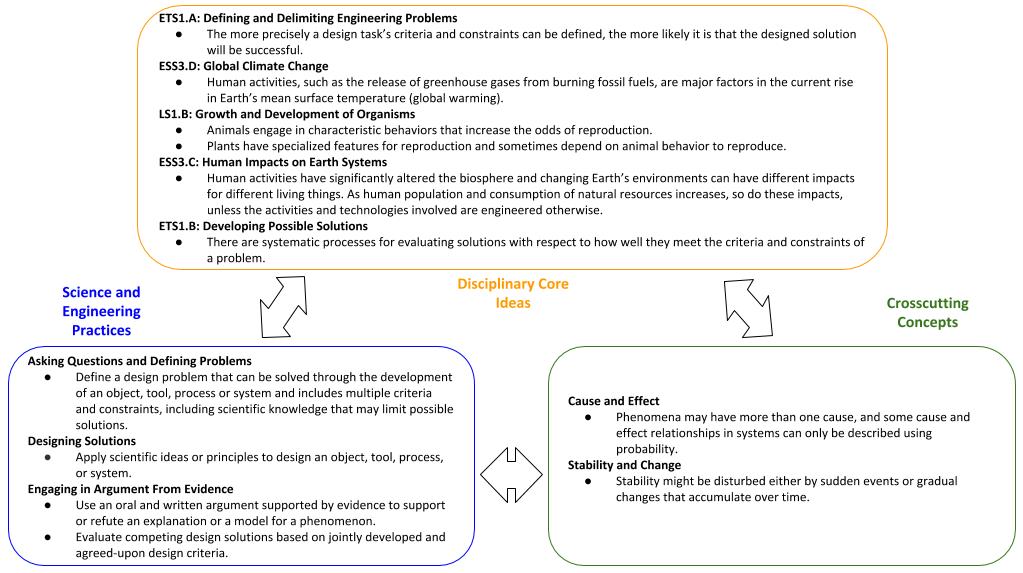
**Unit Essential Question:** *How do humans impact organisms around the world and what can we do about it?*

**Introduction**

In the Lift-Off Task, students saw that bee populations are drastically decreasing. We are seeing these kinds of changes in organisms around the world—changes in population size and even in behavior and in traits. Why is this happening and what can we do about it?

In this culminating project, each group’s task is to pick a plant or animal affected by global warming and then design a method to monitor and minimize this impact. Students have likely seen images or videos depicting very sad stories of animals affected by climate change. While it is certainly sad, there is still hope! As a group, students create an advocacy video that describes the human impact on their organism and gives a potential solution, thus replacing the sad and hopeless type of video we usually see. Individually, they will then compare and evaluate all the different solutions amongst their classmates and present it in the format of their choice (report, poster, powerpoint, video, podcast, etc.).

**3-Dimensional Assessment**

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\*As compared to the other three units, Unit 4 is unique in that it introduces two PEs (MS-ESS3-3 and MS-ETS1-2) in the final project only and not during the tasks themselves. These PEs will be easier for students to engage with in the full context of the project.

**Time Needed (Based on 45-Minute Periods)**

10 days at end of unit

* Group Project: 5 periods (includes 1 presentation day)
* Individual Project: 5 periods
  + First draft: 3 periods
  + Feedback: 1 period
  + Revision: 1 period

**Materials**

Advocacy Video

* Recording Device (phone, computer, camera, etc.)
* Movie Editing Software (Optional)
* Poster Paper (Optional for visuals)
* Color pencils/markers or computer graphics (Optional for Visuals)

Solutions Evaluation

* Depends on choice in format

**Instructions for the Culminating Project**

1. Introduce the Culminating Project at the end of the Lift-Off task, including both group and individual components outlined in the Challenge.
2. Read over the Culminating Project Task Card with the students. We recommend only reading the Challenge and Group Project Criteria for Success at this time in order to not overwhelm students with information.

* Take questions for clarification.

1. We have provided a list of organisms that students may choose from in the Culminating Project Task Card. At the end of this Teacher Version, we also provide a table that gives you relevant information on each organism, sources you may wish to give students as they conduct their own research, and some potential solutions students may come up with.
2. Remind students as they complete the Project Organizer that they will be planning pieces of their advocacy video and recording scientific concepts they will likely need for their individual project. However, there is nothing wrong with going back and changing their ideas over the course of the unit. The students won’t fully develop their advocacy video or solutions evaluation until the end of the unit, so change during the imaginative and creative time is acceptable and often experienced.
3. Make sure the students fill out the Project Organizer after each task, which will help the students think about different parts of their advocacy video or solutions evaluation along the way. This process allows students to both apply and document relevant scientific concepts as they move throughout the unit. This will inform both their group and individual projects.

* We recommend that students complete the Project Organizer individually. They might discuss ideas first as a group, but should then respond individually. This allows students time to process concepts on their own and generate their own ideas, which can be used later when it comes to developing their group project. The one exception to this is for Task 1; at this point, students will need to work as a group to select an organism for their Culminating Project.

1. The table below summarizes how the Project Organizer guides the students through developing different components of their advocacy video (group product) and solutions evaluation (individual product).

|  |  |  |
| --- | --- | --- |
| **Task** | **Project Organizer** | **Group and Individual Culminating Project** |
| **Lift Off**  Bad News for Bees | * Make a hypothesis: What do you think is causing the bee population to decrease? * Do you think other organisms around the world might also be affected by the same cause? How? | N/A |
| **Task 1**  Heating Up | Select an organism for your culminating project.   * Define the **problem**: What is happening to global temperature and why might it be a problem? * Identify the **criteria** for a successful solution: How will you know if a solution addresses the problem? * Identify the **constraints** of solving this problem: What might make it hard to solve this problem? | * Group: A description of the problem, including criteria and constraints. * Individual: A description of the problem, including criteria and constraints. Description cites global warming as the root of the problem, including evidence to support this claim. |
| **Task 2**  It Takes Two | * What specialized structures OR behaviors does your organism have that help it survive and reproduce? Describe how these characteristics specifically help with survival and/or reproduction? | * Group: N/A * Individual: An argument for how all the presented organisms’ behaviors or structures affect their probability for successful reproduction, supported by evidence. |
| **Task 3**  Feeling the Impact | * Summarize the ideas from your poster here.   + Describe the feedback you received from peers and how you plan to revise it based on that feedback. * Return to your criteria and constraints that you identified after Task 1. Based on what you have learned about your organism so far, how can you revise them or add to them? | * Group: A description of the problem, including how the chosen organism is affected. An explanation of a method to monitor or minimize the impact on the organism. * Individual: An argument for how the reproductive behaviors or structures are being affected by rising temperatures, supported by evidence. |

1. After all the learning tasks and the Project Organizer are completed, the students can start to develop their advocacy video. The Project Organizers and Group Project Criteria for Success should be used as reference to remind students to include all the components of their advocacy video.

* As always, we recommend the use of group roles for Culminating Project work time (See “How to Use This Curriculum” for details). We recommend changing the roles every work day.

1. While groups are presenting their videos, we highly recommend students take notes about the videos since they will be evaluating them in their individual project. You may choose to provide them with a graphic organizer to organize their notes. An option is provided at the end of this Teacher Version.
2. Once students have taken notes on all the videos, they are ready to move on to their individual project. Each student will compare and evaluate the different solutions amongst the groups. This can be in the format of their choice but it must meet all the criteria in the student handout. Because students can choose a variety of formats, no optional template is provided. Remind students to reference the *Individual Project Criteria for Success* as they create their Solutions Evaluation.

* Optional: Before students begin their evaluation, you may want to have a class discussion to come to consensus on the criteria and constraints for the human impact problem facing all these organisms. Ask students to consider what they think would make a solution successful and what limitations might constrain a solution.

1. Conduct a peer review of the Solutions Evaluation after students have completed a first draft.

* Copy the Solutions Evaluation Peer Review Feedback form found in the Student Instructions. Another option is to use the Student 3-Dimensional Individual Project Rubric.
* Assign each student a partner, preferably a partner from a different group.
* Students switch drafts and assess them using the peer review feedback form.
  + Remind each student to give one positive comment and one constructive comment for each section on the checklist.
  + Allow students time to present their feedback to their partner, so their partner may ask clarifying questions if needed.

1. After receiving feedback, allow students time to complete a final draft based on the feedback they received.

**Assessment**

The Project Organizer can be formatively assessed using:

* *Criteria of your choice.* We recommend using the 3-Dimensional Assessment matrix from the Unit Overview to inform your criteria.

The Group Culminating Project will be summatively assessed using:

* The *Group Project Criteria for Success* Checklist

The Individual Culminating Project will be summatively assessed using:

* The *3-Dimensional Individual Project Rubric*.
* Keep in mind that the Proficient level indicates that the student has successfully demonstrated understanding of the criteria. Because we are in the early stages of NGSS adoption, it may take multiple opportunities throughout the course of the year for students to reach Proficient.
* If you wish to give students a numeric score, you could take the average score of all of their rubrics or add up rubric scores to give students a summation out of the total. Because of the note above, this scoring may not correlate to traditional grading systems.
* While we recommend scoring all of the project criteria with the rubrics for each student, we understand the burden of that level of scoring.
  + One option is to select the rubrics that you wish to focus on for this project and use those to assess each student’s individual project.
  + Another option is to review the Proficient level of each of the project’s rubrics and use the descriptions to generally analyze all student work for trends.

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| --- | --- | --- | --- | --- |
| **Organism** | **Characteristic that Helps Reproduction** | **How This Is Affected By Global Warming** | **Optional Source** | **Potential Solutions** |
| Magpie Larks | Nesting – Magpie Larks use mud and grass to make nests in trees in order to protect their eggs. | Rising temperatures and decreased rainfall associated with global warming are reducing the availability of mud available to make their nests. Without mud, Magpie Larks are unable to protect their offspring. | * <https://www.bou.org.uk/mainwaring-climate-change-nests/> | * Irrigate the drier areas with water from wetter locations to increase the amount of mud available. |
| Shorebirds | Nesting – Shorebirds build their nests on shore. | Global warming is causing reduced snow cover, which is affecting the populations of various prey for Arctic Foxes. Without their usual prey, Arctic Foxes are feeding on Shorebirds’ eggs in their nests. | * <https://www.birdwatchingdaily.com/news/conservation/increase-shorebird-nest-predation-climate-change/> | * Construct birdhouses that keep eggs safe inside, but still have narrow openings to allow adults in and out to feed offspring. * Construct protected habitats with fences to keep out predators. |
| Finnish Birds | Nesting – Finnish Birds build their nests on arable (farm) land. | Global warming has caused Finnish Birds to shift their breeding time earlier in the season. This means Finnish Birds are building nests on arable land before fields are plowed, so the eggs are destroyed when the fields are plowed. | * [https://www.sciencedaily.com/releases/2018/01/180111100848.htm](https://www.sciencedaily.com/releases/2018/01/180111100848.html) | * Designate a certain percentage of protected land to remain unplowed. * Build a nest-detecting device to attach to the farmers’ tractors. |
| Salmon | Migration – Salmon migrate from the ocean upstream into rivers to find a suitable spot to lay eggs. | Salmon are migrating and spawning earlier because of the warmer temperatures. The changing conditions can make growth and survival more difficult when the babies are born, or migrating animals arrive before their food is available. Global warming is also causing either less river water so it is hard for salmon to migrate, or it is causing extreme storms that wash out spawning locations. | * <https://blogs.ei.columbia.edu/2015/02/03/climate-change-poses-challenges-to-plants-and-animals/> * <https://www.worldwildlife.org/stories/sockeye-salmon-and-climate-change> | * Build a device to help regulate river water temperatures in spawning pools. * Build a device that detects spawning and releases food into river near spawning areas. * Transporting water from wetter locations for water storage. * Construct dams to hold back excess water during extreme weather events. |
| Whooping Cranes | Migration – Whooping Cranes migrate north during the spring for better nest locations with an abundance of food. | They are now migrating earlier in the spring and later in the fall because of warmer temperatures. This poses a risk of getting caught in snowstorms on their migration journey without food. | * <https://phys.org/news/2017-09-climate-affecting-whooping-cranes-migration.html> | * Construct and strategically place birdhouses for early migrators. |
| Hummingbird | Migration – Hummingbirds migrate to breeding grounds during peak flower blooms to have plenty of nectar (food) for their offspring. | Global warming is causing flowers to bloom earlier. Thus, hummingbirds are now arriving at the breeding grounds too late for flower blooms, and thus too late for adequate food for their offspring. | * <https://www.audubon.org/conservation/how-climate-change-affects-hummingbirds-feeding-behavior> * <https://www.climatecentral.org/gallery/graphics/climate-change-risk-to-hummingbirds> * <https://bioone.org/journals/natural-areas-journal/volume-34/issue-2/043.034.0213/Timing-is-Everything--An-Overview-of-Phenological-Changes-to/10.3375/043.034.0213.full> | * Construct and strategically place birdhouses with food inside for late migrators. |
| Caribou | Migration – Caribou migrate south for breeding where there is an abundance of food. | Spring plant growth is now earlier because of warming temperatures. This is happening well before calving, so many calves are dying without adequate food available at the breeding site. | * <https://www.seattletimes.com/seattle-news/environment/5-plants-and-animals-utterly-confused-by-climate-change/> | * Harvesting and storing food for later caribou migration. * Developing a planting protocol that ensures plant growth later in the Spring. * Genetically engineer plants to grow later in the spring. |
| Spider Orchid | Sex Pheromones and Bright Flowers – The Spider Orchid mimics female bees by having bright flowers that look like a bee and releasing a sex pheromone. | Warming temperatures are causing bees to emerge much earlier and the Spider Orchids only slightly earlier. This mismatch between the timing of bees’ presence and the Spider Orchid’s flowering means Spider Orchids are not being pollinated. | * <https://www.theguardian.com/environment/2018/apr/05/climate-change-threatens-rare-british-orchid-that-tricks-bees-into-mating> * <https://www.theguardian.com/environment/2014/nov/06/climate-change-is-disrupting-flower-pollination-research-shows> | * Introducing other insects that can pollinate the Spider Orchid. * Artificial Pollination. |
| Lilac | Bright Flowers – The Lilac attracts pollinators with its bright flowers. | Warming temperatures are causing Lilacs to bloom earlier. The insects that eat them are thus plentiful earlier, so by the time birds arrive for breeding season, there are not enough insects for the birds to eat. | * <https://www.thoughtco.com/spring-phenology-and-global-climate-change-1203890> | * Construct and strategically place birdhouses with food inside for migrators. * Developing a planting protocol that ensures lilac growth later in the Spring. * Genetically engineer lilacs to grow later in the spring. |
| Glacier Lily | Bright Flowers: The Glacier Lily has bright flowers to attract hummingbirds. | Warming temperatures are causing Glacier Lilies to bloom earlier, before the hummingbirds arrive. This affects pollination for the Glacier Lily and a food source for the hummingbird. | * <https://www.aaas.org/hummingbirds-lilies-thrown-climate-change> * <https://bioone.org/journals/natural-areas-journal/volume-34/issue-2/043.034.0213/Timing-is-Everything--An-Overview-of-Phenological-Changes-to/10.3375/043.034.0213.full> | * Artificial Pollination for the Glacier Lily. * Construct and strategically place birdhouses with food inside for hummingbirds. |

**Advocacy Video Notetaker**

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| --- | --- | --- | --- |
|  | **Organism** | **Notes** | **How well does the solution meet the criteria and constraints of the problem? Could this solution work for my organism?** |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
|  | **Organism** | **Notes** | **How well does the solution meet the criteria and constraints of the problem?** |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |
|  | **Organism** | **Notes** | **How well does the solution meet the criteria and constraints of the problem?** |
| 7 |  |  |  |
| 8 |  |  |  |
| 9 |  |  |  |