

# Sustainability NOW





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A digital version of this curriculum can be found here: <https://sites.google.com/ucsc.edu/sustainabilitynow>



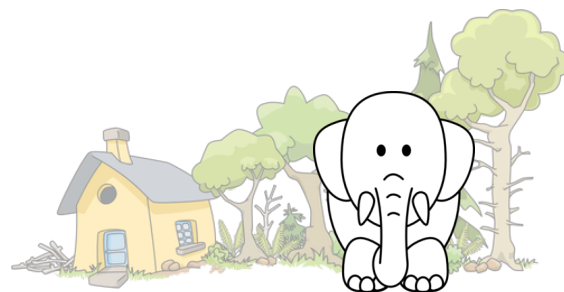
# Unit 1: What is Sustainability?

So, what is '**Sustainability**'? And why do we need it 'NOW?'

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

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

Naturally, "like an elephant spied through the woods, whatever part is glimpsed often dominates the perspective" (McNall, et al., 2011, p.3).



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

## Group Discussion Exercise

1. What happened to the population of 'fish' in the lake when the fisher person was given more tools to fish?
2. As our global population increases and new technologies/tools make processes like fishing easier, do you think this can do more harm than good? Why or why not?

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**Individual Reflection: What does 'sustainability' mean to you?**

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**NOTES:**

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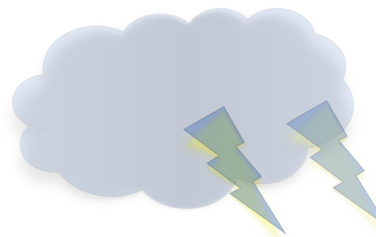
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## Unit 2: Climate Change

*"Whether you live in California, Texas or Timbuktu,  
climate change is real and it's long past time for action"*  
Gov. Jerry Brown



### Climate vs. Weather

NASA defines **climate** as "conditions over the long term and over an entire region" ("NASA Climate Kids," n.d.).

**Think big.** **Climate** "is the big picture of temperatures, rainfall, wind and other conditions over a larger region and a longer time than weather" ("NASA Climate Kids," n.d.).

**Weather**, on the other hand, is "local and temporary," ("NASA Climate Kids," n.d.), meaning that it occurs sporadically and is a singular event, as opposed to climate which identifies an overall pattern.

Check out this example from NASA:

- For example, 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 rains there a lot ("NASA Climate Kids," n.d.).

### So is the Earth getting warmer?

The answer is a resounding **YES**. From the enactment of global initiatives like the Paris Agreement, and the rise of more 'green' and 'renewable' products and sources of energy, we're witnessing an increasing level of awareness about matters of sustainability and climate change.

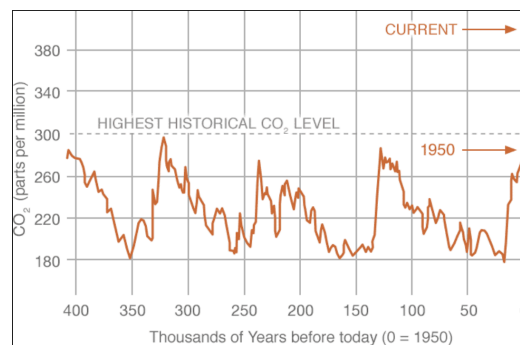


### But why does it matter?



#### **Climate Change Facts & Figures**

- 90% of the hottest years on record in the past two decades (Basile, 2013)
- The average “global carbon dioxide concentration has risen by 38% from the pre-industrial level, and almost all is due to human emissions” (Basile, 2013).



<https://climate.nasa.gov/vital-signs/carbon-dioxide/>

There is one earth—our livelihoods, our families, our 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**” (“NASA Climate Kids,” n.d.).

### Individual Reflection:

- What happened when you selected the ‘Allow Increased CO<sub>2</sub> Emissions’ option? Is that option or choice sustainable? What are some real-life examples of ‘Allowing Increased CO<sub>2</sub> Emissions’?
- What happened when you selected the ‘Level off CO<sub>2</sub> Emissions’ option? Is that option or choice sustainable? What are some real-life examples of ‘Leveling off CO<sub>2</sub> Emissions’?
- What happened when you selected the ‘Reduce CO<sub>2</sub> Emissions’ option? Is that option or choice sustainable? What are some real-life examples of ‘Reducing CO<sub>2</sub> Emissions’?
- Is there a correct answer with respect to these options? What should we do?



i.

ii.

iii.

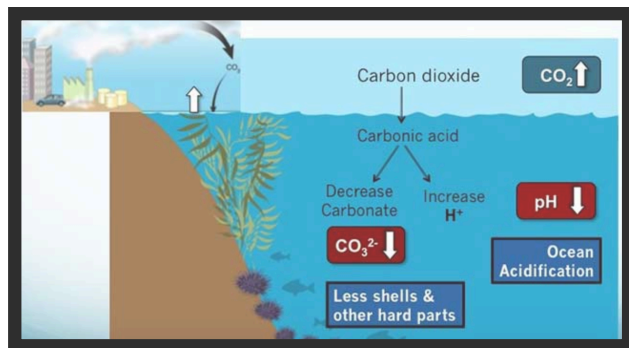
iv.

So, what's the **local impact** of Climate Change?

According to the Monterey Bay National Marine Sanctuary (MBNMS), the effects are 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, CO<sub>2</sub> is released into the atmosphere and the ocean absorbs about one third. This CO<sub>2</sub> 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 CaCO<sub>3</sub> shells and hard parts" ("MBNMS Resource Issues: Climate Change," n.d.).

**Figure 2.1** on page 7 illustrates this process.

Dry Ice is a solid form of carbon dioxide. When a solid changes to a gas, the process is called sublimation. And what does this mean for wildlife and oceanic food sources?



**Figure 2.1**

Carbon dioxide is heavier than air, so our oceans absorb the excess CO<sub>2</sub>, which is converted to carbonic acid. You may be asking yourself, so what? What impact can this possibly have on Monterey Bay?

Check out an excerpt from an article by Virginia 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 [...]*

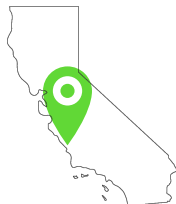
*Chris Scholin, president of MBARI, said the bay's acidity is exacerbated by upwelling of older, nutrient-rich and oxygen-poor water. "Over time," he said, "as the ocean becomes more acidic, it can upset certain metabolisms in animals and impair calcification," the process that builds animals' shells 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 (Hennessey, 2013).*





Some more **food for thought** (Climate Change's Impact on *Local* Agriculture):



### More Local Impacts

"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 (n.d., p.38).

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 ("Risky Business" n.d., p.38).

"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" (Facts, Figures & FAQs, n.d.). Additionally, "nearly 1 in 4 households relies on income related to agriculture which supports 76,054 jobs" (Facts, Figures & FAQs, n.d.).

### NOTES:




# 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, as earth is our shared environment. Earth does **NOT** have the capacity to continue to provide us with it's resources for food and energy indefinitely.

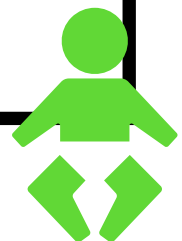
## Population Growth Facts and Figures

### **Global**

- Global population is projected to reach 8.4 billion by the year 2032 (Basile, 2013).
- On a global scale, diminishing resources and the scarcity of vital natural resources like water, which the World Economic Forum rated as a threat second "only to 'major systemic financial failure'" (Winston, 2014, p.45).

### **Local**

- The Public Policy Institute of California acknowledges that "one of every eight US residents lives in California" and that "by 2050, California's population is projected to reach 50 million people" (n.d.).
- In our school district, MPUSD, enrollment continues to grow. In 2011-2012, enrollment was at 1,572. In 2015-2016, enrollment reached 1,943. Over the span of three academic years, the enrollment has increased by 23.6%.





**Group Discussion Exercise:**

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

1.)

**NOTES:**



## Unit 4: Technological Automation

While advances in technology can positively impact matters of sustainability, they can also be harmful to the way that our society currently operates. For example, there are many careers that can be affected by increasing dependence on technological automation. In this Unit, we'll cover the potential impacts of our increasing reliance on systems of technological automation.



### Technological Automation Facts and Figures

#### ***Global***

The Global Risks Report of 2017 states that "47% of US jobs are at risk of automation, affecting over 80% of low income workers" (25). Increasingly, "human labor is being displaced by automation, robotics and artificial intelligence" ("The Global Risks Report" 2017 p.35).

#### ***Local***

For example, "increased automation is changing the \$9 billion agriculture industry in [the] Salinas Valley, as workers and technology combine to increase agricultural efficiency and productivity" (Schaber, 2017). A labor shortage has contributed to the advancement of automation, which is enticing local businesses in the Salinas Valley to "tap into emerging technologies to meet demand" (Schaber, 2017).



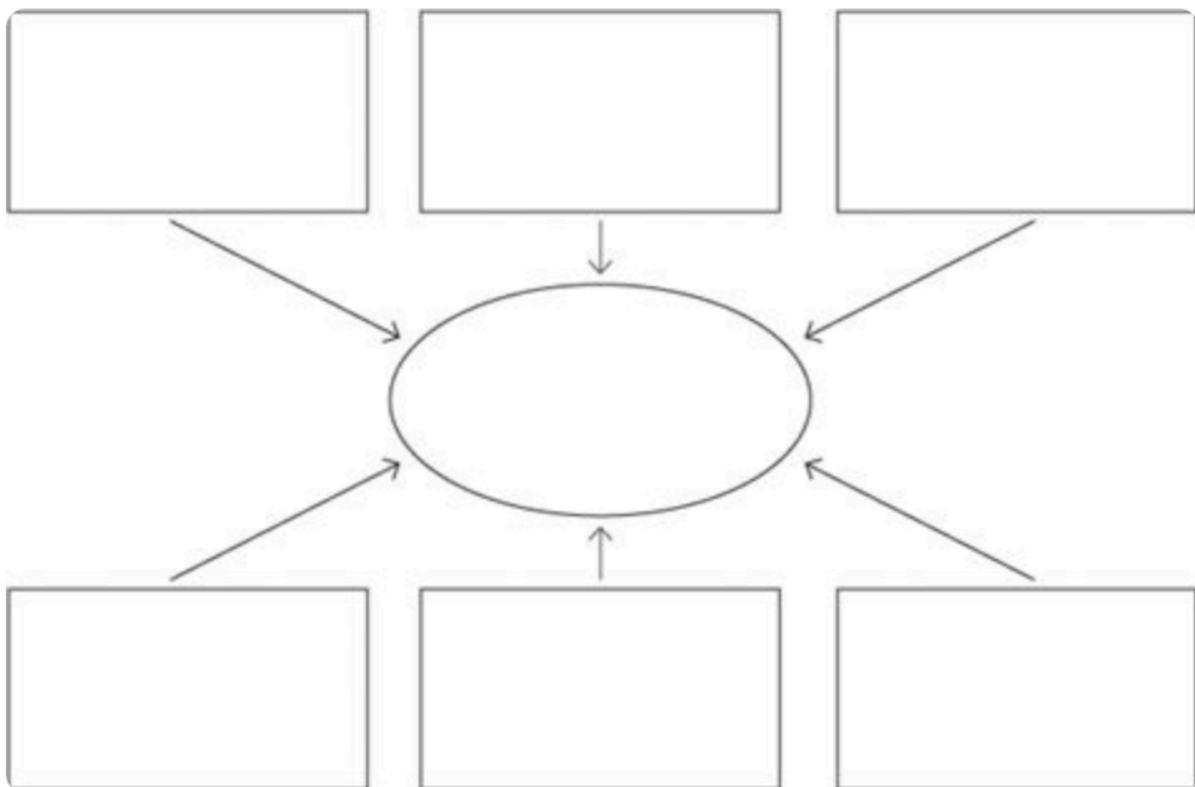
## Concept Map Exercise

Now that you've identified an industry that can be potentially affected by technological automation, please complete the following concept map with your group.

### Instructions:

- In the center of the map, name the industry that will be affected by technological automation.
- After listing your industry, please identify three potential causes for automation in the industry you identified (ex. Labor shortage) on **the top row**.
- After listing causes, please work with your group to determine three potential impacts (ex. Loss of Employment/Wages) on **the bottom row**.

### ***Technological Automation Concept Map***





## Unit 5: Finding Your Voice



Over the course of Units 1-4, we've learned about the concept of sustainability, and the implications/consequences of climate change, population growth, and technological automation. We've explored these ideas, threats, and opportunities on a global and local level.

After learning about these threats and opportunities, it's clear that we're at a critical juncture which 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" (18). There's also evidence in the private sector which suggests that consumers will purchase green products when price equity is achieved. The sheer innovation witnessed over the past 10 years in 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. As the authors of "Risky Business" remind us, "this is not a problem for another day" (2017, p.45) and that if we "act now, the US can still avoid most of the worst impacts and significantly reduce the odds of costly climate outcomes" (p.7). In order to act, **we need to find our voice.**

The issues facing sustainability today are complex, interdependent and daunting—but every available piece of 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?



**Individual Reflection: Based on the information provided in the link ([http://myfootprint.org/en/take action/reduce your footprint/](http://myfootprint.org/en/take_action/reduce_your_footprint/)), please list 3 three ways that you can reduce your carbon footprint and when you will make these changes (ex. in a week, over the next month, etc).**

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**Individual Reflection: What does 'sustainability' mean to you?**

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