Matrix of Environmental Principles and Concepts in CA NGSS

K-2	3-5	6-8	9-12
Principle I: The continuation and health of individual human lives and of human communities and societies depend on the health of the natural systems that provide essential goods and ecosystem services.			
• Humans need food, clean air, and water from healthy natural systems in order to live, grow, and survive. • Everything that humans do, such as building and moving from place-to-place, depends on natural resources from healthy natural systems. • The health of natural systems influences the amount of food, clean air, water and other resources available to meet human needs.	• Ecosystem goods obtained from healthy natural systems, such as timber, fuels, water, and clean air are essential to human life and to the functioning of our economies and cultures. • Ecosystem services from healthy natural systems, such as water filtration, decomposition, cycling of nutrients, oxygen production, and pollination are essential to human life and to the functioning of our economies and cultures.	• Human lives, communities, societies, and activities (e.g., agriculture, industry) depend on matter (e.g., timber, water, carbon, nitrogen, phosphorus) produced by natural systems. • The quality, quantity, and reliability of the ecosystem goods and services humans obtain from Earth's land, ocean, atmosphere, and biosphere are directly affected by the health of those natural systems. • The health, viability, and biological diversity of the natural systems on which humans depend are directly affected by human population growth, human activities, and per-capita consumption of ecosystem goods and services.	• Human lives, communities, societies, and activities (e.g., agriculture, fisheries, and industry) depend on and benefit from the biodiversity of Earth's natural systems. • The biodiversity of natural systems influences the quality, quantity, and reliability of the ecosystem goods and ecosystem services that human lives, communities, societies, and activities depend on. • The availability and reliability of the ecosystem goods and ecosystem services that natural systems provide humans are directly affected by the size and growth of human populations, and their consumption rates, as well as the operation of human communities.
Principle II: The long-term functioning and health of terrestrial, freshwater, coastal and marine ecosystems are influenced by their relationships with human societies.			
• Human activities cause changes to natural systems (habitats) where plants and animals, including humans, get what they need to live, grow, and survive. • Human activities that change natural systems influence which plants and animals can survive in an area, and may cause some species to disappear.	• Human activities can have major effects on natural systems by decreasing the amount of water, polluting air and water, and removing native vegetation. • Changes to natural systems due to human activity can affect how organisms interact with the environment and their chances for survival. • Growing human communities can result in habitat destruction, changes to the numbers and kinds of organisms living in an area, and the overall health of ecosystems.	• Human population growth, consumption of ecosystem goods and services, and the operation of human communities directly and indirectly affect the health, viability, and biological diversity of natural systems. • Human practices such as methods used to extract, transport, and consume resources, and social systems (e.g., laws, economics, and politics) directly and indirectly influence the geographic extent, composition, biological diversity, and viability of natural systems. • Human-caused changes to natural systems can occur at rates that can cause species to die, move away, or go extinct.	• Human social systems (e.g., laws, economics, and politics) and practices (e.g., methods used to extract, transport, and resource consumption) can alter natural systems processes and cycles, thereby influencing the carrying capacities of ecosystems and their geographic extent, composition, biological diversity, health, viability, and functioning. • Human population growth and associated anthropogenic changes (e.g., habitat destruction, pollution, climate change, invasive species) result from extracting, harvesting, transporting, and consuming natural resources, and can lead to the disruption of natural systems, thereby influencing the functioning and geographic extent, composition, biological diversity, and viability of ecosystems and threatening the survival of some species.
Principle III: Natural systems proceed through cycles that humans depend upon, benefit from and can alter.			
• Not applicable	• Humans depend on and benefit from cycles (e.g., water, carbon, nitrogen, life cycles) and processes (e.g., erosion, decomposition, soil formation) that occur in Earth's systems (biosphere, hydrosphere, atmosphere, and geosphere). • Human activities and practices (e.g., mining, manufacturing, land management, energy production and use) alter the cycles and processes that occur in natural systems. • Human-caused changes to natural systems cycles and processes affect the functioning of those systems and the organisms that depend on them.	• Humans depend on and benefit from the repeated cycling of matter between living and nonliving parts of ecosystems. • Human activities and practices alter cycles and processes in natural systems, disrupting physical and biological components of ecosystems, and causing shifts in populations of organisms. • Human lives, communities, and societies, and activities (e.g., agriculture, fisheries, and industry) depend on and benefit from natural systems cycles among the biosphere, hydrosphere, atmosphere, and geosphere. • Human-caused changes to natural systems cycles and processes can affect the health, viability, and functioning of those systems and the organisms that depend on them.	• Human practices, including the methods used to extract, harvest, transport and consume natural resources alter the cycles and processes that operate within natural systems, directly and indirectly influencing the quality, quantity, and reliability of ecosystem goods and ecosystem services available to support human lives, communities, and societies. • Human activities can alter Earth's major cycles and processes influencing the geographic extent, composition, biological diversity, health, viability, and functioning of natural systems. • Human-caused changes to cycles and processes in natural systems can diminish supplies of fresh water and clean air and may also result in global-scale changes such as: desertification, climate change, and decreased availability of arable soil.

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Principle IV: The exchange of matter between natural systems and human societies affects the long-term functioning of both.			
• Not applicable	• Human activities (e.g., manufacturing, energy production, agriculture) require matter from natural systems and produce byproducts. • The byproducts of human activities are not readily prevented from entering natural systems where they may result in beneficial, neutral, or detrimental effects. • Human use of matter from natural systems and resulting byproducts can affect the health, viability, and functioning of those systems and the organisms that depend on them.	• When byproducts (e.g., chemicals, waste products, other materials) of human activities enter natural systems they cause changes to local conditions that directly can affect the growth of plants and animals, which in turn can affect the health, viability, and functioning of the overall system, and the other organisms that depend on them. • Energy is released as a byproduct of many human activities (e.g., power production, manufacturing) and enters natural systems where it causes changes to and affects the functioning of terrestrial, freshwater, coastal, and marine ecosystems. • The capacity of natural systems to adjust to the matter and energy entering from human activities depends on the nature of the system as well as the scope, scale, and duration of the activity and the types of byproducts.	• The increasing consumption of resources (matter and energy) from growing human populations and associated activities is resulting in global-scale changes to natural systems (e.g., increased amounts of atmospheric carbon dioxide, overfishing, loss of tropical rainforests) which influence the capacity of Earth's natural systems to adjust to human-caused alterations. • The byproducts of human activities (e.g., pollution, waste products) that result from the expansion and operation of human communities and the use of natural resources, influence the functioning and geographic extent, composition, biological diversity, and viability of ecosystems and can threaten the survival of some species. • The scope, scale, and duration of human activities that consume natural resources and produce byproducts, influence the capacity of natural systems to recover from human-caused alterations and directly influence both the long-term viability of associated natural systems and the sustainability of human societies.
Principle V: Decisions affecting resources and natural systems are based on a wide range of considerations and decision-making processes.			
• There are many different factors to consider when making choices and decisions about human activities that can cause changes to natural systems. • When designing and choosing a solution to a problem, it is important to understand how different solutions might affect natural systems and the plants and animals that live there.	• There are many different things to consider when thinking about and making choices about activities that can affect natural systems, including how to minimize the impacts on natural systems and the living things that depend on them. • Criteria for success and design constraints should take into account potential effects on natural systems. • Research on engineering design problems and solutions should include determining potential impacts on natural systems.	• There are many different things to consider when thinking about and making choices about activities that can affect natural systems, including how to minimize the impacts on natural systems and the living things that depend on them. • Research on engineering design problems and solutions should include determining potential impacts on natural systems. • Systematic processes for evaluating possible solutions, and the legal, economic and political systems that govern them, should consider criteria for success and design constraints that account for potential impacts on natural systems.	• The spectrum of what is considered in making decisions about natural systems and resources, and how those factors influence decisions, should take into account sustaining biodiversity and natural system function, as well as human dependence on the living world for the resources and other benefits provided by biodiversity. • Established criteria and design constraints should take into account potential impacts on natural systems and should be quantified to the extent possible and stated in such a way that one can tell if a given design minimizes those impacts. • Global challenges can impact natural systems and resources, as well as social, economic, and political conditions in local communities, therefore engineering design solutions should take into account the full spectrum of these factors when evaluating and engineering design solutions. • Decisions about the priority of certain criteria over others (trade-offs) should assess social, economic, and political factors, with particular emphasis on environmental factors that can influence the long-term functioning of affected ecosystems and the survival of the organisms that depend on them.