

Creating and Using a Nature Trail



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Overview: Learn about your local habitat while giving back to the community. In this long term activity, students develop and utilize a school nature trail.

Targeted Grade: 5

Additional Connections: K, 2, 3, MS, HS

NGSS Standard(s)	CT Social Studies Standards
5-ESS3-2 Protecting Resources/Environment 3-5-ETS1-1 Defining Design Problems Using Specified Criteria 3-5-ETS1-2 Generate/Compare Design Solutions	CIV 5.2 Benefits and challenges of working with multiple groups
Common Core Math Standard(s)	Common Core ELA Standard(s)
5.MD.1 Measurement and Data in Real-World Problems 5.MD.3-5 Calculating Volume 6th Grade standard reaches: 6.RP3.B Solving Real-World Problems Using Ratios/Rates 6.RP3.D Unit Conversions	RI.5.7 Synthesizing Information RI.5.9 Analyzing Evidence W.5.2 Write informative texts W.5.8 Recall & Summarize

The standards presented here are suggestions only; you may identify others! Please refer to your grade level at Next Generation Science Standards (<http://www.nextgenscience.org/search-standards>) and Common Core State Standards (<http://www.corestandards.org/>).

This project should start with students surveying the proposed area and discussing their ideas, plans, and questions with conservation, landscape, and naturalist professionals. It is important to identify species and habitats to be protected, as well as the educational opportunities that your unique area provides.

Part of the survey should be a photo journal and maps of the area. As the trail is identified, students might take “before and after” photos from selected marked spots with a plan to observe changes at those vistas over time. (An example of marking might be a post that students place their backs to and shoot photos in a specific compass direction.)

Students should also survey selected habitat areas, marking them for ongoing future studies and observations once the areas have more human impact.



Materials needed: Each trail will be unique, but possible materials include: gravel, lumber for sides of trail, materials for signage (could be anywhere from simple to ornate; you choose!), tools to remove rocks and cut back brush where appropriate. Partnerships should be explored—town or regional groups may wish to work with students on this project, and may support costs and efforts, or provide materials.

- **Life Sciences: 5-ESS3-1:** Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.
 - Students should review relevant prior lessons and knowledge, including how society protects the environment through preservation and conservation projects
 - **Initial Project Design:** Students should identify several areas on or around their school grounds that may be suitable for a nature trail.
 - Consideration should be given to:
 - Available space. If little/no pre-cleared space is available, what work will be required?
 - Ease of passage from one observation station to the next
 - Presence of unique natural features
 - Absence of regular pedestrian/vehicular traffic
 - Potential for passage through more than one type of ecosystem (i.e. field to highland forest to lowland forest to wetlands)
 - Students should refer to prior knowledge and/or textual evidence to assist in identifying various habitats (RI.5.7; RI.5.9)
 - Students should create lists of species they observe, to help plan for observation stations
 - Consider partnering with town conservation commissions, local scouts, 4H clubs, CT Audubon, garden clubs, colleges/universities, etc. Each may have an “expert” that can assist in identifying species
 - Students should distinguish between native/non-native species
 - Investigation and identification of any local invasive plant species might also be included
 - Students should investigate species that might be planted, to improve the ecosystem’s carrying capacity/overall health
 - Presence of threatened/endangered species
 - Water drainage – Is the area prone to flooding or erosion, which may affect the ability of students to use the trail?
 - **IMPORTANT! Consult your administration to ensure ADA access requirements!**
 - With adult (and possible expert) guidance, students should brainstorm other factors for consideration when picking a site, and what constitutes a “successful” project.
 - If the land belongs to the school, seek administration approval. If the land belongs to the town, State, or private land trust, seek their approval and



- support. This must be completed prior to designing the trail. Students could be involved in the process to understand benefits and challenges of working with multiple stakeholders. (CIV 5.2)
- **Materials:** Once approval has been received, students should survey potential trail paths to assist in determining what materials will be required.
 - Students should measure and record the distances between observation stations. Students should use their inch/feet measurements to calculate the total trail length, in inches, feet, and miles (5.MD.1).
 - Advanced students may be asked to convert measurements between unit systems (i.e. feet to meters) (6.RP.3.D)
 - Students should measure and determine an appropriate width for the trail.
 - Students should use the average of several measurements, collected at various points along the trail
 - Using this data, and the length data collected previously, students should calculate the total volume of gravel or woodchips that would be needed to cover the path to a depth of 1", 2", or 3" (5.MD.3; 5.MD.4; 5.MD.5; 5.MD.1)
 - The teacher should research local unit-pricing for materials (i.e. \$2/ft³ for gravel, \$1.50/ft³ for wood chips, \$5/ea. for 8' lengths of 4"x4" fence posts, etc.). Students could be split into groups, with each group responsible for calculating the cost, and total area/volume of a certain material (6.RP.3.B). Another group might cross check their calculations. Students should present their findings, recommendations, and calculations to the class.
 - This calculation experience could be repeated in subsequent years as a theoretical math or design problem.
 - **Final Design Proposal:** Students' group-work should be incorporated into a design proposal (3-5-ETS1-1; 3-5-ETS1-2) that includes:
 - Criteria for success
 - Discussion of stakeholder approvals
 - Intended use of finished product
 - Teachers should include how the nature trail supports specific standards-based curricular goals
 - Methodology for selecting design components
 - Calculations of anticipated materials, costs, and time
 - Student-impact statements – Students should write a short essay explaining why the nature trail is important to them personally, how they think it will help them learn, and what environmental benefits might be realized (W.5.2)
 - Students could create graphics and short videos recorded at potential observation stations, etc. (SL.5.5)
 - Submit your students' design proposal to local businesses and students' parents for donations of materials and/or labor. Alternatively, consider crowd funding sources such as DonorsChoose.org (see Donors Choose write-up).

- Ask students to write a short reflection on the process of seeking partnerships for the conservation project, (W.5.8) reflecting on challenges faced, and how were they overcome, and what they might do differently.
 - **Design Implementation:** Student participation in design implementation should include:
 - Measuring (5.MD.1) and delineating the trail route (using stakes or other markers)
 - Creation of a trail brochure (SL.5.5)
 - Develop informational signage for trail entrance and observation stations. See “Student-Created Signage” for more information
 - **Community Outreach:** Students should coordinate a “Grand Opening” event, inviting town officials, and other partners, and provide student-led informative tours.

Once built, a **Nature Trail** can support many other standards-based curricular goals, at several different grade levels. Some ideas include:

Elementary

NGSS Standard(s)	CT Social Studies Standards
K-LS1-1 Patterns of Survival (Plants/Animals) K-ESS2-2 Plants/Animals Changing Environments to Meet Needs	GEO K.1 & GEO K.2 Construct and Use Maps
Common Core Math Standard(s)	Common Core ELA Standard(s)
K.CC Counting/Cardinality K.MD.2 Comparing Objects	W.K.2 Informative/Explanatory Texts, Using Drawing, Writing & Dictating SL.K.3 Ask/Answer Questions SL.K.4-5 Describing

- **Life Sciences: K-LS1-1** Use observations to describe patterns of what plants and animals (including humans) need to survive
 - While walking along the nature trail, students could make observations and ask questions about the characteristics of habitats populated by various species (SL.K.3)
 - Do grasses grow in the forest, where there is little light?
 - What kinds of animals live under logs?
 - Are there more plants in areas where water is abundant?
 - Students could make maps of the areas they visited and use them to compare the relations to other places (GEO K.1 & GEO K.2)
 - Students could report their findings in short responses (W.K.2; SL.K.3; SL.K.4-5)
- **Earth & Space Sciences: K-ESS2-2** Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs
 - While walking along the trail, students could ask questions and make observations of how species work to change their environment to support their needs (SL.K.3). Examples might include:



- Birds collecting twigs and leaves to build nests in trees
 - Burrows dug by animals to make dens or by insects in logs
 - Beaver dams
 - Human modifications, including creation of the nature trail itself
 - Students could report their findings in short responses (W.K.2; SL.K.3; SL.K.4-5)
- While walking along the trail, and through prompting by the teacher, students can practice Common Core Math skills such as Counting & Cardinality (K.CC) and comparing objects (K.MD.2).
 - Teachers could ask, for example: “How many leaves are on this tree branch” or “Which rock is bigger?” or “What color is this.....?”

NGSS Standard(s)	CT Social Studies Standards
2-LS4-1 Diversity of Life	GEO 2.4 Environment impact on people’s lives
Common Core Math Standard(s)	Common Core ELA Standard(s)
2.OA.1-3 Addition and subtraction 2.MD.1-6 Measuring lengths 2.MD.9-10 Data tables and graphs 2.G.2 Partitioning a rectangle	SL.2.5 Recounting Experiences

- **Life Sciences: 2-LS4-1** Make observations of plants and animals to compare the diversity of life in different habitats
 - Students could complete a “Bio Blitz” to compare the presence of various species between various habitats
 - Students could compare and count species in different habitats in a selected small area, e.g. using a measured grid (2.G.2) Comparison could be made between very different areas, e.g. wooded vs grassy areas. (2.OA.1)
 - Classroom word problems might be set up (by the teacher or students), using the species observed. (2.OA. 1-3)
 - Students could measure common objects using rulers, tape measures, and meter sticks and practice estimation on selected objects (2.MD.1-4) and create data tables of their measurements (2.MD.9-10)
 - Students could compose an illustrated story of their travels between habitats, complete with annotated drawings of the species and resources present in each (SL.2.5)
 - Students could talk about how the environment affects people’s lives and how their nature trail can be protected. (GEO 2.4)



NGSS Standard(s)	CT Social Studies Standards
3-LS2-1 Animal Groups 3-LS4-3 Habitats	GEO 3.6 Population Distribution
Common Core Math Standard(s)	Common Core ELA Standard(s)
	W.3.2 Informative/Explanatory Texts W.3.3 Writing narratives of real or imagined experiences W.3.7-8 Conduct short research projects RI.3.3 Describing Relationships

- **Life Sciences: 3-LS2-1** Construct an argument that some animals form groups that help members survive
 - While walking along the trail, students could make observations of the presence of groups of animals, and consider how groupings promote species survival. Examples might include ant or bee colonies, beaver families, or schools of fish in a pond.
 - Students could research and write informative/explanatory texts that describe how groupings promote survival (W.3.2; W.3. 7-8)
 - Students could write narratives about real or imagined animal interactions (W.3.3)
- **Life Sciences: 3-LS4-3** Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all
 - Students could compare the variety and population of species between two habitats along the trail, noting any differences in resource availability that might promote, hinder, or preclude species survival. Examples include:
 - Mushrooms found growing in shady areas with ample ground-level dead trees, but not in open fields
 - Wildflowers growing in open fields, but not in shady forests
 - Species of trees growing in upland forests where the soil is drier, compared with different trees growing in lowland forests where the soil is wetter, or the same trees growing taller in lowland forests, due to greater water resources
 - Students could write informative/explanatory texts that explain the differences that students observe (W.3.2)
 - Students could also explore how different environmental characteristics impact where people distribute themselves. Students could compare and contrast these similarities and differences. (GEO 3.6)



Middle School

NGSS Standard(s)	CT Social Studies Standards
MS-LS2-1 Resource Availability & Organism- Populations MS-LS2-2 Patterns of Interactions MS-LS2-4 Population Changes in Ecosystems MS-LS1-5 Influence of Environmental/Genetic Factors on Organism Growth MS-LS5 Evaluate design solutions	GEO 6-7.1 & GEO 8.1 Constructing maps GEO 6-7.2 Use maps/photography to explain relationships
Common Core Math Standard(s)	Common Core ELA Standard(s)
6.EE.9 Using Variables 6.SP2-5 Statistics and Probability 7.RP.1-3 Ratios and Proportional Relationships 7.SP.1-2 Statistics and Probability 7.G 1-6 Geometry	RST.6-8.7 Integrating Textual/Graphical Information WHST.6-8.1-2 Supporting Arguments and Informative/Explanatory Texts SL.8.5 Integrating Multimedia Sources into Presentations

- **Life Sciences: MS-LS2-1** Analyze and interpret data to provide evidence for the effects of resources availability on organisms and populations of organisms in an ecosystem
 - Students could collect and compare data of varying characteristics of organisms in different parts of an ecosystem. Observations should be made of the surrounding area, with particular attention to resource availability. (6.SP 2-5; 7.SP.1-2)
 - Students could measure average population density and size of a species, in different parts of the same ecosystem and support arguments for different causes and effects. (WHST.6-8.1-2)For example:
 - Do oak trees grow larger, on average, in areas where they are spaced further apart?
 - Do oak trees grow larger around streams or lakes, where water is more available?
 - Students could use a soil-moisture probe to quantitatively measure water-content
 - To investigate and calculate ratios-- students collect a 100g soil sample. The sample should then be heated, either over a Bunsen burner or in a kiln, until all water is evaporated. Have



students determine the mass of the dry sample, and calculate the percent moisture content (e.g. 100g sample – 82.4g dry weight = 17.6g moisture content = 17.6%) (7.RP.1-3)

- Do more mushrooms grow in areas where there is more ground-level non-living organic matter?
- Do plants grow taller and/or fuller in areas with greater sunlight penetration?
 - Students could use a light-meter to acquire quantitative data regarding sunlight levels
 - Students could also use the data collected to “Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms” (MS-LS1-5). In this scenario, emphasis is on environmental factors.
 - Students could compose an informative/explanatory essay, supported with pictures, graphs, and/or tables of their data, explaining their findings (6.EE.C.9; RST.6-8.7; WHST.6-8.2; SL.8.5)
- **Life Sciences: MS-LS2-2** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
 - Students could examine patterns of producers, consumers and decomposers in one area of the ecosystem to calculate ratios of each (7.RP.1-3) and compare those ratios to another group’s calculations for another area of the ecosystem.
 - Students could research producers, consumers and decomposers in nature at large, and make projections and draw conclusions based on their findings and research. (WHST.6-8.1-2)
- **Life Sciences: MS-LS2-4** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations
 - Students could construct a 2’x2’ leaf pile (see “Leaf Pile” lesson links) and compare the presence of organisms, such as insects and decomposers, to an adjacent 2’x2’ natural area.
 - Students could plant a butterfly garden (see “Butterfly Garden”) and compare the presence of butterflies before and after planting
 - Students could compose an informative/explanatory essay, supported with pictures, graphs, and/or tables of their data, explaining their findings (6.EE.C.9; RST.6-8.7; WHST.6-8.2; SL.8.5)
 - Students should relate their findings to the MS-LS2-1 investigation regarding resource availability and organism populations
- **Life Sciences: MS-LS2-5** Evaluate competing design solutions for maintaining biodiversity and ecosystem services
 - Students could set up different engineering solutions to control erosion in a portion of their nature trail. Over time, and possibly successive years, teams of students could evaluate the effects, or effectiveness of prior solutions. They could also implement new solutions or discuss/implement iterative changes.

- Solutions should be documented and photographed, along with periodic reports on status and changes. (GEO 6-7.2)
- **Earth & Space Sciences: MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales
 - Students could collect data about erosion of soil at various points along the trail
 - Students should determine a baseline surface level from which measurements of deviation may be recorded. This may be achieved by driving stakes into the ground and using a marker to draw a line where the ground-surface intersects the stake
 - Students should collect data periodically and especially after every major weather event
 - Students should consider the relationship between erosion and deposition. This may be shown by comparing up-trail erosion with potential down-trail deposition
 - This might be marked with bands of white sand placed perpendicular to the expected path of erosion on a slope, allowing students to document small changes in the surface deposition in those areas.
 - Students could map their work areas to scale using Geometry skills (7.G 1-6) (GEO 6-7.1) (GEO 8.1)

High School

NGSS Standard(s)	CT Social Studies Standards
HS-ESS2-2 Systems Feedback HS-ESS2-5 Water & Earth’s Surface Processes HS-ESS3-4 Mitigating Human Effects on Natural Systems	Civics & Government GEO 9-12.1 Economic and Political decisions impact on regions
Common Core Math Standard(s)	Common Core ELA Standard(s)
HSN-Q.A.3 Accuracy of Measurement MP.4 Modeling w/ Mathematics	RST.6-8.7 Integrating Textual/Graphical Information WHST.9-12.2 Informative/Explanatory Texts WHST.9-12.7 Research Projects WHST.9-12.9 Supporting Research with Textual Evidence

- **Earth & Space Sciences: 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
 - Students could begin an investigation of the relationship between ground vegetation and erosion, by selecting and delineating two areas of equal size (about 5’-8’ square), on opposite sides of the trail. (NOTE: This work could be the basis of the **MS-LS2-5** challenge to evaluate competing design solutions discussed in the Middle School section, with erosion mitigation solutions left in place for future study)



- Preference should be given to areas with topographic relief that are as similar as possible, with relatively abundant plants, but few trees (if any). One will be the experimental area, and the other will be the control.
- Alternatively, two pairs of sites may be chosen. One could be sited on flat ground, while the other is sited on a hill slope. The latter should provide more pronounced data.
- Clear any and all vegetation from one of the selected sites (it is for this reason that areas without trees are preferable). Remove both plants and roots.
 - Ideally, this would occur in areas populated by a majority of invasive species
 - Explain to students that even though purposefully removing healthy vegetation is normally counter-productive, in this case, the potential lessons learned from experimentation outweigh the harms
 - Allow students to assist in formulating a remediation plan, so the site may be returned to normal health following the experiment
- Students should determine a baseline surface level from which measurements of deviation may be recorded. This may be achieved by driving stakes into the ground and using a marker to draw a line where the ground-surface intersects the stake
 - Students should collect data periodically and especially after every major weather event
- Students should take periodic measurements of soil moisture content. This may be achieved in one of two ways (HSN-Q.A.3):
 - If time is a constraining factor, use a soil-moisture probe. This will allow for instantaneous data collection.
 - If additional laboratory practice is desired, and time permits, have students collect a 100g soil sample. The sample should then be heated, either over a Bunsen burner or in a kiln, until all water is evaporated. Have students determine the mass of the dry sample, and calculate the percent moisture content (e.g. 100g sample – 82.4g dry weight = 17.6g moisture content = 17.6%)
- Students should compare erosion and soil-moisture data collected from each site, with the aim of determining the relationship between the removal of ground vegetation, and surface runoff. Do the data support the claim that less vegetation is correlated with increased runoff (less soil-moisture) and erosion? (**HS-ESS2-5**)
 - Ask students to consider where the eroded soil is being deposited, and what effect, if any, it may have on areas down slope.
 - Students could explore how areas that have been exposed to eroded soil have been impacted. They could research the economic and political decisions that may have impacted such regions and ultimately how that impacts the community. (Civics & Government GEO 9-12.1)
 - Conversely, ask students to consider how the purposeful planting of vegetation, particularly on hill slopes, can help mitigate erosion (**HS-ESS3-4**)

- Students could use their data, in conjunction with a stream table, to compare rates of erosion of wet vs. dry soils. Use wet soil that has a soil-moisture content as close to the recorded values from the field as possible (MP.4)
 - Remind students that soil-moisture is only one factor influencing rates of erosion, and that the root system of plants, although not present in the stream table, contribute to the physical adhesion of soil
 - Have students observe the differential effects of downstream deposition in the two soils
- Students should present their findings by writing a lab report, integrating data from the experiment with textual evidence from supporting materials (RST.6-8.7; WHST.9-12.2; WHST.9-12.7; WHST.9-12.9)
- **NOTE:** This investigation relies on natural rainfall for optimum data collection. In the event that rainfall is minimal and access to a stream table is unavailable, the investigation may still be completed by using a hose. Ensure that the height of the hose above the site, length of time, and rate of water flow remains constant at each site. This could also lead to a discussion of experimental design and controls on variables.

These suggestions are examples only, and may require adaptation. Check your grade-specific standards to determine whether or not the suggestions provided meet your individual curricular needs.

For more information, contact ctgreenleaf@ctgreenschools.org

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