Symphony emerge! It's also fun to raise your hands to raise the volume and then gradually lower them until the symphony dies out.
- b. **Taking it Home** (Grades 1-5): Choose one wrap-up topic:
 - i. Ask students to think about opportunities for waste to become “food” at home. One obvious answer will be home compost. How about sneakers that get turned into playground surfaces? Or plastic bottles that become all kinds of recycled building materials (fleece jackets, composite lumber, etc.)?
 - ii. Ask students to imagine themselves teaching a younger student or sibling about the Egg Mobile. If time permits, have the children pair up and practice with a partner. Encourage them to take their Egg Mobile diagrams home and try explaining them.

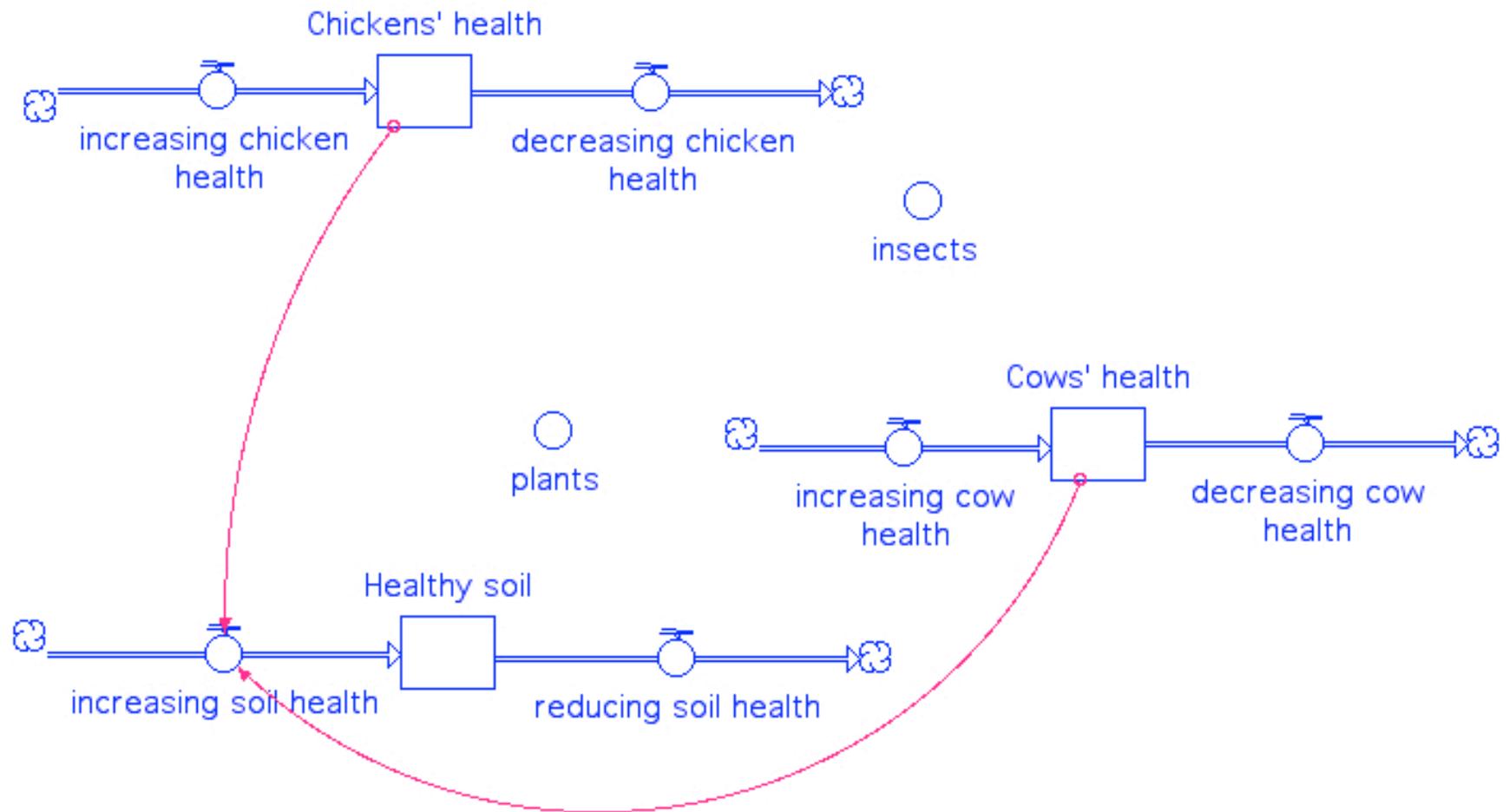
Stock/Flow Diagram 1



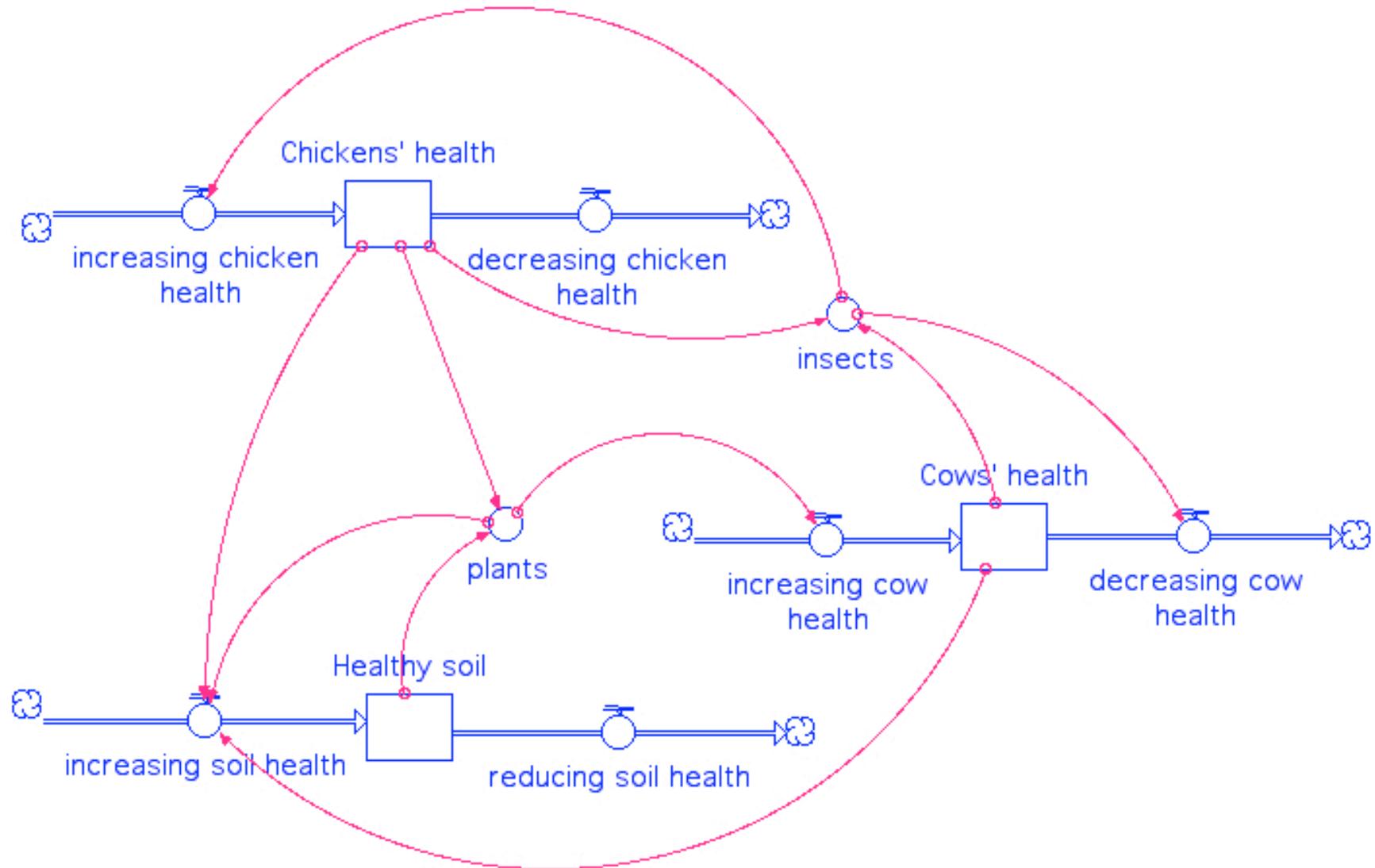
Stock/Flow Diagram 2



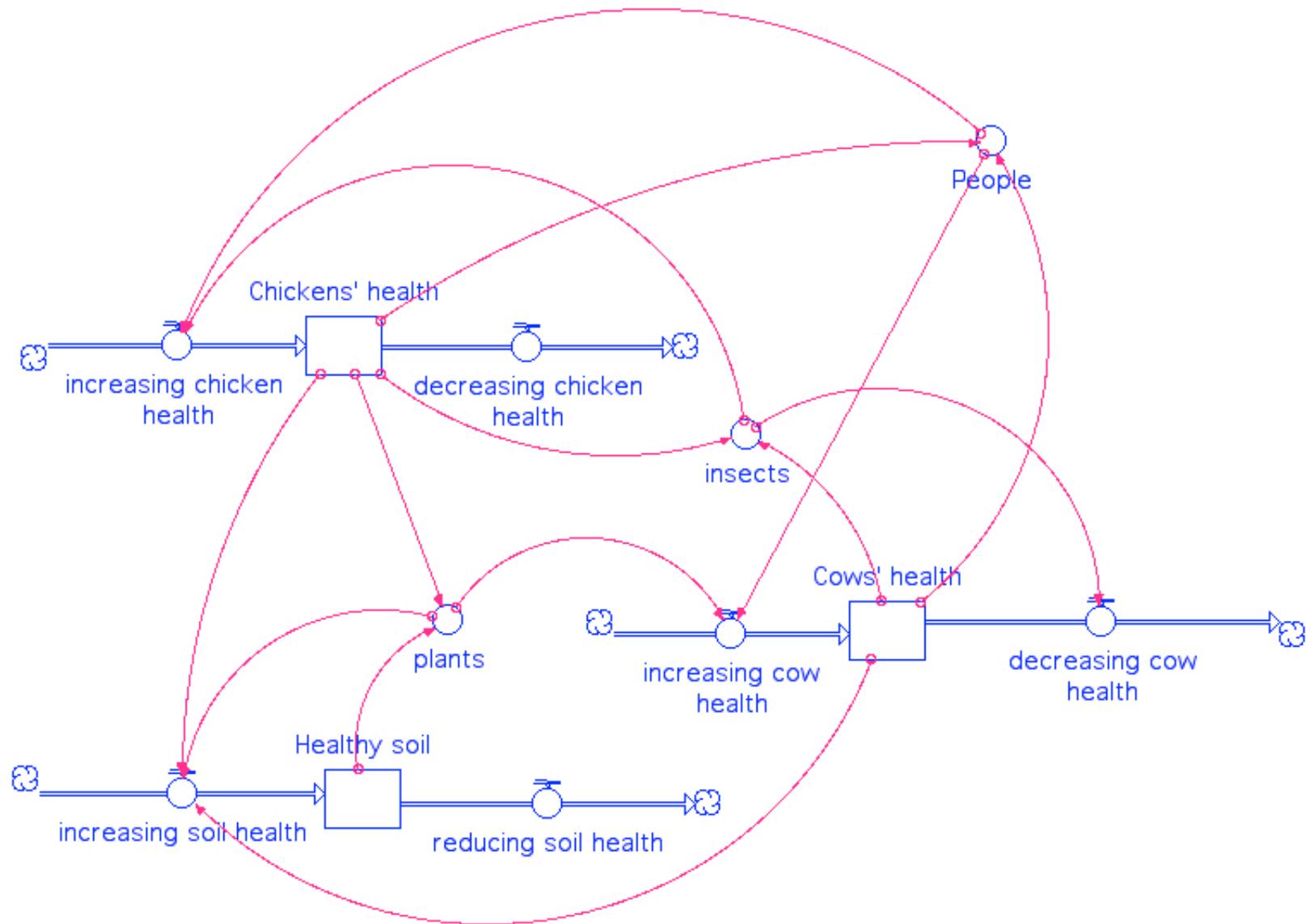
Stock/Flow Diagram 3



Stock/Flow Diagram 4

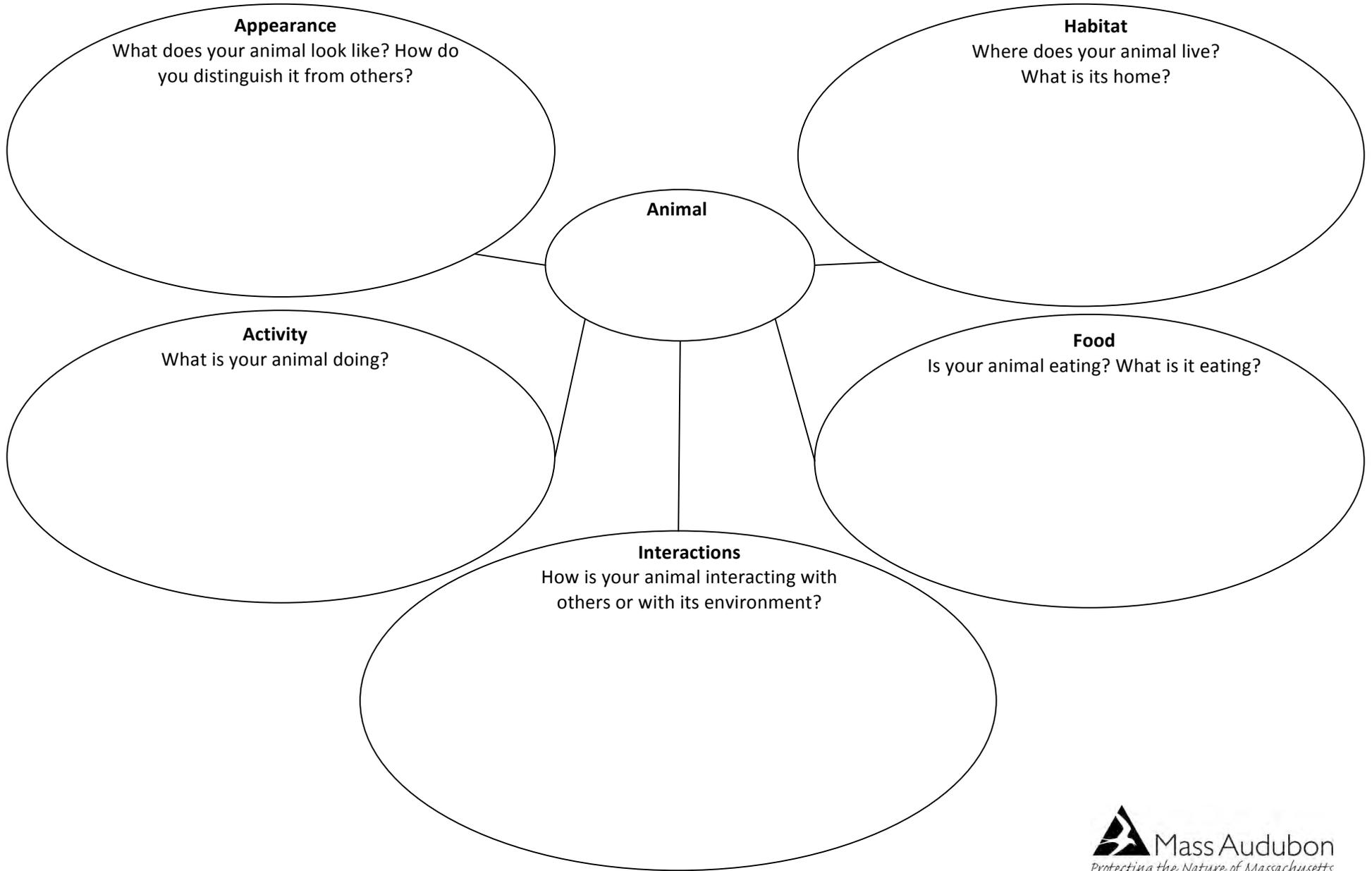


Stock/Flow Diagram 5

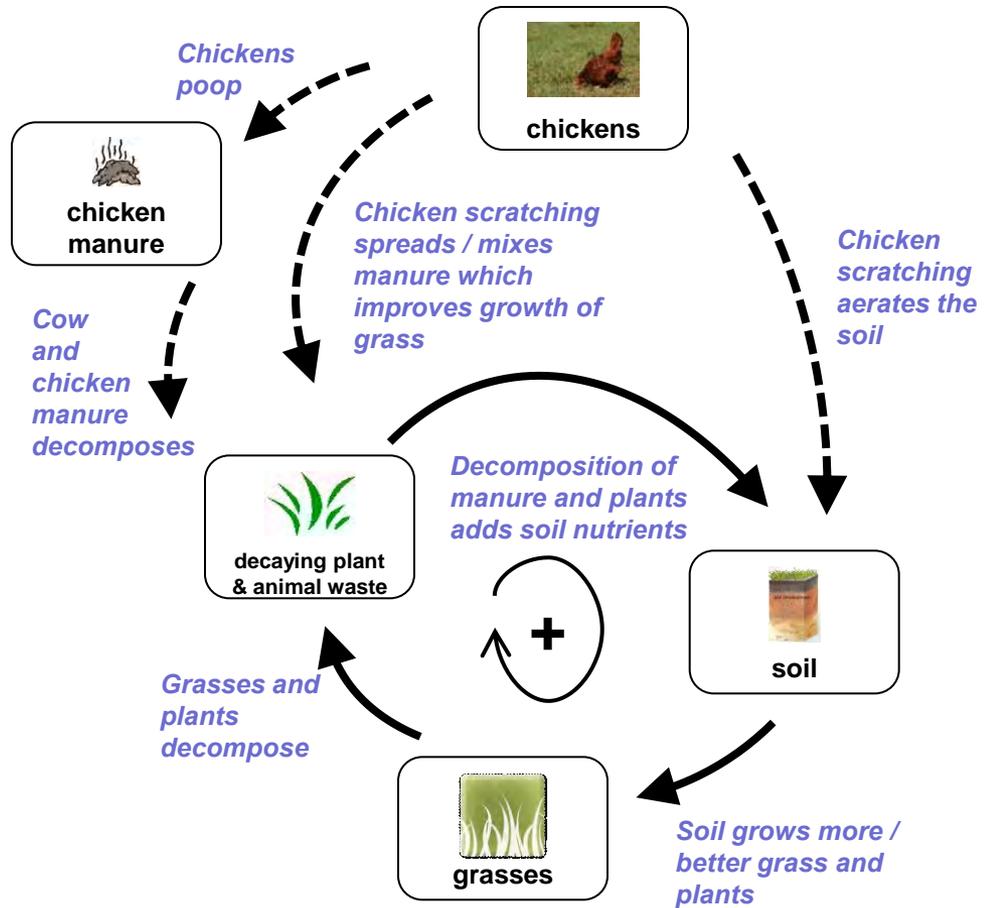


EGG MOBILE OBSERVATION SHEET

Name _____ Date _____ Weather _____



SOIL HEALTH FEEDBACK



→ **Causal connection**

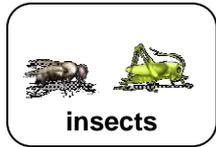
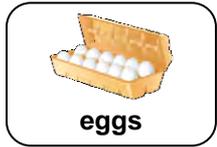
- - - → **Input / Output**



Reinforcing feedback loop

CHICKEN HEALTH FEEDBACK

Eggs from pastured chickens are more nutritious



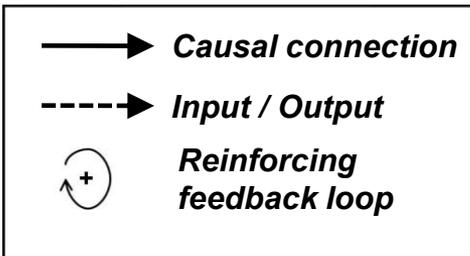
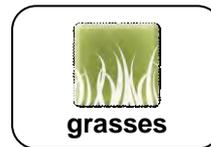
Having access to wild foods (grasses and insects) makes for a more natural environment for chickens



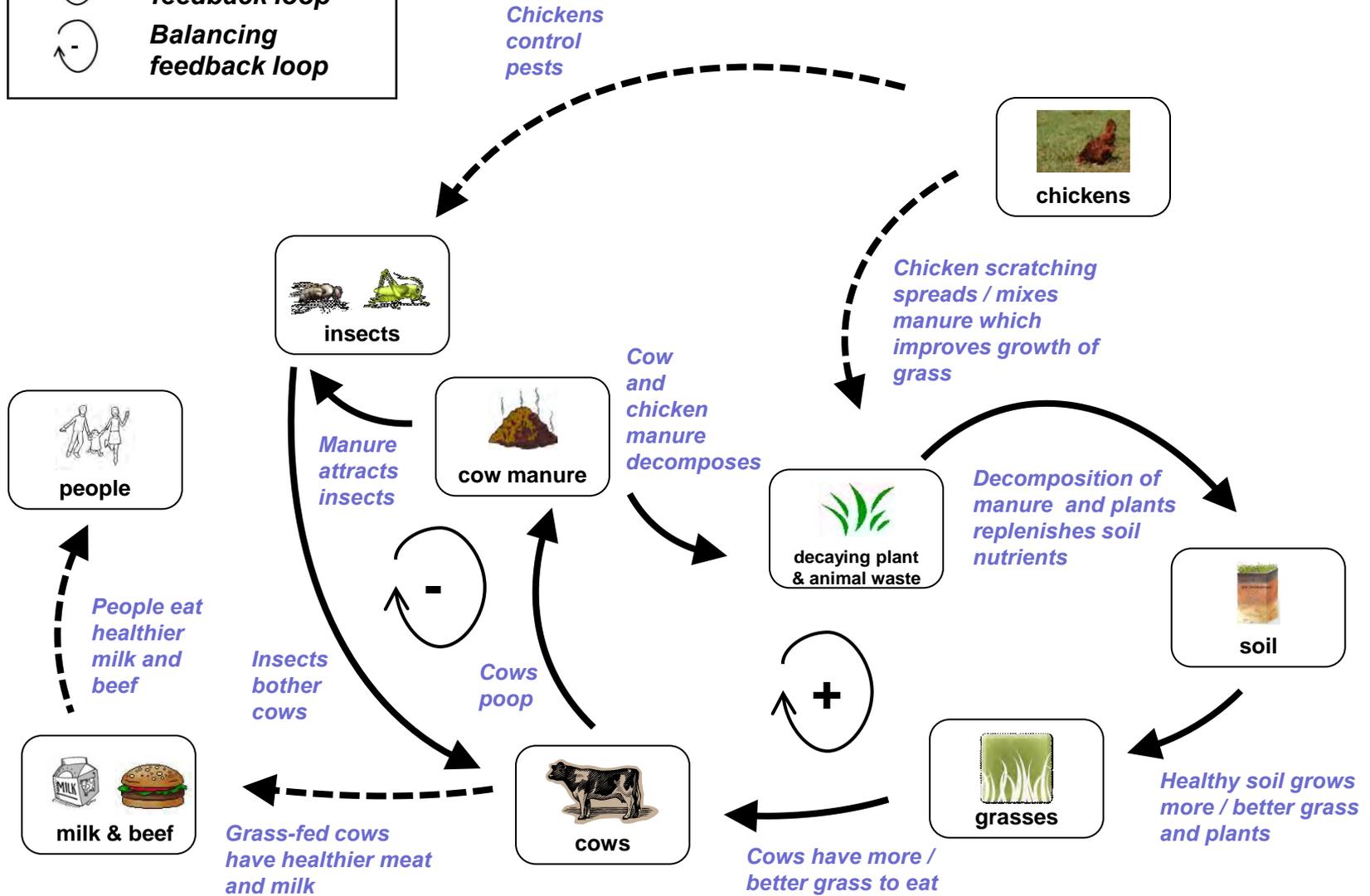
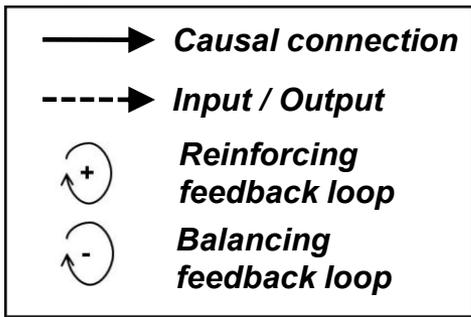
Chicken scratching aerates the soil



Soil grows more / better grass and plants



COW HEALTH FEEDBACK



APPENDIX: Vocabulary

INTERCONNECTION: A relationship in which each partner affects the other.

LIVING SYSTEM: An arrangement of parts and processes that continually affect one another over time.

FEEDBACK LOOPS: Living systems are made up of circular processes that create either stability or imbalance. Balancing feedback is generated by counteracting or lessening changes among the system components, while reinforcing feedback amplifies or reinforces changes. [For a detailed explanation of feedback, see “Road Maps: A Guide to Learning System Dynamics” provided by the System Dynamics in Education Project (SDEP) at MIT. In particular, the chapter on Feedback (Road Map 2, Section 4) can be found at <http://sysdyn.clexchange.org/sdep/Roadmaps/RM2/D-4691.pdf>.]

WASTE = FOOD: In living systems, waste from one system becomes food for another. All materials in nature are valuable, continuously circulating in closed loops of production, use, and recycling.

STOCK/FLOW STRUCTURES: An amount of something—chickens, bugs, soil, people, money—is a stock. The rate at which a stock changes, going up or down, is its flow. In a bathtub the accumulation of water in the tub is the stock; the faucet controls the inflow into the stock, and the drain controls the outflow. Stocks and flows create many of the most perplexing dynamics we encounter because stocks tend to accumulate, causing inertia and time delays. [For a detailed explanation of stock/flow structures, see *The Shape of Change, Including The Shape of Change: Stocks and Flows* by Quaden, Ticotsky, and Lyneis (Creative Learning Exchange, 2009) available at <http://www.clexchange.org/shapeofchange/>.]

TIME HORIZON: The interval of time over which change occurs (e.g., 1 hour, 1 day, 1 year).

APPENDIX: Egg Nutrition

The 2007 *Mother Earth News* egg testing project found that, compared to official U.S. Department of Agriculture (USDA) nutrient data for commercial eggs, eggs from hens raised on pasture may contain:

- 1/3 less cholesterol
- 1/4 less saturated fat
- 2/3 more vitamin A
- 2 times more omega-3 fatty acids
- 3 times more vitamin E
- 7 times more beta carotene

Source: <http://www.motheearthnews.com/Real-Food/2007-10-01/Tests-Reveal-Healthier-Eggs.aspx>