Sustainability NOW

Student Workbook

UC SANTA CRUZ
Educational Partnership Center
Creating college-bound communities

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GEAR UP
I'm Going To College
Educational Partnership Center

Unit 1: What is Sustainability?

What is sustainability? And why do we need it now?

Sustainability is the ability to preserve and maintain diverse biological systems and resources indefinitely. In other words, sustainability is about the preservation of resources.

You may saying to yourself, that's a big idea—and you're right. It's a broad concept that applies to many issues in our society.

As you will learn over the course of these units, matters of sustainability affect everyone in a variety of ways.

Group Discussion Exercise:

What happened to the population of fish in the lake when the fisher was given more tools to fish?

As our global population increases, and new technologies and tools make fishing easier, do you think this can do more harm than good? Why or why not?

Individual Reflection: What does sustainability mean to you?

Unit 2: Climate Change

Understanding Climate vs. Weather

NASA defines **climate** as "conditions over the long term and over an entire region." **Climate** "is the big picture of temperatures, rainfall, wind and other conditions over a larger region and a longer time than weather."

Weather, on the other hand, is defined as "local and temporary," meaning that it occurs infrequently and over shorter periods of time.

Check out these examples from NASA:

- The weather was rainy in Phoenix, Arizona, last week. But this city usually gets only about 7 inches of rain each year. So the climate for Arizona is dry.
- Much of Southern California also has a dry, desert climate.
- Brazil has a tropical climate, because it's warm and it rains there a lot.

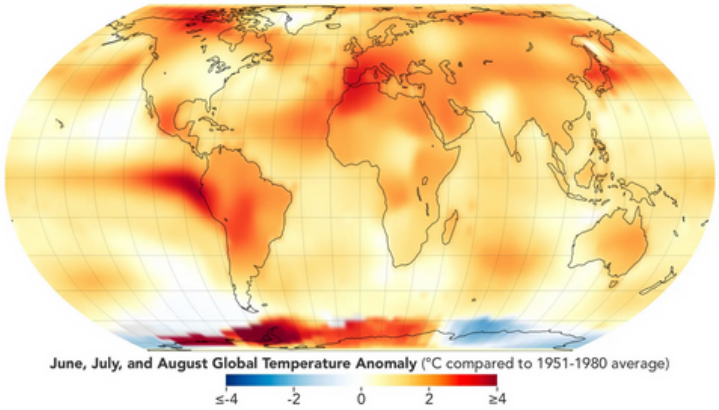
Think of climate as a pattern or trend, and weather as an individual, isolated incident. There is a big difference!

Unit 2: Climate Change

So is the Earth getting warmer?

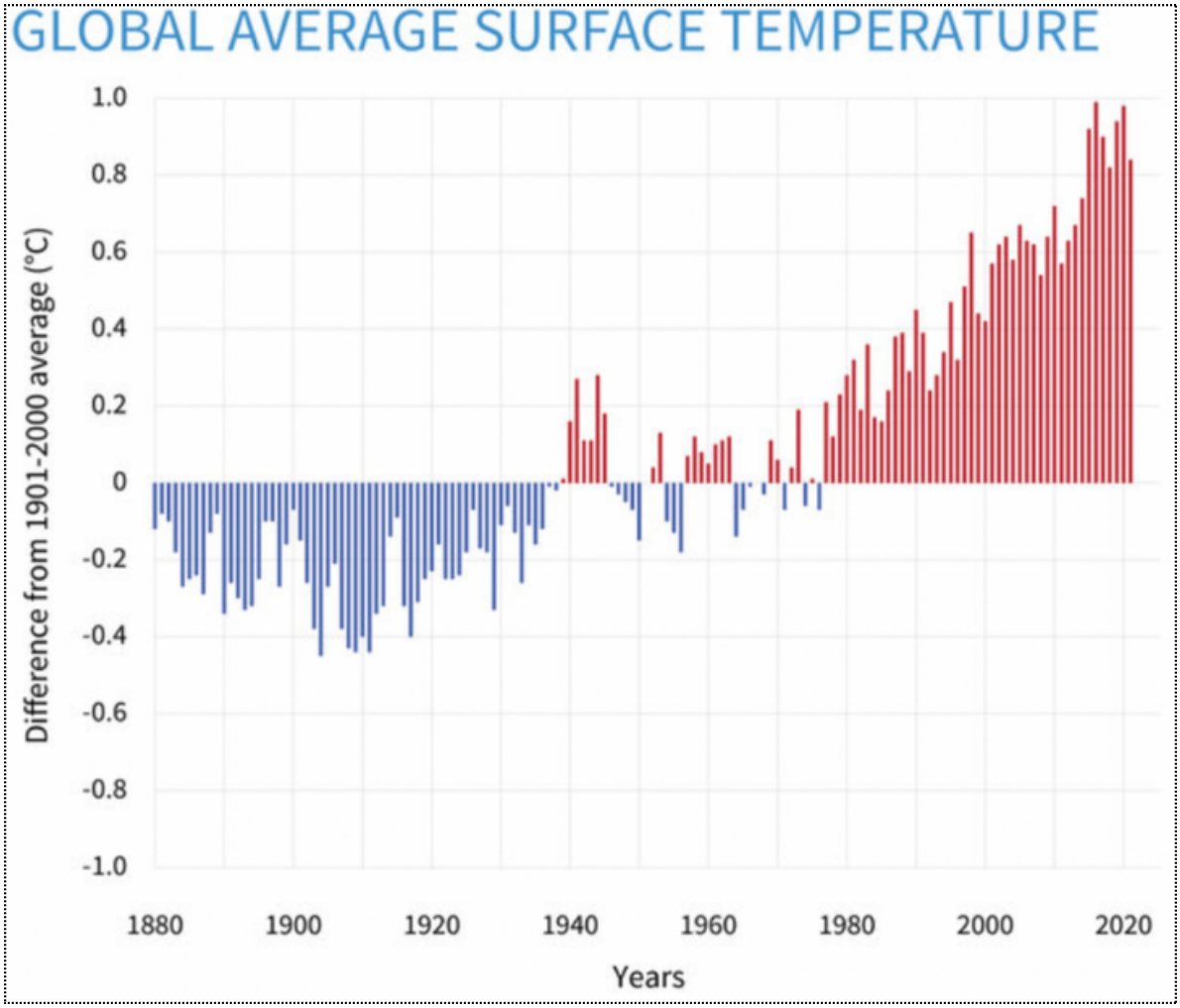
The answer is a resounding yes.

NASA recently announced that the summer of 2023 was the hottest on record!



This map depicts global temperature anomalies for meteorological summer in 2023 (June, July, and August). It shows how much warmer or cooler different regions of Earth were compared to the baseline average from 1951 to 1980. Credit: NASA's Earth Observatory/Lauren Dauphin

2023 is not an isolated incident. Remember, NASA defines climate as "conditions over the long term and over an entire region." These dire conditions are demonstrated by the chart below.



Unit 2: Climate Change

Why does it matter?

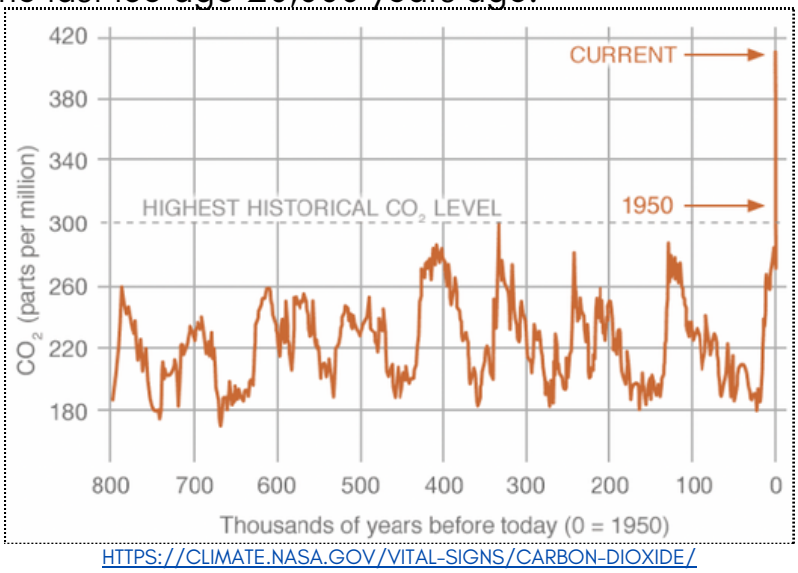
There is only one Earth—our livelihoods, families, and futures are at stake.

As NASA reminds us, "Earth has its own control system. The oceans, the land, the air, the plants and animals, and the energy from the sun all affect each other to make everything work in harmony. Nothing changes in one place without changing something in another place. The overall effect gives us our global climate."

Climate Change Facts & Figures

Carbon dioxide (CO2) is an important heat-trapping gas, or **greenhouse gas**, that comes from the extraction and burning of fossil fuels (such as coal, oil, and natural gas), from wildfires, and from natural processes like volcanic eruptions.

Since the beginning of the industrial era (in the 18th century), human activities have raised atmospheric CO2 by 50%, meaning the amount of CO2 is now 150% of its value in 1750. This is greater than what naturally happened at the end of the last ice age 20,000 years ago.



HTTPS://CLIMATE.NASA.GOV/VITAL-SIGNS/CARBON-DIOXIDE/

Individual Reflection:

- What happened when you selected the **allow increased CO2 emissions** option? Is that option or choice sustainable? What are some real-life examples of allowing increased CO2 emissions?

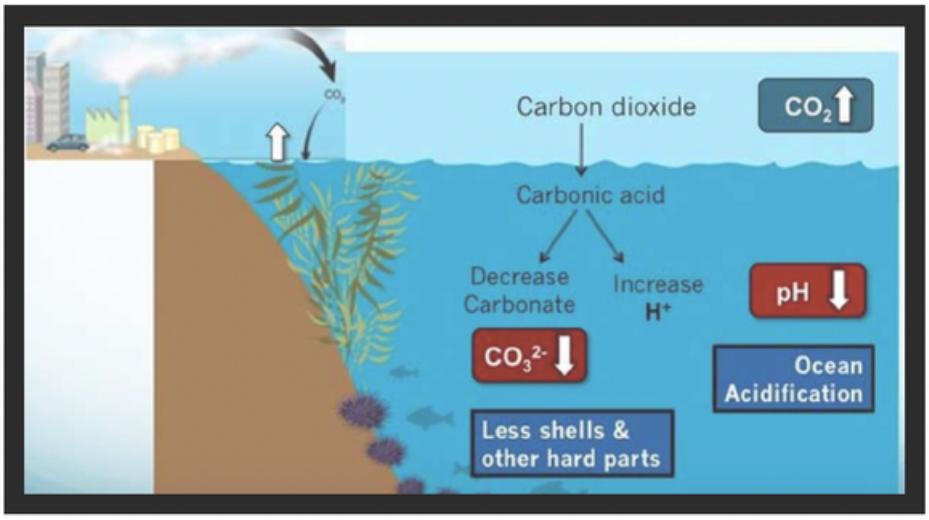
- What happened when you selected the **level off CO2 emissions** option? Is that option or choice sustainable? What are some real-life examples of leveling off CO2 emissions?

- What happened when you selected the **reduce CO2 emissions** option? Is that option or choice sustainable? What are some real-life examples of reducing CO2 emissions?

- What do you think we should we do when considering these options? Is there only one correct response?

The local impact of climate change

According to the Monterey Bay National Marine Sanctuary (MBNMS), the effects of climate change are already visible in our local environment. One of these effects is **ocean acidification**. MBNMS explains that "as we burn fossil fuels from cars and factories on land, CO2 is released into the atmosphere and the ocean absorbs about one third. This CO2 then reacts with seawater to form carbonic acid and releases H ions, which lowers pH and makes the ocean more acidic. The H ions pull away carbonate ions to form bicarbonate, making carbonate ions less available to organisms to form CaCO3 shells and hard parts" (MBNMS Resource Issues: Climate Change).



As you will learn in your lab, dry Ice is a solid form of carbon dioxide that is helpful in visualizing this process. When a solid changes to a gas, the process is called **sublimation**. What does this mean for wildlife and oceanic food sources?

Carbon dioxide is heavier than air, so our oceans absorb the excess CO2, which is converted to **carbonic acid**. You may be asking yourself, so what? What impact can this possibly have on Monterey Bay?

Unit 2: Climate Change

Check out the following excerpt from an article by Virgina Hennessey, a reporter for the Herald, entitled "Monterey Bay Affected by Climate Change":

The trickle-down effect of climate change can be seen from the highest Sierra peaks to Monterey Bay. Melting glaciers in the mountains contribute to sea levels that have risen an average of 7 inches along the California coast over the past century [...] Meanwhile, warming temperatures seep up the food chain, shifting the populations of krill, snails and small fish needed to sustain the populations of larger fish and marine mammals [...] MBARI scientist Francisco Chavez was instrumental in research into the ocean's increasing acidity due to absorption of carbon dioxide. Chavez's research showed the coastal waters of Monterey Bay have increased in acidity since 1993 at a rate greater than the open ocean near Hawaii [...] Chris Scholin, president of MBARI, said the bay's acidity is exacerbated by up-welling of older, nutrient-rich and oxygen-poor water." Over time, he said, "as the ocean becomes more acidic, it can upset certain metabolisms in animals and impair calcification," the process that builds animals' shells and coral reefs [...] The problem is already having a commercial impact on the West Coast, he said, where poor calcification has affected young oysters in aquaculture operations.

Some more food for thought (climate change's impact on local agriculture):

- "Risky Business: The Economic Risks of Climate Change in the United States - A Climate Assessment for the United States," found that 80% of California's GDP comes from coastal counties.
    - The report projects a significant rise in sea levels by the year 2100, a rise that could wipe out 80% of the state's economy.
- "Agriculture contributes over $4.49 billion per year to Monterey County's economic output, with a total estimated impact of over $8.1 billion on the local economy." Additionally, "nearly 1 in 4 households relies on income related to agriculture" (Facts, Figures & FAQs).

Unit 3: Population Growth

We face serious challenges with population growth. After all, Earth is a system of living organisms that are interdependent, meaning that we are all affected by population growth. Earth does not have the capacity to continue to provide us with resources for food and energy indefinitely.

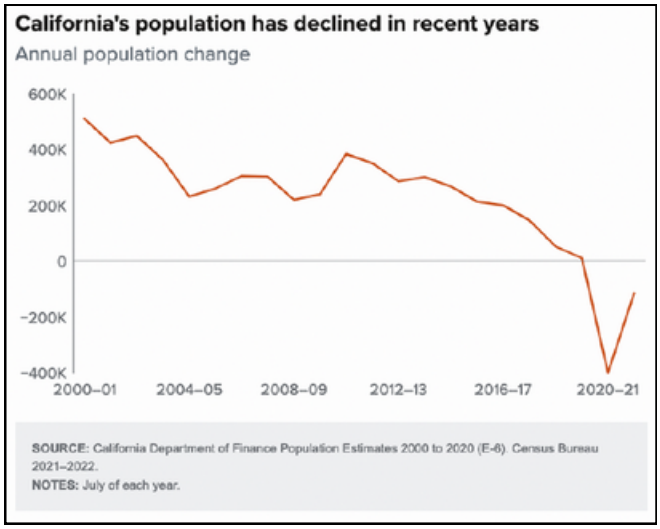
Population Growth Facts and Figures

Global

- Global population is projected to reach 8.5 billion by the year 2030 (United Nations, 2022).
- Diminishing resources, and the scarcity of vital natural resources like water, are of major concern. The World Economic Forum rated this threat as second "to 'major systemic financial failure'" (Winston, 2014).

Local

- The Public Policy Institute of California acknowledges that "with over 39 million people (according to 2022 Census Bureau estimates), California is the nation's most populous state."
- The California Department of Finance projected in 2022 that the state's "population will reach almost 42 million by 2030" but those projections have been impacted by the COVID-19 pandemic.
- While the growth rate has stalled, California's population is "the eleventh youngest in the nation" and future growth is expected.



Group Discussion Exercise:

When did you notice the most growth in global population? Identify 3 events, scientific/technological innovations, and social changes that contributed to rise in global population.

Unit 4: Technological Automation

While advances in technology can positively impact our lives, they can also be harmful to the way that our society currently operates.

For example, there are many careers that can be negatively affected by the rise of artificial intelligence and technological automation. But there is hope! In this unit, we'll cover the impacts of technological automation on jobs and industry sectors.

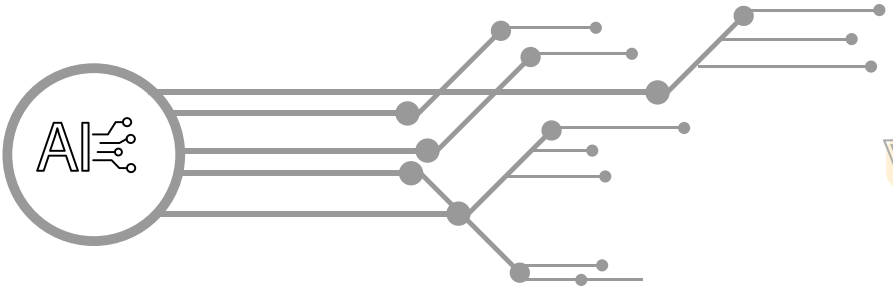
Facts & Figures

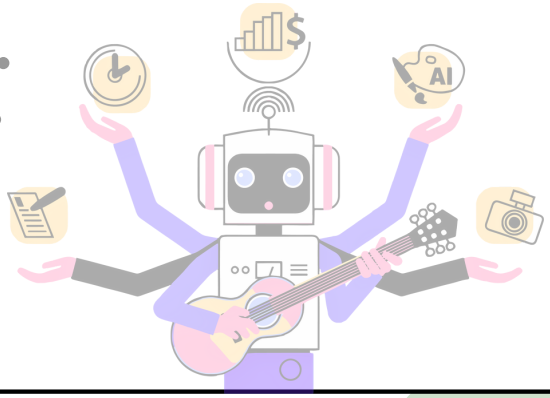
Global

- The US Government Accountability Office states that "workers with lower levels of education and who perform routine tasks—think cashiers or file clerks—face the greatest risks of their jobs being automated. Automation is likely to have widespread effects. Researchers estimate that anywhere from 9% to 47% of jobs could be automated in the future" (2022).

Local

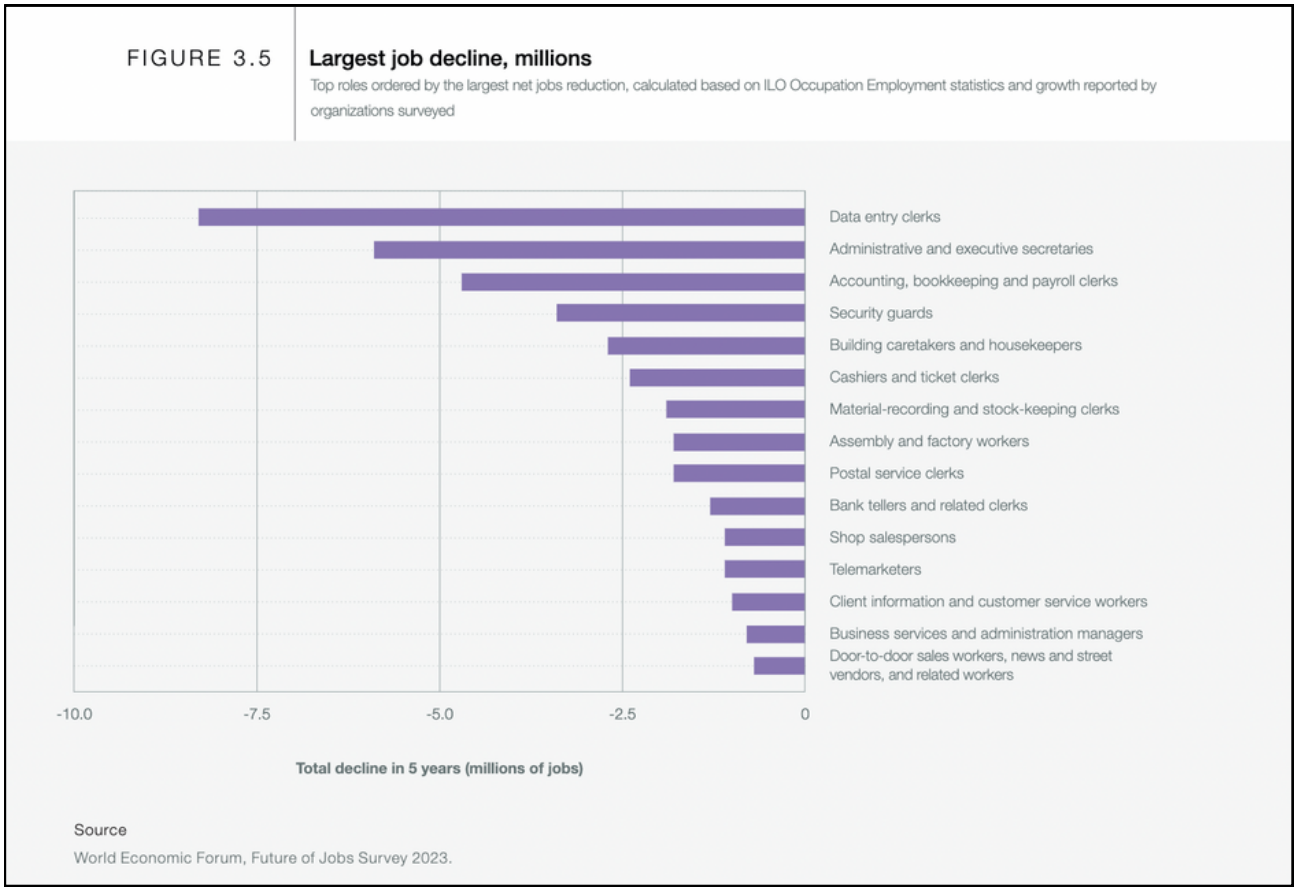
- Self-driving tractors and harvesting robots are the latest iteration of the global agricultural-technology revolution that could lead to the displacement of farm workers. Our state is developing and testing much of this technology." The maker of one such robot claims that it can "produce as much as a human being with 95% accuracy" (Sainato, 2022).
- Additionally, labor shortages further contribute to the advancement of automation.





Unit 4: Technological Automation

The World Economic Forum's *Future of Jobs Survey* reveals more detail on what jobs are most at risk of automation, as shown below:



Research & Respond

Navigate to this online tool to discover the risk of automation for a future occupation of your choosing and answer the following questions:

- What is the automation risk of your chosen occupation? Is this concerning? Why or why not?

- What are the resilient alternatives to your chosen occupation?

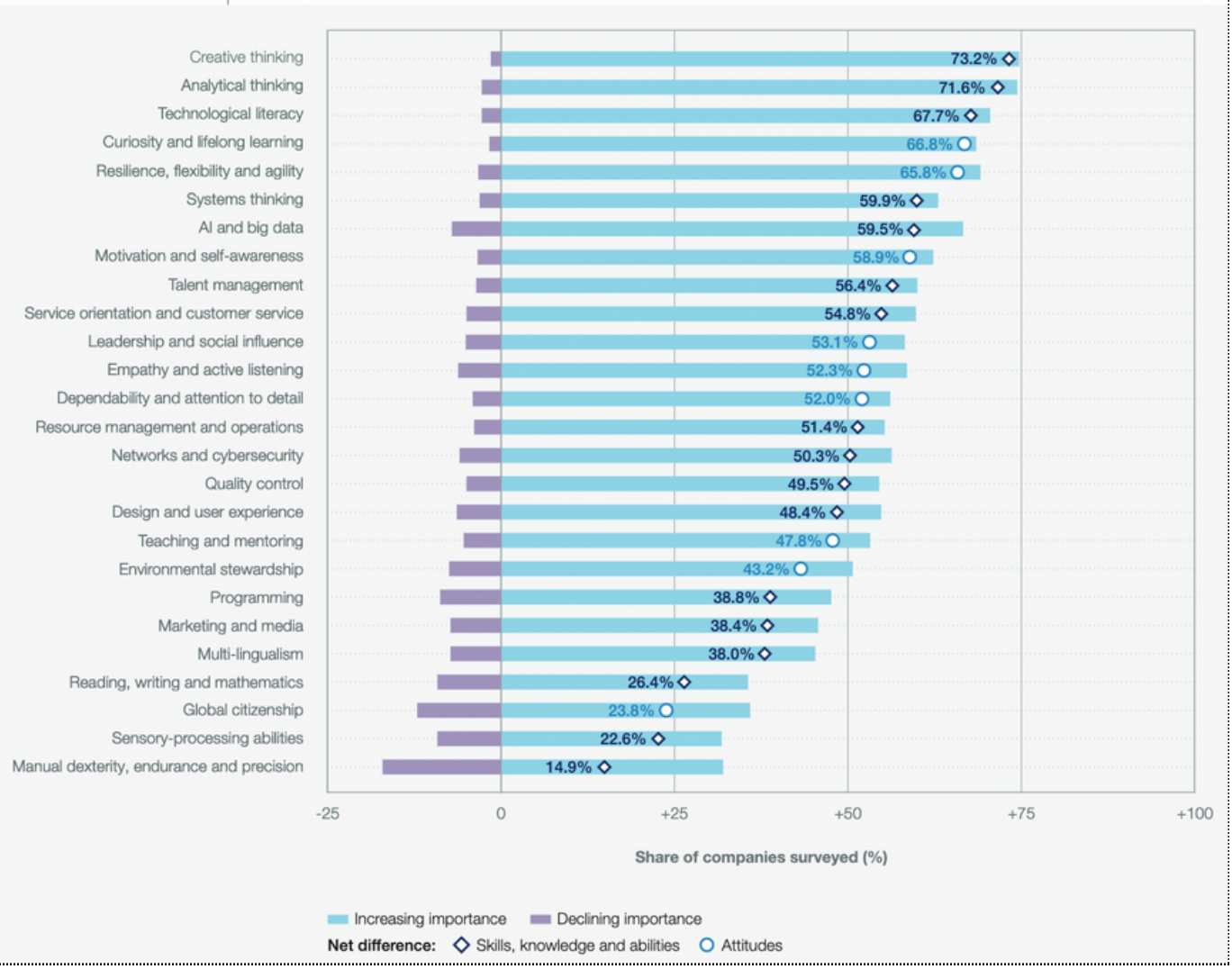
Unit 4: Technological Automation

While the risk of automation can be alarming, the World Economic Forum estimates that "by 2025, technology will create at least 12 million more jobs than it destroys, a sign that in the long run, automation will be a net positive for society" (Nunes, 2021).

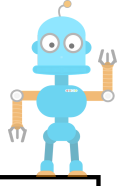
Examine the chart below to identify skills that employers deem most important in our rapidly evolving society.

FIGURE 4.3 **Skills on the rise**

Share of organizations surveyed which consider skills to be increasing or decreasing in importance, ordered by the net difference.



Unit 4: Technological Automation



According to the World Economic Forum's *Future of Jobs Survey*, large-scale job growth is expected alongside the rise of automation, despite job losses in administrative roles and in traditional security, factory and commerce roles.

Employers estimate that 44% of workers' skills will be disrupted in the next five years--meaning that in order to thrive in this evolving job market, we need to be adaptable and learn new skills.

Analytical thinking and creative thinking are the most important skills for workers, followed by technological literacy. A lot of skills will be desired in this new economy, which means we all have time to consider our strengths and chart a path forward in a career field of our choosing.

Think about the information you have learned in this unit. Review the prompts below, discuss your thoughts with your classmates, and respond to the questions individually in your workbook.

- What skills can you bring to an evolving job market? What are your strengths?

- Do you think education and training will be important in the future to secure a job in the career field that most interests you? Why or why not?

- Are you concerned about the rise of artificial intelligence and technological automation? What can we do as a society to ensure that no one gets left behind?

Unit 5: Finding Your Voice

Over the course of the preceding units, we have learned about the concept of sustainability, the implications of climate change, population growth, and technological automation. We've explored threats and opportunities on a global and local level.

It's clear that we are at a critical juncture that requires collaboration and cooperation on environmental, social and economic levels. While the challenges may seem too big, or too daunting, there is reason for hope and optimism.

Even in the midst of outlining several challenges, the authors of the Global Risks Report acknowledge that "the shift to clean energy could create a substantial increase in net employment." There's also evidence in the private sector that consumers will purchase green products when price equity is achieved. The sheer innovation witnessed over the past 10 years with the rise of electric vehicles and energy efficient appliances is evidence of a foundation from which to build.

So where do we go from here?

It's not too late to reverse course and mitigate risk. Whatever steps we take now will lessen the impacts on future generations. But it will take all of us! In order to act, we need to find our voice.

The issues we are facing today are complex—but evidence suggests that the pieces are in place to capitalize on this challenge and emerge stronger than ever before. The question is, are you up for the challenge?

On the next page, you'll have a chance to learn more about the world's top 5 climate activists.

Unit 5: Finding Your Voice

Review this article in Sustainability Magazine to learn more about the world's top 5 youth climate activists & watch Greta Thunberg's address at the UN Climate Action Summit.

Leah Namugerwa

Anuna De Wever

Jerome Foster II

Haven Coleman

Greta Thunberg

Ways to get involved:

- Speak up! Share your views and sustainability/climate change content through social media to generate awareness and buy-in toward solutions!
- Join climate-related groups and movements (on a global and/or local level).
- Demand that your school, community, city, or country embrace sustainability and concrete solutions toward a more just and healthy environment for all.
- Join the United Nations' #ActNow campaign for climate action and sustainability.
- Join YOUNGO, a global network of children, youth activists, and youth NGOs on climate change.
- Keep learning!
  - #Youth4ClimateLive Educational Toolkit
  - The Climate Reality Project

Unit 5: Finding Your Voice

Individual Reflection:

Based on the information provided in the ecological footprint assessment, please list 3 three ways that you can reduce your footprint and when you will make these changes (ex. in a week, over the next month, etc.).

What does **sustainability** mean to you?

What specific steps are you planning to take to address sustainability issues on a local level?