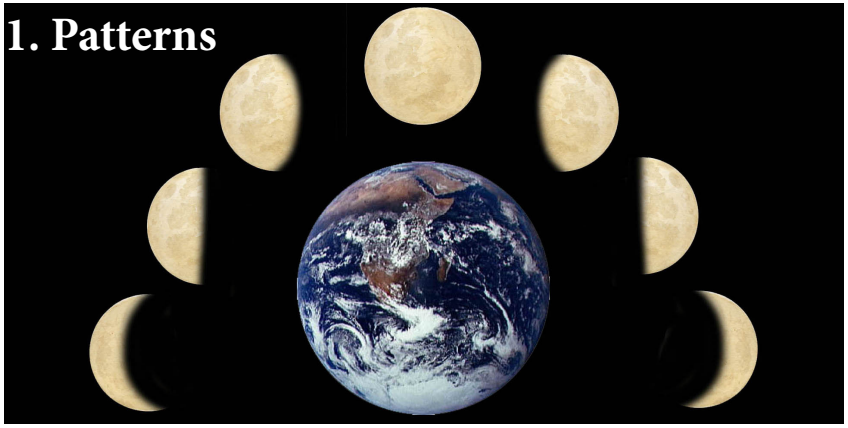
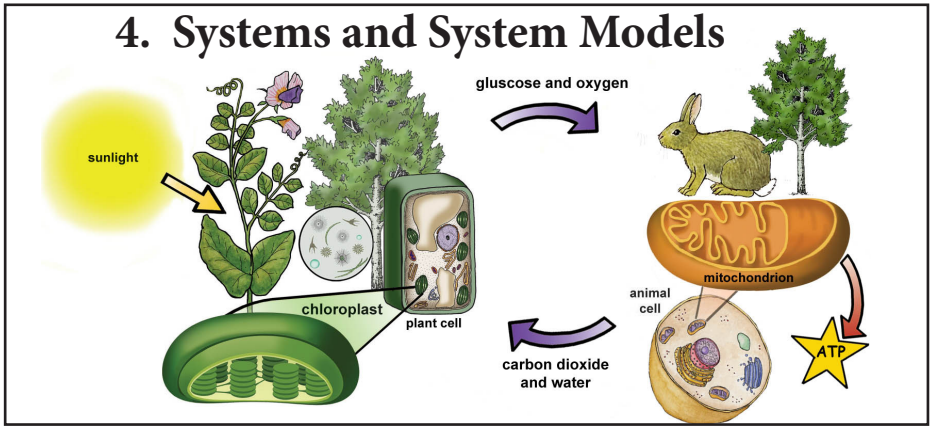
Next Generation Science Standards – Crosscutting Concepts for 3-5

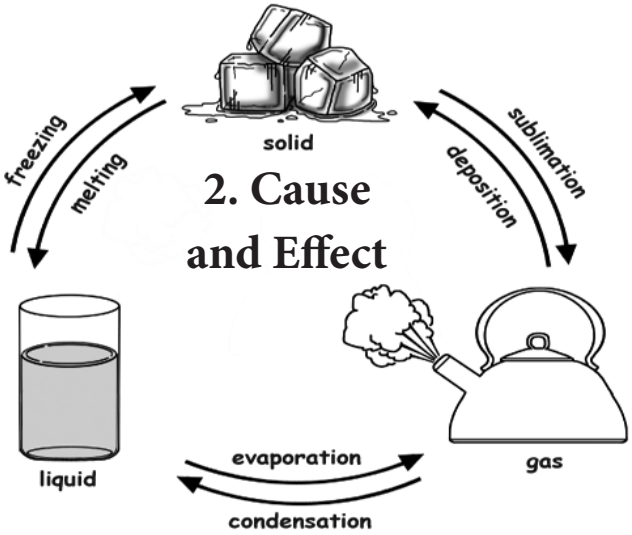
1. Patterns



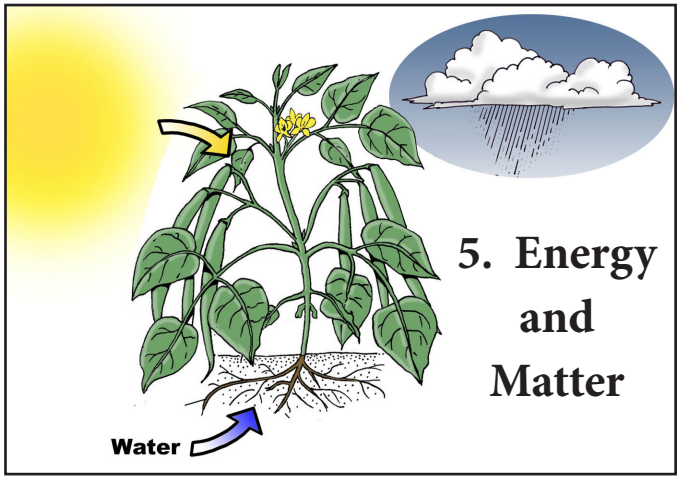
4. Systems and System Models



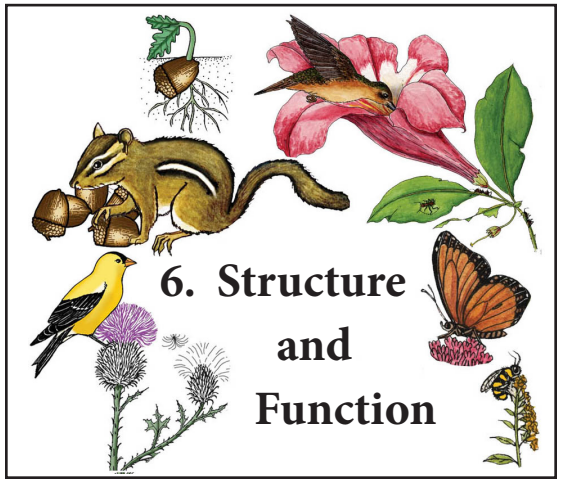
2. Cause and Effect



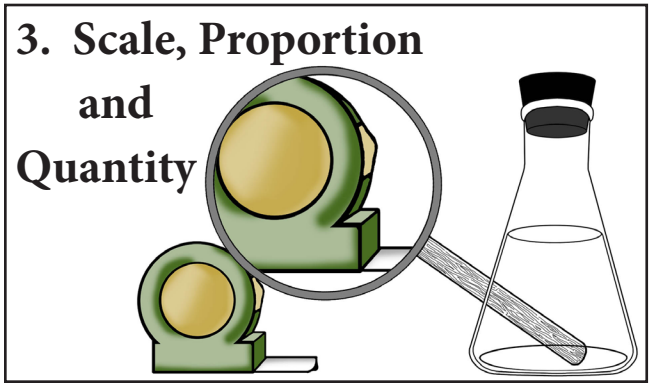
5. Energy and Matter

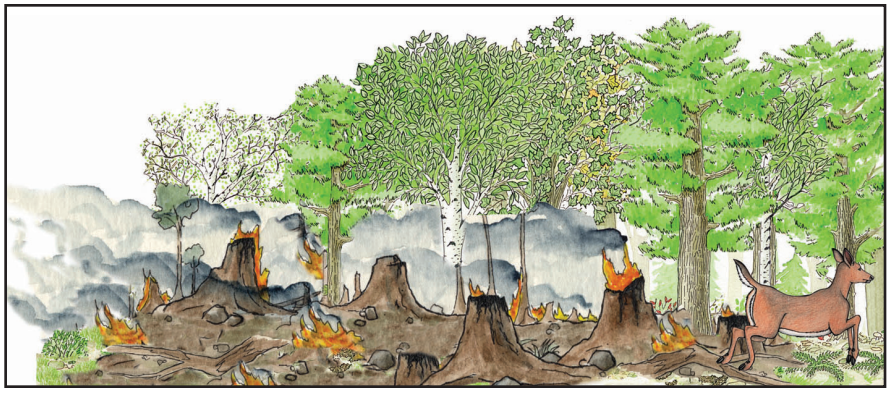


6. Structure and Function



3. Scale, Proportion and Quantity





7. Stability and Change

Next Generation Science Standards – Crosscutting Concepts

1. Patterns - Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them. Patterns exist everywhere—in regularly occurring shapes or structures and in repeating events and relationships. For example, patterns are discernible in the symmetry of flowers and snowflakes, the cycling of the seasons, and the repeated base pairs of DNA.

2. Cause and Effect - Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts. Cause and effect is often the next step in science, after a discovery of patterns or events that occur together with regularity. A search for the underlying cause of a phenomenon has sparked some of the most compelling and productive scientific investigations.

3. Scale, Proportion and Quantity - In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance. Scale, Proportion and Quantity are important in both science and engineering. These are fundamental assessments of dimension that form the foundation of observations about nature. Before an analysis of function or process can be made (the how or why), it is necessary to identify the what. These concepts are the starting point for scientific understanding, whether it is of a total system or its individual components.

4. Systems and System Models - Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering. Systems and System Models are useful in science and engineering because the world is complex, so it is helpful to isolate a single system and construct a simplified model of it.

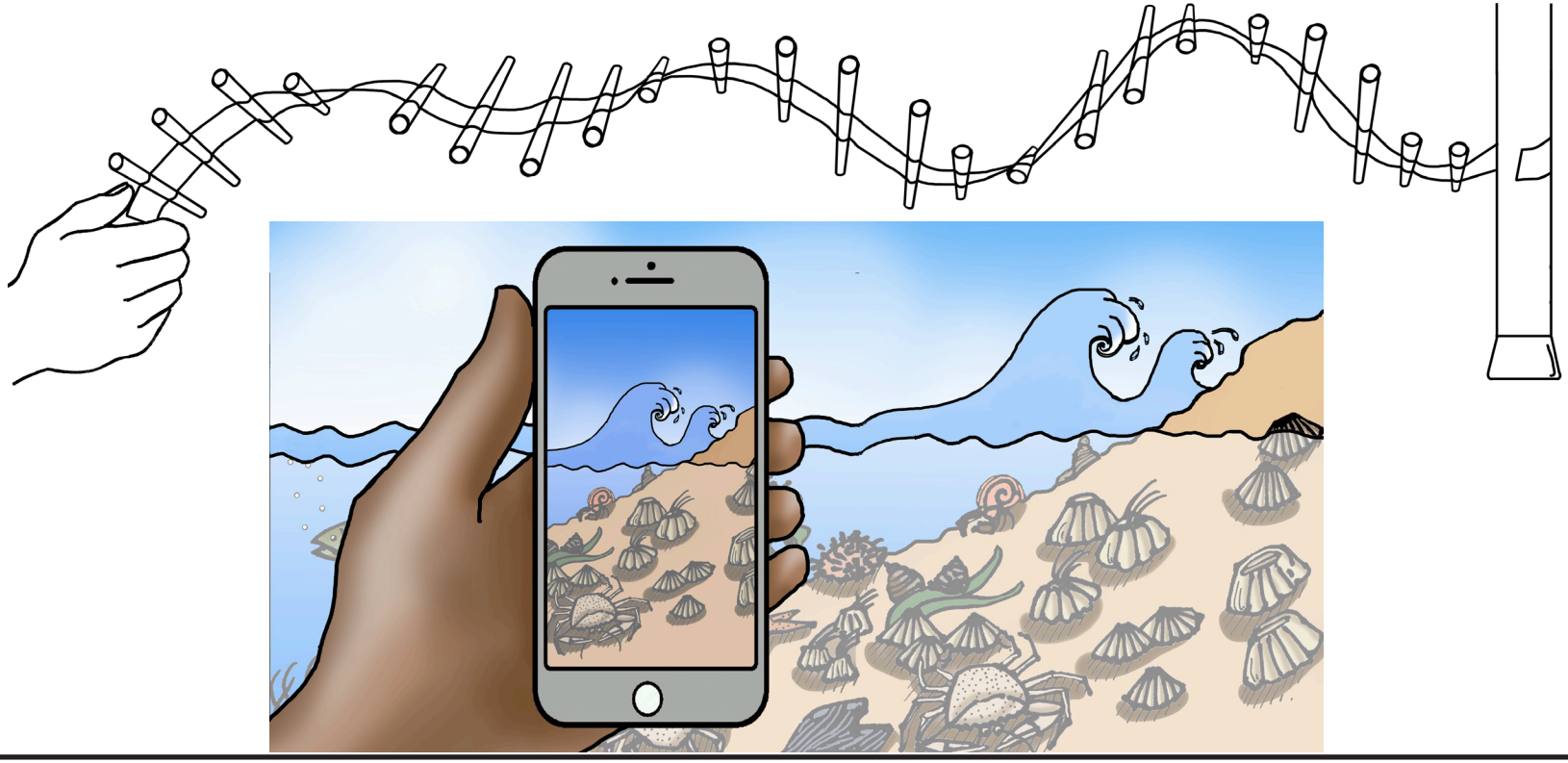
5. Energy and Matter - Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations. Energy and Matter are essential concepts in all disciplines of science and engineering, often in connection with systems.

6. Structure and Function - The way in which an object or living thing is shaped and its substructure determine many of its properties and functions. Structure and Function are complementary properties. "The shape and stability of structures of natural and designed objects are related to their function(s). The functioning of natural and built systems alike depends on the shapes and relationships of certain key parts as well as on the properties of the materials from which they are made.

7. Stability and Change - For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. Stability and Change are the primary concerns of many, if not most scientific and engineering endeavors. "Stability denotes a condition in which some aspects of a system are unchanging, at least at the scale of observation. Stability means that a small disturbance will fade away—that is, the system will stay in, or return to, the stable condition.

Crosscutting Concepts - **Patterns**

Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them. Patterns exist everywhere—in regularly occurring shapes or structures and in repeating events and relationships. For example, patterns are discernible in the symmetry of flowers and snowflakes, the cycling of the seasons, and the repeated base pairs of DNA.



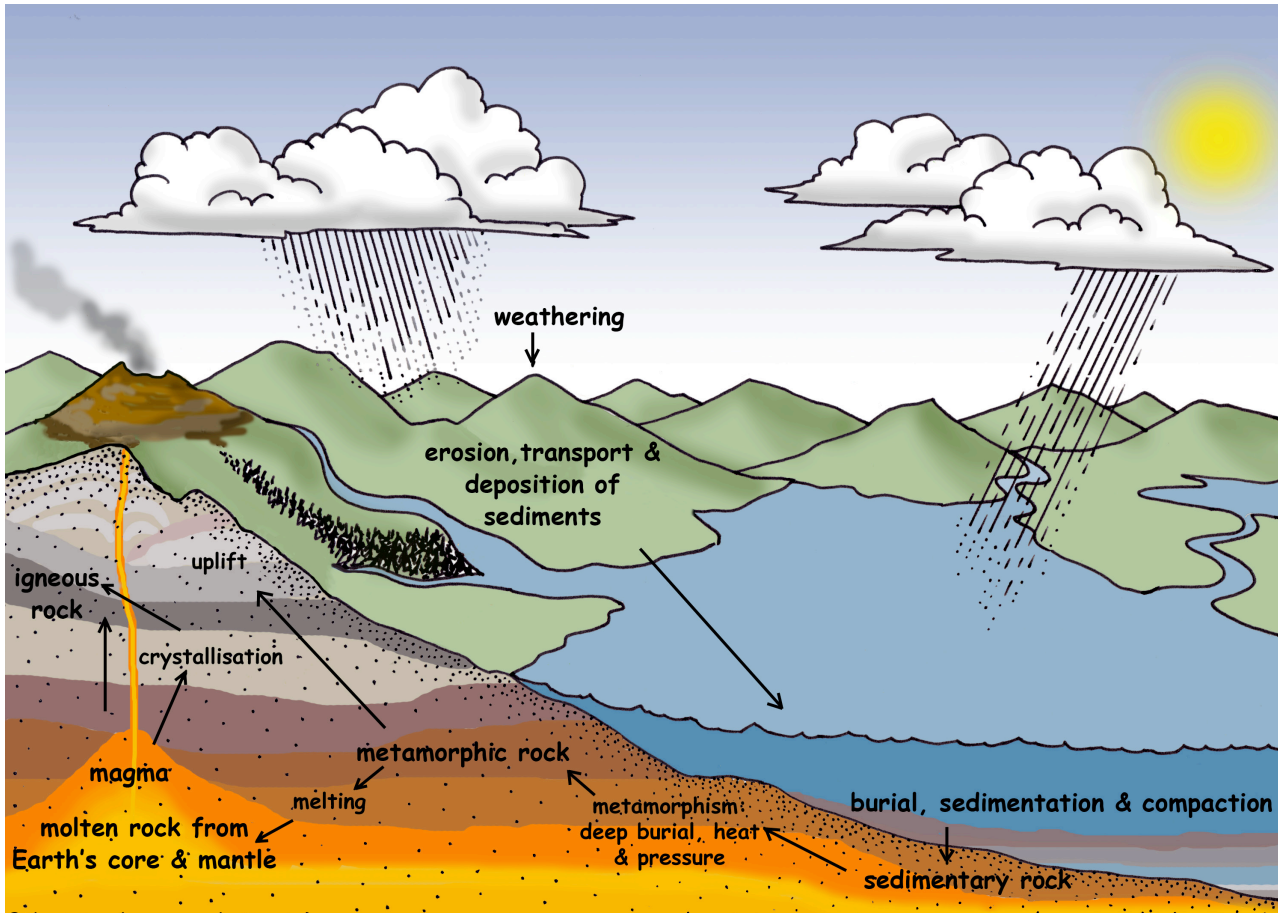
4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

3-5 Students identify similarities and differences in order to sort and classify natural objects and designed products. They identify patterns related to time, including simple rates of change and cycles, and to use these patterns to make predictions.

Crosscutting Concepts

Cause and Effect

Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts. Cause and effect is often the next step in science, after a discovery of patterns or events that occur together with regularity. A search for the underlying cause of a phenomenon has sparked someof the most compelling and productive scientific investigations.

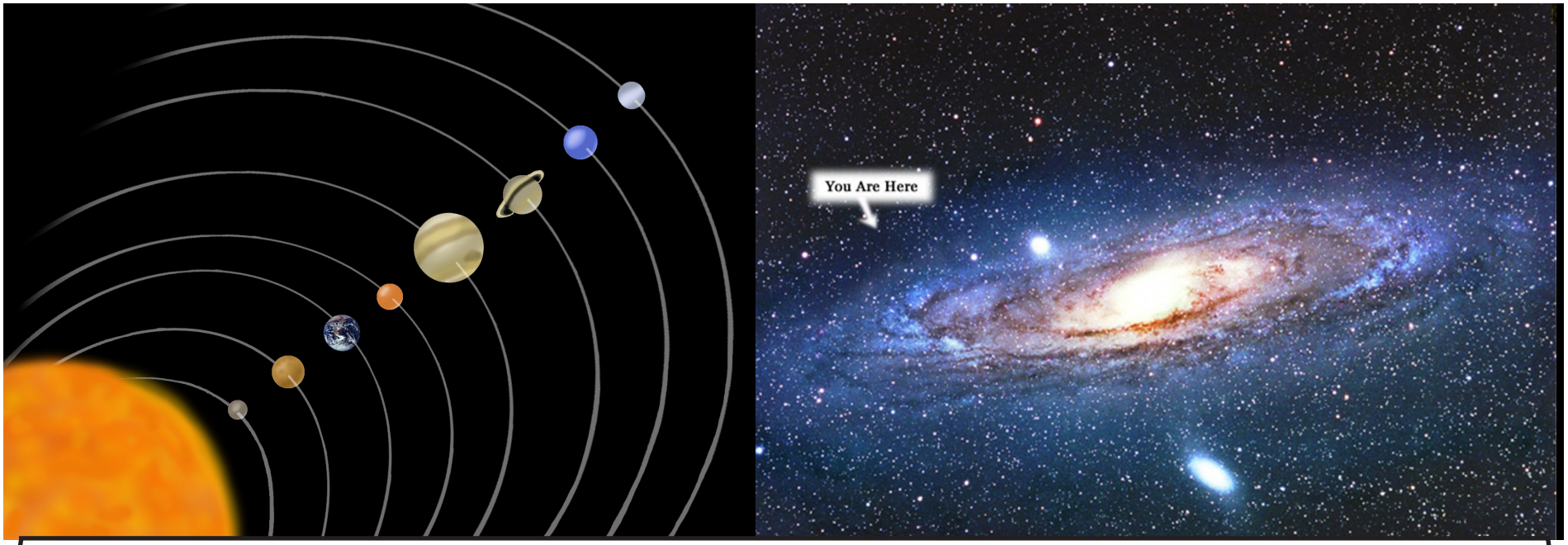


4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

3-5 Students routinely identify and test causal relationships and use these relationships to explain change. They understand events that occur together with regularity might or might not signify a cause and effect relationship.

Crosscutting Concepts - **Scale, Proportion and Quantity**

In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance. Scale, Proportion and Quantity are important in both science and engineering. These are fundamental assessments of dimension that form the foundation of observations about nature. Before an analysis of function or process can be made (the how or why), it is necessary to identify the what. These concepts are the starting point for scientific understanding, whether it is of a total system or its individual components.

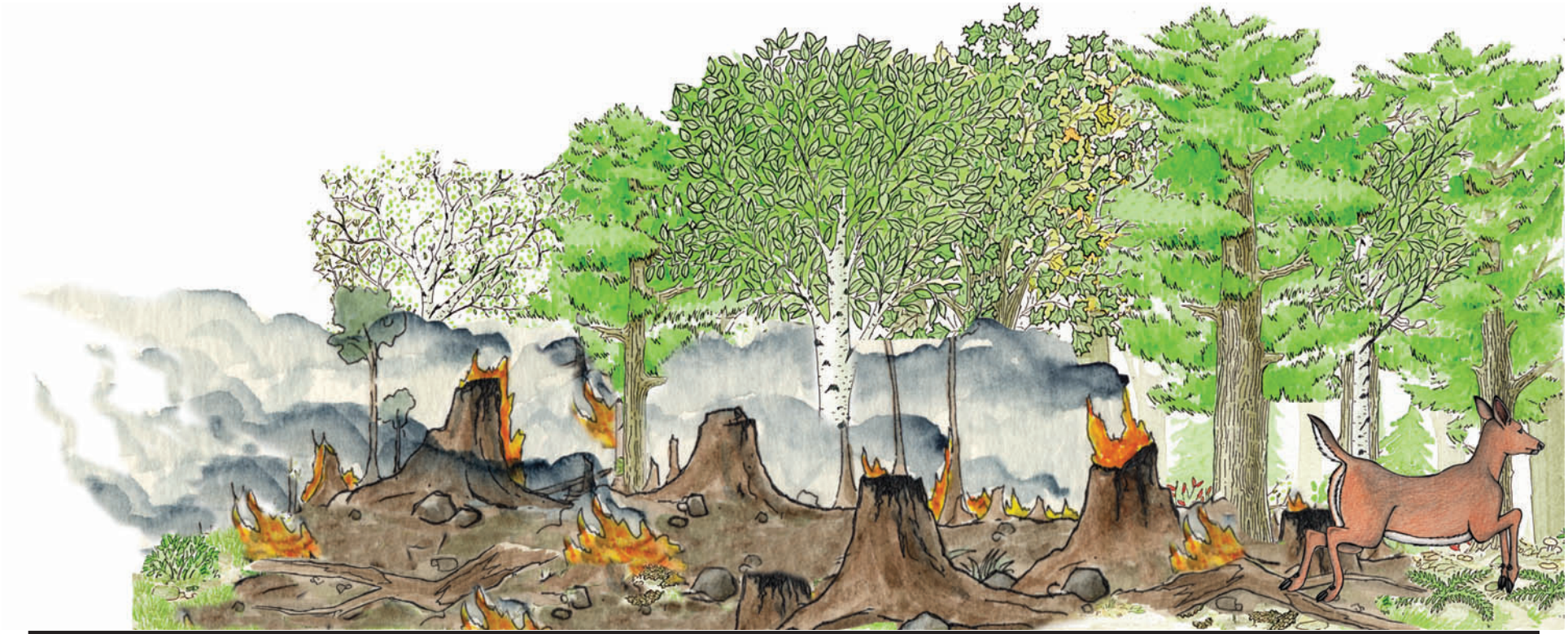


5-ESS1-1. Support an argument that the apparent brightness of the sun and stars is due to their relative distances from Earth.

3-5 students recognize natural objects and observable phenomena exist from the very small to the immensely large. They use standard units to measure and describe physical quantities such as weight, time, temperature, and volume.

Crosscutting Concepts – **Systems and System Models**

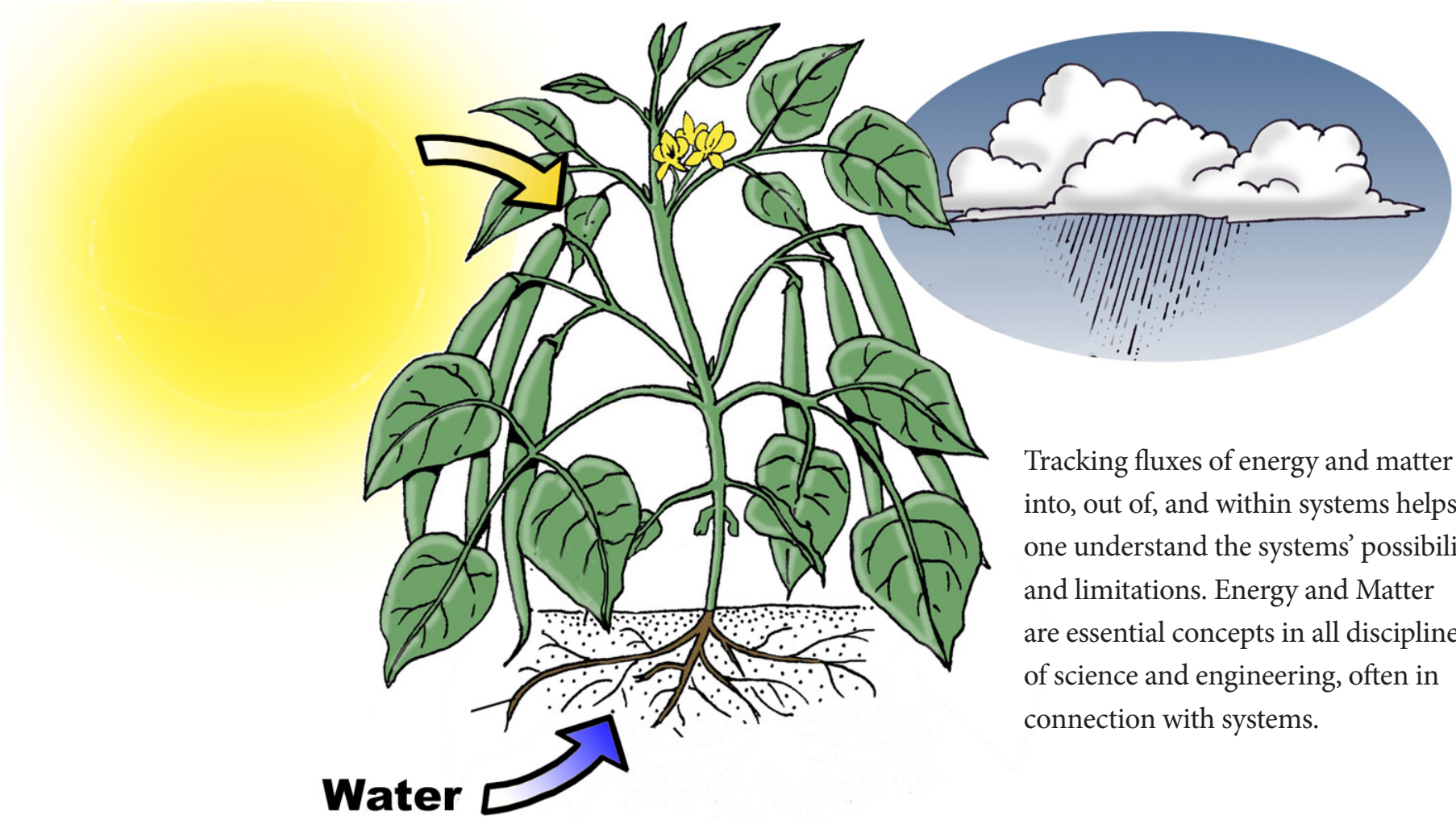
Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering. Systems and System Models are useful in science and engineering because the world is complex, so it is helpful to isolate a single system and construct a simplified model of it.



3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

3-5 Students understand that a system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. They can also describe a system in terms of its components and their interactions.

Crosscutting Concepts – **Energy and Matter**



Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations. Energy and Matter are essential concepts in all disciplines of science and engineering, often in connection with systems.

LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.
3-5 Students learn matter is made of particles and energy can be transferred in various ways and between objects. Students observe the conservation of matter by tracking matter flows and cycles before and after processes and recognizing the total weight of substances does not change.

Crosscutting Concepts – **Structure and Function**

The way in which an object or living thing is shaped and its substructure determine many of its properties and functions. Structure and Function are complementary properties. "The shape and stability of structures of natural and designed objects are related to their function(s). The functioning of natural and built systems alike depends on the shapes and relationships of certain key parts as well as on the properties of the materials from which they are made.

LS2-2. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

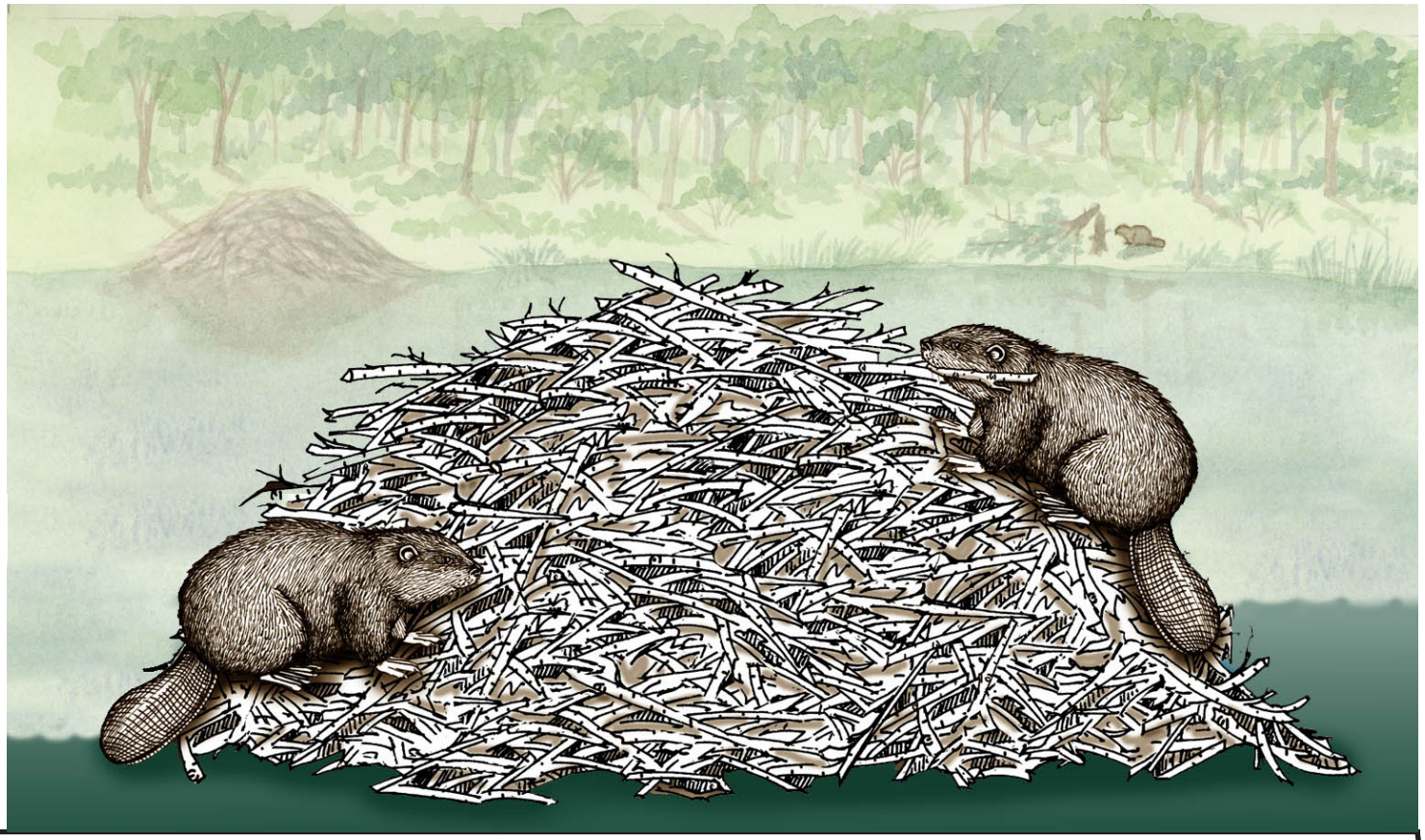
K-2 Students observe the shape and stability of structures of natural and designed objects are related to their function(s).

3-5 Students learn different materials have different substructures, which can sometimes be observed; and substructures have shapes and parts that serve functions.

Crosscutting Concepts – **Stability and Change**

For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. Stability and Change are the primary concerns of many, if not most scientific and engineering endeavors.

"Stability denotes a condition in which some aspects of a system are unchanging, at least at the scale of observation. Stability means that a small disturbance will fade away—that is, the system will stay in, or return to, the stable condition.



2-ESS2-1. Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.

K-2 Students observe some things stay the same while other things change, and things may change slowly or rapidly.

3-5 Students measure change in terms of differences over time, and observe that change may occur at different rates. Students learn some systems appear stable, but over long periods of time they will eventually change .