Differences Between 1997 Illinois Learning Standards and 2014 Illinois Learning Standards (NGSS)

1997 Illinois Learning Standards in Science	2014 Illinois Learning Standards (NGSS)
Grouped by grade spans: **Early Elementary, Late Elementary, Middle/Junior High School, Early High School, Late High School** Each grade span expanded into **Benchmark Statements** Total number of Benchmark Statements: **169**	Grouped by grade levels for grades **K, 1, 2, 3, 4,** and **5** Grade spans for **Middle School** and **High School** Each grade level and grade span expanded into **Performance Expectations** Total number of Performance Expectations: **208**
System Architecture Example: **11. A. 1a**: Goal **11,** Standard **A**, (Scientific Inquiry), Benchmark **1a** refers to Early Elementary	System Architecture Example: **K-PS2-1**: Grade **K**, **P**hysical **S**cience, **2** (Motion and Stability), **1** identifies the number of Performance Expectations Example: **K-PS2** has 2 Performance Expectations.
Inquiry (11A) **not** integrated with other standards	Science and Engineering Practices and Crosscutting Concepts are integrated throughout all of the standards.
Did **not** have connections to Common Core State Standards	Common Core State Standards Connections appear beneath Foundation Boxes
Benchmarks **generalized** into concise, grade span statements	Performance Expectations are **specific** at all grade levels/grade spans.
"Defending conclusions drawn from investigations" appears at the Early High School Level	Defending conclusions and "Constructing arguments" first appears at grade 2 but then every level afterwards
Standard 13.A.1a – 13A.5a: Use basic safety practices, avoiding injury, identifying potential hazards, reducing risk, designing policies to reduce risk in science activities	Safety practices are **not** included in the 2014 ILS (NGSS).
Standard 13.A.2c, 13.A.4d: Keeping accurate records, peer review	Keeping accurate records and statements regarding peer review are **not** included in the 2014 ILS (NGSS).
"Waves" and their properties introduced at middle school	"Waves" and their properties introduced at grade 4
ILS did **not** include how animals receive information through their senses and process information in their brains.	4-LS1-2: Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.
ILS did **not** include developing a model to show how food is rearranged through chemical reactions. Similar: Physical Development and Health 23.A.3: Explain how body systems interact with each other (e.g., blood transporting nutrients from the digestive system and oxygen from the respiratory system).	MS-LS1-7: Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

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ILS did **not** include sensory receptors responding to stimuli or sending messages to the brain.	MS-LS1-8: Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
ILS did **not** address human population and consumption of natural resources but something similar was found in the Social Science Standards. Similar: Social Science Standard 17.C.2a: Explain how human activity affects the environment. Also Social Science Standard 16.E.5a: Analyze positive and negative aspects of human effects on the environment in the United States including damming rivers, fencing prairies and building cities.	MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
ILS did **not** address feedback mechanisms maintaining homeostasis. Similar: Physical Development and Health 20.B.2a: Monitor individual heart rate before, during and after physical activity, with and without the use of technology.	HS-LS1-3: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
ILS did **not** address food molecules being broken down to form new compounds.	HS-LS1-7: Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
ILS did **not** address how natural resources, natural hazards and changes in climate have influences human activity. Similar: Social Science 17.D.2b: Identify different settlement patterns in Illinois and the United States and relate them to physical features and resources. Also Social Science 17.C.3a: Explain how human activity is affected by geographic factors.	HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

Differences in Architecture between 1997 ILS and the 2014 ILS (NGSS)

1997 Illinois Learning Standards in Science (only showing 12B):

12B. Know and apply concepts that describe how living things interact with each other and with their environment.

Early Elementary	Late Elementary	Middle/Junior High	Early High School	Late High School
12.B.1a Describe and compare characteristics of living things in relationship to their environments.	**12.B.2a** Describe relationships among various organisms in their environments (e.g., predator/prey, parasite/host, food chains and food webs).	**12.B.3a** Identify and classify biotic and abiotic factors in an environment that affect population density, habitat and placement of organisms in an energy pyramid.	**12.B.4a** Compare physical, ecological and behavioral factors that influence interactions and interdependence of organisms.	**12.B.5a** Analyze and explain biodiversity issues and the causes and effects of extinction.
12.B.1b Describe how living things depend on one another for survival.	**12.B.2b** Identify physical features of plants and animals that help them live in different environments (e.g., specialized teeth for eating certain foods, thorns for protection, insulation for cold temperature).	**12.B.3b** Compare and assess features of organisms for their adaptive, competitive and survival potential (e.g., appendages, reproductive rates, camouflage, defensive structures).	**12.B.4b** Simulate and analyze factors that influence the size and stability of populations within ecosystems (e.g., birth rate, death rate, predation, migration patterns).	**12.B.5b** Compare and predict how life forms can adapt to changes in the environment by applying concepts of change and constancy (e.g., variations within a population increase the likelihood of survival under new conditions).

2014 Illinois Learning Standards in Science (only showing LS2):

LS2 Ecosystems: Interactions, Energy, and Dynamics (Examples from Grades 2, 3, 5, Middle School, and High School).

Students who demonstrate understanding can:

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

3-LS2-1. Construct an argument that some animals form groups that help members survive.

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

The standards, also known as Performance Expectations, are listed at the top of each page (MS-LS2-1 through MS-LS2-5). The Foundation Boxes, also known as Science and Engineering Practices, Disciplinary Core Ideas and Crosscutting Concepts appear beneath the standards. The Connecting Boxes, showing connections to other DCIs and the Common Core State Standards, are below the Foundation Boxes. Please refer to the How to Read the Next Generation Science Standards document for a complete description.

http://www.nextgenscience.org/sites/ngss/files/How%20to%20Read%20NGSS%20-%20Final%2008.19.13.pdf.

MS-LS2 Ecosystems: Interactions, Energy, and Dynamics

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Students who demonstrate understanding can:

MS-LS2-1. **Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.** [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]

MS-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.]

MS-LS2-3. **Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.** [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.] [Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.]

MS-LS2-4. **Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.** [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

MS-LS2-5. **Evaluate competing design solutions for maintaining biodiversity and ecosystem services.*** [Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop a model to describe phenomena. (MS-LS2-3)

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS-LS2-2)

Engaging in Argument from Evidence

Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS2-4)
- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-LS2-5)

Connections to Nature of Science

Disciplinary Core Ideas

LS2.A: Interdependent Relationships in Ecosystems

- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1)
- Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)
- Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of 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. (MS-LS2-2)

LS2.B: Cycle of Matter and Energy Transfer in Ecosystems

- Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)
- Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-LS2-5)

LS4.D: Biodiversity and Humans

- Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling.

Crosscutting Concepts

Patterns

- Patterns can be used to identify cause and effect relationships. (MS-LS2-2)

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)

Energy and Matter

- The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3)

Stability and Change

- Small changes in one part of a system might cause large changes in another part. (MS-LS2-4),(MS-LS2-5)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

- The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-LS2-5)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3)

MS-LS2 Ecosystems: Interactions, Energy, and Dynamics

HS.ESS3.B (MS-LS2-4); **HS.ESS3.C** (MS-LS2-4),(MS-LS2-5); **HS.ESS3.D** (MS-LS2-5)

Common Core State Standards Connections:

ELA/Literacy –

RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts. (MS-LS2-1),(MS-LS2-2),(MS-LS2-4)
RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-LS2-1)
RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. (MS-LS2-5)
RI.8.8	Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. (MS-LS-4),(MS-LS2-5)
WHST.6-8.1	Write arguments to support claims with clear reasons and relevant evidence. (MS-LS2-4)
WHST.6-8.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS2-2)
WHST.6-8.9	Draw evidence from literary or informational texts to support analysis, reflection, and research. (MS-LS2-2),(MS-LS2-4)
SL.8.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. *(MS-LS2-2)*
SL.8.4	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. *(MS-LS2-2)*
SL.8.5	Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points. *(MS-LS2-3)*

Mathematics –

MP.4	Model with mathematics. *(MS-LS2-5)*
6.RP.A.3	Use ratio and rate reasoning to solve real-world and mathematical problems. *(MS-LS2-5)*
6.EE.C.9	Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *(MS-LS2-3)*
6.SP.B.5	Summarize numerical data sets in relation to their context. *(MS-LS2-2)*