## Summer Institute for Teachers 2022 - Industrial Farming

**<u>Warm Up</u>: Brainstorm what you believe industrial agriculture looks like. Is there a lot of biodiversity? How do plants get nutrients/water? How are farm workers treated?**

**<u>Taro Farming Video</u>: During the video, jot down any notes you have on how industrial farming impacts traditional ways of life for Indigenous peoples. How can we use this information and relate it to our communities? What kind of impacts can be seen/who is being the most impacted?**

**<u>Main Activity</u>: You will be assigned an ecological impact of industrial agriculture. Once you have your impact, read the section of the environmental impact sheet (attached to this worksheet) that matches your ecological impact then complete a flowchart linking industrial crop production, ecological impacts, and human health. You can choose to work alone or with another teacher with the same ecological impact. Complete your flowchart in the space below and be prepared to share your ideas with the group.**

Example: Ecological impact - decrease in bee population
1. Pesticide use on crops kills insects → Bees that pollinate crops are exposed to pesticides and die → Decrease in bee populations

2. Decrease in bee populations → Fewer bees to pollinate crops → Crop yields decline → Food prices rise → Low-income populations are unable to afford enough food → Rise in malnutrition

**Environmental Impacts Information:**

**Agriculture is built upon fertile soil, a favorable climate, ample freshwater, a diversity of plant and animal species, and the skills and labor of farmers and farm workers. These are the ecological foundations of our food system. They are also endangered by depletion, disruption, or disease. Finding ways to better preserve the health of agricultural ecosystems is key to the long-term sustainability of our food supply.**

1. **SOIL (Ecological impact: soil erosion)**
    - Far from being lifeless dirt, fertile soil is teeming with organisms, including worms, arthropods, bacteria, fungi, and plant life. The decaying (and fully decayed) remains of these and other organisms, and their excrement, make up the part of soil called organic matter. The remaining mineral fraction of soil is composed of sand, silt, and clay. Building and maintaining healthy soil requires care on the part of farmers.

    - Throughout history, farmers have mismanaged this essential resource, sometimes with catastrophic results. Plowing soil and compacting it (e.g., by driving over it with heavy machinery), for example, can make soil more prone to erosion—the removal of soil by wind, rain, and other forces. Erosion is particularly damaging because the top layer of soil (topsoil) is richest in organic matter (organic matter and the organisms that live in it are a big part of why soil is fertile). Erosion can also contribute to water pollution by transporting pesticides and excess nutrients into

nearby streams and rivers. On much of the world's agricultural land, fertile soil is still being eroded much faster than it can be restored by natural processes.

2. **FRESHWATER (Ecological impact: depletion of groundwater)**
    - Growing crops and raising animals for food depend on a reliable supply of freshwater. This resource is surprisingly scarce: of all the water on Earth, only 2.5 percent is freshwater; the rest is salty. The vast majority (99 percent) of freshwater is locked in glaciers, icecaps, or below ground, and is mostly unavailable. The remaining amount—a tiny fraction of all the water on Earth—is responsible for serving most of our water needs.

    - Where rainfall is inadequate, farmers draw from rivers, lakes, reservoirs, wetlands, and groundwater to supply crop fields with freshwater. An estimated 17 percent of global agricultural lands are irrigated, and crop irrigation accounts for an estimated 90 percent of global freshwater consumption.

    - In many parts of the world, freshwater supplies are being depleted much faster than natural processes can restore them. Some aquifers (naturally occurring underground water reservoirs) are already being depleted due to industrial agriculture - mostly because of corn crops which require a lot of water. While water is a renewable resource, it could take hundreds or even thousands of years for these aquifers to naturally replenish.

3. **PESTICIDE USE (Ecological impacts: decrease in bee populations & emergence of pesticide-resistant weeds)**
    - Pesticides are used with the intent of killing a target organism (pest), such as an insect, plant, or fungus that interferes with a food crop. Pesticides often have unintended effects on other, non-target organisms. Some pesticides are non-toxic to humans, while others are highly toxic. Some pesticides persist (do not break down) in the environment, remaining toxic to people and wildlife for many years.

    - People may be exposed to pesticides by breathing or touching them (e.g., while working on a farm where pesticides are sprayed), drinking contaminated water, or eating produce with pesticide residues. Depending on the pesticide, exposure may increase people's risk for certain cancers and problems with their reproductive, immune, endocrine (hormone regulation) , and nervous systems. Over time, pests may develop resistance to the chemicals used against them. When this happens, farmers may apply more (or different) pesticides to achieve the desired result, worsening the potential dangers posed by their use.

    - Many studies suggest insecticides are contributing to recent and dramatic declines in honey bee populations—a global phenomenon called colony collapse disorder

(CCD). Recent surveys indicate that roughly 30 percent of U.S. honey bee colonies are lost each winter, in part due to CCD.

4. **NUTRIENT POLLUTION (Ecological impact: aquatic dead zones)**
    - To provide crops with nutrients for growth, farmers often apply fertilizers such as synthetic nitrogen, minerals, animal manure, or human sewage. The use of human and animal excrement as fertilizer is an ancient method of recycling organic matter, transforming waste into food. But when more fertilizer or manure is applied than plants can use, the excess nutrients become “too much of a good thing,” seeping down into groundwater or being carried into nearby waterways by runoff (the flow of water, e.g., rain or irrigation water, over land).

    - Nutrient pollution in aquatic ecosystems can stimulate algal blooms—rapid accumulations of algae. After the algae die, bacteria feed on the decomposing remains, using up oxygen from the water. This process can create dead zones—underwater regions where oxygen levels are too low for most plants and animals to survive. Globally, the number of dead zones has roughly doubled every decade since the 1960s. A dead zone in the Gulf of Mexico, largely a result of fertilizer and manure runoff from corn and soy fields in the Midwestern United States, reaches the size of the state of New Jersey at times of the year.

    - Nutrient pollution can also impact health. Drinking groundwater contaminated with high levels of nitrate (a form of nitrogen, an important crop nutrient) has been linked to reproductive problems, diabetes, thyroid conditions, and blue baby syndrome—a potentially fatal condition among infants.

5. **FOSSIL RESOURCES (Ecological impact: depletion of phosphorous & fossil fuels)**
    - Fossil fuels have been widely used in agriculture only since the early 1900s, with the invention of mechanized tractors and synthetic (human made) nitrogen fertilizers. These resources are called “fossil” fuels because they are made from the decayed remains of prehistoric life.
    - Today, over half of the global energy use for commercial agriculture is attributable to manufacturing synthetic nitrogen fertilizers. Fossil fuels are also used in manufacturing pesticides, powering irrigation systems, and transporting goods to and from farms
    - Fossil fuels are not a renewable resource - once they are gone, they’re gone forever and we are estimated to be near peak oil (the point at which their extraction declines). As fossil fuels become more scarce, their prices will rise which will lead to higher prices for food & more people going hungry
    - Phosphorus, a nutrient necessary for plant growth, is present in animal manure and other sources. Like oil, phosphorus can also be obtained from the buried remains of once-living organisms.

- The value of phosphorus as an agricultural fertilizer is illustrated by the extraordinary efforts made to obtain it. By the 1800s, England had dug up the phosphorus-rich skeletal remains of countless soldiers from European battlefields, to be ground up and applied to farm fields. Today, commercial sources of phosphorus are obtained by mining phosphate rock—a nonrenewable resource estimated to be depleted in 50 to 100 years.

**Supplementary information on farm workers:**
**FARM WORKER HEALTH**

- U.S. agriculture depends on an estimated 2.5 million hired farm workers. Hired farm workers are distinct from farmers, who manage the farm and are usually self-employed.38 Farm workers are often hired for part of the season to help with labor-intensive tasks such as harvesting, washing, and processing fruits and vegetables.

- U.S. farm workers face particularly high risks of toxic exposure to pesticides, particularly when pesticides drift (are blown by wind) away from where they are sprayed.39 Workers in crop production also suffer 80 percent more injuries compared to the national average for private industries.40 Only one in 10 seasonal farm workers claims the ability to read or speak English fluently, potentially increasing their risks of pesticide exposure and injury (e.g., if they are unable to read warning labels).

Information provided by Johns Hopkins Center for a Livable Future - food systems primer