Life Science 2 Progression

This progression is about the interactions of organisms within ecosystems. Ecosystems are complex, interactive systems that are dynamic. They are ever changing because of the interdependence of organisms of the same or different species, and with the nonliving elements of the environment.

At the elementary level, students should understand that all organisms are limited to what sort of environments they can survive in. Some organisms may survive in different environmental conditions, but some may struggle or even die. Students will be asked to provide evidence for their argument about how a particular organism might fare in a given environment, such as pointing out that organisms that breathe through their skin need moisture that would not be present in a desert environment. This content knowledge will be foundational for the understanding of how organisms depend on the living and nonliving factors in their environment for survival.

The cross- cutting concept of matter, energy flow, cycles and conservation plays a significant part of understanding the progression in middle school. Students need to have a foundational understanding that energy and matter are conserved and that both can be traced through an ecosystem or across ecosystems. It is important that students make connections between different scales of interactions (from the macroscopic scale to the organismal scales to the ecosystem scale). This builds on the idea from grade 3 that considered only how the organism is impacted by environmental conditions. Students will need to observe or investigate patterns of interactions between organisms to determine their relationships. Students will develop understanding of a broader set of interactions between organisms (mutualism and individual competition through resources). Relate individual interacting (python eats rabbit) to consequences at the population scale (predator/prey). Examples of patterns might be observing predatory behaviors (stalking), patterns of

adaptations (common characteristics of prey organisms, leaf shapes), or interrelationships (oxpeckers and zebras).

High school students use knowledge of the mechanisms that seem to allow organisms in ecosystems to maintain stable numbers. Students learn that ecosystems provide resources related to food, clothing, shelter, medicine, fresh water and oxygen that humans depend on for survival. As we prepare students to make informed decisions (private or public decisions) they need to understand that there are limits and constraints as to how ecosystems can handle the impact of disturbances (i.e., climate change, fracking, habitat destruction) within the ecosystem. The ecosystem may change therefore providing more or less of the resources needed by the organisms within the ecosystem. Types of changes can be floods, plagues, fire and results of pesticides which generally affect a small population but spread their effect to other species through biotic or abiotic relationships or disturbances caused by invasive species or climate change which fundamentally change an ecosystem. Students will evaluate claims and evidence and provide reasoning that physical or modest biological disturbances have effects on ecosystems.

Grade 4: Page 3

Grade 7: Page 4

Grade 11: Page 5 &6

Grade 4:

Alternate KSA Aligned to KCAS for Science:

Support an argument with evidence that in a particular habitat some organisms can survive well, while other organisms struggle, or may even die.

3-LS4-3: Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. [Clarification Statement: Examples of evidence could include the needs and characteristics of the organisms and habitats involved. The organisms and their habitats make up a system in which the parts depend on each other.]

SEP (Science and Engineering Practices)	DCI (Disciplinary Core Ideas)	CC (Crosscutting Concepts)
Construct an argument with evidence.	For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.	Cause and effect relationships are routinely identified and used to explain change.

Grade 7:

Alternate KSA Aligned to KCAS for Science:

Make predictions based on patterns and explain interactions among organisms in different ecosystems (interactions include competitive, predatory, and mutually beneficial).

06-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]

SEP (Science and Engineering Practices)	DCI (Disciplinary Core Ideas)	CC (Crosscutting Concepts)
Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena.	Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations or organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.	Patterns can be used to identify cause and effect relationships.

Grade 11:

Alternate KSA Aligned to KCAS for Science:

Evaluate evidence that interactions in ecosystems remain relatively consistent over time in stable conditions (in terms of numbers and types of organisms), but ecosystems can change as a result of disruptions (e.g., farming, hunting, flooding, fire, or volcanic eruption) that are moderate to extreme.

HS-LS2-6: Evaluate the claims, evidence and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood, and extreme changes, such as volcanic eruption or a sea-level rise.]

SEP (Science and Engineering Practices)	DCI (Disciplinary Core Ideas)	CC (Crosscutting Concepts)
Evaluate the claims, evidence and reasoning behind currently accepted explanations or solutions to determine the merits of	A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme	Much of science deals with constructing explanations of how things change and how they remain stable.

arguments.	fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.	