May 2021

# NGSS Standards Alignment Chart

Center for Urban Resilience

| Grade Level | CA-NGSS Science Standard | Content Connections | L1 | L2 | L3 | L4 | L5 | L6 | L7 | L8 | L9 | L10 |
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| 4 | 4-LS1-1.A): Structure and Function: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. | plant parts and characteristics, plant growth and reproduction, pollination | X | X | X | X | X | X | X | X | X | X |
| 4 | 4-ESS3-1.A: Natural Resources: Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. | human impact on the environment (trash, pollution) | X | | | | X | X | | X | | |
| 5 | 5-LS1-1.C: Organization for Matter and Energy Flow in Organisms Plants acquire their material for growth chiefly from air and water. | resources needed for plant growth | X | X | X | X | X | X | X | X | X | X |
| 5 | 5-LS2-1.A: Interdependent Relationships in Ecosystems The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a | role of plants in food webs, energy transfer, ecosystems, needs of organisms for survival | X | X | X | X | X | X | X | X | X | X |

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| | relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. | | | | | | | | | | | |
| 5 | 5-LS2-1.B: Cycles of Matter and Energy Transfer in Ecosystems<br>Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. | cycles of matter, energy transfer | X | X | X | X | X | X | X | X | X | X |
| 5 | 5-ESS3-1.C: Human Impacts on Earth Systems:<br>Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1) | human impact on the environment (trash, pollution) | X | | | | X | X | | X | | |
| 5 | 5-PS3-1 (PS3.D): Energy in Chemical Processes and Everyday Life: The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). | energy transfer, photosynthesis, plant growth | X | X | X | X | X | X | X | X | X | X |
| 3-5 | Technology & Engineering Standards<br>ETS1.A: Defining and Delimiting Engineering Problems<br>Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for | identifying materials and resources needed to create a solution, researching possible solutions, designing solutions, communicating proposed solutions with peers, testing and refining solutions | | | X | X | X | X | X | | | |

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| | solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3–5-ETS1-1)<br>ETS1.B: Developing Possible Solutions<br>▪ Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3–5-ETS1-2)<br>▪ At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3–5-ETS1-2)<br>▪ Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3–5-ETS1-3)<br>ETS1.C: Optimizing the Design Solution<br>Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3–5-ETS1-3) | | | | | | | | | | | |
| 6 | 6-LS1-4.B: Growth and Development of Organisms<br>Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. | resources needed for plant growth | X | X | X | X | X | X | X | X | X | X |

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| 6 | 6-LS1-5.B: Growth and Development of Organisms<br>Genetic factors as well as local conditions affect the growth of the adult plant. | effect of growing conditions on plant growth | X | X | X | X | X | X | X | X | X | X |
| 6 | 6-MS-ESS3.C: Human Impacts on Earth Systems<br>Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. | positive impacts of gardens on the environment / biosphere | X | X | X | X | X | X | X | X | X | X |
| 7 | 7-MS-LS1-6 (PS3.D): Energy in Chemical Processes and Everyday Life:<br>The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen.<br>Cellular respiration in plants and animals involves chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. | energy transfer, photosynthesis, cellular respiration | X | X | X | X | X | X | X | X | X | X |

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| 7 | 7-LS2-1.D: Interdependent Relationship in Ecosystems<br>▪ Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.<br>▪ 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.<br>▪ Growth of organisms and population increases are limited by access to resources. | availability of resources on growth of plants | X | X | X | X | X | X | X | X | X | X |
| 8 | 8-LS3-1.B: Variation of Traits<br>In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. | genetic variation in plants | X | X | X | X | X | X | X | X | X | X |
| 8 | 8-LS4-5.B: Natural Selection<br>In *artificial* selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. | genetically modified organisms (GMO's) | X | X | X | X | X | X | X | X | X | X |
| 8 | 8-LS4-4.B: Natural Selection<br>Natural selection leads to the predominance of certain traits in a population, and the suppression of others. | genetic traits, natural selection | X | X | X | X | X | X | X | X | X | X |

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| 6-8 | ETS1.A: Defining and Delimiting Engineering Problems<br>The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)<br>ETS1.B: Developing Possible Solutions<br>▪ A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)<br>▪ There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3)<br>▪ Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)<br>▪ Models of all kinds are important for testing solutions. (MS-ETS1-4)<br>ETS1.C: Optimizing the Design Solution<br>▪ Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be | identifying materials and resources needed to create a solution, researching possible solutions, designing solutions, communicating proposed solutions with peers, testing and refining solutions | | | X | X | X | X | X | | | |

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| | incorporated into the new design. (MS-ETS1-3)<br>▪ The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4) | | | | | | | | | | | |
| 9-12 | HS-LS1-5.C: Organization for Matter and Energy Flow in Organisms: The process of photosynthesis converts light energy to store chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. | energy transfer, photosynthesis | X | X | X | X | X | X | X | X | X | X |
| 9-12 | HS-LS2-1,2.C: Interdependent Relationships in Ecosystems:<br>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. | carrying capacity, resource availability, competition for resources | X | X | X | X | X | X | X | X | X | X |
| 9-12 | HS-LS2-3.B: Cycles of Matter and Energy Transfer in Ecosystems<br>Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. | photosynthesis, cellular respiration, cycles of matter, energy transfer | X | X | X | X | X | X | X | X | X | X |

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| | HS-LS2-4.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. | | | | | | | | | | | | |
| 9-12 | HS-LS2-2, 6.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, | Ecosystem dynamics, effects of human activity (pollution, habitat destruction, etc.) on plants | X | X | X | X | X | X | X | X | X | X |

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| | however, can challenge the functioning of ecosystems in terms of resources and habitat availability.<br>HS-LS2-7.C: Ecosystem Dynamics, Functioning, and Resilience:<br>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. | | | | | | | | | | | | |
| 9-12 | HS-ESS3-3.C: Human Impacts on Earth Systems:<br>The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.<br>HS-ESS3-4.C: Human Impacts on Earth Systems:<br>Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. | natural resource management, human impacts on Earth | X | X | X | X | X | X | X | X | X | X |
| 9-12 | ETS1.A: Defining and Delimiting Engineering Problems<br>▪ Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1) | identifying materials and resources needed to create a solution, researching possible solutions, mitigating risk associated with the solution, designing solutions that meet a local or global need, being realistic about constraints of the solution, using | | | X | X | X | X | X | | | |

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| | ▪ Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)<br>ETS1.B: Developing Possible Solutions<br>▪ 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. (HS-ETS1-3)<br>▪ Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (HS-ETS1-4)<br>ETS1.C: Optimizing the Design Solution<br>Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (HS-ETS1-2) | technology in designing a solution, communicating proposed solutions with peers, testing and refining solutions | | | | | | | | | | | |