Next Generation Science Standards + Great Lakes in My World 9-12

Activities							Coastal Journey	A Sense of Place	State of the Great Lakes Coast	Restore and Explore	Getting to the Bottom of the Lakes	Coastal Habitat Research	The Great Race for Survival	Food Web Invasion	Coastal Careers	Create-a-Watershed	Bird's Eye view	Coastal Community Planning	Plant Plans	Habitat Analysis	Watershed Mysteries	Adopt-A-Habitat	Coastal Habitat Action Plan
							9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12
Area	**Code**	**Standard**	**Scientific and Engineering Practices**	**Disciplinary Core Ideas**	**Crosscutting Concepts**		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
HS.Interdependent Relationships in Ecosystems	HS-LS2-1.	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.	**Using Mathematics and Computational Thinking:** Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (HS-LS2-1)	**LS2.A: Interdependent Relationships in Ecosystems:** Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1),(HS-LS2-2)	**Scale, Proportion, and Quantity:** The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-LS2-1)			**DCI**			**DCI**										
HS.Interdependent Relationships in Ecosystems	HS-LS2-2.	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.	**Using Mathematics and Computational Thinking**: Use mathematical representations of phenomena or design solutions to support and revise explanations. (HS-LS2-2) **Scientific Knowledge is Open to Revision in Light of New Evidence:** Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence. (HS-LS2-2)	**LS2.A: Interdependent Relationships in Ecosystems:** Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1),(HS-LS2-2) **LS2.C: Ecosystem Dynamics, Functioning, and Resilience:** 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 fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2),(HS-LS2-6)	**Scale, Proportion, and Quantity:** Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (HS-LS2-2)												**Std, SEP, DCI, CC**		**SEP, DCI, CC**	

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Activities						Coastal Journey	A Sense of Place	State of the Great Lakes Coast	Restore and Explore	Getting to the Bottom of the Lakes	Coastal Habitat Research	The Great Race for Survival	Food Web Invasion	Coastal Careers	Create-a-Watershed	Bird's Eye view	Coastal Community Planning	Plant Plans	Habitat Analysis	Watershed Mysteries	Adopt-A-Habitat	Coastal Habitat Action Plan
						9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12
Area	**Code**	**Standard**	**Scientific and Engineering Practices**	**Disciplinary Core Ideas**	**Crosscutting Concepts**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
HS.Interdependent Relationships in Ecosystems	HS-LS2-7.	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*	**Constructing Explanations and Designing Solutions:** Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-LS2-7)	**LS2.C: Ecosystem Dynamics, Functioning, and Resilience:** Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (HS-LS2-7) **LS4.D: Biodiversity and Humans**: - Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). (secondary to HS-LS2-7) - Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (secondary to HS-LS2-7),(HS-LS4-6.) **ETS1.B: Developing Possible Solutions:** When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts. (secondary to HS-LS2-7),(secondary to HS-LS4-6)	**Stability and Change:** Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-6),(HS-LS2-7)							**Std, SEP, DCI,**					**Std, SEP, DCI, CC**					
HS.Earth's Systems	HS-ESS2-2.	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.	**Analyzing and Interpreting Data:** Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HS-ESS2-2)	**ESS2.A: Earth Materials and Systems:** Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HS-ESS2-2) **ESS2.D: Weather and Climate:** The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. (HS-ESS2-2)	**Stability and Change**: Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS2-2) **Influence of Engineering, Technology, and Science on Society and the Natural World**: New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS2-2)									**Std, SEP, DCI, CC**						
HS.Earth's Systems	HS-ESS2-5.	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.	**Planning and Carrying Out Investigations:** Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-ESS2-5)	**ESS2.C: The Roles of Water in Earth's Surface Processes:** The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. (HS-ESS2-5)	**Structure and Function:** The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials. (HS-ESS2-5)	**DCI**				**SEP, CC**					**Std, SEP, DCI, CC**						
HS.Earth's Systems	HS-ESS2-7.	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.	**Engaging in Argument from Evidence:** Construct an oral and written argument or counter-arguments based on data and evidence. (HS-ESS2-7)	**ESS2.D: Weather and Climate:** Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. (HS-ESS2-6),(HS-ESS2-7) **ESS2.E Biogeology:** The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's	**Stability and Change:** Much of science deals with constructing explanations of how things change and how they remain stable. (HS-ESS2-7)											**Std, SEP, DCI, CC**					

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Area	Code	Standard	Scientific and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	Activities	Coastal Journey	A Sense of Place	State of the Great Lakes Coast	Restore and Explore	Getting to the Bottom of the Lakes	Coastal Habitat Research	The Great Race for Survival	Food Web Invasion	Coastal Careers	Create-a-Watershed	Bird's Eye view	Coastal Community Planning	Plant Plans	Habitat Analysis	Watershed Mysteries	Adopt-A-Habitat	Coastal Habitat Action Plan
							9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12
							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
HS.Structure and Function	HS-LS1-1.	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.	**Constructing Explanations and Designing Solutions:** Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-1)	**LS1.A: Structure and Function:** - Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) - All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1) (Note: This Disciplinary Core Idea is also addressed by HS-LS3-1.)	**Structure and Function:** Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-LS1-1)					**DCI, CC**						**Std, SEP, DCI, CC**				
HS.Matter and Energy in Organisms and Ecosystems	HS-LS2-4.	Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.	**Using Mathematics and Computational Thinking**: Use mathematical representations of phenomena or design solutions to support claims. (HS-LS2-4)	**LS2.B: Cycles of Matter and Energy Transfer in Ecosystems:** Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. (HS-LS2-4)	**Energy and Matter:** Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems. (HS-LS1-7),(HS-LS2-4)							**DCI**								
HS.Human Sustainability	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.	**Constructing Explanations and Designing Solutions:** Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1)	**ESS3.A: Natural Resources**: Resource availability has guided the development of human society. (HS-ESS3-1) **ESS3.B: Natural Hazards:** Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations. (HS-ESS3-1)	**Cause and Effect:** Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS3- 1) **Influence of Science, Engineering, and Technology on Society and the Natural World:** Modern civilization depends on major technological systems. (HS-ESS3-1),(HS-				**Std, SEP, DCI, CC**	**SEP, DCI, CC**					**Std, SEP, DCI, CC**		**SEP, DCI, CC**				
HS.Human Sustainability	HS-ESS3-3.	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.	**Using Mathematics and Computational Thinking:** Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-ESS3-3)	**ESS3.C: Human Impacts on Earth Systems:** The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3)	**Stability and Change:** Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS3-3) **Influence of Science, Engineering, and Technology on Society and the Natural World:** - Modern civilization depends on major technological systems. (HS-ESS3-1),(HS-ESS3-3) - New technologies can have deep impacts on society and the environment, including some that were not anticipated. (HS-ESS3-3) **Science is a Human Endeavor:** Science is a result of human endeavors, imagination, and creativity. (HS-ESS3-3)									**CC**							

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Area	**Code**	**Standard**	**Scientific and Engineering Practices**	**Disciplinary Core Ideas**	**Crosscutting Concepts**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
HS.Human Sustainability	HS-ESS3-4.	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*	**Constructing Explanations and Designing Solutions:** Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of ev idence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)	**ESS3.C: Human Impacts on Earth Systems:** Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4) **ETS1.B: Developing Possible Solutions**: When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (secondary to HS-ESS3-2),(secondary HS-ESS3-4)	**Stability and Change:** Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS3-4) **Influence of Science, Engineering, and Technology on Society and the Natural World:** Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. (HS-ESS3-2),(HS-ESS3-4)												**Std, SEP, DCI, CC**		**SEP, DCI, CC**		**Std, SEP, DCI, CC**
HS.Human Sustainability	HS-ESS3-6.	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.	**Using Mathematics and Computational Thinking:** Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)	**ESS2.D: Weather and Climate:** Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. (secondary to HS-ESS3-6) **ESS3.D: Global Climate Change:** Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. (HS-ESS3-6)	**Systems and System Models:** When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-ESS3-6)										**Std, SEP, DCI, CC**			**Std, SEP, DCI, CC**				