**DEP Environmental Education Curricula**

**Lesson Plan**

**GRADE/LEVEL: Middle School**

**LESSON TITLE: Sustainability**

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| --- | --- | --- |
| **Next Generation Science Standards** |  |  |
| **MS-ESS3-3** | **MS-ESS3-3** | Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. |
|  | **Science and Engineering Practices** | [Apply scientific principles to design an object, tool, process or system.](http://www.nap.edu/openbook.php?record_id=13165&page=67) |
|  | **Disciplinary Core Ideas** | [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.](http://www.nap.edu/openbook.php?record_id=13165&page=194)[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.](http://www.nap.edu/openbook.php?record_id=13165&page=194) |
|  | **Crosscutting Concepts** | [Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.](http://www.nap.edu/openbook.php?record_id=13165&page=87) |
| **Objectives** |
|  |  | **Objective 1:** Students will be able to list and discuss the three pillars of sustainability.**Objective 2:** Students will consider “strong” versus “weak” sustainability.**Objective 3:** Students will define “anthropogenic” and discuss how it may affect our view of sustainability.**Objective 4:** Students will discuss ways to contribute to a more sustainable world. |
| **Vocabulary** |  |  |
|  | **Anthropocentric** | Considering human beings as the most significant of the universe. (As opposed to God or animals).  |
|  | **Energy Star** | A program which provides certification to buildings and consumer products which meet certain standards of energy efficiency. |
|  | **Life Cycle** | A series of stages through which an item or object passes during its lifetime. |
|  | **Permaculture** | A system of agricultural and social design principles centered around simulating or directly utilizing the patterns and features observed in natural ecosystems. |
|  | **Riparian** | Relating to or situated on the banks of a river. |
|  | **Xeriscaping** | Landscape in a style which requires little or no irrigation. |
| **Background** |  |  |
| **Teacher Version**Selected Materials from …What is Sustainability? | **Sources:** <https://www.epa.gov/sustainability/learn-about-sustainability#what> or as listed below. |
| **What is Sustainability?**Sustainability is based on a simple principle: Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. To pursue sustainability is to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations.Sustainability is about affording each generation equal opportunity to enjoy undiminished welfare, by comparison to the welfare opportunities available to earlier generations. The National Environmental Policy Act (NEPA) of 1969 committed the United States to sustainability, declaring it a national policy “to create and maintain conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations.” (Source: www.epa.gov)In the years since NEPA was enacted, the public’s interest in sustainability has broadened. According to the National Research Council, there are many additional drivers for sustainability. In the areas where the US has seen considerable progress in sustainability, a common driver for sustainability efforts is citizens and other stakeholders concern. In addition, sustainability practitioners are becoming more ambitious in their sustainability efforts and are working together to share best practices to ensure the greatest environmental, economic and social impact. (Source: [www.epa.gov](http://www.epa.gov))Moving towards sustainability is also a social challenge that entails [international](https://en.wikipedia.org/wiki/International_law) and national [law](https://en.wikipedia.org/wiki/Law), [urban planning](https://en.wikipedia.org/wiki/Urban_planning) and [transport](https://en.wikipedia.org/wiki/Transport), local and individual [lifestyles](https://en.wikipedia.org/wiki/Lifestyle_%28sociology%29) and [ethical consumerism](https://en.wikipedia.org/wiki/Ethical_consumerism). Ways of living more sustainably can take many forms from reorganizing living conditions (e.g., [eco-villages](https://en.wikipedia.org/wiki/Ecovillages), [eco-municipalities](https://en.wikipedia.org/wiki/Eco-municipalities) and [sustainable cities](https://en.wikipedia.org/wiki/Sustainable_cities)), reappraising economic sectors ([permaculture](https://en.wikipedia.org/wiki/Permaculture), [green building](https://en.wikipedia.org/wiki/Green_building), [sustainable agriculture](https://en.wikipedia.org/wiki/Sustainable_agriculture)), or work practices ([sustainable architecture](https://en.wikipedia.org/wiki/Sustainable_architecture)), using science to develop new technologies ([green technologies](https://en.wikipedia.org/wiki/Green_technologies), [renewable energy](https://en.wikipedia.org/wiki/Renewable_energy) and sustainable [fission](https://en.wikipedia.org/wiki/Generation_IV_reactor) and [fusion power](https://en.wikipedia.org/wiki/Fusion_power)), or designing systems in a flexible and reversible manner, and adjusting individual [lifestyles](https://en.wikipedia.org/wiki/Lifestyle_%28sociology%29) that conserve natural resources. (Source: https://en.wikipedia.org/wiki/Sustainability)**Three Dimensions of Sustainability**The [2005 World Summit on Social Development](https://en.wikipedia.org/wiki/2005_World_Summit) identified sustainable development goals, such as economic development, social development and environmental protection. (Source: <https://en.wikipedia.org/wiki/Sustainability>) On September 2015 countries adopted a set of goals to end poverty, protect the planet and ensure prosperity for all as part of a new sustainable development agenda. (Source: http://www.un.org/sustainabledevelopment/sustainable-development-goals/)https://upload.wikimedia.org/wikipedia/commons/thumb/1/1b/Nested_sustainability-v2.svg/250px-Nested_sustainability-v2.svg.pngEconomy and Society are constrained by Environment (Source: https://en.wikipedia.org/wiki/Sustainability)[Environmental sustainability](http://www.thwink.org/sustain/glossary/EnvironmentalSustainability.htm) is the ability to maintain rates of renewable resource harvest, pollution creation, and non-renewable resource depletion that can be continued indefinitely.[Economic sustainability](http://www.thwink.org/sustain/glossary/EconomicSustainability.htm) is the ability to support a defined level of economic production indefinitely.[Social sustainability](http://www.thwink.org/sustain/glossary/SocialSustainability.htm) is the ability of a social system, such as a country, to function at a defined level of social wellbeing indefinitely. (Source: <http://www.thwink.org/sustain/glossary/Sustainability.htm>)**EPA Strategic Plan**EPA’s Mission: To Protect Human Health and the Environment * Goal 1 – Core Mission: Deliver real results to provide Americans with clean air, land, and water, and ensure chemical safety.
* Goal 2 – Cooperative Federalism: Rebalance the power between Washington and the states to create tangible environmental results for the American people.
* Goal 3 – Rule of Law and Process: Administer the law, as Congress intended, to refocus the Agency on its statutory obligations under the law. (www.epa.gov)

**Topics of the Strategic Plan*** Energy Efficiency – the goal to reduce the amount of energy required to provide products and services. (Source: www.Wikipedia.org)
* Green Infrastructure – a cost effective, resilient approach to managing wet weather impacts that provides many community benefits. (stormwater control etc. by allowing non-paved, non-piped ground to accept the water and soak it in; using trees for shade to lower air conditioning costs, or as wind breaks to reduce heating costs in winter etc.)
* Sustainable Materials Management (SMM) is a systematic approach to using and reusing materials more productively over their entire life cycles. By looking at the entire life cycle we can find new opportunities to reduce environmental impacts, conserve resources, and reduce costs.
* Sustainable Purchasing and Products – You can help by buying greener products and services for your home, business, or school. (www.epa.gov)

**How Do We Measure Sustainability?*** Weak Sustainability
	+ Based on the idea that what we owe the future is to avoid actions that will make them *poorer* than we are in terms of opportunities to achieve welfare equal to ours.
	+ Each generation is required to maintain and pass on the economic capital they have inherited.
	+ No environmental goals should be given priority over other investments that have greater expectations of return in terms of capital. (Source: Bryon Norton)
* Strong sustainability
	+ Incorporates a category of social value - called “natural” capital.
	+ This capital is not created by humans.
	+ This capital is deemed essential to the well-being of the people of the future.
	+ Requires the protection of natural capital to be passed to the next generation. (Source: Bryon Norton)
* What items have value to be passed to the next generation?
	+ This depends on who you ask…
	+ Financial assets?
	+ Technology?
	+ Labor?
	+ Natural resources?
	+ Some people feel these items are all interchangeable. (Source: Bryon Norton)

Some feel that because we do not know what people in the future will want, and because resources are intersubstitutable anyway *all we can be expected to do is to avoid impoverishing the future by over-consuming and under-saving.*Most mainstream economists and many philosophers prescribe to what Norton calls the “Grand Simplification”* + By stating we are ignorant of the future’s wants this wipes away any specific obligations beyond the next generation.
	+ As technologies change we can’t know what resources will be crucial to future generations…so we need not act.

**How do we Track Progress on Sustainability?**“**Indicator**” – a summary measure that provides information on the state of, or change in, the system that is being measured. (Source: [www.epa.gov](http://www.epa.gov))EPA’s Report of the Environment (ROE) shows how the condition of the U.S. environment and human health is changing over time. The ROE presents the best available indicators of national trends in five theme areas: air, water, land, human exposure and health, and ecological condition.“A Framework for Sustainability Indicators at EPA” provides useful methods and guidance to support the application of sustainability indicators in EPA decision making. (Source: [www.epa.gov/sustainability](http://www.epa.gov/sustainability))From the perspective of environmental research and regulatory policy, there are two fundamental questions that underscore the need for indicators of progress towards sustainability (Kates et. al 2001):* How can today’s operational systems for monitoring and reporting on environmental and social conditions be integrated or extended to provide more useful guidance for efforts to navigate a transition towards sustainability?
* How can today’s relatively independent activities of research planning, monitoring, assessment and decision support be better integrated into systems of adaptive management and social learning?

Based on the three pillars concept, a sustainability indicator can be defined as a measurable aspect of environmental, economic, or social systems that is useful for monitoring changes in system characteristics relevant to the continuation of human and environmental well being.The use of sustainability indicators and corresponding metrics is essential for an integrated systems approach to the addressing challenges of sustainability. When carefully chosen and implemented, indicators can help managers and policy makers to:* Anticipate and access conditions or historical trends
* Provide early warning information to prevent adverse outcomes
* Benchmark against other systems
* Communicate ideas
* Support decision-making
* Formulate strategies and establish improvement goals
* Track progress

(Source: modified from “An overview of sustainability assessment methodologies” Singh, et. al, 2009)**Anthropocentric versus Non-Anthropocentric Viewpoints*** **Anthropocentric** – humans are considered to be the center, with others items put on earth for the humans use.
* **Non-anthropocentric**
	+ Humans are not considered the center
	+ Is it really possible to have a non-anthropocentric view if the viewer is human?

**Big Picture…*** Does nature have intrinsic value?
* Does it matter if nature has intrinsic value?
 |
| **Crosscutting Concepts** | [Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.](http://www.nap.edu/openbook.php?record_id=13165&page=87)Discuss with the students causal (relating to or acting as a cause) and correlation (a mutual relationship or connection between two or more things). Can there be a correlation between students’ actions and making a more sustainable world? |
| **Classroom Discussion** | **Ways to Live Sustainably** |
| **Ask the students in your classroom about the following topics. Have them consider which practices they and their families already practice, and those that they might adopt.** * Are there topics that the students had not known or thought about?
* are there topics that they or their family members choose not to participate in?
	+ For *what reason might they not choose to participate in a particular practice? (financial obligations – maybe they or their family would like to take an ACTION, but can not afford to at this time? religious observences – dietary restrictions, etc., safety reasons – plastic to wrap/preserve food for safety, how could we replace it? Not driving? – an interesting goal but difficult in a rural state like maine. etc.)*
* are there any practices that the students have now learned about that they are planning to discuss with their families?

**WAYS TO LIVE MORE SUSTAINABLY**Every day we make choices in our lives that affect the environment, the climate and other species. From what we eat to how many children we decide to have, there's a lot we can do to “choose wild” and reduce our environmental footprint to leave more room for wild animals and plants.http://www.biologicaldiversity.org/programs/population_and_sustainability/sustainability/images/thumbs/ForgetShopping_Flickr_MaretH_200.jpg**1. Think twice before shopping.**“Reduce, Reuse, Recycle” may feel retro, but it's just as important today as when the phrase was first coined. Every product we purchase has an environmental footprint, from the materials used to create it to the pollution emitted during manufacturing to the packaging that ends up in landfills. So before you buy, ask yourself if you *really* need it. If you do, consider buying gently used instead of new, and look for minimal packaging and shipping. Consider your waste stream – is composting an option? Can you buy local and reduce the need to ship food and items long distances?**2. Make sure your big purchases have big environmental benefits.**Not everyone can run out and trade in their old gas-guzzling clunker for the latest planet-friendly hybrid car. And that's not necessarily a bad thing; manufacturing new cars takes a lot of resources too. But if you're in the market for a new car, look for a fuel-efficient model — you'll save thousands on gas money and reduce your carbon footprint over the years. If you're buying a new refrigerator, washer or dryer, look for the Energy Star label to find the most efficient appliances. Need a new water heater? Consider upgrading to solar.http://www.biologicaldiversity.org/programs/population_and_sustainability/sustainability/images/thumbs/PlasticPollution_Flickr_Plastiic_Pollution_200.jpg**3. Ditch the plastic.**Plastic never goes away. Today billions of pounds of it can be found in swirling convergences making up about 40 percent of the world's ocean surfaces. Every year thousands of seabirds, sea turtles, seals and other marine mammals are killed after ingesting plastic or getting tangled up in it. You can start cutting down on your plastic waste in a few simple steps: always bring reusable bags when you shop, ditch one-time use water bottles and avoid products made from or packaged in plastic whenever possible (e.g. select unwrapped produce at the grocery store, shop local, cut down on online shopping.)**4. Boycott products that endanger wildlife.**Products made from animals on the endangered species list are illegal to buy, sell, import or trade in the United States, but if a plant or animal hasn't been listed yet, they can still be harmed for someone's profit. Also, some products harm endangered species by threatening their habitat, from cutting down old-growth forests to using up the water that riparian species need to survive. To avoid contributing to the endangerment of wildlife, shop conscientiously and look for products made from sustainable materials like bamboo and dine at restaurants that refuse to serve imperiled species like bluefin tuna. **5. Pay attention to labels.**http://www.biologicaldiversity.org/programs/population_and_sustainability/sustainability/images/thumbs/Labels_Flickr_photologue_np_200.jpgFrom coffee to fruit to clothing, the number of options out there can get overwhelming — but there are some clear leaders when it comes to minimizing your impact on wildlife and the planet. If you're a coffee drinker, look for “shade-grown” coffee, which is grown while keeping forest habitats intact for migratory birds and other species. Choose Fair Trade certified goods when possible to support companies dedicated to sustainable production and paying laborers a fair wage. Buy organic food whenever possible; it may cost a little more, but it keeps harmful pesticides out of our land and water, protecting farm workers, wildlife and your family.**6. Be water wise.**Skip the bottled water. Bottled water companies try to give tap water a bad name, even though the water from your faucet is practically free and much city water has won quality tests and taste tests against name-brand water. And the extraction of water and production of all those plastic bottles is notoriously harmful to communities and wildlife. Water conservation is also critical, especially as our growing population puts increased demand on the nation's water sources and we face unprecedented droughts. You can conserve water by taking shorter showers, fixing leaky toilets, and choosing low-flow and low-water appliance options. Also, consider xeriscaping your yard, a landscaping technique that uses native, drought-adapted plants that require less water and maintenance over time, and provide habitat and food for birds and bees.http://www.biologicaldiversity.org/programs/population_and_sustainability/sustainability/images/thumbs/Bicycle_Flickr_JasonTromm_225.jpg**7. Drive less, Drive green.**Changing your driving habits can dramatically reduce your carbon footprint. Walk, bike, carpool or use public transportation whenever possible. Combine errands to make fewer trips. Participate in, or start, car-free days in your community. It's also important to keep your car in shape with regular tune-ups and tire inflations. Tune-ups can increase your fuel efficiency by 4 percent to 40 percent, and if every American kept his or her tires inflated, gas use nationwide would decrease by 2 percent. **8. Green your home.**Just as keeping your car in shape improves your fuel efficiency, keeping your home in shape improves your energy efficiency. Make sure your home has adequate insulation and energy-saving windows, and use a programmable thermostat for more efficient heating and cooling — and, of course, energy-saving lightbulbs for more efficient lighting. Many states now offer incentives to help you green your home or rental at low or no cost. Call your energy provider to see if it offers free energy audits or knows of a company that does.**9. Opt for renewable energy.**http://www.biologicaldiversity.org/programs/population_and_sustainability/sustainability/images/thumbs/SolarPanels_Flickr_LivingOffGrid_125.jpgKicking the fossil fuel habit is critical to saving wildlife, slowing climate change and protecting our lands and waters. If your state allows you to pick your electricity supplier, use a Green-e certified company that generates at least half its power from wind, solar and other clean sources. Also explore the options — and tax credits — for installing rooftop solar panels or solar water heating in your home. Depending on your productivity, you can even add clean power to the grid, further offsetting your carbon footprint.**10. Take extinction off your plate: Eat less meat.**Meat production may be one of the most environmentally destructive industries on the planet, responsible for massive amounts of water use, pollution, greenhouse gas emissions and habitat destruction. You have three chances a day to improve the health of the planet — by reducing your meat consumption you can reduce your environmental footprint. Eating locally sourced fruits and vegetables also lowers the amount of fossil fuel used to transport food over long distances. |
| **Teacher Prep**  |  |  |
|  | **Advanced Preparation Steps &****Duration** | 1. Read and consider associated background material and questions for discussion. (30 hour)
2. Review Introduction to Sustainability video clip (2 minutes)
3. Review Sustainability PowerPoint (30 minutes)
 |
| **Needed Materials**  |  |   |
|  |  | 1. Sustainability Lesson Plan
2. Sustainability PowerPoint with embedded video
 |
|  | **Duration of activities** | 60 minutes |
|  | **Safety notes** | N/A |
| **Procedures for instruction** |  |  |
|  |  | Introduce the class to the idea of sustainability.  | ~2 minutes |
|  |  | Sustainability Presentation | ~30 minutes(PowerPoint & embedded video) |
|  |  | In Class Discussion | ~25 minutes |
| **Student workbook** |  |  |
|  | Background Informational Sheet | Reading assignment prior to the lesson day. |

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| --- |
| **Student Background Information Sheet – Sustainability** |
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(Source: modified from “An overview of sustainability assessment methodologies” Singh, et. al, 2009)**Anthropocentric versus Non-Anthropocentric Viewpoints*** **Anthropocentric** – humans are considered to be the center, with other items put on earth for the humans use.
* **Non-anthropocentric**
	+ Humans are not considered the center
	+ Is it possible to have a non-anthropocentric view if the viewer is human?

**Preparation for Class Discussion**Read the following list and consider changes you might make to live a more sustainable life. Bring two of your favorite ideas to class to share with your classmates and teacher.**WAYS TO LIVE MORE SUSTAINABLY**Every day we make choices in our lives that affect the environment, the climate and other species. From what we eat to how many children we decide to have, there's a lot we can do to reduce our environmental footprint.[1. Think twice before shopping.](http://www.biologicaldiversity.org/programs/population_and_sustainability/sustainability/live_more_sustainably.html#shopping)[2. Make sure your big purchases have big environmental benefits.](http://www.biologicaldiversity.org/programs/population_and_sustainability/sustainability/live_more_sustainably.html#purchases)[3. Ditch the plastic.](http://www.biologicaldiversity.org/programs/population_and_sustainability/sustainability/live_more_sustainably.html#plastic)[4. Boycott products that endanger wildlife.](http://www.biologicaldiversity.org/programs/population_and_sustainability/sustainability/live_more_sustainably.html#wildlife)[5. Pay attention to labels.](http://www.biologicaldiversity.org/programs/population_and_sustainability/sustainability/live_more_sustainably.html#labels)[6. Be water wise.](http://www.biologicaldiversity.org/programs/population_and_sustainability/sustainability/live_more_sustainably.html#water)[7. Drive less, drive green.](http://www.biologicaldiversity.org/programs/population_and_sustainability/sustainability/live_more_sustainably.html#driveless)[8. Green your home.](http://www.biologicaldiversity.org/programs/population_and_sustainability/sustainability/live_more_sustainably.html#greenhome)[9. Choose renewable energy.](http://www.biologicaldiversity.org/programs/population_and_sustainability/sustainability/live_more_sustainably.html#energy)[10. Take extinction off your plate: Eat less meat.](http://www.biologicaldiversity.org/programs/population_and_sustainability/sustainability/live_more_sustainably.html#lessmeat)(Source: http://www.biologicaldiversity.org/programs/population\_and\_sustainability/sustainability/live\_more\_sustainably.html) |

**Project Assessment**

**Project Title:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Instructor/School/Grade: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/\_\_\_\_\_\_\_\_**

**Instructor Contact Information: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date you assigned this project to your class: \_\_\_\_\_\_\_ Number of Students Participating \_\_\_\_\_\_**

The following questions are intended to help us understand your feelings regarding the presentation and materials. Your sincerity in answering these questions is appreciated. Please feel free to use the space at the end of the form for any additional comments that you may have. *This form has been left in Microsoft Word format so that you may fill it in electronically. Please fill out the form completely and email your assessment to* david.madore@maine.gov.

**Ranking System**

 1 ~ Excellent / Strongly agree

 2 ~ Good – Above average / Moderately agree

 3 ~ Average – ok / Neutral in agree or disagree

 4 ~ Poor – below average / Moderately disagree

 4 ~ Very poor – not acceptable / Strongly disagree

 NA / not applicable

*Please continue on the second pagee…*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **1** | **2** | **3** | **4** | **5** | **NA** | **Questions** |
|  |  |  |  |  |  | **Course Content** |
|  |  |  |  |  |  | 1. Value of course content to you.
 |
|  |  |  |  |  |  | 1. Importance of course content given your teaching topic.
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|  |  |  |  |  |  | 1. Overall rating of course content.
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|  |  |  |  |  |  | 1. Ease of implementing materials into daily lessons.
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|  |  |  |  |  |  | **Materials/Project** |
|  |  |  |  |  |  | 1. Movie (if applicable) was easy to present.
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|  |  |  |  |  |  | 1. Student worksheet was useful and easy to follow.
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|  |  |  |  |  |  | 1. Student project stimulated thinking & conversation.
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|  |  |  |  |  |  | 1. The project put ideas across effectively.
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|  |  |  |  |  |  | 1. Teacher materials were useful and easy to follow.
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|  |  |  |  |  |  | 1. The method of material presentation encouraged students feel free to ask questions, disagree, express ideas, etc.
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|  |  |  |  |  |  | **Self-Evaluation (Instructor)** |
|  |  |  |  |  |  | 1. What was your level of knowledge concerning this topic prior to this presentation?
 |
| **Please share any recommendations you feel would be helpful.** |

**Thank you for providing your feedback!**

Please email your assessment to david.madore@maine.gov.