

# Aligning Next Generation Science Standards (NGSS) with UN Sustainable Development Goals (SDG)

The [United Nations Sustainable Development Goals](#) (SDGs) provide a powerful lens for student learning that connects local and global issues. SDGs can be brought into a unit and project framework to help define the problem, create an action project, and give relevance to learning and applying the content concepts. This document offers alignments between the SDGs and the [Next Generation Science Standards](#) (NGSS) you are teaching. There are certainly additional connections that can be made! The following SDGs are aligned below: 2, 3, 6, 7, 9, 11, 12, 13, 14, 15. The other goals – 1, 4, 5, 8, 10, 16, 17– are more directly rooted in social issues that could be integrated with a wide range of NGSSs as a motivating challenge for student learning and application of conceptual understanding.



**SUSTAINABLE DEVELOPMENT GOALS**  
17 GOALS TO TRANSFORM OUR WORLD



LIFE SCIENCE	
Next Generation Science Standards (NGSS) Disciplinary Core Ideas	Relevant UN Sustainable Development Goals (SDGs)
<p><b>LS1.B: Growth and Development of Organisms</b></p> <ul style="list-style-type: none"> <li>Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.</li> <li>Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.</li> <li>Genetic factors as well as local conditions affect the growth of the adult plant.</li> </ul>	

<p><b>LS1.B: Growth and Development of Organisms</b></p> <ul style="list-style-type: none"> <li>Animals engage in characteristic behaviors that increase the odds of reproduction.</li> </ul>	 
<p><b>LS1.C: Organization for Matter and Energy Flow in Organisms</b></p> <ul style="list-style-type: none"> <li>Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use.</li> <li>Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy.</li> </ul>	  
<p><b>LS1.D: Information Processing</b></p> <ul style="list-style-type: none"> <li>Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories.</li> </ul>	
<p><b>LS2.A: Interdependent Relationships in Ecosystems</b></p> <ul style="list-style-type: none"> <li>Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.</li> <li>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.</li> </ul> <p><b>LS2.B: Cycle of Matter and Energy Transfer in Ecosystems</b></p> <ul style="list-style-type: none"> <li>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.</li> <li>Growth of organisms and population increases are limited by access to resources.</li> </ul> <p><b>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</b></p> <ul style="list-style-type: none"> <li>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.</li> </ul>	 

<p><b>LS3.A: Inheritance of Traits</b></p> <ul style="list-style-type: none"> <li>• Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits.</li> <li>• Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited</li> </ul>	
<p><b>LS3.B: Variation of Traits</b></p> <ul style="list-style-type: none"> <li>• In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other.</li> <li>• 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.</li> </ul>	
<p><b>LS4.C: Adaptation</b></p> <ul style="list-style-type: none"> <li>• Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.</li> </ul> <p><b>LS4.D: Biodiversity and Humans</b></p> <ul style="list-style-type: none"> <li>• 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.</li> </ul>	 

# EARTH SCIENCE

Next Generation Science Standards (NGSS) Disciplinary Core Ideas	Relevant UN Sustainable Development Goals (SDGs)
<p><b>ESS2.C: The Roles of Water in Earth’s Surface Processes</b></p> <ul style="list-style-type: none"> <li>• Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.</li> <li>• Global movements of water and its changes in form are propelled by sunlight and gravity.</li> </ul>	  
<p><b>ESS2.D: Weather and Climate</b></p> <ul style="list-style-type: none"> <li>• Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns.</li> <li>• Because these patterns are so complex, weather can only be predicted probabilistically. The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents.</li> </ul>	
<p><b>ESS3.A: Natural Resources</b></p> <ul style="list-style-type: none"> <li>• Humans depend on Earth’s land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes</li> </ul> <p><b>ESS3.C: Human Impacts on Earth Systems</b></p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.</li> </ul>	      
<p><b>ESS3.D: Global Climate Change</b></p> <ul style="list-style-type: none"> <li>• Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth’s mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.</li> </ul>	

# PHYSICAL SCIENCE

Next Generation Science Standards (NGSS) Disciplinary Core Ideas	Relevant UN Sustainable Development Goals (SDGs)
<p><b>PS1.A: Structure and Properties of Matter</b></p> <ul style="list-style-type: none"> <li>Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms.</li> <li>Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.</li> <li>Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.</li> <li>In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations.</li> <li>Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals).</li> <li>The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.</li> </ul>	    
<p><b>PS2.A: Forces and Motion</b></p> <ul style="list-style-type: none"> <li>For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law).</li> <li>The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.</li> <li>All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared.</li> </ul> <p><b>PS2.B: Types of Interactions</b></p> <ul style="list-style-type: none"> <li>Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.</li> <li>Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun.</li> <li>Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively).</li> </ul> <p><b>PS3.A: Definitions of Energy</b></p> <ul style="list-style-type: none"> <li>Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed.</li> <li>A system of objects may also contain stored (potential) energy, depending on their relative positions.</li> </ul>	   

<ul style="list-style-type: none"> <li>• Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.</li> </ul> <p><b>PS3.B: Conservation of Energy and Energy Transfer</b></p> <ul style="list-style-type: none"> <li>• When the motion energy of an object changes, there is inevitably some other change in energy at the same time.</li> <li>• The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment.</li> <li>• Energy is spontaneously transferred out of hotter regions or objects and into colder ones.</li> </ul> <p><b>PS3.C: Relationship Between Energy and Forces</b></p> <ul style="list-style-type: none"> <li>• When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object.</li> </ul> <p><b>PS4.B: Electromagnetic Radiation</b></p> <ul style="list-style-type: none"> <li>• When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object’s material and the frequency (color) of the light.</li> <li>• The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends.</li> </ul> <p><b>PS4.C: Information Technologies and Instrumentation</b></p> <ul style="list-style-type: none"> <li>• Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.</li> </ul>	
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## Resources

### UN Sustainable Development Goals

- About the UN Sustainable Development Goals. Retrieve at [www.un.org/sustainabledevelopment/sustainable-development-goals/](http://www.un.org/sustainabledevelopment/sustainable-development-goals/)
- Climate impacts on different sectors [SEGS]. Retrieve at [https://19january2017snapshot.epa.gov/climate-impacts/climate-change-impacts-sector\\_.html](https://19january2017snapshot.epa.gov/climate-impacts/climate-change-impacts-sector_.html)
- Videos about each SDG. Retrieve at [www.un.org/sustainabledevelopment/news/videos/](http://www.un.org/sustainabledevelopment/news/videos/)
- Why the SDGs matter. [pdfs about each goal]. Retrieve at [www.un.org/sustainabledevelopment/why-the-sdgs-matter/](http://www.un.org/sustainabledevelopment/why-the-sdgs-matter/)

### The Next Generation Science Standards

- DCI arrangement of the Next Generation Science Standards. Retrieve at [www.nextgenscience.org/sites/default/files/NGSS%20DCI%20Combined%2011.6.13.pdf](http://www.nextgenscience.org/sites/default/files/NGSS%20DCI%20Combined%2011.6.13.pdf)
- The Next Generation Science Standards. [www.nextgenscience.org/](http://www.nextgenscience.org/)