Introduction to Sustainability

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Contents

Overview

Welcome to the Introduction to Sustainability open educational resource (OER). This resource has been developed to be an introduction to sustainability from an interdisciplinary perspective. The book begins with an introduction to sustainability, examining different models and definitions and looking at the field's recent history.

Next, the book introduces systems thinking. Systems thinking is commonly identified as a key competency of sustainability and is fundamental to understanding the complexity of sustainability challenges and opportunities.

The book's third section explores the domains of sustainability — economics, environment, social, and cultural — as well as the United Nations Sustainable Development Goals. This section highlights how all domains are interconnected and are required in some form to achieve sustainability.

Finally, the learnings from the earlier sections in the book are applied to specific sustainability challenges and opportunities, such as climate change and food. This section creates an opportunity to learn more about sustainability within a particular topic.

Throughout the book, there are a number of additional resources to contribute and support learning, including embedded media created specifically for the OER, activity descriptions and reflection questions, and links to external sources. The links to external sources have been specifically chosen to introduce diverse perspectives and expertise, as diversity is key to achieving sustainability.

Acknowledgements

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Accessibility Information

We have done our best to create a fully accessible resource. If you notice areas that could use improvement, please email the primary author, Dr. Tai Munro, at munrot@macewan.ca.

A few notes:

- all links in the book will open in a new tab
- videos have closed captioning
- text descriptions of videos are available where the narration does not cover the images on screen
- podcasts are available as both audio and transcript
- all images have alt-text. In some cases, the system limits the number of characters for alt-text. In these cases, enough description has been provided to convey the intention of the image
- from testing, the online version of the text functions slightly better than the PDF version for text-to-speech software

PART I

INTRODUCTION

Chapter 1: What is Sustainability

TAI MUNRO

Key Ideas

In this chapter, you will learn about:

- the beginnings of the modern sustainability movement
- the different models and definitions of sustainability

The Modern Sustainability Movement

While Hans Carl von Carlowitz is documented as introducing sustainability ideas in the eighteenth century (Seefried, 2015), there was little discussion of sustainability prior to the 1970s (Caradonna, 2018; Seefried, 2015). However, as the sustainability movement "would not have come into existence" without the environmental movement (Johnson & Greenberg, 2018, p. 138), it is relevant to discuss the environmental movement prior to the 1970s.

The environmental movement in the late 1800s to early 1900s largely fell into two main approaches: conservationism, which focused on protecting pristine nature for human recreational use, and preservationism, which protected untouched nature. Both shared a complete ignorance of the legacy of Indigenous Peoples while applying Western values, including the separation of humans from nature, the dominance of humans over nature, and that all problems could be solved in the future (Johnson & Greenberg, 2018). These approaches were maintained until after the world wars.

In the decades following World War II, a number of developments set the stage for "the explicit formulation of the sustainability movement, which took shape in the 1980s and 1990s" (Caradonna, 2018, p. 10). These developments included growing awareness of ecology and the risks of nuclear energy, environmental pollutants, and hazardous wastes (Johnson & Greenberg, 2018); the work of economists like E.F. Schumacher and Herman Daly, who argued that economies had to recognize that nature is finite (Caradonna, 2018; Schumacher, 1973); the emergence of systems theory, primarily from the Club of Rome (Caradonna, 2018; Seefried, 2015); and the work of people like Rachel Carson, who was foundational in connecting environmental damage to the lives of everyday people (Caradonna, 2018; Johnson & Greenberg, 2018; Seefried, 2015).

U.S. Fish and Wildlife Service employee photo
Public Domain. Circa 1940

Rachel Carson was a biologist and advocate for the environment. One of her most commonly known works is *Silent Spring,* published in 1962. Carson wrote the book after seeing widespread harm due to the use of pesticides. Carson and *Silent Spring* were catalysts for the environmental movement at the time. In addition, she stands out as one of the few voices at that time that was not a white male. While some of the issues have changed, reading *Silent Spring* also points out how much the system has not changed. Carson talks about the speed of changes created by humans (Carson, 1962). This speed, which we are witnessing today with disasters like climate change, is too fast for nature to adapt to and thus is causing widespread issues.

Another event that shaped the movement around this time was a photograph called Earthrise (Johnson & Greenberg, 2018; Seefried, 2015). Astronaut William Anders took Earthrise as he orbited the moon on Apollo 8. This was the first real photograph that pictured the Earth against the inky blackness of space. It dissolved arbitrary borders and showed the precariousness of life on Earth. As Anders said 30 years later, "All of humanity appeared joined together on this glorious-but-fragile sphere" (2018, para. 7).

Image by NASA

There were indications that humans would become more environmentally friendly following these events and others. Concerns about humans running out of oil fueled these efforts during the 1970s. However, new sources of oil were found, and the myth of abundance grew again (Seefried, 2015).

While not directly connected to the environmental movement, there were several social justice movements over this same time period, including the civil rights movement, women's liberation, and the student movement. These movements contributed to the development of sustainability, which, unlike the environmental movement, was interested in "balancing social issues, environmental concerns, and economics" (Caradonna, 2018, p. 12).

Jump ahead to the late 1980s, and we see the publication of the Brundtland Report "Our Common Future." This document provided a definition of sustainable development that mentioned keeping future generations in mind and meeting needs. Since then, many definitions and models have bounced around the field. They attempt to identify the different areas of concern that need to be considered to achieve sustainability, generally centering on the environment, economy, society, and, most recently, culture. Despite the presence of these other areas within the definitions and models, the environment is still the most common focus.

Before we continue, it is important to recognize that the history of sustainability documented here and within the emerging field of history of sustainability "has been based on printed sources written by social, intellectual,

and political elites in Europe and North America" (Caradonna, 2018, p. 13). Thus, while we have traced the emergence of the concept in Western society, we are missing many voices from this discourse.

Sustainability Definitions and Models

Caradonna (2018) has synthesized the history of defining sustainability and has found four main ideas:

1. "Human society, the economy, and the natural environment are necessarily interconnected" (p. 12).
2. In order to persist over long periods of time, human societies need to stay within ecological limits.
3. Human society needs to engage in "future-oriented planning" (p. 12).
4. Small and local needs to be prioritized over big and centralized in order to exist long term.

While Caradonna (2018) argues that these are key ideas within sustainability definitions, they do not necessarily all appear within our common or popular definitions or models of sustainability.

Reflection 1.1: Definitions and Models

Take some time with each definition and model that follows, and ask yourself:

- What ideas are the most prominent?
- What is your initial reaction?
- What does it imply about the relationship between or the importance of different components of sustainability?
- Are there opportunities for different people to interpret it differently? If so, is this positive, negative, or neutral?

The definitions and models have been selected to provide a range of examples of how sustainability may be understood and to examine how they may compare and contrast with each other; for each one we chose, there are others we did not include.

Definitions

Oxford English Dictionary: Sustainability is "the quality of being sustained at a certain rate or level; the property of being environmentally sustainable; the degree to which a process or enterprise is able to be maintained or continued while avoiding the long-term depletion of natural resources."

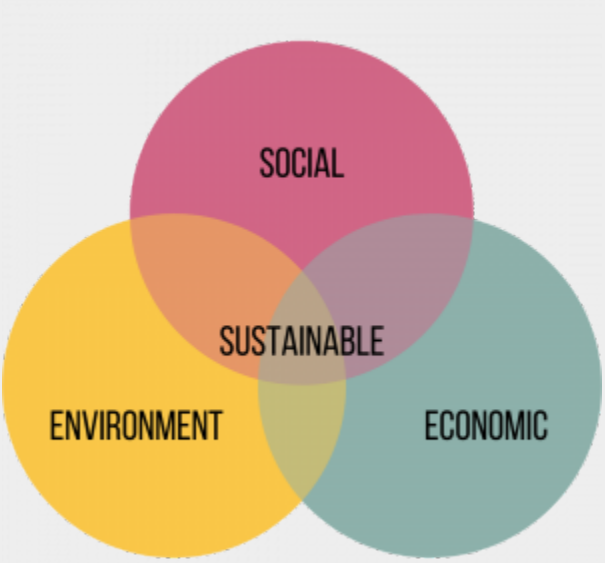
United Nations report “Our Common Future” by Gro Harlem Brundtland in 1987: “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (p. 41).

“Sustainability is a lifestyle designed for permanence” (C. Turner as cited by Caradonna, 2014, p. 1).

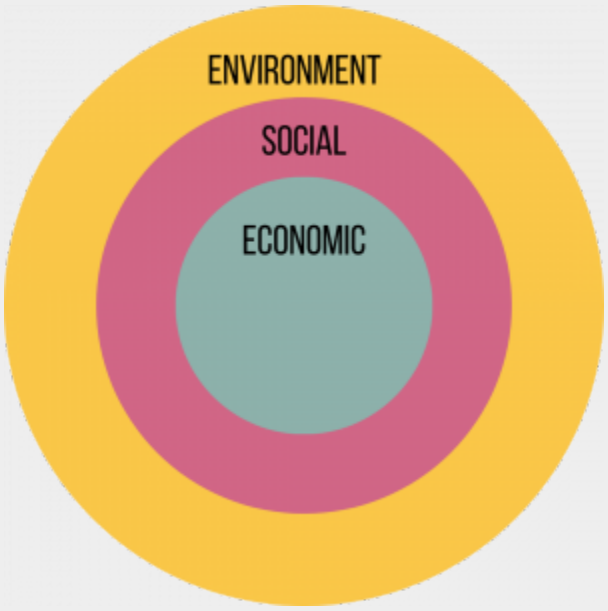
Sustainability means simultaneous improvements in human and environmental wellbeing, not just reductions in damage or harm (University of British Columbia, 20-Year Sustainability Strategy).

Models

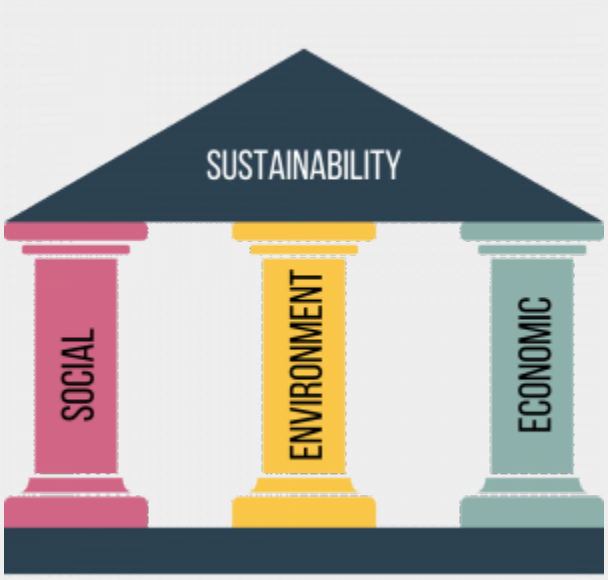
Models are another way of communicating what is included within sustainability. There are a number of common models of sustainability. Unfortunately, the models are used so ubiquitously that it is generally difficult to determine their first use and, therefore, difficult to credit the original sources for each.



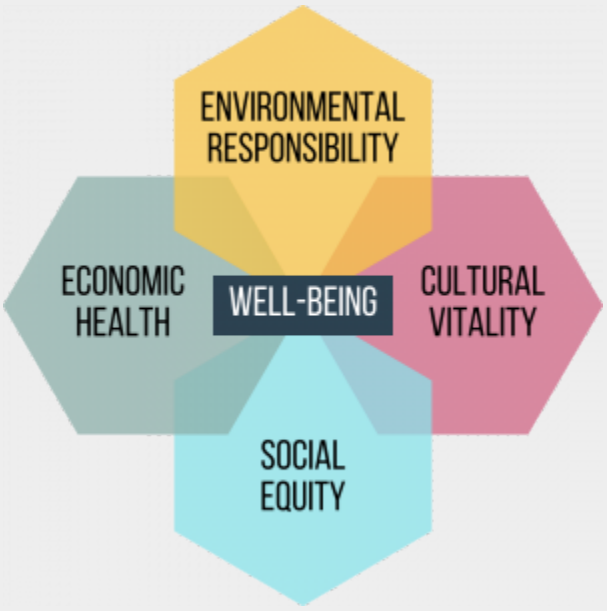
Venn diagram of sustainability. Image adapted by Tai Munro. CC0



Embedded circles model of sustainability Image adapted by Tai Munro. CC0



Three pillars model of sustainability. Image adapted by Tai Munro. CC0



MacEwan University's model of sustainability. Image adapted by Tai Munro.

Another prominent model within the field of business is the triple bottom line of people, profit, and planet. This model is similar to the first model shown here but changes the labels on the circle. It is a good example of how, with so many different stakeholders, sustainability will likely always be subject to discussion and debate. This can make working together towards a common goal challenging for people. It also means that even when we use the same language, we may understand it differently. As a result, we can completely miss that we might have a basic difference in understanding until it is too late, unless we take time to clarify what we all mean. On the other hand, Ramsey (2015) argues that having a clear definition of sustainability will not actually clarify the issue of sustainability. To clarify sustainability, we need to look at the actions we do; how is sustainability performed?

Activity 1.1: What is Sustainability Discussion

Based on your prior understanding of sustainability and the history and definitions that you have been introduced to in this chapter, answer the following:

- Were you surprised by this history or by any of the definitions and models of sustainability? In what way was it surprising or not?
- Are there one or more definitions and models that appeal to you and why?

- Are there any definitions or models that you disagree with and why?

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Dr. Tai Munro is a settler on Treaty 6 territory. She views sustainability as something that must centre relationships with ourselves, each other, and the more-than-human. As an Assistant Professor of Sustainability Studies at MacEwan University she is an advocate for open and inclusive education. She believes that sustainability involves everyone and sets out to enable others to join and contribute to the community.

PART II

SYSTEMS THINKING

Chapter 2: Systems Thinking

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Key Ideas

In this chapter, you will learn about:

- wicked problems
- systems thinking
- parts of a system

Wicked Problems

Sustainability problems are what are known as wicked problems. There are formal definitions of wicked problems (e.g., Rittel & Weber, 1973), but generally speaking, they are problems that:

- require many different people to be involved
- we have incomplete information for
- the requirements are contradictory or changing
- there is no single solution for
- require a culture shift to address

Most problems that we define as wicked, like climate change, addiction, and inequity, have ways of thinking and knowing that influence them. For example, we might agree that we need a program to support people suffering from addiction, but factors like whether we believe that addiction is caused by differences in brain function or by lack of learned impulse control will impact how we design addiction support programs.

These characteristics make wicked problems resistant to being resolved. Let's take two problems as examples.

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Not Wicked: Difficulty Getting Up in the Morning

While to the individual, this is a pretty challenging problem, in relation to problems, this one is pretty easy to solve. People can easily collect data on things like when they go to bed, how long it takes them to get to sleep, and how many times they wake up at night. Then, without consulting anyone else, they can try some different solutions like going to bed early, starting or stopping a bedtime snack, wearing headphones while they sleep or using a white noise generator app, and trying a wake-up light.

They can experiment until they find success and then hopefully continue the habits that created that success.

Wicked: Ending Homelessness in Your City

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Different types of homelessness need to be addressed (chronic and episodic); there are many different stakeholders and partners; homelessness can be connected to the availability of affordable housing, unemployment, support for physical and mental health concerns, etc.

How do we experiment with the different factors? How do we know how much we need to change each element? How do we know that we have ended homelessness?

Western Approaches to Problem Solving

In Western problem-solving traditions, we tend to break things down, or reduce them, to their parts and then look at them individually. Capra and Luisi (2014) describe this as a focus on "What is it made of?" or the material objects and structures (p. 4). This approach works well for problems like not being able to get up in the morning. But, by ignoring the interconnections between the different parts or what Capra and Luisi (2014) describe as the non-material processes and patterns of organization, it is generally insufficient for dealing with wicked or complex problems like ending homelessness.

Some of the consequences of this traditional approach to problem-solving include:

- We focus on finding answers or solutions (even if we don't fully understand the problem) (Ackoff, 1978).
- We assume that it is easy to trace a problem to its cause (Stroh, 2015).
- We are often unaware of the systemic structures that influence behaviour over time. We "*just find ourselves compelled to act in certain ways*" (Senge, 2006, p. 44).
- We believe that we can optimize the whole by optimizing the parts (Stroh, 2015).

- We ignore the context of the larger whole (Capra & Luisi, 2014).

To overly simplify this challenge, traditional problem-solving approaches ignore the context and relationships that influence what and how problems occur. Systems thinking is a way of addressing this challenge.

It should be noted that while this approach, often referred to as reductionism or a mechanistic view, has been dominant in Western culture for the past 300 years, since the Scientific Revolution, it had previously competed for prominence with a more holistic view (Capra & Luisi, 2014). In addition, thinking in many other cultures has not focused so heavily on this mechanistic approach (Capra & Luisi, 2014).

Introducing Systems

Before we look at systems thinking, we have to start by asking what a system is. Meadows (2008) defined a system as "an interconnected set of elements that is coherently organized in a way that achieves something" (p. 11). This is a good place to start. It tells us that a system includes elements or parts that are connected in such a way that they achieve something. The interconnections or relationships are important to the system. And the system is going to achieve something. But, a few key characteristics aren't clearly captured in this definition.

Many of us understand the word "organized" as meaning that an actor organizes something. However, a system is self-organizing. This means that it is dictated or organized by internal rules rather than external forces (Capra & Luisi, 2014). Thus, the idea of organization in a system can be confusing. While a system, such as a traffic system, might include organizing elements that have been planned by humans, like traffic laws, the system as a whole is governed by self-organizing features that arise from all of the interconnections in the system. This is one reason why certain roads tend to have higher rates of speeding even though the traffic laws penalize speeding.

Another challenge in Meadows' definition is the idea that the system "achieves something." Similar to "organized," the problem isn't inherent in the words but in how we understand them. "Achieves something" guides us to believe that a system will achieve a particular goal and that that goal will be what we want it to be. However, this is not the case. Many systems do not achieve something desirable. Homelessness, addiction, poverty, injustice, environmental degradation, and climate change are all achievements of human systems that we do not want. Meadows (2008) discusses this characteristic of systems, but the challenge with our common understanding of the language remains.

In their efforts to trace the history of the development of systems thinking, Capra and Luisi (2014) define a system as "an integrated whole whose essential properties arise from the relationships between its parts" (p. 64). This shares a lot with Meadows' definition but avoids some of the challenges embedded in our understanding of the language. At the same time, it is helpful to consider both definitions, as they reveal more about what a system is. A system:

is made up of elements

that are interconnected with each other

to create an integrated whole

that, through self-organizing and emergence,

result in properties that are not found in the individual elements.

Let's spend a moment looking at what self-organizing and having emergence mean.

Self-organization is a property where the organization of the whole arises from the interactions of the parts of the system. You may also hear this referred to as **autopoiesis** which refers to the ability of something to reproduce itself. But reproduction here should be clarified. It is not reproduction in the sense of making another organism, system, or offspring of any sort but of its ability to maintain itself over time. An example may help clarify here. A sports team regularly changes individual players, but this does not often result in a significant change to the team. This is because the goals and behaviours of the team are governed by the interactions in the system, and individual players rarely impact these in significant ways. Or, as Pirsig wrote, "if a factory is torn down but the rationality that produced it is left standing, then that rationality will simply produce another factory" (as cited in Meadows, 2008, p. IX).

Emergence occurs when novel system properties arise "from the specific relationships and interactions among the parts in the organized ensemble" (Capra & Luisi, 2014, p. 155). In other words, the system's properties cannot be isolated to any of the individual parts. While emergent properties can be what makes something unique such as how your genetics, physiology, upbringing, education, and other factors, come together to make you a talented artist, athlete, leader, or another role, emergent properties can also be the properties that we don't want like homelessness and environmental degradation.

Systems Thinking

Einstein is famously quoted as saying, "we cannot solve our problems with the same thinking we used when we created them." As different fields have developed, many have sought out new ways of thinking to solve difficult problems. Accordingly, the history and practice of systems thinking include many fields, such as quantum physics, cybernetics, ecology, and management and leadership (Capra & Luisi, 2014; Senge, 2006). The challenges of sustainability, from climate change to food security, grew out of the mechanistic approach to thinking. Therefore, we must adopt a new way of thinking to solve these challenges. Systems thinking is most commonly identified as an appropriate approach (Evans, 2019; Redman & Wiek, 2021). Or as Capra and Luisi (2014) put it, "the systemic understanding of life… is the cognitive foundation of our endeavor to move towards a sustainable future" (p. 362). But what exactly is systems thinking?

Let's start with a few definitions again:

- "The understanding of a phenomenon within the context of a larger whole" (Capra & Luisi, 2014, p. 64)
- Building on the definition of systems from Meadows, Stroh (2015) defines systems thinking as "the ability to understand [the interconnections between elements] in such a way as to achieve a *desired* purpose (p. 16, italics original)
- "Systems thinking is a conceptual framework, a body of knowledge and tools… to make the full patterns clearer, and to help us see how to change them effectively" (Senge, 2006, p. 6)

What do you notice between these three definitions? What do they share? What is different?

Like the second and third definitions, Russel Ackoff also includes the ability and intention to change systems as part of his definition. Watch the following video (4:05) to learn more about the differences between **reductionism** and systems thinking and how Ackoff wants us to think about changing systems.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://openbooks.macewan.ca/introductiontosustainability/?p=47#oembed-1

Reflection 2.1: Solving Problems

Can you think of a time when you tried to solve a problem that seemed resistant to change? You knew there was an issue, but you couldn't do anything effective to change it? What strategies did you try to solve the problem? Do you think these strategies demonstrate reductionist or systems thinking?

While a definition is helpful, it doesn't tell us much about how we might do systems thinking. And indeed, the descriptions of how to do systems thinking are almost as numerous as the fields that engage in systems thinking. However, there are some common characteristics.

Thinks about the whole: Not surprisingly, considering the focus on the interconnectedness of systems, a common characteristic of systems thinking is that we need to shift our perspective from the individual parts to the integrated whole. This includes recognizing that humans and individuals are parts of the system (Sweeney & Meadows, 2010). This is not to say that we do not need to think about the parts but that we need to consider the interplay and relationships between the parts and the whole (Capra & Luisi, 2014).

Integrates multiple perspectives: Team learning (Senge, 2006) or multidisciplinarity (Capra & Luisi, 2014) are needed to move beyond individual perspectives or disciplines.

Maps relationships: While we may be able to quantify individual items, relationships need to be examined qualitatively. Further, we need to look for and identify "interrelationships rather than linear cause-effect chains" (Senge, 2006, p. 73). To support pattern identification and understanding, we must map the system's relationships and causal loops (Senge, 2006; Sweeney & Meadows, 2010; Capra & Luisi, 2014).

Examines mental models: We all have "deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the world and how we take action" (Senge, 2006, p. 8). In systems thinking, we must consider how these mental models create our futures (Sweeney & Meadows, 2010). By examining mental models, we can then challenge them. Mental models show up in many ways, such as stereotypes.

Considers the long-term: We need to acknowledge that short-term solutions may not be solutions for the long term (Sweeney & Meadows, 2010). As Senge (2006) states, "vision without systems thinking ends up painting lovely pictures of the future with no deep understanding of the forces that must be mastered to move from here to there" (p. 12). This also includes paying attention to time delays that occur within systems and can hide consequences over the short-term (Meadows, 2008; Sweeney & Meadows, 2010). We need to look for "processes of change rather than snapshots" (Senge, 2006, p. 73).

The Parts of a System

To help us talk about and map systems, as we will do in the next chapter, it is helpful to establish some common language. Different sources use different terms to describe the same things. Therefore, it is also important to pay attention to the general characteristics included in each term so that you might be able to transfer what you are learning to other resources and materials in the future.

Image by Tai Munro

Elements

The **elements** of a system are often tangible things like the paddlers in a boat, the boat they are paddling, the water body they are on, and the weather they are experiencing. However, elements, such as the paddlers' skills, can also be intangible.

Interconnections

The **interconnections** are "the relationships that hold the elements together" (Meadows, 2008, p. 13). In the boat example, the paddles apply force to the water that moves the boat because the paddlers are in the boat; they are interconnected. The paddlers have to communicate with each other. The wind may push against the boat, affecting its path or how difficult it is to move. As Meadows (2008) points out, you can change the elements without drastically affecting the overall system; however, the interconnections impact the system's emergent properties and, therefore, tend to have a more significant impact on the system's outcomes.

See if you can answer the following questions about elements and interconnections.

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An interactive H5P element has been excluded from this version of the text. You can view it online here: https://openbooks.macewan.ca/introductiontosustainability/?p=47#h5p-2

Emergent Properties

Emergent properties were discussed earlier in this chapter. Emergent properties are properties that arise

from a system but are not properties of individual elements or interconnections. Systems thinkers may assess emergent properties as positive, negative, or neutral.

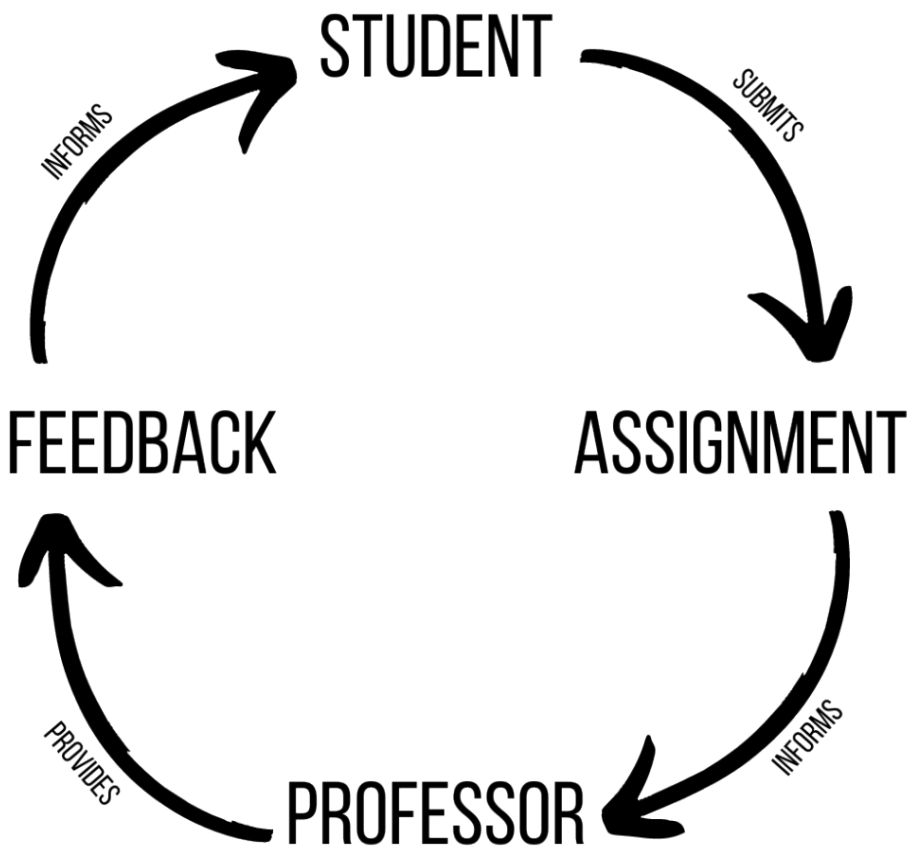
For example, presumably, the goal of a food bank is to alleviate food insecurity by providing access to food to people in need. However, we must ask whether a food bank changes how often or why people experience food insecurity. A food bank can only really provide a temporary solution to the existing problem in the system. That existing problem is an emergent property of the system. Without change, the system will continue to produce conditions that result in economic inequality and food insecurity.

Food Banks Canada has recognized this. One of their major goals is to find "long-term policy solutions to food insecurity" in Canada (Food Banks Canada, 2022, Policy and Advocacy, para. 1). This is an attempt to change the system so that food insecurity is no longer an emergent property.

Feedback Loops

Feedback is one of the key parts of systems. However, feedback is challenging to see because we are used to seeing causality as a linear process (Senge, 2006). Let's break down a common experience in school to help us understand **feedback loops**.

As presented, we see a linear process. A leads to B which leads to C. When we get to the end, the professor provides feedback, but the causal chain stops there. Unfortunately, although you probably don't do this, an all too common occurrence is that the student checks their grade on the assignment and then doesn't do anything else with it. They might not even read the feedback. But feedback in systems thinking is "any reciprocal flow of influence" (Senge, 2006, pp. 74-75). In other words, feedback is something that happens in such a way that both the initial element and the subsequent elements influence each other in related ways. So let's look at what this would look like to a systems thinker.



What wasn't apparent when we looked at the process in a linear diagram is that the feedback should influence the student. This is the idea of using the feedback that you get on one assignment to either improve that assignment or to help you with your next assignment.

Watch the next video (1:20) to learn more about feedback loops.

Note: The following video is a whiteboard-animated video. The illustrations used depict what is being described in the narration. You do not need to see the illustrations to understand the video.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://openbooks.macewan.ca/introductiontosustainability/?p=47#oembed-2

It isn't surprising if you had trouble seeing the loop part of causal loops. How we are taught, and the English language structure both teach us to see causality as a linear process rather than a circular one (Senge, 2006). In addition, we typically see humans as separate from systems and the feedback process in Western culture. Shifting our awareness so that "*the human actor is part of the feedback process… represents a profound shift*" (Senge, 2006, p. 77, italics original) and one that can be difficult to make.

We will look more at feedback diagrams in the next chapter. For now, let's move on to looking at the two main types of feedback that exist in systems.

Balancing Feedback Loops

A balancing feedback loop occurs when there is a goal or target for the level of an element, and the changes occur in such a way that the level always stays around that goal. There are many examples of balancing feedback loops, such as:

- your eyes adjusting how much light they let in based on the brightness of the space you are in
- eating when you are hungry
- keeping a certain amount of stock of different products on a shelf
- the number of a single species in a habitat
- the temperature of your cup of coffee

An important point regarding balancing feedback loops is that "the system has its own agenda" (Senge, 2006, p. 84). Thanks to the laws of thermodynamics, that cup of coffee you have sitting with you while you read this has a goal of being at room temperature. Unfortunately, this means that the real goals of the balancing process are often hidden. Watch the next video (2:37) to learn more about balancing feedback loops.

Note: The following video is a whiteboard-animated video. The illustrations used depict what is being described in the narration. You do not need to see the illustrations to understand the video.

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One reason balancing loops are hard to identify is that it often "*looks* like nothing is happening" (Senge, 2006, p. 86, italics original). Unless you have diabetes or another condition that impacts your blood sugar levels, you probably don't really notice any changes in your blood sugar throughout the day. This doesn't mean that it isn't changing. But your body maintains the balance well enough that you don't notice the small changes that are happening. Similarly, the sales of a particular product tend to stay at the status quo, making it hard to see what factors might be impacting product sales.

Reinforcing Feedback Loops

A reinforcing feedback loop occurs when there are runaway effects (exponential growth or collapse). If changes in an element result in more changes in the same direction, you get a reinforcing feedback loop. In other words, a small change will build on itself in an accelerating manner. You might have heard of these in other terms, such as self-fulfilling prophecies or vicious circles. An example of this is when something goes viral: people like something, which results in more people seeing it, which results in more people liking it, which results in more people seeing it, and so on.

A big challenge with reinforcing feedback is that, up to a point, the changes are small enough that they are

hard to detect, or they just don't seem like a big deal. Watch the next video (1:33) to learn more about reinforcing feedback loops and review some examples.

Note: The following video is a whiteboard-animated video. The illustrations used depict what is being described in the narration. You do not need to see the illustrations to understand the video.

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See if you can answer the following questions about feedback loops.

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An interactive H5P element has been excluded from this version of the text. You can view it online here: https://openbooks.macewan.ca/introductiontosustainability/?p=47#h5p-4

Causation Versus Correlation

You may have heard about the difference between causation and correlation before. Correlation means that there is a relationship between two things, but one does not cause the other. Causation means that one thing causes something else to happen. Correlation often means that another element is connected to the two things you are looking at. The difficulty in distinguishing between these two can make it harder to find the actual feedback loops in a system because you need to find causation, not correlation. Watch the video (2:33) to learn more.

Note: The following video is a whiteboard-animated video. The illustrations used depict what is being described in the narration. You do not need to see the illustrations to understand the video.

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Leverage Points

Leverage points are points where you can push a system in order to trigger systems change. You probably use leverage points all the time without thinking about it. Let's consider some examples of leverage points in different situations.

- A leverage point that students often try to use is to study for more hours. They aren't happy with their grades, so they dedicate more time to studying. This can have an impact, but there might be better leverage points to push, such as studying for the same amount of time but using more effective study strategies or meeting with their professor and asking specific questions. (In case you are interested in what might be some more effective study strategies, you can check out the Learning Scientists videos.)
- One leverage point that sports teams often attempt to use is bringing in a star player to revitalize the team. This, in theory, is supposed to make the whole team better.
- Applying carbon taxes or funding solar panels or energy-efficient appliances are leverage points intended to incentivize better practices or equipment.
- Systems thinking itself is a leverage point. By looking at challenges through a systems lens, we can identify new ways to intervene in a system. For an example of this in health care, watch the video *Systems Thinking!* posted by james swanson.
- Another leverage point is to use other ways of looking at challenges, such as Indigenous perspectives, disability perspectives, or gender equity perspectives. The town Karlskoga in Sweden used a process of gender mainstreaming to assess snow removal practices in the town. The town's snow clearing policies prioritized clearing snow off main roads after a snowfall. Because women in Karlskoga are more likely to travel by foot, public transit, or bike, and men are more likely to travel by car, the snow-clearing policies affected men and women differently. An emergent property of the system was prioritizing men's daily activities and safety over women. By using gender equity as a leverage point, the town changed their snow removal practices to prioritize sidewalks and residential areas over main roads. As a result, hospital costs in Karlskoga declined because there were fewer injuries, primarily to women, from walking on local icy sidewalks and no real increase in car accidents on the main roads. You can watch the first 3:17 minutes of the video *Sustainable Gender Equality – a film about gender mainstreaming in practice* published by SKR Jämställdhet to learn more.

You may have noticed in reviewing these examples and in thinking of some of your own that while there are many potential leverage points, they don't all have the same level of impact. Senge (2006) suggests that "our non-systemic ways of thinking consistently lead us to focus on low-leverage changes. Because we don't see the structures underlying our actions, we focus on symptoms where the stress is greatest" (p. 113). A good example of this is food banks, which were discussed earlier in the chapter. A food bank is a leverage point to alleviate food insecurity on a short-term or temporary basis. It addresses a symptom of the problem so that fewer people go hungry, but it does not address the reasons that food insecurity occurs in the first place.

Another example of low-leverage versus high-leverage changes comes from agriculture. In the short term, adding synthetic fertilizers can help increase yield, but it does not address the systemic issues causing declines in soil health. In fact, synthetic fertilizers can contribute to declines in soil health. This means that although applying these fertilizers is a short-term leverage point to increase yield, it also creates a reinforcing feedback loop that requires more and more fertilizers and other additions to maintain yields over the long term.

Looking for Leverage Points

One of the key places to find leverage points is within feedback loops. If we can change how the feedback loop works, we can impact the system. Options include strengthening, weakening, breaking, or reversing current loops, or creating new feedback loops. We will look at how we can strengthen, weaken, or reverse a loop. This is not comprehensive, but gives you a starting point to look at.

Strengthening Feedback Loops

To strengthen the loop, you might reduce the delay between the one element and the next. For example, if a student submits an assignment and gets feedback from their professor faster, they are more likely to incorporate that feedback into their next assignment. The leverage point is reducing the time it takes to receive feedback.

Weakening Feedback Loops

To weaken a loop, you can do the opposite: you increase the delay between one element and the next. In our feedback example, if the student doesn't receive any feedback from their professor until the semester is over, they won't be able to incorporate it into their work in the class.

Reversing Feedback Loops

To reverse a loop, you make a change that switches the loop from reinforcing to balancing or from balancing to reinforcing. The most common way to switch a feedback loop from reinforcing to balancing or from balancing to reinforcing is to introduce or take something away from the feedback loop. For example, you may have a population of mice in a field. That population keeps expanding as more mice have more babies – a reinforcing feedback loop. But then a predator, like a coyote, moves into the field. Now, the coyote hunts the mice, limiting their population. If there are more mice, then they can feed more coyotes, allowing the coyote population to grow. They eat more mice, and the mouse population shrinks, which means the coyote population will also shrink. However, now that there are fewer coyotes, the mouse population can grow again. The introduction of the predator is a leverage point that results in the loop switching to a balancing feedback loop.

Summary

Before we move onto systems mapping, Kalen Pilkington's TedX Talk (11:08) from the MacEwan TedX event in 2018 provides a great review of systems thinking and a concrete example from her undergraduate student experience. As you watch, try to identify the part of the system we just reviewed: elements, interconnections, emergent properties, feedback loops, and leverage points.

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See how you did with identifying the different parts of the system.

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Reflection 2.2: Leverage Points

Think about an area in your life where you would like to achieve change. See if you can identify three possible leverage points that you could apply a change and trigger a significant impact on the overall system. Some examples that you might want to consider include making more time for friends and family, improving your overall fitness and health, or improving your performance at school or work.

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Dr. Tai Munro is a settler on Treaty 6 territory. She views sustainability as something that must centre relationships with ourselves, each other, and the more-than-human. As an Assistant Professor of Sustainability Studies at MacEwan University she is an advocate for open and inclusive education. She believes that sustainability involves everyone and sets out to enable others to join and contribute to the community.

Chapter 3: Systems Mapping

TAI MUNRO

Key Ideas

In this chapter, you will learn about:

- the value of systems maps
- how to construct a systems map

A systems map is a way to visualize systems. They are essential to understanding systems because, as Capra and Luisi (2014) argue, relationships, which are fundamental to systems, cannot be understood through measurement; they have to be understood through mapping. You have probably seen systems maps before without calling them that. For example, the water cycle that many of us learned about in school is a map of a system, the water system (more complex versions of this map that also include human use and influence are also available, such as this one by Water Science School with the USGS: *The Water Cycle*). Mapping systems helps us to visualize the system and all of its parts. It also helps us to develop a common understanding of the system we are talking about and identify patterns within the system (Capra & Luisi, 2014).

We are going to use two different types of maps: cluster mapping and causal loop mapping. Together, these two types of maps will help you explore the system, identify relationships, and determine causality.

Cluster Mapping

A cluster map is a first step at mapping a system. The general steps are:

- identify an issue that you want to explore
- brainstorm everything that you can think of that relates to that issue
- draw connections between the different items as you identify relationships and interconnections

Let's work through an example together to help clarify this.

Warning: This will be messy.

Step 1

Identify an issue that we want to explore. We are going to start simple and look at the temperature in a home.

Note: The best way to learn systems mapping is to do it, so follow along and write the issue in the centre of a piece of paper.

Step 2

Brainstorm everything that you can think of that relates to that issue. Complete your own brainstorming first and then compare yours to the example. Don't expect them to be exactly the same. Remember, different people bring different perspectives and experiences.

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Step 3

Now start to connect the different nodes in your cluster map. The majority of what you identified will probably be elements. You will put a circle around these as you make connections between elements. To draw the relationships or interconnections, draw a circle around each element and connect the elements with an arrow. The arrows should be single-headed, i.e., they point in one direction. If there is also a reciprocal relationship, draw a second arrow pointing in the other direction. Label the arrows with a description of the relationship. An important note is that the interconnection label should not be the consequence but should focus on how they interact with each other. For example, the thermostat "adjusts" the furnace.

As you do this process, you may find that you identify some elements that you missed in your initial brainstorming. This is to be expected. Add them in as they occur to you.

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Step 4

This step is about starting to look for insights in your map. Some of the questions you may want to ask include:

- Are there key elements or connections that impact lots of the map?
- What are the key insights that you gained from the activity? An example of an insight is a key element or interconnection that wasn't obvious initially.
- What potential low-impact or high-impact leverage points can you see?
- Where is there feedback in the system?
- What **biases** are present, or do you think might be present, in your map? How do you know?

Now that you have a cluster map, you can use it to identify areas of a system that you want to look deeper at. One tool you can use to do this is causal or feedback loop mapping.

Causal (Feedback) Loop Mapping

Remember that identifying circular causality is one of the biggest challenges in systems thinking because it is so different from how we are taught for most of our lives. We already worked on this a little bit in chapter 2, so if you need to go back and review the material, do that first.

Let's start with a simple causal loop: managing your hunger level at home. Watch the video (3:24) to see how we build a causal loop map.

Note: The following video is a whiteboard-animated video. The illustrations used depict what is being described in the narration. You do not need to see the illustrations to understand the video.

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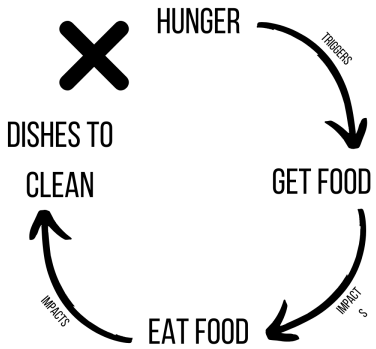
See if you can describe the steps that we took to build this simple causal loop map before comparing your steps to the ones we have identified.

Steps for Drawing Causal Loop Diagrams

1. Identify elements that have a causal relationship. We recommend starting with two elements but they can have more or less. Make sure that A causes a change in B and B causes a change in A. How you name the elements in a causal loop is important. You should consider:
    - Can the element change? For example, a fridge can't change, but the amount of food in the fridge can. Therefore, best practice is to write down "amount of food in fridge" as the element.
    - Is the element neutral? Keeping the elements neutral allows the diagram to show how it might change in either direction. For example, from the example in the video we use hunger as the element rather than more or less hungry.
2. Draw the arrows in the direction of causality. Important points to consider at this step include:
    - The arrows should all point in either a clockwise or counterclockwise direction. There should never be two arrows pointing to the same element



- within a causal loop. This would break the chain of causality.
- Each element must cause a change in the next one. For example, being hungry makes you go get food. Getting food allows you to eat the food. Ea
  ting the food changes how hungry you are. A common pitfall at this point is pointing to another element that is connected but not causally related. For example, eating food might cause a change in the number of dishes you have to wash, but the number of dishes you have to wash will not cause a change in how hungry you are.

3. Track the direction of change for each relationship. This is when we determine if the relationship should be labelled with an s or an o to indicate the direction of change relative to the previous item in the loop. One strategy to help figure this out is to use small temporary arrows on each item. This approach is demonstrated in the next video (1:13). Please note that this is a visual strategy.

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4. Determine if the loop is reinforcing or balancing. The loop will be reinforcing if:

   - there are no “o’s” in the loop
   - there is an even number of “o’s” in the loop

   Otherwise, the loop is a balancing feedback loop.

Of course, many of these causal loops don’t happen in isolation; so loops can be connected to other loops. Let’s look at an example in the next video (2:07).

Note: The following video is a whiteboard-animated video. The illustrations used depict what is being described in the narration. You do not need to see the illustrations to understand the video.

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Check whether the loops are reinforcing or balancing:

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Predicting the Impacts of Leverage Points

Recall from the previous chapter that feedback loops are a good place to look for leverage points. Once you have created your causal loop diagram, you can use it to examine the impacts of a potential leverage point. It is helpful here to talk through the impacts of a change to some aspect of the feedback loop on the loop as a whole. For example, in the interconnected loops from the previous video, we might consider how a change in the availability of groceries at the store, due to significant price increases or perhaps a supply chain breakdown, would affect our ability to put food in the fridge. This could have cascading impacts through all of the loops affecting how much you can eat and how hungry you are. The supply chain breakdown would weaken the feedback loop between the amount of food in the fridge and the amount of groceries you buy. It would likely increase the delay in your response because you would have to wait longer to get the food you need.

Telling the Story of the System

The maps are part of telling the story of the system, but they are influenced by our own perceptions and biases, especially when we are building them by ourselves. This is why looking at the story the map tells is important once you think you are done. Does the story match the map? Are there hidden plot twists you didn't know existed in the story? Are there biases in the story that need to be overcome?

Recommended Resources

Check out Systems Mapping by Leyla Acaroglu (2017). The first type of map described in this post is the cluster map. Acaroglu also goes over a third type of map called connected circles mapping. The site has some helpful tips on how to construct the systems map that will be useful as you start to develop your own maps.

Another helpful resource is Causal Loop Construction: The Basics by Colleen Lannon.

Let's Get a Little More Complex

Next, see if you can follow the steps you just learned to map a more complex system. We recommend looking at an organization like a college, university, or another organization you are familiar with. Because we are mapping a different system from you, our maps will be different. But once you are done, look at our map of an undergraduate university and see if you can see some common patterns.

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To take this a step further and help show our reasoning, we can also explain the interconnections more fully. We have done this with the explanation between faculty, students, and the community.

Although there may be other connections between these three elements in theory, faculty and students interact through teaching and learning. They bring the community in through projects and placements. Faculty or students may engage in research projects that involve or study the community, and many students participate in placements within the community through specific programs or courses. In turn, these interconnections may contribute to teaching and learning.

Next, we need to identify feedback or causal loops. Here are two examples:

There is (hopefully) a feedback loop between faculty and students. Faculty use teaching methods to help students. The students then complete assessments. The faculty grade the assessments. Based on the grades, faculty will change or maintain their teaching methods. Watch the video (2:23) for a discussion of this causal loop.

Note: The following video is a whiteboard-animated video. The illustrations used depict what is being described in the narration. You do not need to see the illustrations to understand the video.

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Another feedback loop would be between students and funding. If tuition increases too much, then fewer students will attend the university, and the university will have to raise funds through different means, such as higher tuition or grants and donations. If tuition becomes very low, there might be more students than the university can accommodate, which would potentially result in restrictions such as program caps and competitive admission. Watch the next video (2:27) to review this loop.

Note: The following video is a whiteboard-animated video. The illustrations used depict what is being described in the narration. You do not need to see the illustrations to understand the video.

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Leverage points

A leverage point in the system is government funding. If the government reduces funding, it has many repercussions throughout the system, including a reduced number of classes, increased class size, fewer staff and resources, higher tuition, etc.

Emergent properties

Remember, one of the main characteristics of systems is that they have emergent properties. These are properties that emerge from the system due to the relationships rather than from any one item. What emergent properties can you think of for the organization that you mapped?

Some of the emergent properties that appear in the system of the undergraduate institution may include:

- prioritizing money and funding over the quality of learning experiences
- professors prioritizing activities other than teaching depending on how they are evaluated

Add One More Level

Watch the video *Systems thinking: A cautionary tale (cats in Borneo)* by Sustainability Illustrated for the final practice map. This is an excellent example because it describes a number of feedback loops and identifies different leverage points, although the video doesn't use that language, so you will need to interpret it. Based on the video, try to:

- draw a cluster map of the system
- draw a minimum of two causal loop diagrams, including the direction of change and whether they are balancing or reinforcing
- identify two leverage points
- identify one emergent property

Check your cluster map in the following interaction. Remember, they probably won't be identical. Look for similarities and differences between your map and the sample to help you identify areas where you might need clarification.

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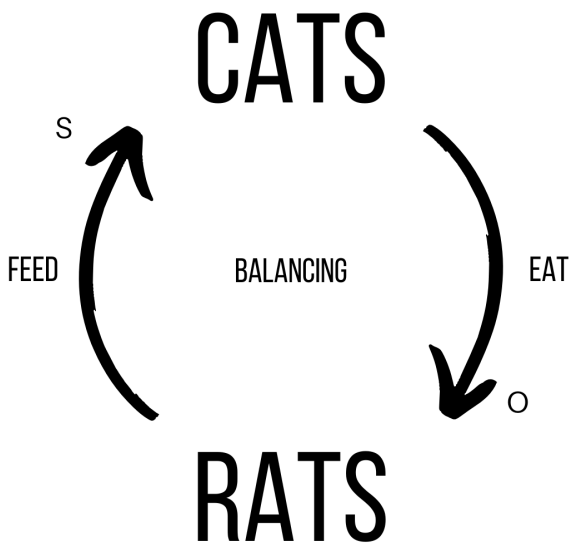
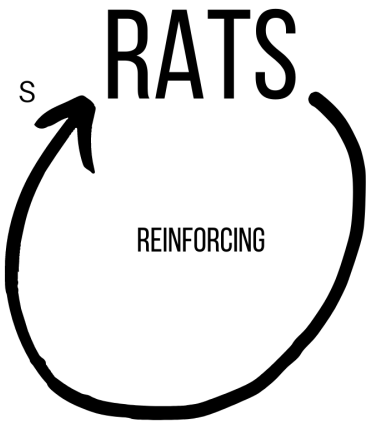
Feedback loops

The cats eating the rats is normally a balancing feedback loop because the cats keep the rat population around a certain number.

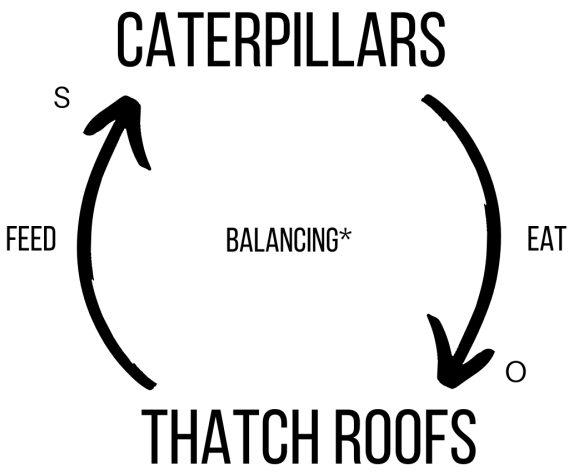


But when the cats died, the rats became part of a reinforcing loop because more rats led to even more rats.



The caterpillars and the thatch roofs without the presence of wasps is a balancing feedback loop because as the caterpillars eat the thatch roofs, less thatch will be available, which will reduce the food available for the caterpillars. However, within a shorter timeline, when the caterpillars have not yet eaten enough thatch to

reduce their food supply, this loop would appear to be reinforcing because as the caterpillars ate thatch and weren't killed by the wasps, they were able to breed more and therefore eat more thatch.



There is one concept that is relevant here that we haven't talked about yet. It is beyond the scope of this textbook except for a brief mention. Delays are another fundamental part of a system; paying attention to delays is part of systems thinking. The caterpillars and the rats without the presence of their predators, appear to be reinforcing. However, this is because we are looking within a short time frame. Ultimately, the rats would run out of shelter and fewer would survive, although there would be more than there were in the presence of cats. And the caterpillars would eventually eat all the thatch and start to die off. Delays make the causal loops harder to identify accurately because we can miss the impacts. This is an important concept if you are going to continue your systems thinking journey.

Leverage point

The cats and the DDT are both leverage points in this system. The cats have a significant impact because they control the rats, which improves the Dayak people's health and the availability of food. DDT is also a leverage point because it affects many parts of the system — mosquitoes, cats, and wasps — which in turn affects many other parts of the system. The use of DDT in this example shows that leverage points are not always positive.

Emergent property

A main emergent property of this system is the poor health of the Dayak people.

Activity 3.1: Systems Mapping

Now that you have practiced building a systems map, see if you can build a map about a familiar topic. You may choose something like the system that affects your mental health and well-being, the education system where you live, or the system found in an organization. Another option is to watch a video describing a system and see if you can map it. George Monbiot hosts a good series of videos to use for this purpose on the Sustainable Human YouTube Channel. Some options are:

- *How beavers engineer the land [Remastered HD]*
- *How wolves change rivers [Remastered HD]*
- *How whales change climate [Remastered HD]*

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Dr. Tai Munro is a settler on Treaty 6 territory. She views sustainability as something that must centre relationships with ourselves, each other, and the more-than-human. As an Assistant Professor of Sustainability Studies at MacEwan University she is an advocate for open and inclusive education. She believes that sustainability involves everyone and sets out to enable others to join and contribute to the community.

PART III

DOMAINS OF SUSTAINABILITY

Chapter 4: Economics

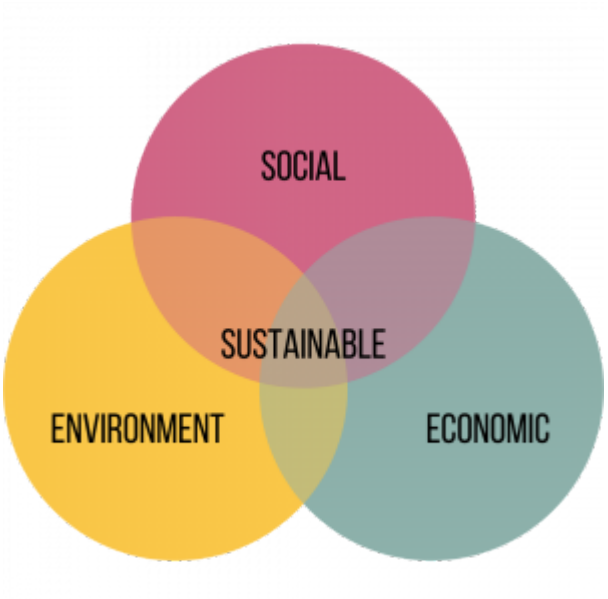
TAI MUNRO

Key Ideas

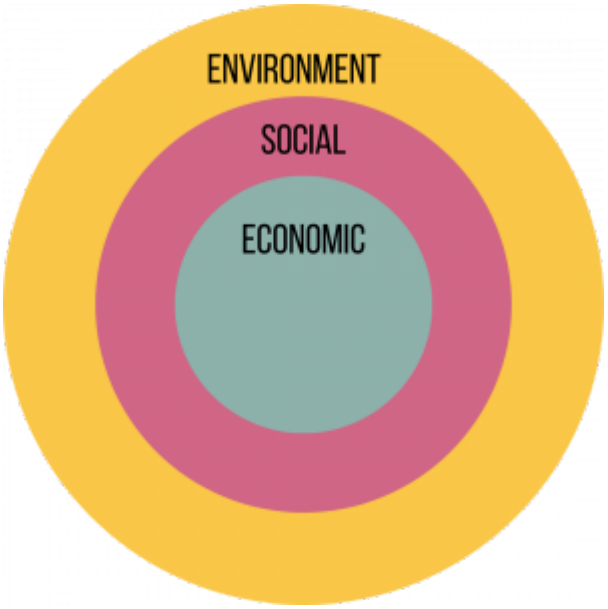
In this chapter, you will learn about:

- how value is determined
- current alternative economic models

Generally speaking, when people think of sustainability, they think about the environment. We'll see how this is being questioned from a social and cultural perspective in the next chapter. The **economy** is often included in some form, whether we intend to or not. When considering the following two models of sustainability that we considered at the start of this text, you will notice that the economy has a prominent position in each.



Venn diagram of sustainability. Image adapted by Tai Munro. CC0



Embedded circles model of sustainability Image adapted by Tai Munro. CC0

The image with the interlocking circles, is visually very similar to the model of the triple bottom line from business: people, profit, planet. Do you think that profit is the same as economic?

The image with the embedded circles can be problematic. While the intention is to show that society must be nested within the environment and the economy must be nested within society, some interpretations see this as the economy is central and, therefore, the first concern above both society and environment. There are no clear answers here, and achieving sustainability requires asking some difficult questions. The following podcast (16:55) discusses some of the current consequences of how we currently think about economics and some alternatives. Listen (recommended) or read the following and consider how value and success might impact how we act. This post was originally published at ConnectingWithScience.org under CC-BY-4.0 by Munro (2020).

Reflections on Value and How We Measure Success

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://openbooks.macewan.ca/introductiontosustainability/?p=58#audio-58-1

Regardless of your opinion of the role of economics in sustainability, it is impossible to argue that the economy does not currently have a large impact on each of our lives and our lives as a community. It is difficult to be concerned about changing light bulbs if I can't put food on the table, or if I don't have a table to put food on. It is also interesting to note that economics used to be known as political

economy — that is, until the powers that be decided to science it to make economics more like sciences like physics, impartial and non-value driven (Mazzucato, 2018). This sits poorly for me, as a student of science, because there is growing recognition that science is value-laden, rather than value-free. And really, that's where we need to start: by thinking about value. For the next couple of minutes, I'm hoping that you might think about three different questions. I'll ask you a question and then give you 30 seconds (s) to answer it. If you want to grab something to write on, put me on pause and go do that. There will be background nature sounds playing for the 30 s.

Look around you, what elements in your environment have value to you?

-30 s-

If you need more time, feel free to pause me again and continue your list. Just press play when you're ready to continue with the next question.

What elements in your environment contribute money to the economy?

-30 s-

Now compare your two lists. What made it onto both lists and what didn't? What does comparing the two lists make you think or feel?

-30 s-

I did this activity while sitting outside in a city park. That's something I value, having access to open spaces and being able to interact with nature. I value the time I have spent with friends in parks. I value the trails I can ride my bike along and the river I can paddle on. I value the sun shining down on me and the birds chirping in the trees. I can't see them, but I know there is other wildlife around me too, like it should be.

But when I think about what contributes money to the economy, I struggle. The trails and facilities do require maintenance, so there are people who have jobs, but I don't pay to use this park. There are education and sports programs that use the park, not to mention dog companions (most people call them owners, but can we own another being?). They all contribute money to the economy in some way, exchange of services or purchase of equipment. My friends and I might bring food to the park — that adds a little bit to the economy.

But what about when I compare my lists? It isn't the food that we bring to the park that I value; it's the time I spend with people I care about. I do value the people who maintain the park trails, but that's so that I can continue to ride my bike safely and not have to pay to go to a gym just to get a workout. I enjoy the wind in my face — no economic value there unless we're talking wind turbines. There is value to be found in the trees in the way that they prevent the bank from washing away, but not economic value. We can save money by leaving the trees in place, but if we need to support the economy as it is, we'd be better off to cut the trees down, process them for paper, and erect erosion guards on the bank to stop the river from washing the soil away.

The concept of value is one that we don't often think about. What determines value? Is value the same thing as cost? Is the most expensive thing you own, also the most valuable to you? I remember going to a concert while I was a student. I had my computer with me and they wouldn't let me take my bag into the theatre and told me I could leave it in their secure coat check. I was, shall we say, reluctant, but it had nothing to do with the value of the computer. It had everything to

do with the value of what was on that computer, which was my entire thesis for my PhD. It was the time that I had put in. It was the thought that that document contained that I was terrified of losing.

Value is an interesting term, isn't it? We've been confronted by it within the covid-19 pandemic. The value of things like toilet paper has suddenly been made clear, as was the value of the people who perform essential services, which, for a time anyway, included grocery store staff. For many, the value of a teacher who spends their day helping 30 eight-year-olds learn also became abundantly clear. Funny how none of those people are the highest paid in our society.

Generally speaking, when we measure how a country is doing, we look at the GDP or GNP. These are the gross domestic product or gross national product, respectively. It is the measure of the "value" of all goods and services produced in an economy. So, for the GDP, all spending is good and everything that doesn't involve goods and services that are bought and sold means nothing. Therefore, as Robert F. Kennedy said,

> Our Gross National Product (GNP)... counts air pollution and cigarette advertising, and ambulances to clear our highways of carnage. It counts special locks for our doors and the jails for the people who break them. It counts the destruction of the redwood and the loss of our natural wonder in chaotic sprawl. It counts napalm and counts nuclear warheads and armoured cars for the police to fight the riots in our cities... Yet the gross national product does not allow for the health of our children, the quality of their education or the joy of their play. It does not include the beauty of our poetry or the strength of our marriages, the intelligence of our public debate or the integrity of our public officials. It measures neither our wit nor our courage, neither our wisdom nor our learning, neither our compassion nor our devotion to our country, it measures everything in short, except that which makes life worthwhile. (Remarks at the University of Kansas, March 18, 1968)

Think about that for a moment — a car accident is good for the economy because it results in spending on repairs or new cars, higher insurance, physiotherapy, and who knows what else. But being a safe driver with its reduced costs is not. Similarly, being active and eating healthy is less valuable to the economy than someone who eats poorly and smokes. Oh, and if you volunteer to do anything, or take on the challenge of being a stay-at-home parent, you are simply not a contributing member of society.

So long as the GDP continues to rise, we are told that we are on a good path, but the research says something else. Yes, you need enough money to meet basic needs and a bit above that, but beyond a certain point, more money does not equate to more happiness, or as Anielski (2007) puts it, more well-being.

This is where the idea of universal basic income or universal basic services might enter into the discussion. What if everyone had the ability to access basic services either because they were simply available (acknowledging, of course, that for this to occur, we would need to first tear down the systemic racism and inequality that prevents many from accessing the services that are available) or because they were guaranteed enough income to be able to pay for them. Of course, someone might ask who determines what is basic, and we end up back in a conversation about value. Is access to healthy food essential? On that, we might be able to agree. But what about access to knowledge on how to prepare healthy food — is that essential? What would you say if someone got to go to a basic cooking class for free so that they could prepare food for their family? I'm sure

someone out there would argue that it isn't essential. What about a gym membership? Is that essential, or should people be expected to exercise outside at minus 30 or in a basic apartment that just gives them enough space to eat and sleep?

This question of who decides what is valuable is an important one that we rarely even consider, even in education programs designed to teach people about economics and business. And what is valued in terms of the GDP has changed over time. Did you know that finance and banking activities weren't included in the GDP until the 1970s (Mazzucato, 2018)?

There is significantly more that can be said about the downsides of measuring success with dollars and cents, but the thing is that, unless we have an alternative, it is very difficult, if not impossible, to change. So, is there an alternative?

The first country to really try an alternative is Bhutan, a tiny country on the edge of the Himalayas. Bhutan was a monarchy, and their king decided that if they were going to interact with the Western world, they were going to do it on their terms, and that meant focusing on the well-being of the nation. Thus, they introduced Gross National Happiness which, according to Bhutan Prime Minister Dr. Lotay Tshering, "means contentment, control of your mind, control of wants in your life. Don't be jealous with others, be happy with what you have, be compassionate, be a society where you can be more than happy to share." It is "development with values" (in LaMotte, 2019, para. 5-6). Bhutan banned plastic bags in 1999 and tobacco in 2005 and a minimum of 60% of the country must remain under forest cover.

New Zealand is another country that is trying a different model. With their well-being budget and the Living Standards Framework (LSF), they "consider that drawing on a range of data and evidence to understand the interdependencies and trade-offs across the different dimensions of wellbeing is simply robust economics" (New Zealand Government, 2019, para. 5). The LSF includes 12 domains of current well-being, including housing, income and consumption, but also social connections, cultural identity, and even subjective well-being. It also includes four stocks: natural capital, social capital, human capital, and financial and physical capital.

Doughnut economics, developed by Kate Raworth, is a model of economics that argues that we need to meet the needs of people without exceeding the limits of the environment. It too is gaining traction, as locations like Amsterdam look to recover from the recession triggered by the covid-19 pandemic while also addressing the extensive social and environmental issues of the times (Doughnut Economics Action Lab, 2020).

There are other alternatives as well. Modern monetary theory argues that countries that issue their own currencies can't actually run out of money the way an individual or a business can, and, therefore, the idea of a country going into debt is a social construct (Kelton, 2020). We might also consider Indigenous economics, which recognizes that Indigenous peoples had trade and specialization, public infrastructure, property rights, and mediums of exchange long before Europeans ever arrived on Canada's shores.

So, we started thinking about what we value and where do we finish? Well, we finish rethinking the mentality that the economy we know is the only possible option. There are questions that need to be asked by every individual, community, and country. What are the things that we wish to measure our success on? Is a system that is supported by the negatives of society like poor health and systemic racism the system we want to be using? What would it take to achieve change?

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Sometimes we are so embedded within the systems we operate in that it is hard to tell that it is a system or that there could be different systems. However, this is exactly what projects like doughnut economics, modern monetary theory, and Indigenous economics attempt to introduce: a new (or old) economic system that sees things like value and growth differently than the GDP. While all of these alternatives are interesting and relevant when it comes to sustainability, we are going to look at doughnut economics.

Activity 4.1: Doughnut Economics Discussion

Watch *A healthy economy should be designed to thrive, not grow*. As you watch, consider:

- What surprised you in Raworth's talk?
- What opportunities can you identify in doughnut economics?
- What challenges can you identify in doughnut economics?
- Is there anything missing from Raworth's model?

Systems Thinking and Economics

Consider Raworth's (2018) discussion about the impacts of the view that economic growth is not just desired but necessary. If we think of that as being the goal of our current system, what are some of the potential consequences through the rest of the system? What feedback loops exist because our economy is designed to grow? What elements don't get included into our system as a result of this goal? The goal of constant growth is

what humans want out of the system, at least some humans. But then what are the emergent properties of the system? What is the observed behaviour of the system? What do the inner and outer circles of the doughnut model show us about how the system is behaving?

Reflection 4.1: Perceptions of Growth in Your Life

How does the idea that all growth is positive show up within your discipline or your personal or professional life? What are the consequences of this image for how you or others interact with those around you, including the natural environment?

Activity 4.2: Unthing

Go for a minimum of 72 hours without something that you would have used frequently in that time.

Being sustainable is often paired with the idea of sacrifice, but this is often because we can't see another way. Your challenge is to identify what you gain from your unthing. Connect your experience in this activity to the discussion around doughnut economics and GDP. At the end of your experience, consider the following:

- What your unthing was and why you chose it?
- Identify 2 elements and 1 interconnection between your unthing and other aspects of your life.
- How does your unthing relate to sustainability broadly?
- What did you gain from your experience?
- What was your experience of focusing on what you gained rather than what you were sacrificing?
- Which economic model (doughnut or GDP) would be more likely to benefit from your unthing and why?

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About the author

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Dr. Tai Munro is a settler on Treaty 6 territory. She views sustainability as something that must centre relationships with ourselves, each other, and the more-than-human. As an Assistant Professor of Sustainability Studies at MacEwan University she is an advocate for open and inclusive education. She believes that sustainability involves everyone and sets out to enable others to join and contribute to the community.

Chapter 5: Environment

TAI MUNRO

Key Ideas

In this chapter, you will learn about:

- historical and cultural conceptions of the environment
- Indigenous-led conservation projects

Defining Environment

Many text definitions of sustainability struggle to define the environment. Terms like natural resources and meeting needs (implied as human) are often used to communicate what sustainability is. But they raise the question, does "the environment" within the context of sustainability only matter insofar as its use by humans? Plumwood (2001) suggests that as long as humans are viewed as separate from the environment, the environment will be an object to be either exploited or protected. With this in mind, listen to the following podcast, "What is 'The Environment'?" (10:47), originally published at ConnectingWithScience.org under CC-BY-4.0 (Munro, 2020).

What is "The Environment"?

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://openbooks.macewan.ca/introductiontosustainability/?p=114#audio-114-1

What is "the environment"? Do you know where the border is between environment and not environment? The environment has featured heavily in conversations about sustainability. In fact, most people assume that sustainability is really environmental responsibility and that we need to be better in how we manage natural resources. This, we connect directly to nature. So, I want you to

take 30 seconds and picture your perfect nature scene. You can do this in whatever form you would like, be that a memory, a photograph, a description, or a drawing. What is your perfect nature scene?

–30 s–

If you're not ready to come back yet, just pause me and come back when you're ready.

Now that you have a picture of nature. I'm going to ask you some questions about it. To give you time to answer, I'll wait 20 seconds before continuing. This may seem like a long time but continue to reflect as you may start to notice things that aren't immediately apparent.

Where are humans in your scene?

–20 s–

What signs are there that the scene is changing?

–20 s–

How close is the scene to what you would call wilderness?

–20 s–

I have a particular fascination with how we picture things. I even used participant-led photography as the method in my research for my Ph.D. I think how we picture something or how we frame a photograph can reflect many things that are unsaid, hidden from the viewer and perhaps even hidden from ourselves. My perfect nature scene does not show any humans, but its perspective is such that the image taker or creator is surrounded by nature, embedded within nature. You can feel the sunlight on your face as you look up into the glowing canopy of trees in my nature scene. If you strain hard enough, you should be able to hear the leaves rustling and the birds singing. And yet, even though you are there, right in the middle of nature there is a barrier. You can't actually strain hard enough the hear the birds. You are not warmed by the sunlight. Ultimately, you are just a distant visitor who may as well be looking down upon the scene. My perfect nature scene has changed for me. The boundary between me and "the environment" has reappeared.

Did you know that landscape was "not considered a fit subject for painting by Europeans until the 19th century" (Talbot, 1969)? Europe didn't really have wilderness, except for that which was inaccessible and barren (Talbot). What "wild" areas there were existed for hunting (Talbot). Thus, landscape painting was not an appropriate medium until colonizers from Europe and England spread across the world. Indeed, in the quest to differentiate themselves from their European counterparts, the landscape, or more specifically the frontier, the boundary between wilderness and civilization, became a popular artistic subject among the colonizers in places like the U.S. and Canada (Hall, 2002).

This idea of the frontier was important because it was only once a colonizer had built a comfortable urban environment that they could appreciate nature and wilderness (Hall). Depictions of Indigenous people's ranged from childlike to savage, reflecting the European belief that to live with nature was a lesser form of being (Talbot, 1969).

Wilderness, however, was perceived as part of the American identity, and arguably other colonized nations as well, such as Canada and Australia. The wilderness was to be preserved in a way that set these populations apart from their European beginnings, and thus began the creation of national parks (Hall, 2002). George Catlin, a painter in the early 1800s, expressed that we should preserve the

animals and the Indigenous Peoples for the "refined" American to view and appreciate (Hall, 287). When the first national parks were signed into being, they focused on preserving nature and excluding the local peoples. Banff National Park in Canada evicted the local Nakoda to ensure that their subsistence practices didn't interfere with growing tourism economies. In addition, their eviction ensured that they remained on reserves, where they could be exposed to assimilation tactics through the church and residential schools (Mason, 2018). They were allowed back into the park each year for Indian Days in order to, just as Catlin had argued, perform their traditions for the spectacle of the civilized colonizers. And thus, we preserved the frontier, the edges of civilization that we may explore while maintaining the constant movement towards progress and separation from "the environment."

This is why in my ideal nature scene, I am unable to recognize the role of people in living with nature. I can't see how careful, thoughtful actions would alter the landscape without destroying it. I can't see how Indigenous Peoples might have used fire to increase the diversity of the plants, and how those increases in plant diversity would, in turn, support the populations of bear and deer and caribou that could be in this space. I can't see how thinking of nature as anything other than natural resources and national parks might be creating nothing more than an imaginary wall that makes me think that I am not part of environment. And thus, I am part of not the environment but of the Eurocentric quest to, in Rachel Carson's words, alter the nature of his (sic) world" (p.23).

But, this isn't who I am. I am often stuck with language that conveys a separation between environment and humans but I don't believe that. I do appreciate my raincoat and my winter boots but rather than seeing these as things that separate me from nature, I see them as things that bring me closer. I had never heard of the Norwegian term **friluftsliv** until a recent news article (Ferrier, 2020), but I have lived it for many years. I don't have sufficient fat stores or thick enough fur to get outside in the middle of an Edmonton winter, but I can use clothing so that I can be active all year. So that I can enjoy free-air-life (Ferrier). I may not have the green thumb to grow my own food, but neither does the bear. The bear shops at the stream for salmon and the forest edges for berries, I shop at the farmers market. Richard Lewontin was one of the first biologists to question the idea that there is a genetic background for race; he found that there is not (as cited in Aronson, 2001). He also questions the idea that there is a "the environment" that is somewhere out there in need of and even waiting for human protection (1991). These social constructs of race and the environment are not unrelated.

Indigenous protected areas, Indigenous-led research, and the recognition of the importance of culture in relationships with nature are pushing back against the idea that Eurocentric organizations should invite "others" to the table. Perhaps we shouldn't have a table. Perhaps the Eurocentric organizations need to be invited.

How do we talk about sustainability without talking about the environment? Perhaps we should be asking those people who have never needed to create a word for sustainability because it was simply part of living. So perhaps I can feel the sun on my face as I stand as part of nature and not looking at a nature scene.

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Indigenous-Led Conservation

As we were just exploring, the history of conservation in colonized nations is based on the idea that separation from nature, keeping nature as a space to visit but not live, was seen as more civilized than living with nature. This led to the forced removal of Indigenous Peoples from their traditional lands. Today, things are starting to change. Indigenous-led conservation projects are becoming more common. They are also seeing success where traditional conservation has not. However, there is still a high risk that these partnerships result in tokenism and disconnect. It is not enough to take Indigenous Peoples' knowledge or pay Indigenous Peoples to work on projects. Indigenous Peoples must have meaningful decision-making roles within these projects.

Activity 5.1: Indigenous-Led Conservation Discussion

Complete at least one of the following three readings and consider the associated questions.

Canada working towards new future for Indigenous-led conservation by James Dinneen (2020).

- Indigenous thought leader and former Chief of the Lutsel K'e Dene First Nation is quoted saying that conservation can be useful for articulating the meaning of reconciliation. How do you respond to his description of reconciliation? How is it the same or different from other activities or descriptions of reconciliation that you have seen?

- What is your view, based on your own background and experience, of what conservation should look like?
- What are some reasons that you can think of that "the land-use decisions of Indigenous communities and conservationists will not always align" (Dinneen, 2018, On a global scale, para 3.)?

Hawaiian communities restore Indigenous conservation, from mountains to sea by Roxanne Hoorn (2023).

- The article describes three Indigenous communities that have revived traditional stewardship approaches from mountain to sea. To do this, the communities had to overcome many obstacles in how the state and national governments had divided the land. As described, do you think that this is an example of **reconciliation**?
- What is your view, based on your own background and experience, of what conservation should look like?
- The scientific article on which this article is based was written by Indigenous and community leaders who have been working to restore Indigenous stewardship. How does knowledge from these individuals fit within the context of scientific and social scientific research and literature?

Indigenous women record age-old knowledge of bees in Colombia's Amazon by Astrid Arellano (2023).

- What do you think is the role and importance of Indigenous knowledge, songs, and stories within science generally and within conservation and sustainability?
- What is your view, based on your own background and experience, of what conservation should look like?
- In what ways is the information and knowledge the women are gathering beneficial for the broader conservation community outside of the local communities?

Systems Thinking and Environment

Ecologists often have one of the easiest times adopting systems thinking because they can recognize systems and the parts of systems in much of their work. Think back to the discussion of systems components. Predator-prey cycles — where the number of prey increases, which supports a greater number of predators, who then kill more prey which reduces the number of prey, which results in less food for predators, so the population shrinks, which allows for the number of prey to increase again — are a prime example of a balancing feedback loop. Beavers, who create new habitats by damming streams, are a leverage point that impacts large parts of the local ecosystem. The challenge goes back to the earlier quote from Plumwood about humans seeing the environment as something separate from themselves. If, from a Western lens, we see the environment as separate, then the interconnections between human and non-human are seen as weak interconnections at best. If we then try to combine that lens with an Indigenous worldview of greater connection and reciprocity, we can run into challenges just having a conversation because the meaning behind the language is so different.

Reflection 5.1: Boundaries

Choose a particular space to explore and reflect on. It may be indoors or outdoors. Start by defining the boundary of the human system in the space. Where does the system stop being human and become the environmental system? Now, try to find the holes or flaws in your own boundary. For example, did you define a building as part of the human system? Does that mean the wood that makes up the doors in that building is no longer part of the environment? See how many holes you can find in the boundary between human and environment. What does that say about the idea that there is an environment that we need to sustain?

Activity 5.2: Ecological Footprint Analysis and Reflection

Ecological footprint calculators were once very popular as a key tool to achieving sustainability because they helped provide more information about the consequences of an individual's living patterns. More recently, there have been significant critiques that they are an attempt to put responsibility for sustainability on individuals rather than broader systems like corporations and governments. The reality probably lies somewhere in between. The value of the calculators is that they raise awareness, but do they also inspire actions? Do they help educate users on what actions they can take to make a difference? Do they address all of the domains of sustainability?

One of the most important skills you develop as a student is the ability to ask questions and think critically about sources. With that in mind, use an online ecological footprint calculator such as this one by the Global Footprint Network to assess your current footprint. Once completed, answer the following:

- What surprised you about your footprint?
- Are you inspired to make any changes to reduce your footprint? Why or why not?
- What do you think was done well with the calculator?
- What do you think was missing from the calculator?
- Do you think that these types of calculators are helpful for sustainability? Why or why not? Use what you have learned so far to help support your answer.

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Chapter 6: Social and Cultural

TAI MUNRO

Key Ideas

In this chapter, you will learn about:

- the importance of social justice and cultural vitality in achieving sustainability
- the implications of only having a single story

In this chapter, we will look at social equity and cultural vitality. These two areas are often lumped together under social justice. Unfortunately, this can lead to ongoing inequity and cultural loss depending on how social justice is understood. If you look back at the doughnut model proposed by Raworth, culture is not mentioned. Can we assume that culture will be included in things like having a political voice, gender equality, housing, and food?

Let's start by looking at what culture is. What do you consider to be part of your culture? The food you eat? The beliefs you hold? The way your family and social groups interact? The way you learn? Culture includes all of these and more. Culture is a set of shared practices, goals, values, and attitudes that characterize a group. We often think of culture as having geographic or racial origins; however, there are many different cultures that we move between in our lives. You may have chosen the school you are going to because of the culture. One challenge with culture is that it can be difficult to identify what is part of your culture when you are part of the dominant culture. This is because beliefs, practices, and things like stereotypes do not stand out when they are part of the dominant culture. They are perceived as the *way things are*. On the other hand, cultural elements that are not part of the dominant culture can stand out and can be challenging to uphold. This can lead to criticism that these practices are incorrect.

Let's consider housing as an example. How big does a house have to be in order to house a family? Does the culture of the family make a difference?

In Western countries like Canada, refugees often live in small homes within multi-family housing units like apartment buildings and townhomes. But these types of dwellings are designed for small families, one or two children with one or two adults. Refugees with larger, multi-generational families struggle to fit within these small living spaces. This has the potential to lead to beliefs that this is not the *correct* way to live. Fortunately, there is growing awareness of this cultural bias and its implications.

A collaborative project in Edmonton, Alberta, Canada, between a church, a community, and a not-for-profit looked to address this housing issue. They engaged a builder specializing in sustainability and net zero buildings to complete a project that created spaces for 16 larger, low-income families, a new church that was more affordable to maintain, a daycare, and an influx of children to the nearby struggling elementary school (P. Amerongen, personal communication, March 15, 2019).

Recommended Resource

Read more about the story from Edmonton in Stolte (Jan 09, 2018). Do you know of, or can you find, any projects like this near where you live?

Our cultures and the social contexts that we have been exposed to and gotten used to impact how we perceive and interact with the world around us. Therefore, social and cultural contexts cannot be separated from how we view sustainability. Listen to the following podcast (10:47) for an overview of why sustainability includes both social and cultural components. It was originally published at ConnectingWithScience.org under CC-BY-4.0 (Munro, 2020).

Sustainability is Social and Cultural

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://openbooks.macewan.ca/introductiontosustainability/?p=116#audio-116-1

Have you ever thought about how the place you grew up affected you later in your life? What messages did you receive from the places you experienced?

Was where you lived or spent time focused on the car or on the people?

Was nature a space to explore or fear? Was the idea of walking to school a necessity or an impossibility?

In keeping with the theme of this series of posts, I'm going to give you some time to reflect on those questions: What was the message of the place you spent time as a child?

What about the spaces that you inhabit now? What messages do they send to you, to your neighbours, or to someone who might visit?

I'm fortunate to have many positive memories of the places of my childhood; but when I think about sustainability, one particular memory stands out. I remember playing street hockey in the parking space for the townhouse complex I lived in. We would set up right in the middle of the road. For any of you who have played street hockey, you are likely familiar with the "car!" call and the momentary opening that allows the car through before the game continues.

Looking back, I'm both baffled and fascinated by this exchange. We had the road, it was our place,

and we had to grant permission for the car to pass. Today, I can see the privilege in this story, but at the time, I only saw that the game, the community, the activity had priority over the car. This had an impact on my perception of what space is for, who space is for.

Today, I am a bike commuter and I have a very different perception of my place on the road. I want to have the place I had as a kid but I've experienced too many honking horns, swearing drivers, and an accident that resulted in multiple surgeries. Now, before you think that my childhood experiences left me racing through traffic and dodging between cars, I don't. Half of my incidents, including my most serious one, have been when I have been riding on separated bike paths. I know the research says that these paths are safer, but my experience has not been positive. Unlike my street hockey games, cars don't have to give me any space when I'm on a separated bike path. Of course, they take it a step further by yelling at me for being near their space. What was so clear as a kid, that public space was for community, is quite apparently not the case as an adult.

Place is an important concept. We will put effort into protecting places we love, and that can be positive such as events like the annual (except in covid times) river valley cleanup in Edmonton. But it can also be negative if we prevent, or try to prevent, others from using a space because they are different from us, as happened in May 2020, when a white woman called the police on a Black man who was birding in the area. Or as we looked at before with First Nations peoples being removed from their traditional lands in order to preserve the place as a national park.

Place also matters through processes like gentrification. With catch phrases like "revitalization," communities are redeveloped. Public art, new transportation lines, and business recruitment can make the once-local residents wonder how they fit in with someone else's vision for their place. Even buildings with their front and back sides can send messages about who belongs in what place, a reality that the Royal Alberta Museum in Edmonton actively tried to challenge with their new building by placing real entrances on three sides of the building.

Place can also have cultural implications. Consider advocates for the 100-mile diet. As an Albertan, the 100-mile diet has little appeal, as I would face an upcoming winter of beef and potatoes. But consider a Syrian refugee or an immigrant from the Philippines; the 100-mile diet would likely mean no recipes from home ever.

Place matters for sustainability, but we have to make sure to ask — a place for whom? Do we want sustainability that makes a driver feel like they can yell at me for being near them on the road or one that lets the kids decide when to grant access to the car? Do we want places that barely tolerate someone who is different or where we can ask to learn from every visitor and resident? Do we want public art regardless of its cultural relevance? Do we want revitalization that pushes people from homes they can no longer afford? Or do we want places that invite people in no matter what direction they are coming from? Do we want to eat within 100 miles or do we want to eat the foods of our culture and family?

If you've followed the last two posts in this series, you may be noticing a trend. When we talked about the economy, we considered what values we have compared to what has value in our economy. In "What is the environment?", we asked who gets to define what "the environment" even is. These both have implications for our social and cultural health. If we value consumption, then what is the point of putting a welcoming entrance on the "backside" of a building? After all, we wouldn't have a reason to invite someone in who couldn't afford our services. If we value nature that

is untouched by human hands, then shouldn't everyone be behind the fence regardless of any aspect of their identity?

Economy, environment, society, and culture are not the four pillars of sustainability because sustainability won't be built on pillars. Pillars, or legs of a stool, or even interconnected circles — all common images when defining sustainability — all imply that these are separate topics that only connect to sustainability when things are right. But that's just not the case. We can't separate the environment from our culture any more than we can separate the economy from our society. Imagining that we can see these areas as discreet entities has led us to the place where we exclude people by default. It prevents us from recognizing that "small actions" like carrying reusable grocery bags mean nothing if you have no access to groceries. It prevents us from realizing that the trees we cut down because they disrupted the view were performing a service that will not be matched by building an erosion guard where the trees once were. It prevents us from realizing we are all in this together.

I used to run an activity with kids in the camp programs I led. We took a ball of yarn and connected the parts of a food web. But then we would remove something from the web, perhaps the nearby pond that had been filled in to make way for a shopping complex. The web would shift and change, parts of it would collapse, perhaps all of it would collapse, or sometimes one part of the web would grow in response while others withered and died. I feel like this is a much better analogy for the relationships among society, culture, environment, and economy. They are fundamentally interconnected, but when you let a component drop, like trying to extract culture from the First Nations through residential schools, the ripples spread out continually along the rest of the web.

So, what is the web of sustainability? What parts have overgrown more than they should? How do we support the re-emergence of what has been lost? How do we change our thinking so that we see connections rather than boundaries? Perhaps we once had those ways of thinking when we looked at our places through our eyes as a child, when places could be for community, recognizing that many people learn at very young ages all the barriers in the way of community.

Reflection 6.1: Culture and Sustainability

As you consider your relationship with sustainability and culture, consider these questions:

- What was your relationship with the surrounding world when you were growing up? Who had the right-of-way? Was nature a place for adventure or fear?
- What are some examples where you or someone you know might not be able to access culturally appropriate housing, food, or clothing? What are the impacts of this experience?

Just Sustainabilities

Dr. Julian Agyeman is a Tufts University professor of urban and environmental policy and planning. He introduced the concept of **just sustainabilities** to counteract the focus on environment that most people have when they think of sustainability. In his talk, he discusses three areas of just sustainability: space and place, food, and culture.

Activity 6.1: Just Sustainabilities Discussion

Watch *Julian Agyeman: Toward Just Sustainabilities (Conserving Nature for the Next 100 Years)* (18:53). As you watch, consider the following:

Space and Place

- What is spatial justice?
- What examples can you identify of spatial justice or spatial injustice around where you live?
- Are the streets where you live democratized? How do you know?
- What influence do the streets where you live have on how you perceive the world?
- What design change could make your favourite park or greenspace more inclusive?

Food

- Do you agree that food is a good place to start talking to someone about the environment? Why or why not?
- What would you have to give up in your diet if you could only access food that should be grown in an area?
- What is your local food?

Culture

- What are the limits of multiculturalism?
- What evidence do you see of multiculturalism or interculturalism in an organization you are familiar with?
- In what ways does your city embrace or not embrace diversity?

Finally, what factors limit our imagination of what the system could be? What strategies might we be able to use to challenge those limits?

Sustainability Stories

In Chapter 1, we looked at a brief history of the modern sustainability movement. Chapters 2 and 3 then introduced a way of looking at the world called systems thinking. These two topics come together in this chapter. When it comes to sustainability, Selby (2000) argues that we are still grounded in reductionism. As a result, concepts like interdependence are viewed as "an intricate relationship between still separate parts" (p. 89). This statement helps illustrate the influence of culture on our perception of sustainability. Humans are not separate from the environment, yet Western society acts like we are. As we heard in Chapter 5, this view of separation played a large role in making colonizers feel that they were justified in removing Indigenous Peoples from the land.

This is the danger of having a single story. If we only ever hear of a single way of being or doing, it is easy to assume it is correct in every situation, but is that the case?

Reflection 6.2: A Single Story

Watch *The Danger of a Single Story*, a TedTalk by novelist Chimamanda Adichie. As you watch, consider when you have held a single story or been subjected to someone else's single story.

Agyeman challenges the single story of sustainability in his talk about just sustainabilities. He challenges ideas like the 100-mile diet and what a street must look like. In the next video, Yankunytjatjara elder and traditional owner of Uluru, Bob Randall, explains the connections between him, the land, and every other living thing.

Reflection 6.3: Comparing Stories

Watch *The Land Owns Us,* a video from the Global Oneness Project featuring Bob Randall. As you watch, consider how his story compares with your own.

Wicked Problems, Multiple Stories, and Systems Thinking

Recall that sustainability problems are wicked problems; we are missing information, many people need to be involved, the requirements change and sometimes contradict each other, and there is no single solution. Another way to think about this is that there is no single story for sustainability, even though that is what most of us know and want. We want to know that if we all switch to reusable straws, we will achieve sustainability, but that isn't the case. We want to know that if we can just get our energy from renewable sources, we will achieve sustainability, but that isn't the case.

One of the values of systems thinking is that it can include multiple stories or perspectives; in fact, multiple stories will make your understanding of a system more robust. This was shown by Cole *et al*. (2022) in a study on making landscape decisions in order to achieve **net zero**. Scientific modelling and knowledge need to be connected and situated in the social context to succeed. As a result, the right solution needs to be identified for each place and include local decision-making.

Activity 6.2: Connecting Stories with Wicked Problems

Choose a social issue that affects your community. You may define community however you would like, but you must include an explanation of the community you chose. The social issue may be well documented, such as homelessness, but it may also be something that is more anecdotal.

- Identify the issue and describe why you think it is relevant to your community.
- Do an internet search to identify two potential strategies to address the issue. Don't forget to record the reference information. For each strategy:
    - What is the story that is revealed by the proposed strategy? Think about what the proposed strategy implies about the causes of the issue. For example, if you are considering overdose deaths in a community, and a proposed strategy is to strengthen drug laws to allow for increased charges and incarceration, what does that say about how drug users are perceived?
    - Does the strategy use a systems thinking perspective or not? In other words, does it address the system or just symptoms?
- Identify two actions you could take to learn more or contribute to addressing the social issue.

The devastating injustices that First Nations, Inuit, and the Metis Nation, along with Indigenous Peoples worldwide, have experienced at the hands of colonizers is another example of the danger of a single story. In Canada, the *Truth and Reconciliation Commission of Canada: Calls to Action* were developed to "redress the legacy of residential schools and advance the process of Canadian reconciliation" (p. 1). Reconciliation is something that we all play a role in. In engaging, we can hopefully all begin to see both the dangers of a single story and the importance of the Indigenous stories that we are at risk of losing and those that we have lost.

Activity 6.3: 150 Acts of Reconciliation

Fraser and Komarnisky (2017) developed a resource called *150 Acts of Reconciliation* in relation to Canada's 150th birthday. The acts range from the small and every day to more provocative acts "that encourage people to think about Indigenous-settler relationships in new ways."

Visit the resource 150 Acts of Reconciliation. Choose at least one act and complete it. Record your experience, including:

- which act you chose and why
- what did you do to complete it
- reflection on your experience
- description of how actions like the one you completed contribute to cultural vitality as part of sustainability

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Chapter 7: The UN Sustainable Development Goals

TAI MUNRO

Key Ideas

In this chapter, you will learn about:

- the United Nations (UN) Sustainable Development Goals (SDGs)
- how the SDGs connect with systems thinking and the areas of sustainability that have been covered thus far

Agenda 2030

Most organizations have some sort of plan for what they want to do. You might have a plan that you are using to guide your own actions at the moment. To guide these plans, we generally need a goal or vision we want to reach. A term you might hear is **BHAG**, which stands for big hairy audacious goal. A BHAG isn't supposed to be something that will be easy to achieve. It should be big and potentially even a little innovative or trend-setting. The audacity of the goal helps define a vision for the future and gets people to work together to achieve it.

Reflection 7.1: BHAG for the World

Take some time and think about what the world would look like if you had complete control. Don't let the current reality constrain you. What would you want the world to be like? Some areas you may want to consider include:

- Is there money? An alternative economic system? Do people have to earn something to get something? Are people's material needs met automatically, or do they have to do something to get them?
- Where do you live? What type of housing is there? Do you share with others or have your own space? Do you have neighbours? What are they like?
- What are the relationships between people like? Does everyone respect each other? Is society hierarchical? On what criteria is the hierarchy built?

- What does the planet look like? Are humans considered part of nature and the planet or separate from it? Are natural systems mixed with human ones or separated?

Agenda 2030 "is a plan of action for people, planet and prosperity" (Department of Economic and Social Affairs, 2015). It addresses peace, poverty, environmental degradation, human rights, and gender equality. The SDGs are laid out within Agenda 2030. They are a BHAG for the planet. They are intended to challenge and inspire people around the world to work together to achieve the goals. Watch the video (1:54) for an overview of the goals.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://openbooks.macewan.ca/introductiontosustainability/?p=149#oembed-1

Recommended Resource

Check out Agenda 2030. While it is quite long, it is interesting to read how they introduced a BHAG for the world.

As we have seen so far, sustainability includes many different areas. In addition, we need to take a systems perspective to achieve sustainability. There are limits to an individual's perspective or even the perspective of a single city, region, or nation. What concerns Canada or the United States is not the same as for Tuvalu, an island country that is expected to be completely submerged by rising sea levels due to climate change within the next few decades. However, many sustainability issues do not stay within borders. Widespread forest fires in Canada resulted in widespread air quality issues in the U.S. in 2023. Clothing purchased in North America may be made under unethical and unsustainable conditions in places such as Bangladesh and Cambodia, then disposed of in places like Ghana. Greenhouse gas emissions from industrialized countries are primarily at fault for Antarctica's ice sheet loss and Tuvalu's impending loss.

The United Nations is an international organization. It currently has 193 Member States. The United Nations is "one place where the world's nations can gather together, discuss common problems, and find shared solutions" (United Nations, About Us, para. 1). The SDGs arise from this network and therefore acknowledge the problems and targets at a global scale. At the same time, there is recognition that every nation will have its own path towards the goals. The goals are intended to provide targets without being prescriptive about how to get there. Thus, there are both challenges and opportunities with the SDGs. Some examples are discussed below.

Opportunities

Common Language

The goals and their associated targets can help people, organizations, and countries talk about sustainability in ways that are commonly understood by all parties. Or at least, the conversations can start from this common base, which can help speed up the amount of time it takes for people to communicate clearly with each other.

Illustrate the Breadth of Sustainability

As we discussed earlier, many people think of sustainability as being about the environment. Something along the lines of using fewer resources so that there are resources left for the future. But as we've seen thus far, sustainability necessarily includes economic, social, cultural, and environmental components interconnected in ways that they cannot be separated. By including goals relating to areas like education, poverty, gender, peace and justice, and environment, the goals illustrate how many components there are within sustainability.

They Are a BHAG

The very nature of having these international goals can give organizations and governments something to aim for that is an international goal. They have the potential to help break down artificial borders by focusing on the world as a whole instead of its individual pieces. In short, they give a target for the system to aim at, rather than just parts of the system.

Challenges

Can Lead to Assumptions

While the SDGs give us a common language, there is also a risk that comes with this. What if we think about quality education differently from each other? We might be using the same terms but actually talking about different things. By starting with a common language, we might forget that we still need to clarify what that means.

Do the Goals Go Far Enough?

The very term sustainable development is full of controversy. Does everyone agree that development, if it is done sustainably, is the goal? Development implies growth, but can we continue to grow without stopping?

Are the Goals Inclusive?

Do the goals have space for all cultures and ways of being? Target 4.6 states that all youth and many adults will have literacy and numeracy. What does this mean? Does being literate mean that we can read certain written

texts? What about someone who can read the land to find herds of caribou, can hunt and gather to find food, can contribute to their family but can't read — does that mean the goal has failed?

Reflection 7.2: Are the Goals Representative of Sustainability?

Consider what you have learned about systems thinking. Do you think that you could create a systems map of the SDGs? Are they interconnected with each other? Can you eliminate poverty without also achieving quality education and gender equality? Do we need peace and justice to have economic growth? What happens if we treat them separately instead of as interconnected?

Do you see the different domains of sustainability — culture, social, environment, and economics — in the 17 goals? Is there anything missing? Are they given equal weight? Is this good or bad?

Activity 7.1: 170 Actions to Change the World

Go to 170 Actions to Combat Climate Change. Choose one of the goals you are interested in, then select it and choose one or more of the actions identified under that goal to combat climate change and do the action. Then record:

- your reasons for choosing the specific goal and action(s)
- what you did to complete the action
- reflection on your experience

Also, answer the question:

- In what ways do you think the goal and the specific action you chose contribute to a more sustainable world?

Other Global Initiatives

There are a number of different global initiatives that have been in place for varying lengths of time. Many, like the Universal Declaration of Human Rights (1948), which identifies education, food, and recognition as a person before the law as just three of the fundamental rights that everyone has, focus on items that have been integrated into the SDGs in some way. We will briefly look at a few relevant initiatives here. There are links at the end that you can review for more information.

Paris Agreement

The Paris Agreement is a legally binding international treaty on climate change. It was adopted at the UN Climate Change Conference (COP21) in 2015 by 196 parties. The goal was to limit the global average temperature increase to less than 2°C above pre-industrial levels. Recently, there has been more stress on limiting warming to 1.5°C, as this number has been identified by the Intergovernmental Panel on Climate Change as leading to severe climate change impacts.

Intergovernmental Panel on Climate Change

Specifically related to climate change, the United Nations Intergovernmental Panel on Climate Change (IPCC) assesses the science related to climate change. The reports review current scientific, technical, and socio-economic knowledge about climate change impacts, risks, and mitigation options. One goal of the IPCC reports is to be policy-relevant but not policy-prescriptive. This means that they aim to provide objective and transparent reviews regarding the state of knowledge so that other bodies, such as national governments, can develop appropriate policies for adaptation and mitigation.

Science-Based Targets initiative (SBTi)

Science-based targets is an initiative specifically for corporate climate action. Created through a partnership between CDP, the United Nations Global Compact, World Resources Institute (WRI), and the World Wide Fund for Nature (WWF), the SBTi identifies best practices for reducing emissions and setting net-zero targets and provides technical assistance and resources. The initiative is created based on the idea that private industry is necessary in reducing greenhouse gas emissions and developing resilience and mitigation practices. This organization supports and encourages the private sector to take action regardless of government regulation or public pressure.

United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)

This declaration provides a framework for the minimum standards regarding the survival, dignity, and well-being of the world's Indigenous Peoples. It extends existing human rights standards and fundamental freedoms to apply to the specific contexts of Indigenous Peoples. Notably, although these countries have now supported the declaration, Australia, Canada, New Zealand, and the United States voted against the declaration when it was first adopted in 2007.

Recommended Resources

- Universal Declaration of Human Rights
- The Paris Agreement
- Intergovernmental Panel on Climate Change
- Science-Based Targets initiative
- United Nations Declaration on the Rights of Indigenous Peoples

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PART IV

SUSTAINABILITY CHALLENGES AND OPPORTUNITIES

Chapter 8: Climate Change

TAI MUNRO

Key Ideas

In this chapter, you will learn about:

- the basics of what climate change is
- climate change and feedback loops
- research about how people see themselves in climate change

What is Climate Change: A Brief Overview

Climate change and global warming are terms that get thrown around a lot in society today, but what do they actually mean? Global warming was the first term popularized to describe the changes happening to the Earth's climate. Through industrialization and new technologies, humans began to unlock energy stored in the past. Up until this point, we could only operate with the energy from current or recent sunlight. We could cut down trees and burn the wood to release the energy the plants had stored from the sun. But this was all on a fairly recent time scale. With the advent of technologies that extracted and burned fossil fuels, we could access the energy stored from ancient sunlight. This was great for productivity because we didn't have to wait for new trees to grow. But when we burn things, we release the gas carbon dioxide. By burning fossil fuels, we were releasing much more carbon than we had previously. The carbon, in the form of carbon dioxide, builds up in the atmosphere, where it stops heat from leaving the Earth. Think of it like a blanket wrapped around the Earth to keep the heat in. Global warming describes the overall heating of the planet, but it doesn't capture all the other changes that happen as a result. That's where the term climate change comes in. The overall push on the climate is the increased temperature, but this doesn't play out the same way everywhere. Some places end up colder, and we get more extreme weather, so things like massive storms, floods, and droughts all happen more frequently, and the seasons are shifting in many places, with spring often starting earlier than it used to. Climate change refers to these more general changes in an attempt to capture the breadth of the consequences of putting more carbon dioxide and other greenhouse gases into the atmosphere.

Recommended Resource

Check out the TEDEd video (2:49) Climate change: Earth's giant game of Tetris developed by Joss Fong to learn more about how climate change works.

If you would like to learn more, we also recommend:

- How Do Greenhouse Gases Actually Work? (3:08) by MinuteEarth
- David Spiegelhalter: Why is Probability Difficult and Unintuitive? (1:44) published by Wired UK

The video on probability is interesting because it gives some insight into why it is so difficult to understand and sometimes accept climate change.

Feedback Loops

Climate change is an area where we see feedback loops in action. In fact, it is the feedback loops that create some of the challenges and unknowns with climate change. Because our global climate is a system, many interconnections and relationships exist. But, as you have seen, sometimes our actions have unintended consequences. The climate isn't directly determined by how many parts per million of greenhouse gases are in the atmosphere. That is part of the equation, but other factors, like how reflective the Earth's surface is, also impact it. You have probably heard that wearing dark-coloured clothing on a sunny day will make you warmer. This is because dark colours absorb more sunlight compared to light colours. The same thing happens with our planet. When we have lots of ice, the ice reflects the sun's heat away. But as climate change causes sea ice to melt, we lower the reflectivity of the earth's surface. As a result, the Earth absorbs more heat, which then causes more melting.

Recommended Resource

Feedback loops are a significant part of climate change. We can't identify the action level needed without considering the feedback loops. The following resource illustrates four major feedback loops that impact climate change. If you want to know more about climate change or if you would like more information about feedback loops, this is a helpful resource: Climate Emergency: Feedback Loops.

Global Initiatives

In Chapter 7, we briefly mentioned global initiatives in addition to the UN SDGs. You may have noticed that several of them focused on climate change. The IPCC reports provide a basis for many other climate change initiatives. The IPCC aims to objectively analyze the existing scientific, technical, and socio-economic knowledge about climate change. One of the ways that they do this is by ensuring diversity and representation among the authors of the various reports. Remember that systems thinking is best done by a diverse group of people. Everyone has their own biases and perspectives, but by combining many different perspectives, we can work to

overcome biases. Therefore, ensuring diverse representation is important to completing an objective analysis. At the same time, there will always be voices that are missing. The IPCC relies on all authors completing the work voluntarily. As a result, most, if not all, authors will be employed by an organization that would support their participation as part of their job. This has the potential to exclude some individuals.

Activity 8.1: What Do You Want Someone Else to Know?

There is a lot to unpack in the IPCC reports. Fortunately, there are organizations that help to break down the information in these reports. Check out CarbonBrief's resources on the IPCC sixth assessment cycle. Choose a resource from the list on a topic that interests you and consider the following:

- Why is your chosen topic relevant to you and/or your discipline?
- What surprised you about what you learned?
- What would you want someone else to know about the topic?

Create a social media post or infographic that informs someone else about what you think is the most interesting or important information from the resource.

Visualizing Climate Change

What do you think of when you think about climate change? Are there any pictures that come to mind?

Extreme storms?

Polar bears?

Drought?

The images can seem quite distant and separate from our everyday lives. This can make it challenging for us to respond with any urgency. For her doctoral research, Dr. Tai Munro worked with a group of outdoor educators to explore how they might visualize climate change in their personal contexts. Watch the next video to learn more.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://openbooks.macewan.ca/introductiontosustainability/?p=118#oembed-1

Reflection 8.1: How Would You Picture Climate Change?

As you move through your life for the next few days, think about how the participants in the research

study ended up relating to climate change. Do you see any symptoms or causes of climate change in your daily life? What photos would you take?

Expanding Your Knowledge

Climate change impacts many aspects of our personal and professional lives, whether we realize it or not. From insurance rates to fiction to systemic racism, climate change is part of the story. If you think back to systems thinking, we saw how different parts of our world are interconnected in important ways that impact how systems behave. How is climate change connected to the parts of your system?

Activity 8.2: Expanding Your Knowledge

Conduct an online search to find two to three resources that connect climate change to a field you are interested in. Then create or find an image that you could use to help explain the main points of the resources to someone. Some potential resources include:

- "How Extreme Weather is Shrinking the Planet" by Bill McKibben
- "Black Lives Matter and the Climate" in *How to Save a Planet*
- "War vs Climate" in *Energy vs Climate*
- "How Climate Change is Disrupting the Global Supply Chain" by Jacques Leslie

Activity 8.3: Can You Save the Planet?

Access The Climate Game created by *The Financial Times*. Complete the activity and write up a summary and reflection that includes:

- Which advisor did you choose? Why do you think that approach would be the most likely to achieve the goal?
- What was your end result? How much warming occurred, etc.
- What were your biggest limiting factors when making your decisions and why? What, if anything, did you do to overcome the limiting factors?
- What are the benefits of activities like these for combatting climate change?
- What are the limitations of activities like these for combatting climate change?

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Chapter 9: Circular Economy

TAI MUNRO AND KALEN PILKINGTON

Key Ideas

In this chapter, you will learn about:

- what the circular economy is and the principles of a circular economy
- one set of business models for the circular economy

What is the Circular Economy?

At its most basic, a circular economy is one that keeps materials, products, and services in circulation for as long as possible. It is a model of production and consumption that uses various strategies such as sharing, repairing, and refurbishing to reduce the amount of waste created and practices like recycling and regeneration to use waste from one industry or product as materials for the next. This is opposed to the current linear system where materials are used, a product is produced and used, and when it is no longer being used, it gets disposed of as waste. An increasing number of companies and governments are starting to look at how to participate in the circular economy; you likely have some in your own community.

Activity 9.1: Introduction to the Circular Economy

Watch the video (6:07) *Circular Economy: Definition and Examples* by Sustainability Illustrated. As you watch, consider:

- What is the approach to waste in your culture or household? How does that approach fit with either the circular economy or the linear economy?
- What do you think is one of the biggest barriers to achieving a circular economy?

There are a number of principles for the circular economy. Different sources will list slightly different principles. The following are from the Ellen Macarthur Foundation, a leader in the circular economy.

The three principles of the circular economy are:

- eliminate waste and pollution

- circulate products and materials (at their highest value)
- regenerate nature

In addition, there is an expectation of both a transition to renewable energy and materials. Let's look at each of these principles a little more in-depth.

Eliminate Waste and Pollution

Ideally, everything in the circular economy has a positive purpose; therefore, there would be no waste or pollution. However, this is difficult to achieve within a single industry. Another way to think about it is that waste becomes food. This is how nature works. Leaves fall off of the trees. Decomposers eat the leaves and return the nutrients to the soil, making food for more plants. Within the current economy, we are starting to see examples of waste from one business or industry being used as a resource in another business or industry. For example, a bakery might partner with a brewery to make bread with spent grains leftover from brewing beer. Or, different plastics are being recycled to create fleece clothing items. On a systems level, there is no waste.

Circulate Products and Materials

You may have grown up hearing about reduce, reuse, recycle, and repair. Unfortunately, recycle became the dominant "R" and the focus of many campaigns. But recycling requires a significant amount of resources. Therefore, we are better off to focus on the other three "R's."

Reducing what we have and use is the first step because it reduces the amount of resources that have been used in the first place. There are a number of examples of projects intended to reduce resources, such as tool libraries where you can check out tools like you might check out a book, use the tool for the project you need, and then return it for someone else to use. Book libraries have been around for thousands of years; this is just expanding the idea to other types of materials.

Repairing items is another important step. Rather than throwing out a pair of jeans because they have a hole in them, you, or someone else, would repair the jeans. Repairing items has two requirements. First, someone needs to have the skills to do so. You might not be able to patch your jeans or fix the drive train on your bike, but someone else probably has that skill set. Repairing items can expand the economy through skill-based labour. The second requirement is that the item has to be repairable. Unfortunately, this is not always the case. Proprietary practices have led to certain items, particularly technologies like cell phones, being unrepairable because of how they have been put together. Right to Repair is a growing movement that demands that consumers can repair goods themselves or have them repaired.

Finally is reuse. This has been a big topic in recent years, as the harms of single-use plastics become more well-known. Carrying your reusable water bottle or coffee mug, even selling or donating your fancy dress so that it can be reused by someone else, will contribute to the circular economy.

Natural items are also subject to this principle. Fortunately, recycling is often done by nature; however, there are things that we can do to help. For example, even if your shirt is made of 100% cotton, it will still struggle to decompose if you drop it in the landfill. And using more of something because it is natural still doesn't help us use less energy and reduce our overall use of materials.

Regenerate Nature

Many of our current practices degrade nature. Over-extraction and pollution are two ways we consistently leave nature worse than before. If we instead focus on regeneration, then we can rebuild natural systems or at least give them time to rebuild themselves. This requires us to emulate natural processes more than trying to control what is happening. Indigenous cultures hold vast amounts of knowledge that could lead the way on this principle, as they have for many generations prior to colonization, supporting their local environment to flourish while also being able to take what they needed from nature.

Honourable Mention: Building Resilience

Although the Ellen Macarthur Foundation does not explicitly list resilience as a principle of the circular economy, it is fundamental to implementation. Resilience needs to be built into the system such that no one resource is required in every case. Energy generation is an excellent place to start with what this looks like. One of the critiques of renewable energy is that it is difficult to guarantee. Since we have a difficult time storing energy for the long term, we need to be able to generate energy almost continuously. Renewable energies like wind and solar are, by their nature, intermittent. However, by drawing on multiple different sources of energy, it is possible to build a robust and resilient energy system.

Systems Thinking is Essential

Thinking in systems is an essential part of achieving a circular economy. Systems thinking allows us to identify connections between different companies and industries. As a result, we can see where one industry's waste might play a role as a resource for the next. In addition, we require causal loop thinking, rather than thinking of causality linearly, in order to assess the implications of each innovation or action fully.

Visualizing the Circular Economy

The butterfly diagram is a helpful tool to picture what is involved in the circular economy.

Activity 9.2: Exploring the Butterfly Diagram

Review the webpage *The Butterfly Diagram: Visualising the Circular Economy* on the Ellen Macarthur Foundation website. As you review the webpage, consider:

- What items do you currently use that fit on the butterfly diagram? Which part of the cycle do they fit in?
- What are some of the barriers that prevent us from using products in the inner circles on the technical side like sharing?

The Business Models of the Circular Economy

We will look at three business models in relation to the circular economy. Please note that the circular economy is still a relatively new concept, so you will find other models. We have chosen these three for their ease of understanding and application.

- Most of what we are used to falls into a **product-oriented model**. In this model, you may purchase extra ongoing services like maintenance, but everything is geared towards the sale of the product to the final consumer. The other two models are more likely to contribute to a circular economy.
- The product is still central in a **use-oriented model**, but instead of buying the product, you are buying the use of the product. An example of this would be renting a canoe for a canoe trip. Instead of buying a canoe, you are paying for the use of a canoe.
- The final one is a **result-oriented model**. In this model, you are not looking for a specific product but for a specific result. This one is a little tougher to understand, but if you think about some of the services you might either provide or want to buy, it can help clarify. For example, you might pay for a lawn care service. You might not care what type of equipment the service provider uses. They could be out there cutting every blade of grass with scissors, or they might replace the grass with something like clover that requires less maintenance. You're paying to have the result of an enjoyable outdoor space.

One of the biggest challenges for the circular economy is getting the products back from the consumer. The use and result-oriented models support this access to the used products because the supplier is always in touch with the consumer in some way. As a result, they can collect more data, such as what parts are wearing out first. This data will help them to improve their product over time.
Watch the next video (3:12) to learn more about these business models.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://openbooks.macewan.ca/introductiontosustainability/?p=120#oembed-1

Expanding Your Knowledge

The circular economy has the potential to impact every area of our economy and our lives, from how cities are designed to our consumption of food and fashion. Can you think of any opportunities for the circular economy in your personal or professional life?

Activity 9.3: Expanding Your Knowledge

The Ellen Macarthur Foundation is dedicated to providing education and resources for the circular economy. They have developed a number of modules that connect the circular economy to a particular

part of the economy. Explore at least one module from their Learning Hub to learn more about the circular economy in an area that interests you.

Activity 9.4: Circular Economy Investigation

Based on what you have learned about the Butterfly Diagram and the principles of a circular economy, find two examples of products or businesses that are engaging with the circular economy. Identify the following for each example:

- name and purpose of product or business
- which loop on the butterfly diagram applies?
- explain how at least one principle of the circular economy applies to the product or business
- identify the product-service business model that applies (product-oriented, use-oriented, or result-oriented) and explain why

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Chapter 10: Fashion

TAI MUNRO

Key Ideas

In this chapter, you will learn about:

- why fashion is a significant sustainability issue
- opportunities for rethinking fashion from new and historical lenses

Sustainability and Fashion

Sustainability and fashion is a topic that has changed and evolved over time. At one point in history, available materials, costs, time, and culture meant that the clothes humans wore were sustainable. We didn't have synthetic fabrics, so everything would biodegrade when it was disposed of. We didn't have easy and convenient facilities to wash our clothes with, so they were washed less often and made more durably. Every scrap of fabric and other materials like buttons was considered important because you may be unable to access or afford any more. And you weren't judged when you wore the same outfit multiple times. Even as times changed and fashion became more of a statement of who someone was, there have been measures that increased sustainability. For example, during the world wars, rationing resulted in distinct changes in clothing design, such as less use of buttons and snaps and less extra material, such as switching from double-breasted to single-breasted suits. Today, however, a global economy allows for the exploitation of both people and land, and consumerist culture privileges the newest trend. As a result, the fashion industry is a significant contributor to unsustainability. Carbon emissions, wastewater production, and human rights violations are all prevalent in the industry.

Watch the video (2:43) for an overview of the impacts of fashion and some of the current trends towards sustainability.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://openbooks.macewan.ca/introductiontosustainability/?p=124#oembed-1

Reflection 10.1: Who Made Your Clothes?

#WhoMadeMyClothes was a social media movement launched following the Rana Plaza collapse in 2013. It had the goal of encouraging consumers to learn about the brands that they purchased from and supported and how they treated workers and the environment. Learn more about the movement.

Consider what questions you ask about the brands you purchase. What are the criteria that you use to decide to purchase something or not? Are you interested in learning more about the brands you purchase?

Fast Fashion

Fast fashion is an approach that focuses on rapidly producing high volumes of clothing. It generally replicates trends with low-quality materials and manufacturing to quickly bring large quantities of clothing items to the consumer. This approach has led to high levels of consumption and subsequent harm to garment workers and the environment.

Recommended Resource

To learn more about fast fashion, you can review:

- What is Fast Fashion, Anyway? by Audrey Stanton
- What is Fast Fashion and Why is it So Bad? by Solene Rauturier

Some companies have been working to build their reputation based on the ethical production of clothing. Patagonia, an outdoor clothing company, has made headlines for their business choices on multiple occasions. Check out two examples:

- Don't Buy This Jacket: Patagonia and Their Black Friday Ad
- A Letter from Yvon Chouinard: Earth is Now Our Only Shareholder

Expanding Your Knowledge

Whether you are interested in fashion or not, the fashion industry's sustainability affects all of us. In addition, fashion is connected to many other aspects of our lives, as seen in systems thinking. How do the activities you choose to do, or have to do, impact your clothing choices? How does culture impact the clothes that people expect you to wear? How do trends or customs impact the money we spend on clothes?

Activity 10.1: Expanding Your Knowledge

Conduct an online search for a resource that considers sustainability and fashion. Explore the resource and see how it might connect to the different areas in your personal or professional life. Some potential resources include:

- The Wardrobe Crisis with Clare Press
- A New Textiles Economy: Redesigning Fashion's Future by the Ellen Macarthur Foundation
- Global Perspectives on Sustainable Fashion edited by A. Gwitt, A. Payne, and E. A. Ruthschilling (2019)

Activity 10.2: Company Investigation

Choose a company you are interested in. You can choose either a clothing company or a retailer. Research the company policies regarding sustainability and corporate responsibility. Create a summary and reflection that includes responses to the following:

- Does the company use fast fashion, not use fast fashion but not oppose it, or actively oppose fast fashion?
- Are there any indications in the policies you found that the company is engaged with a systems perspective on sustainability (think about the models and definitions from the start of the course)? Are there any contradictions in their policies (for example, promoting living wages but using toxic chemicals without safety protocols)?
- Can you find any reports/violations/fines on the company? What do these indicate?
- Would you purchase clothing from this company in the future? Why or why not?

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Chapter 11: Food

TAI MUNRO

Key Ideas

In this chapter, you will learn about:

- the complexity of food sustainability
- current projects that are challenging how we think about food

Food Systems Complexity

As you have already seen in this book, systems thinking is a way of approaching complex topics. Food systems have many different elements and interconnections, feedback loops, and leverage points. This complexity can make food and sustainability seem overwhelming. Food systems include many different actors and activities, including food producers, processing, distribution, consumption, and disposal. It also includes many sub-systems; each of the items in the previous list could be a sub-system and interacts with other systems such as energy, transportation, trade, and health. The Food and Agriculture Organization of the United Nations states that "a sustainable food system (SFS) is a food system that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised" (Nguyen, 2018, p. 1). Recall from Chapter 6 that Dr. Julian Agyeman also advocates for culturally-appropriate food, a concept that is not recognized in the above definition.

Let's break down what that might mean in our daily lives. Imagine talking with someone who drinks at least two 8 oz glasses of milk a day. They currently drink regular 1% milk from the grocery store. They have come to you for help to improve the sustainability of their milk. They are okay with changing the type of milk but don't want to remove milk completely from their diet.

Some initial suggestions you might consider include purchasing organic milk or trying to purchase from a local dairy. Unfortunately, they have looked into both of those and they would both increase the cost too much for their budget. You might then do some research on other types of milk and the environmental impacts of each, but what do you want to consider? The most sustainable type of milk seems to change whether you are looking at greenhouse gas emissions from production, greenhouse gas emissions from transportation, water usage, biodiversity loss from monocultures, and deforestation. Already you're swimming in numbers, trying to figure out the best option for where you live, and then the person you're helping throws another consideration into the mix: nutrition. They would like it if the milk alternative still provides significant levels of protein. That changes things and may result in a different answer, and we haven't even gotten to considerations regarding working conditions and social justice or culture. We also need to consider how much waste is produced both during processing and distribution and by the consumer through wasted product and packaging.

The complexity of a single choice when it comes to food makes it clear that a reductionist approach is not ideal. This is why food systems are gaining support.

Reflection 11.1: Sustainable Food Systems

The Food and Agriculture Organization of the United Nations published: *Sustainable food systems: Concept and framework*. This document explains what food and sustainable food systems are and then develops a potential framework. As you review the resource, consider the following:

- Do you currently know of any sustainable food systems?
- How does a sustainable food system demonstrate systems thinking?
- What parts of systems can you identify in the proposed framework?

Hope is on the Table

While the complexity of food creates significant challenges, it also creates space for many opportunities. Watch the next video (4:33) to learn about just a few places where there is room for hope within food sustainability.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://openbooks.macewan.ca/introductiontosustainability/?p=122#oembed-1

Expanding Your Knowledge

There are many different connections between food and other areas of our lives, personal and professional. Systems thinking provides an approach to think about food that recognizes the complexity. And yet, it can still be challenging to think about all the possible connections that occur.

Activity 11.1: Expanding Your Knowledge

Conduct an online search to find a resource that discusses the complexity of food sustainability. Explore the resource and consider how it might connect to the different areas in your personal or professional life. Some potential resources include:

- Does the Western Megadrought Mean the End of Cheap Cheese and Ice Cream? Gastropod episode with Cynthia Graber and Nicola Twilley
- Slimy, Smuggled, and Worth Top Dollar: Can One Maine Entrepreneur Break Into the Crime-Ridden Global Market for Eel? by Karen Pinchin
- How Indigenous Memories Can Help Save Species From Extinction by Karen Pinchin

Activity 11.2: Create a Food Map

Choose one meal that you eat this week and investigate where the food comes from. Answer the following questions:

- Where was it purchased or gathered from (farmers market, chain grocery store, independent grocery store, grown at home, etc)?
- Where does each item actually come from (e.g., if there are oranges, are they from BC or California)? This may take some work and research to find out depending on the type of food you are including.
- What is the cultural background of the meal? In other words, what culture(s) is the meal drawn from, think types of food, spices, ways of cooking, etc? Does it represent a mixing of cultures?
- Reflect on how your meal affects the four areas of sustainability based on your findings from the previous questions.

References

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Chapter 12: Travel

LAUREN ASCASIBAR; JENNIFER ATKINS; PREEYA LALL; KATIE WALKER; SHAWNA MCKINLEY; AND TAI MUNRO

Key Ideas

In this chapter, you will learn about:

- what sustainable travel is
- eco-friendly travel considerations
- systemic issues around travel

What is Travel?

Sustainable travel can mean something different for each one of us. Typically, travel is considered to be going from one place to another over an extended period of time. It can be for leisure, business, or personal reasons and can be carried out with various modes of transportation such as cars, trains, boats, and planes. Travel plays an important role in society as it moves people and goods and enables trade between communities. Travel provides access to essential services and opportunities to connect with friends, family, and colleagues.

In this chapter, we will refine the lens to discuss destination travel. **Destination travel** is when a person travels to a location outside of their local community for a duration of longer than a day. Local travel is on the rise. While it is outside the scope of this chapter, many of the topics would also apply to how you explore your local area.

People, Economies, and Environment

Travelling opens our eyes to new cultures, traditions, people, and environments. It can lead us to develop deeper connections with ourselves, the people around us, and the world we live in. Travel lets us experience new cultures and people, frees us from our daily routines, and makes us more open to new things. We get to celebrate diversity when travelling and experience new cultures and people.

Reflection 12.1: Connecting Through Travel

Watch Why We Travel: To Connect With Our World – Rick Steves' Europe Travel Guide – Travel Bite (3:40) and consider the following:

- How can travel result in deeper connections with others?
- How does travel give our lives meaning?

In terms of the economy, the first stop is the tourism sector. The **tourism sector** includes the individuals and/or businesses who collectively provide goods and services to travellers. This sector is complex and contributes to many countries' economies. It includes accommodations, transportation, entertainment, food services, attractions, trade associations, and regulators. When you travel individually or in a group, you contribute to some of these elements that make up the tourism sector. But economics also comes into play when we think about who gets to travel, to where, and how.

Recommended Resource

Consider the different ways that people can travel in the video What type of tourism should be promoted? (C2D Albatross Lesson9) by Chungdahm Learning

- In the video, pay attention to the pros and cons of different types of tourism, including mass, sustainable, and virtual.

The environment can be the subject of travel, such as in places like national parks. But, it can also be impacted by travel. Where does the waste from the visitors go? What amenities need to be developed to support tourism? How do those amenities impact the local environment?

Society and culture are also impacted by travel. As we've said, travel can introduce you to new cultures and build openness and bonds. However, travel can also negatively impact culture and society, such as when tourism commodifies local culture.

While travel can connect us to people and places, we also need to consider the full range of economic, social, and environmental impacts that can occur when we travel.

Connecting Travel With the Sustainable Development Goals

Reflection 12.2: What are Your Current Thoughts About Destination Tourism and Sustainability

Before we dig into our discussion about sustainable travel, reflect on the following questions:

- What transportation options do you prefer for long-distance travel?
- What do you think sustainable travel means?
- What do you think is the most sustainable way to travel?
- What do you think you need to consider to travel sustainably?

In Chapter 2, we learned how wicked problems are difficult to solve. They can't be solved with a single solution; they are complex, and they often require a culture shift to be addressed. In Chapter 7, we learned about how the United Nations Sustainable Development Goals (SDGs) outline a plan to tackle these wicked problems and transform our world.

Travel requires infrastructure and services. The level of this might vary, but they all have the potential to reduce or enforce inequalities (SDG 10). Further, with more and more people living in urban areas, how we plan and operate our cities and communities (SDG 11) can have a big impact on how we travel to our destinations and once we get there. We can make choices in how we travel that contribute to responsible consumption and production (SDG 12), but we have to have access to sustainable choices to make sustainable choices. We'll discuss this further a little later. Finally, this contributes to climate action (SDG 13), or lack thereof. We could connect travel to all 17 SDGs if we had the time. See how you can connect travel to one of the SDGs you are passionate about.

Being a More Sustainable Traveler

Sustainable travel is about making choices that support local communities and minimize our individual and collective environmental impacts. There are many ways to consider sustainability as a traveller, especially because sustainable travel isn't just about getting from one place to another; it is the entire journey.

Getting to Your Destination

You are probably familiar with the main transportation options for getting around, but did you know they are all making changes to contribute to sustainability? Watch the video (2:13) to learn more about some of the work being done to adapt our transportation options.

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Aside from the technology, you can also make personal choices in getting to your destination. If you have to fly, choosing economy seats where there is less space, which means there are also fewer emissions per seat, and avoiding short-haul flights can both reduce the impacts of your travel. Choosing to carpool or take options like

the train or bus can also reduce your impact. As mentioned in the video, you can also engage in slow travel like walking or paddling.

Accommodation

The most sustainable places to stay tend to be small and locally run. While mountain refuges, youth hostels, bothies, and campsites naturally fall into this category, going green doesn't have to mean sacrificing luxury. Some of the world's most exclusive lodges and properties take sustainability seriously. After all, these places often have the means to invest in cutting-edge green technology, wildlife, and local communities (Tuppen, 2021). You can also look for places that have used low-impact construction techniques that are sensitive to the environment, landscape, and surrounding community.

Recommended Resource

New sustainable options are being developed. Check out EcoCamp Patagonia, the world's first geodesic dome hotel. It has raised platforms, skylights, solar panels, and insulated walls, along with renewable building materials.

Food and Drink

A lot of the same ideas apply to food and drink when you are travelling as when you are at home. You need to watch for things like meat consumption, out-of-season offerings, and food waste. Where possible, try to enjoy meals from locally owned businesses, which can also help you experience the authentic flavours of the area. Although buffets seem like a great option, they can potentially increase food waste (Juvan, Grün, & Dolnicar, 2018). Checking out the destination in advance can help you prepare for a sustainable and tasty experience.

Exploration

Exploring can be a great way to experience new places, but if you're looking for guided experiences, make sure that you choose ones that are operated by members of the local community. Responsible travel improves lives in the long term by supporting enterprise initiatives and funding the development and continuation of sustainable projects. Remember, you don't want to rely on handouts or fall into the us and them mentality (Tuppen, 2021).

Souvenirs

Souvenirs can support meaningful memories of a trip, but it is important to consider their impacts on

sustainability. Qiu, Rahman, and Dolah (2024) found that souvenirs can contribute to cultural identity expression. They also have economic and community impact. When considering purchasing souvenirs, make sure that you, like with explorations, choose ones that are locally meaningful and contribute directly to the local community. It is important to also keep in mind how you can respect the culture the souvenir represents when you are back at home.

Activity 12.1: Researching a Trip

Identify a trip that you would like to take. Use the following tools and your own research to start planning your sustainable trip.

- Getting there – what modes of transportation can you use? Which one will be the most sustainable? Which one is the most practical? If these don't match, what strategies can you use to make your chosen mode more sustainable? For example, if you have to fly, you can take some quick extra steps like sorting flights by emissions, to make it as low-impact as possible.
- Accommodation – where will you stay? Use a tool like GreenView's Hotel Footprinting Tool to learn more about your hotel's carbon footprint.
- Food and Drink and Exploration – conduct some research before you go to be more prepared, but remember, sometimes the local spots don't have the same marketing budget so you may need to be prepared to finish your research once you arrive and start exploring.

What questions did you come up with when planning your trip? How might you find answers to these questions? How easy was it to find information about the sustainability of different options?

Why is Sustainable Travel a Challenge?

So far, we've discussed some of the interconnections between travel and the SDGs, and we've looked at a few tips on planning our sustainable travel. Unfortunately, it isn't always easy to travel sustainably.

Innovation is Required

The reality is that flights just aren't sustainable. And flights aren't the only challenge. We need more innovation in travel from our means of getting there to the infrastructure at the destination to how local populations work with and in the travel industry. But, as we know, innovation often requires funding, and it's hard to overlook the goal of making a profit or spending as little as possible while getting unique experiences.

Behaviour Change is Hard

Changing our behaviour and our priorities is challenging. Unfortunately, there are many reasons why we might not even recognize that behaviour change is necessary or possible. One way to think about this is through the

discourses of climate delay (Lamb et al., 2020). These discourses accept that climate change exists but justify inaction. The four discourses are:

Emphasizing the downsides. This occurs when we focus on the disruptions that climate action will cause. For example, it emphasizes that vulnerable members of society will be burdened by the change or that "hard-working people cannot enjoy their holidays" (Lamb et al, 2020, p. 2).

Redirect responsibility. In this discourse, it is more important that someone else changes their behaviour first.

Surrender to climate change. In this response, behaviour change is seen as irrelevant because it it will not make a difference to whether or not climate change occurs.

Push non-transformative solutions. This occurs when we engage in activities like setting targets but not acting to achieve those targets, or through over-reliance on technologies that can supposedly allow us to maintain current behaviours and systems.

In the next activity, see if you can match each discourse with an example statement.

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Overtourism has Consequences

We live in a world where an individual can travel anywhere depending on their means. However, this freedom can lead to overtourism. Overtourism is the presence of too many people in one place at a time. The accumulation of economic, social, and environmental impacts determines how many are too many. One way you can contribute to stopping overtourism is by picking destinations that are less well-known or popular.

Recommended Resource

If you want to learn more about Overtourism, check out the Responsible Travel site on overtourism. This site includes several articles and a short documentary.

Reflection 12.3: The Impacts of Overtourism

Think of an example of overtourism that you have experienced or know of. What are the main consequences of overtourism in that area?

Encouraging Systemic Change

Up until now, we have primarily focused on individual choices. These are important, but systemic action is what truly drives change. In travel, this includes changes that impact the entire tourism sector. This includes governments and large organizations like airlines and hotel chains. Change at this level can include innovation, policies, and initiatives. You can encourage systemic change by supporting businesses and governments that follow sustainable practices and are transparent about their efforts, not just the goals they've set.

The Hawaii Tourism Authority's locals-first approach is one example of where this systemic change is happening. As overtourism on the islands increased the struggle for locals to access basic goods and services at reasonable prices, the tourism authority has pivoted away from mass tourism marketing. They are working to empower locals to be responsible for destination management (Habtemariam, 2023).

While the sustainability implications of travel are significant, the solution isn't to shut down travel. There are many economic benefits from the travel industry. In addition, being able to learn and connect with others is essential. In addition, shutting down travel could separate families and communities as so many people now live away from their original homes. Systemic change has the potential to make travel more sustainable for all.

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Chapter 13: Urban Transportation

CARMEN CHAU; DARLA DANIVA; SYDNEY KRISCHKE; ALOY MENDOZA; PRINCIRA PEPRAH; AND TAI MUNRO

Key Ideas

In this chapter, you will learn about:

- how urban transportation impacts and is impacted by sustainability
- 15-minute cities
- how urban transportation is interconnected with other issues like poverty and safety

What is Urban Transportation?

Urban transportation plays a very important role in society because it facilitates the movement of people and goods in highly populated areas. Urban transportation is one area where city planning, economic productivity, citizen health, and action on climate change are all interconnected. As cities continue to expand, the pressure for urban transportation to support sustainability grows. But what exactly is urban transportation? **Urban transportation** includes all elements of transportation of people and goods within an urban area. This includes infrastructure, vehicles of all types, including human-powered, and traffic patterns and flows (Loo, 2009).

Urban transportation holds significant personal and societal relevance in today's fast-paced and interconnected world. On a personal level, it impacts the daily lives of millions of individuals, affecting access to education, employment, healthcare, and leisure. There are many factors that influence the choice of transportation mode, including convenience, cost, and time efficiency. But, the impacts of urban transportation go beyond just how we get around. They can also impact the local environmental conditions and our physical and mental well-being.

Societally, cities are hubs of economic activity, culture, and social interaction. Well-planned and accessible transportation networks can contribute to economic growth, reduce traffic congestion, improve air quality, improve population health, and enhance the overall quality of life. Conversely, inadequate or inefficient transportation systems can increase congestion, air pollution, and economic disparities.

Urban Transportation and Climate Change

According to the United Nations' *World Cities Report* (2020), cities are responsible for 70 percent of global carbon emissions. They also consume two-thirds of the world's energy. Although Welegedara and Agrawal

(2024) found that household energy contributes more to greenhouse gas emissions in high-latitude cities, urban transportation is the biggest emitter in most locations. But what accounts for these emissions?

Emissions from vehicles

The majority of vehicles use fossil fuels. These fuels release greenhouse gases like carbon dioxide into the atmosphere when burned. This contributes to global climate change and creates ground-level pollution. Both of which harm human health and the environment.

Infrastructure construction and maintenance

Another significant contributor is the construction and maintenance of infrastructure to support urban transportation. As our cities grow, this infrastructure continues to expand. In addition, infrastructure design can impact traffic patterns, especially the feasibility of non-motorized transport and public transportation. On the other hand, climate change is expected to have significant impacts on transportation infrastructure. As Liu, Wang, Wang, and Koks (2023) found, extreme weather, including both heat and precipitation, is likely to reduce the life span of transportation infrastructure and will need to be accounted for in planning and maintenance.

Responsible Consumption and Production

Clearly, urban transportation is linked to the UN Sustainable Development Goal 13: Climate Action. However, as we alluded to in the infrastructure discussion, it also impacts responsible consumption and production. Infrastructure can have a big impact on whether individuals can engage in responsible consumption when it comes to transportation. The two main forms of transportation for individuals are collective and individual transportation. A motorized vehicle, such as a car, is the dominant form of individual transportation in many locations. These personal vehicles have high emissions per passenger. There is an increasing focus on encouraging non-motorized individual transport such as cycling and walking. We'll look at one initiative shortly. Regarding collective transportation, public transportation tends to be the main focus. Key to success, though, is ensuring that public transportation is both safe and effective. You can't take public transportation if it doesn't go through the areas that you need access to, and you won't take it if you don't feel safe on it.

In a world that is becoming increasingly urbanized, the relevance of urban transportation cannot be overstated. it influences the daily experiences of individuals and shapes part of the fabric of society. As we confront the challenges of sustainability, inclusivity, and economic development, our decisions regarding urban transportation will have a lasting impact on the well-being of our cities and their inhabitants.

Reflection 13.1: Overcoming Personal Transportation Challenges

Keep track of how you get around for three to four days. Take note of what modes of transportation you

use for different activities in your life and if any of your trips were unusual in how you made them. Next to each activity, record what mode of transportation you used and why. Then, think about and note what challenges, if any, you had in using that transportation mode.

For any trips that you think could be made more sustainably, reflect on what barriers prevent you from using a more sustainable mode of transportation. Are those barriers things that you can change individually, or do systemic challenges cause them?

15-Minute Cities

There are different approaches to improving the sustainability of urban transportation. You might think of improving cycling infrastructure, building and expanding light rail networks, introducing car-free zones, and implementing road diets which typically convert four-lane undivided roads into roads with two through lanes and a centre two-way left turn lane. However, urban transportation is a system; therefore, we need to consider system-level changes. One of these is the 15-minute city.

The 15-minute city and similar concepts are based on the concept of chrono-urbanism. Chrono-urbanism suggests that "the quality of urban life is inversely proportional to the amount of time invested in transportation, more so through the use of automobiles" (Moreno, Allam, Chabaud, Gall, & Pratlong, 2021, Section 5, para. 1). In other words, the longer you have to spend getting around in automobiles, the lower the quality of urban life. There are different models of the 15-minute city, but generally, they require that all individuals can access basic essentials within a 15-minute walk or bicycle ride. Moreno *et al*. (2021) suggest that the essentials include six categories: living, working, commerce, healthcare, education, and entertainment. It should be clarified that this does not mean that you cannot leave that 15-minute area. It means more so that you would have opportunities to, for example, purchase groceries and non-specialty clothing items, visit a gym or other fitness opportunity, access a general medical clinic, and enjoy a public barbeque within a 15-minute walk or bike ride. Opportunities like specialty purchases, large theatre productions, and work and education like universities would still be more centralized and accessible to all. The focus is not on dividing the city into sections but on putting the needs of people and planet first. The 15-minute city, and chrono-urbanism more generally, is working on moving away from car-centric urban design.

Recommended Resource

Check out the TED video (7:52), The 15-minute city, to hear the creator of the concept, Carlos Moreno, discuss why he recommends the 15-minute city and what it involves.

Paris was the first city to adopt this concept. But others have followed, and more are investigating it. Indeed, Allam, Khavarian-Garmsir, Lassaube, Chabaud, & Moreno (2024) identified 77 initiatives worldwide that

launched between 2016, when the concept was first introduced, and 2023. Each city will face different challenges; therefore, a 15-minute city may look different in each location. However, there are some common benefits, including reduced emissions and traffic, increased bike lanes and pedestrian areas, increased support for the local economy, increased green spaces, and an increased sense of community. Areas such as job creation have been focused on less than some other factors (Allam *et al.*, 2024).

Activity 13.1: Urban Transportation, 15-Minute Cities, and Systems Thinking

Systems thinking is one tool that can be used to navigate urban planning, which includes urban transportation. Imagine that you have been brought in as a consultant by your municipal government to help them apply systems thinking as they consider how they might use the 15-minute city concept to improve urban transportation. Develop a list of questions that you might ask the group to start them off on a systems analysis. Don't forget to consider the different parts of systems that were covered in Chapters 2 and 3 of this book.

Now, think about an urban area that you are familiar with. How would you answer the questions that you came up with as a user or inhabitant of the system? In what ways does the perspective of users and inhabitants bring value to a systems analysis of an urban transportation network?

Urban Transportation is a Social, Economic, and Environmental Issue

We've discussed a little about how urban transportation connects to issues like climate change and the 15-minute cities discussion mentions topics like local economies and a sense of community. Urban transportation is very connected to issues such as poverty and social justice. Limited access to reliable transportation can exacerbate poverty. Without affordable and efficient transportation options, individuals in low-income communities may face challenges trying to commute to their jobs or employment opportunities, education, and essential services. Owning a car is expensive. However, it is the only feasible way to get to and from work in some urban areas. This means that to get and keep a job, a person might need a car. The songwriter Ben Folds wrote a song for the 2006 movie Over the Hedge called Rockin' the Suburbs. One of the verses highlights the feedback loop this creates:

> We drive our cars every day
>
> To and from work both ways
>
> So we make just enough to pay
>
> To drive our cars to work each day
>
> Hey, hey

Unfortunately, people have to pay for a lot more than just their car bills. Therefore, urban transportation can impact people's access to work, food, and other needs. And whether they can afford to pay for needs like food, clothing, shelter, and energy. Concepts like 'transport poverty" arise from a lack of transit choices combined with socioeconomic disadvantage, making it difficult to get to key locations such as places of

employment. Poor transit accessibility, walkability, and bikability, combined with other forms of social and economic disadvantage (e.g. disability, not being able to afford a car, etc.), can result in transport poverty (Casas, 2007; Alonso-Epelde, García-Muros, & González-Eguino, 2023). A primary function of an urban transport system is to provide people the opportunity to participate in daily activities, social interactions, and access to destinations necessary for their well-being. However, research demonstrates that within Canada's eight largest cities, 5% of the population living in low-income households are also situated in areas with low transit accessibility. This totals nearly one million people at risk of transport poverty nationwide (Allen & Farber, 2019).

Activity 13.2: Addressing Systemic Barriers to Sustainable Urban Transportation

This activity will build on Reflection 13.1 near the beginning of the chapter. If you have not completed it, please go back to it now. Then return to this activity.

In Reflection 13.1 you were asked to consider the barriers that prevent you from using more sustainable transportation modes. Choose one trip that you currently make or would like to make that requires you to use a less sustainable mode of transportation. What systemic barriers would need to be addressed to enable to you change the mode of transportation for this trip? Areas that you might consider include:

- time constraints
- safety – be specific about the safety of the paths or sidewalks, time of day, lighting, etc
- carrying capacity – do you need to take a lot with you, is there any way that the system could reduce this?
- hygiene – do you have access to facilities such as lockers and showers?
- security – is there a secure place to store a bike, if applicable?
- cost – if modes other than an automobile appear cheapest, at least in the short-term, what would happen if this changed?
- distance
- complexity of route planning

Choose at least two of these barriers and create a story or image that shows how your transportation experience would be different if those barriers were addressed.

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Chapter 14: Renewable Energy

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Key Ideas

In this chapter, you will learn about:

- different types of renewable energy
- advantages and disadvantages of renewable energy
- key economic and societal barriers to renewable energy
- the role of AI in improving renewable energy systems

What is Renewable Energy?

Renewable energy is energy from natural processes, primarily sun, water (hydro), biomass, geothermal, and wind (Natural Resources Canada, 2024). Unlike non-renewable energy sources, such as those derived from coal, fossil fuels, and natural gas, renewable energy sources can be replenished at a rate equal to or faster than they are consumed (Natural Resources Canada, 2024). Although the production of technology and equipment, such as wind turbines, results in the emission of greenhouse gases due to standard production models and materials, once they are generating energy, renewable energy emits low to no greenhouse gases. This helps mitigate climate change and reduce air pollution.

Recommended Resource

Want to learn more about how different renewable energy technologies work? Check out the video What is renewable energy? (7:30) posted by The Independent. This video also provides a good overview of several other topics in this chapter.

Global and Canadian Energy Production

Globally, there is a shift from non-renewable to renewable energy sources. In 2023, global renewable energy supply from solar, wind, hydro, geothermal, and ocean reached 5.7%. Bioenergy, such as biomass generation,

reached 6.5% (IEA, 2025). The shift to renewable energy requires an extensive expansion of low-carbon electricity generation (Donald et al., 2022). While only 13.6% of the energy generated in Canada in 2020 came from renewable energy sources, 60% of Canada's primary energy is projected to be generated from wind alone by 2050 (Agu et al., 2023).

Each province in Canada is responsible for developing and using its energy and establishing decarbonization strategies. This creates a patchwork system of different models (Boucher & Pigeon, 2024). Hydropower (energy created from moving water) is Canada's most common energy source, with Quebec producing the majority, followed by British Columbia (Agu et al., 2023; Xuan, 2025). However, wind energy dominates renewable energy production in Alberta, Saskatchewan, Nova Scotia, and P.E.I.. Despite growing adoption, it is essential to acknowledge that renewable energy has both advantages and disadvantages.

Reflection 14.1: Advantages and Disadvantages of Renewable Energy

Take a maximum of 10 minutes to explore what you think are the advantages and disadvantages of renewable energy before continuing. Begin by jotting down some brief notes about your familiarity with renewable energy and how you have developed this knowledge. How we know what we know can influence our perspective and what we see as an advantage or disadvantage. This activity prepares you to think critically about the advantages and disadvantages of solar energy.

Advantages of Renewable Energy

Reduced Carbon Emissions

There are many advantages to using renewable energy, including emitting fewer greenhouse gases compared to traditional fossil fuels. Burning fossil fuels releases carbon dioxide (CO_2) and other pollutants, which contribute to poor air quality and climate change. On the other hand, several renewable energy sources such as hydroelectric, solar, and wind power produce negligible or no direct emissions while in use (Intergovernmental Panel on Climate Change, 2022). Communities can drastically cut their carbon footprint and reduce the effects of climate change by switching to renewable energy.

Diversification of Energy Sources

The diversification of energy sources also improves resilience and energy security. Dependence on a single energy source, like coal, oil, or natural gas, may result in supply interruptions due to resource depletion, market instability or geopolitical conflicts (IEA, 2023). By offering a variety of sources, such as wind, solar, hydro, biomass, and geothermal, renewable energy helps reduce these risks. This diversification lessens reliance on finite fossil fuels and increases the stability of energy systems. When one energy source faces a setback, others can fill the gap, ensuring a continuous and reliable energy supply.

Job Creation

In addition to mitigating climate change, renewable energy offers substantial economic benefits. Job creation is one of the most important advantages of investing in renewable energy technologies. The renewable energy sector creates jobs in manufacturing, installation, maintenance, and research and development. These are often local jobs that cannot be outsourced, which helps stimulate the economy and supports communities. According to the International Renewable Energy Agency (IRENA) report, the renewable energy sector employed over 12 million people globally in 2020, with wind and solar energy being the largest employers (IRENA, 2021). This job growth can be vital to economic recovery and stability in regions transitioning away from fossil fuel-based industries.

Public Health

Switching to renewable energy also contributes to improving public health outcomes. The reduction in air pollution from burning fossil fuels has direct health benefits. Studies have shown that reducing reliance on coal and oil can lead to significant reductions in healthcare costs and prevent thousands of premature deaths due to air pollution-related diseases (World Health Organization, n.d.). Cleaner air not only improves respiratory health but also reduces the burden on healthcare systems, which can allocate resources to other pressing issues.

Land Use

Renewable energy technologies offer significant environmental benefits compared to traditional fossil fuel extraction methods. While renewable energy production still requires land use and resource extraction, it generally results in less ecological degradation than fossil fuel processes such as mining, drilling, and hydraulic fracturing (fracking). In contrast, the renewable energy sector, while not without its own environmental impacts, has the potential to preserve biodiversity and reduce long-term damage to ecosystems by shifting away from more harmful practices.

Recommended Resource

The blog post Renewable energy projects in Indigenous communities: Balancing tradition and innovation by Rye Karonhiowanen Barberstock on the Indigenous Climate Hub reviews several advantages that First Nations, Métis, and Inuit communities are building through renewable energy projects.

Disadvantages of Renewable Energy

While renewable energy sources provide significant environmental benefits by reducing greenhouse gas emissions and promoting sustainability, it is important to consider the broader impacts of their development and implementation. Beyond energy generation, renewable energy projects can affect land use, resource

extraction, wildlife conservation, and waste management. Understanding these challenges allows for more informed decision-making when transitioning to a greener energy future.

Land Use

One of the primary concerns with renewable energy is the amount of land required for large-scale installations. Solar farms, wind farms, and hydroelectric dams can occupy vast areas, sometimes leading to conflicts over land use (Mulhern, 2020). These costs can also affect traditional territory and land use. Akhtar (2023) highlights the displacement of Indigenous communities due to hydroelectric dam construction, which has led to the loss of traditional lands. Recognizing and addressing these impacts is crucial for ensuring equitable and sustainable development. To minimize disputes and environmental degradation, renewable energy projects should prioritize development on lands already impacted by human activity, such as abandoned industrial sites or degraded farmland (Zhang et al., 2024). Additionally, consulting Indigenous communities in the area and working with them can help mitigate land disruptions.

Recommended Resource

Watch Collaborating with Indigenous Communities to Generate Clean Energy (7:46) by RE:TV to learn more about a partnership between a renewable energy company and local First Nations and about a more sustainable form of hydropower that does not displace communities.

Resource Extraction

The production of renewable energy infrastructure depends on extracting and processing raw materials, which can have significant consequences. The extraction and refinement of these materials are often energy-intensive and can contribute to pollution and habitat destruction (Nakade & Dhadse, 2024). In addition, some countries that contain these minerals experience political instability, which can link mineral extraction to violence, conflict, and human rights abuses (Church & Crawford, 2020). Promoting renewable energy without considering the other costs could be devastating for local communities and ecosystems.

Wildlife Impacts

Taking a deeper look into the wildlife impacts, large-scale projects such as solar farms and wind turbines can lead to habitat fragmentation and disrupt migratory routes for species (Enow, Gbabo, et al., 2025; Smallwood, 2022). Hydroelectric dams, in particular, alter water flow and sediment transport, which can have a severe impact on aquatic life and downstream ecosystems (Enow, Ofoedu, et al., 2025). However, there are a growing number of projects that are looking at how renewable technologies, can be modified or adapted to augment wildlife habitat instead of decreasing it (Boscarino-Gaetano et al., 2024; Enow, Ofoedu, et al., 2025; Estellés-Domingo & López-López, 2025).

Recommended Resource

A project on the Klamath River, located on the California-Oregon border, involves the largest dam removal project to date. The impacts of the dams and their removal on the salmon and the people who depend on them are significant. Learn more about it in this podcast episode by Gastropod: Bringing salmon home: The story of the world's largest dam removal project (58:44)

Waste Management

Although technological advancements in renewable energy are reducing greenhouse gas emissions, waste management remains a growing concern. Solar panels, for example, have a lifespan of 25–30 years, creating concerns for disposal (Li et al., 2023). Similarly, wind turbines pose disposal challenges, particularly with their blades. While many components, such as the tower and nacelle, are easily recyclable, the blades are composed primarily of fibreglass and epoxy resin. These materials make the blades highly durable but difficult to break down or recycle (Delaney et al., 2023). Recycling minerals from solar panels holds promise, but current rates are extremely low and often require the use of fossil fuels to process them (Martínez et al., 2024; Rhodes, 2019). The disposal of both solar panels and wind turbines raises environmental concerns, as toxic materials can leach into the environment if not properly managed (Massoud et al., 2023). Without effective recycling strategies, disposing of outdated renewable energy technologies could undermine their environmental benefits.

Recommended Resource

Learn more about some of the reasons why people may reject renewable energy projects in this article: How do we change landowner perspectives on wind energy? (Alberta Land Institute, 2024).

Social and Economic Costs of Renewable Energy

Renewable energy sources can provide long-term financial benefits by reducing electricity bills and lowering maintenance costs. However, the initial investment required for infrastructure can be substantial, limiting accessibility for many consumers. Technologies such as geothermal, hydropower, and tidal energy demand high up-front costs, making government incentives essential for increasing adoption (Natural Resources Canada, 2023). Industries may need an extra push to adopt renewable energy sources and projects. Therefore, cost-benefit analyses, government funding, and the public push for renewable energy are all needed to motivate necessary change from an economic perspective.

When considering renewable energy from a social perspective, it becomes evident that public support for this

energy source is generally positive, particularly due to concerns over climate change and energy independence (NESO, 2025). Unfortunately, the opinion can shift when projects are initiated in local areas, especially when communities may be displaced. However, the renewable energy sector offers many new employment opportunities to replace jobs in coal, oil, and gas as they decline (IEA, 2023). Ensuring a just transition for these workers through retraining programs and social policies is critical to addressing the social costs of this energy shift (Babatunde et al., 2024). By increasing public awareness, fostering open dialogue, and promoting community engagement, support for renewable energy initiatives can grow (Motavalli, 2021).

Activity 14.1: Can You Power a City?

Explore how costs and power production of different renewable energy sources add up in the online game Energy Island by Siemens. Your goal is to make enough energy for 24 hours without depleting your budget and with low environmental impact. Notice how where you place different facilities impacts how much they cost and the total energy they produce.

A Systems Thinking Lens: Renewable Energy and Remote Communities

Approximately 195,000 Canadians live in off-grid communities (Agu et al., 2023). The majority of remote and Indigenous communities in Canada are currently relying on diesel generators for heat and electricity. Diesel is expensive and runs out quickly (Agu et al., 2023). Therefore, simple daily tasks like heating water for a hot shower become a luxury. Introducing renewable energy supports Indigenous communities in developing independence, reducing emissions, and supporting economic development. Due to these benefits, the Government of Canada has committed to supporting these communities in phasing out diesel power.

Renewable energy offers:

- Economic Opportunities: Creating local jobs in construction, maintenance, and operation, creating income for communities and stimulating local economies.
- Increased Well-being: Communities with renewable energy, especially solar and wind, report higher well-being (Zapata, 2024).
- Energy Independence: Reducing reliance on fossil fuel supply chains.
- Environmental Stewardship: Reducing greenhouse gas emissions and protecting ecosystems.
- Empowerment and Autonomy: Indigenous-owned or led projects are reported to be more successful because the community has more autonomy (Zapata, 2024).

Transitioning from non-renewable to renewable energy in Indigenous, Northern, and remote Canadian communities offers benefits beyond reliable and clean energy. Switching to renewable energy has global benefits (climate change) as well as local benefits (increased local jobs, and higher community well-being), but there are still several barriers to access (Zapata, 2024). Renewable energy technologies often require a significant initial investment, and solar and wind power are intermittent sources of energy, requiring energy storage solutions or grid connections to ensure a reliable power supply (Arbabzadeh et al., 2019). The different climates and sun availability across Canada make some renewable energy sources more reliable than others

(e.g., hydro-energy). Successful energy transitions require institutional reforms, policy changes, diversification, and community engagement to ensure social acceptance and project success.

One example is the Yukon Geological Survey. They have found that the Burwash Landing Area in the Yukon is a promising location for the use of geothermal energy, which comes from the warm groundwaters near the Denali fault; there continues to be extensive research being conducted in the Yukon along with policy changes for the future use of geothermal energy (Government of Yukon, 2022; Tschirhart et al., 2022).

Recommended Resource

Watch the video Iceland and Geothermal Energy (2:50) to learn more about how Iceland's development of geothermal energy and innovation has led to widespread environmental and economic benefits.

Activity 14.2: Mapping a System

Based on what you have learned so far in this chapter and the following resources, see if you can create a cluster map to explore the connections between renewable energy projects and Indigenous sovereignty.

- Video: Montana First Nation: Community Owned and Operated Solar Company (3:22)
- Article: Montana First Nation Builds Healthier Homes Using Green Energy

Does AI Hold the Key to Efficient and Effective Renewable Energy?

Artificial intelligence (AI) is a powerful tool that can enhance the efficiency and effectiveness of renewable energy through its deep learning and machine learning algorithms (Boza & Evgeniou, 2021). One of the most significant challenges with renewable energy is its variability, as seen in wind and solar power. Due to their fluctuating output over time, these are known as variable renewable energy sources (Painuly & Wohlgemuth, 2021). AI-driven energy forecasting can predict the potential electricity production from solar panels, wind turbines, and other renewable sources at any given time, optimize energy distribution, storage, and grid stability. Making renewable energy more effective, efficient, and reliable in the long term (Boza & Evgeniou, 2021). However, the accuracy of these forecasts depends on several factors, such as the quality and the amount of data available to the system.

AI can also predict supply and demand. There will be times of day when energy usage is high in some locations

and lower in others (e.g., high in offices during the work day and lower at homes). By analyzing trends, AI can store energy in optimal locations to prepare for high-usage times.

Unfortunately, AI itself comes with significant environmental costs. Electricity consumption is the impact we think of the most. Water use is another significant impact of AI. AI technologies generate a lot of heat, and heat can damage the technologies. Therefore, companies use evaporative cooling, where water is run through the system. The water collects the heat and evaporates, creating cooling.

Recommended Resources

Want to learn more about the environmental costs of AI? Check out the following resources.

- Electricity consumption: How much electricity will AI need? by International Energy Agency (4:33)
- Water consumption: AI's hidden climate costs | About That by CBC News (14:08)

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Chapter 15: The Arctic

TALYA AHMED; AMAL ALI; OTEIANA DE AZEVEDO; JULIA HEBERT; KAELYN STABEL; DR. DANIELLE DUBIEN; AND TAI MUNRO

Key Ideas

In this chapter, you will learn about:

- the role of the Arctic in global sustainability
- the impact of climate change on the Arctic
- the role of food sovereignty in combating food insecurity
- economic risks of climate change in the Arctic
- the role of two-eyed seeing and Indigenous ways of knowing in sustainability in the arctic

The Arctic and Sustainability

The Arctic is a large and diverse area. It is circumpolar, meaning it circles one of Earth's poles; in this case, the North Pole. Some of the different ways that the Arctic is defined include :

- The Arctic Circle at 66° 33' 44" North, which is the southernmost latitude in the Northern Hemisphere where the sun can stay above or below the horizon for 24 hours.
- The 10°C July Isotherm, which is where the average temperature in July does not exceed 10°C.
- The Arctic Human Development Report Boundary includes the overlapping political and administrative entities in the Arctic.

Recommended Resource

To learn more about what the Arctic Region includes, check out Arctic Definitions from the Icelandic Arctic Cooperation Network.

Our focus is primarily on the Canadian Arctic, but this too is not easy to define. Canada's Arctic and Northern Policy Framework was co-developed by the Government of Canada with Inuit, First Nations, Métis, territorial governments, the governments of Manitoba, Quebec, and Newfoundland and Labrador who are all part of the region. As such, the framework "takes into account both the 'Arctic' and 'Northern' character of the region

and those who live there" (Canada's Arctic and Northern Policy Framework, 2019, p. 9). This region includes "the entirety of Inuit Nunangat—the Inuvialuit Settlement Region in the Northwest Territories, Labrador's Nunatsiavut region, the territory of Nunavik in Quebec, and Nunavut—the Inuit homeland in Canada (Canada's Arctic and Northern Policy Framework, 2019, p. 10). We have used the Arctic as a shorthand throughout the rest of the chapter to represent the Canadian Arctic and North; however, we recognize that this runs the risk of homogenizing the diverse peoples and cultures there.

Recommended Resource

While there has been progress in Canada in recognizing and respect the unique cultures and identities of people in the Arctic and North, there is still much work to be done. It you are interested, you can review the Arctic and Northern Policy Framework to learn about some of the developments and the many tasks left to do.

The Arctic is a crucial region for sustainability thanks to its unique ecosystem, role in climate regulation, significance for Indigenous communities, and economic potential. The Arctic holds vast natural resources, rich biodiversity, and a fragile environment that requires careful leadership. Understanding the Arctic's role in climate systems and its increasing vulnerability is essential for addressing global sustainability challenges. The Arctic is warming at nearly four times the global average, leading to unprecedented environmental and socio-economic consequences (Mead, 2022).

The Arctic plays a vital role in regulating the Earth's climate. The region acts as a global cooling system, with ice and snow reflecting sunlight back into space. This effect helps moderate global temperatures, making Arctic sustainability essential for worldwide climate stability. If the Arctic is compromised, it could lead to increased climate change, rising sea levels, and disruptions in weather patterns. The loss of Arctic sea ice not only accelerates climate change but also threatens biodiversity and the traditional ways of life of Indigenous peoples.

Biodiversity in the Arctic is another reason for its importance in sustainability. The region is home to species uniquely adapted to its extreme conditions, such as polar bears, narwhals, and Arctic foxes. However, climate change and human activities threaten these ecosystems. Research shows that Arctic species are experiencing significant habitat loss due to rising temperatures and ice melt. For example, polar bears are spending up to a month longer on shore than their parents or grandparents did. That's 30 days longer without access to food (Borenstein, 2024).

The Arctic is rich in natural resources, including oil, gas, and minerals. While these resources present economic opportunities, their extraction poses environmental risks. Sustainable development strategies must balance economic growth with environmental conservation. Canada has a responsibility to implement stringent environmental regulations to prevent habitat destruction and pollution in Arctic regions (Nguyen, 2020). The Arctic is home to many Indigenous communities whose traditional knowledge and sustainable practices have helped preserve the region for centuries. Respecting and integrating Indigenous knowledge into policy decisions is vital for Arctic sustainability.

The Arctic's warming affects global food security. Changes in ocean temperatures and currents disrupt marine ecosystems, impacting fish populations that many nations, including Canada, depend on for food and

economic stability. Extreme weather events linked to climate change can damage land suitability and reduce agricultural yields (Schmidhuber & Tubiello, 2007).

The socio-economic consequences of Arctic climate change extend beyond environmental damage. As the Arctic becomes more accessible due to ice loss, geopolitical tensions could rise over control of newly available resources and shipping routes. Canada must prepare for increased international competition in the Arctic while ensuring that development remains sustainable and does not exacerbate climate risks (Mead, 2022).

Facing Greater Climate Risks

Climate change is causing environmental impacts in the Arctic. One of the primary reasons the Arctic is more vulnerable to climate change is the albedo effect; as sea ice melts, darker ocean water is exposed, absorbing more heat and further accelerating ice loss. The result is a feedback loop that amplifies warming, contributing to rising sea levels and habitat destruction (Calma, 2024). Another major issue is the thawing of permafrost. Large portions of the Canadian Arctic are covered in permafrost, which stores significant amounts of carbon. As temperatures rise, permafrost melts, releasing greenhouse gases like methane and carbon dioxide into the atmosphere, further exacerbating climate change. This process has the potential to accelerate climate change to dangerous levels if left unchecked. Melting glaciers and ice caps contribute directly to rising sea levels, which threaten coastal communities in Canada and around the world. The loss of Arctic ice disrupts ocean currents and weather patterns, leading to more extreme storms, heat waves, and droughts in other parts of the globe (Almonte, 2023; Borenstein, 2024). Canadian Arctic communities are particularly vulnerable, facing threats such as coastal erosion, infrastructure damage, and shifting migration patterns of key wildlife species. These challenges necessitate sustainable adaptation strategies, including improved infrastructure, renewable energy initiatives, and policies that prioritize Indigenous knowledge and climate resilience.

Indigenous Communities and Food Sovereignty

Worldwide, the Arctic is home to nearly 4 million people. Roughly 10 percent of the residents are Indigenous. Many Peoples are distinct to the Arctic, including the Inuit (Arctic Council, 2025). Throughout history, Indigenous communities in the Canadian Arctic have relied heavily on hunting, trapping, and fishing as primary sources of food. Traditional food harvest, preparation, preservation, and communal food security methods have been passed through generations. However, they are becoming increasingly vulnerable to environmental, societal, and economic pressures. As a result, Indigenous food security and the preservation of cultural heritage are in jeopardy. One analysis of 92 Indigenous communities between 2008 and 2018 found 48% of families were affected by food insecurity (Ahmed et al., 2024).

Why is Food Insecurity so Common?

There are several reasons why families living in the Arctic experience high levels of food insecurity, including the loss of traditional knowledge and the impact of climate change. Unfortunately, these factors interconnect in complex ways, making them difficult to address. For example, traditional vegetation and meat harvesting techniques, as well as food preservation methods such as drying and smoking (Douglas et al., 2014), have declined significantly in the 20th and 21st centuries (Lambden et al., 2006). Declining traditional skills and knowledge within Indigenous communities are significant contributors; however, other related factors also play

a role. For example, a 2000 survey by the Centre for Indigenous Peoples' Nutrition and Environment (CINE) found that more than 50% of Northern households lacked sufficient hunting or fishing gear to provide their families with nutritious food (Lambden et al., 2006).

Climate change, combined with other factors including resource development, is also having an impact. For example, rising temperatures are changing the migration patterns of many species, including those of the barren ground caribou (*Rangifer tarandus*) (Douglas et al., 2014). As warmer summers and winters become more common and the timing of seasonal patterns shifts, more severe droughts and late frosts damage vegetation, forcing caribou herds to deviate from their historical routes (Douglas et al., 2014). The impacts of resource development, such as mining exploration and development, have contributed significantly to population declines, including the Bathurst caribou herd (Parlee et al., 2018). Further, the extent and stability of sea ice are declining amid higher temperatures, leading to increased safety concerns and reduced hunting success (Malik et al., 2025). The implications of each change vary across communities, shaped by local geography, ecology, and cultural practices. Indigenous Knowledge, while confronting environmental patterns that differ from those previously known, also carries long-standing ways of understanding and responding to landscape change.

Recommended Resource

Listen as Elder Joanasie Karpik speaks to a group of youth about living in two worlds because of the changes Karpik has seen due to climate change: Elder Joanasie Speaks to Youth About Climate Change (6:02).

Please note, the link takes you to a page with a short description of the video. The video was recorded in Karpik's native language and is closed captioned in French and English (you can choose).
Unfortunately, there is no easily accessible transcript of the video.

Food security is further complicated by increases in the number of elderly, single-parent households, and full-time labourers. These factors reduce the time and resources available for hunting, gathering, and growing local foods. In addition, reduced numbers of active hunters limit the resilience of community food networks that rely on household-to-household sharing (Collings et al., 2016). As a result, in the early 2000s, 55% of household income was spent on food (Collings et al., 2016). Sadly, high prices and the previously discussed changes in access to traditional food sources mean that most Northern households rely solely on market foods. Increased consumption of highly processed, calorically dense, nutrient-poor market foods is correlated with rising rates of obesity and diabetes (Collings et al., 2016).

A Systems Thinking Perspective

As we have seen, several factors contribute to high rates of food insecurity. Using a systems thinking perspective, we can see how these factors interact. Paying high prices for food, for example, leads to a lower ability to purchase equipment for hunting, fishing, and trapping, while also reducing the time available to learn traditional skills due to the need to work more hours to pay for the food you can access. Added to these challenges are historical legacies, including colonization. In addition to erasing traditional knowledge,

colonization increased vulnerability through actions such as forcibly relocating traditionally mobile groups into fixed settlements. Many of them are located in areas at high risk due to climate change (Malik & Ford, 2025). Systems thinking can help us see how these different factors interact to create food insecurity as an emergent property.

Unfortunately, the sociocultural dimensions of traditional foods are often disregarded when it comes to considering food insecurity among Indigenous People in northern Canada (Trott & Mulrennan, 2024). Indigenous food security is often addressed through Western perspectives. This "approach is incongruent with the holistic nature and interconnectedness of Indigenous food systems, nor does it resonate with Indigenous concepts of community and individual wellbeing" (Trott & Mulrennan, 2024, p. 15 of 21). Loukes et al. (2021) suggest that the very term food security relies "on apolitical framings of food shortages" (p. 159) as simply relating to caloric deficiencies. They argue that "food sovereignty serves as a more appropriate framework to challenge the structural inequities that lead to limited access to food" (Loukes et al., 2021, p. 160). Centring Indigenous knowledge and frameworks can support reclaiming food sovereignty as a comprehensive and holistic concept. Systems thinking can support it, because the focus on relationship and interconnection "is in fact a very old, ancient, and wise way of thinking that has been protected and nurtured by Indigenous peoples despite cultural genocide and assimilationist policies" (Goodchild, 2022, p. 59).

The focus on Indigenous food sovereignty and the contributions to building resilient local food systems was supported by efforts of the Fort Albany First Nation during the COVID-19 pandemic. The pandemic's increased food insecurity led to the development of new initiatives and the continued support of existing ones. Centring Indigenous knowledge also contributed to overcoming food security challenges during the crisis. This example demonstrates the "need to support Indigenous food sovereignty and build resilient local food systems tailored to the unique needs of First Nations communities" (Ahmed et al., 2024, p. 1 of 13).

Another example examines how food security and Inuit well-being are linked through fish and seafood. Brockington (2025) examined how small-scale fisheries are seen by Elders and community leaders as culturally important. However, they face infrastructure barriers. Fundamental in the discussion is a shift from food security towards food sovereignty, such that policy and research are grounded in Inuit rights and leadership (Brockington, 2025). The cultural significance and benefits of Inuit food harvesting include nutritional, medicinal, mental health, cultural connection, and language (Carter et al., 2025), and are essential to Inuit culture, well-being, and food sovereignty.

Economic Impacts of a Changing Arctic Climate

The Arctic is going through big changes, affecting far more than just the ice and wildlife. As temperatures rise, permafrost is thawing, causing problems for infrastructure, shipping routes, and entire communities. Roads, buildings, and pipelines are collapsing because of unstable ground. At the same time, rising sea levels and stronger storms are flooding coastlines, forcing people to leave their homes. And as ice melts, new shipping routes are opening, bringing new risks, such as oil spills and international conflicts. These changes aren't just affecting the Arctic; they're having a ripple effect worldwide (Lee, 2023).

With the ice melting, new shipping routes are opening up, which seems like a big win for trade. Shorter shipping routes mean faster deliveries, but that advantage comes with many risks. Countries are fighting over control of these routes and the oil and minerals beneath the ice. Even though these shipping routes might seem like an economic opportunity, they're also harming the environment and making the Arctic heat up even faster (Irfan, 2024).

One area that requires increased attention is the impact of climate change on Indigenous livelihoods and adaptation. Malik et al. (2025) found that monitoring environmental trends exclusively through data collection is insufficient. The impacts of environmental changes on community well-being, including food security, cultural practices, and economic activities, are essential to understanding Inuit resilience and experiences (Malik et al., 2025).

The Sustainable Development Goals and the Arctic

The sustainability of the Arctic is directly linked to the United Nations Sustainable Development Goals (SDGs), particularly those related to climate action and sustainable communities, and as we already discussed food security which relates to SDG 2: Zero Hunger. As Canada navigates its role in Arctic governance, aligning policies with the SDGs can help ensure the region's long-term stability and resilience. Arctic communities, primarily Indigenous populations, are on the frontlines of climate change. Rising temperatures, thawing permafrost, and coastal erosion threaten their infrastructure, food security, and cultural traditions. Addressing SDG 11: Sustainable Cities and Communities requires investment in resilient housing, sustainable energy solutions, and community-driven adaptation strategies. Strengthening Indigenous governance and ensuring access to essential services, such as healthcare and education, is expected to enhance the sustainability of Arctic settlements. By integrating the SDGs into Arctic policy and research, Canada can take a leadership role in promoting sustainable development while preserving the Arctic's unique ecological and cultural heritage. The Arctic's future is a global concern, and the measures taken today will determine the resilience of this vital region for generations to come.

The Arctic's vulnerability to climate change underscores the urgency of SDG 13: Climate Action, which calls for immediate and sustained efforts to combat climate change and its impacts. Canada must implement and advocate for policies that reduce greenhouse gas emissions, protect Arctic ecosystems, and support Indigenous-led climate initiatives. Investing in renewable energy sources for Arctic communities can significantly reduce reliance on fossil fuels, mitigating environmental damage while promoting energy security.

Activity 15.1 SDG Connections

When considering the SDGs it is easy to jump to the obvious ones first and then stop. However, looking for deeper connections supports both critical analysis and systems thinking. Based on what you have learned in this chapter and your own areas of interest and study, what other SDGs can you connect to the Arctic? Try creating a table and drawing at least one connection between each of the 17 goals and the Arctic.

Expanding Your Knowledge

Indigenous People who have lived on this land since time immemorial possess incredible knowledge of it.

Unfortunately, Western research practices have often dismissed Indigenous knowledge. Views about this knowledge are changing, but slowly (Petrove & Vlasova, 2021). Fortunately, we are witnessing a growth in the acceptance of Indigenous-led research and a two-eyed seeing approach, which uses both Indigenous and Western approaches.

Western science and Indigenous science are equally sophisticated despite their different approaches. Both can provide viable information to benefit the Arctic (Brooks & Renick, 2024). There is a lack of understanding of the impact of colonization on Indigenous communities and of their contributions to management practices (Buschman & Sudlovenick, 2022). Current management techniques still tend to follow a Western science framework, which is based on a worldview different from that of many Indigenous Knowledge systems. Western science classifies aspects of the world, such as rocks, as non-living. On the other hand, many Indigenous Knowledge systems view the world as fully animate; thus, what Western science views as resources are often understood as gifts in Indigenous Knowledge systems. It should also be noted that many Indigenous peoples actively integrate scientific research alongside their own knowledge systems, recognizing both the value and the limitations of Western science (Grenz, 2020; Kimmerer, 2015). One part of the solution is to obtain support and funding for Indigenous-led research to enhance reparation efforts (Buschman & Sudlovenick, 2022). This can support new opportunities for sustainability in the Arctic and globally.

Indigenous people's strong connection to the land can help determine the key factors driving the changes seen today, especially in the Arctic (Langweider et al., 2023). Non-invasive management practices can reduce costs and address ethical concerns while maintaining the traditions and culture of Indigenous communities (Langweider et al., 2023).

Viewing the two sciences simultaneously while still maintaining separation allows for maintenance of respect and value (Brooks & Renick, 2024). As a result, new management practices can emerge to combat changing climate pressures. *Etuaptmumk* Two-Eyed Seeing, originated by Mi'kmaq Elder Albert Marshall, "refers to learning to see from one eye with the *strengths* of Indigenous knowledges and ways of knowing, and from the other eye with the *strengths* of Western knowledges and ways of knowing, and to using both these eyes together, for the benefit of all (Bartlett et al., 2012, p. 335, italics in original). The Two-Eyed Seeing approach addresses the miscommunication between Western and Indigenous science management methods. An increase in Indigenous-led research reduces bias and power imbalances, allowing a more equal contribution to conservation efforts (Mercer et al., 2025). Consequently, Western and Indigenous views can be combined through respectful discussion, creating long-term partnerships. Ultimately, movement towards a two-eyed seeing can also overcome current limitations, nurture partnerships, and enhance reparation in the Arctic (Petrov & Vlasova, 2021).

Activity 15.2 Two-Eyed Seeing

Watch this video by Science North: Two-Eyed Seeing: Weaving Indigenous and Western Ways of Knowing (9:08).

After you watch the video, choose a topic you are interested in that you have only learned about from a single perspective (Western or Indigenous). Now, do some research to learn about another perspective on this topic. Then consider the reflection questions:

- What new insights did you gain from looking at the topic from the other perspective?
- We have to be careful not to assume that any form of knowledge is monolithic (all the same). This point is especially true of Indigenous perspectives. People sometimes get caught believing that all Indigenous Peoples share the same perspective, which is not the case. For the Indigenous perspective you considered, whether it was one you already knew or one you learned about in this activity, think about the context. Consider who holds that knowledge and in what context they developed it.
- What strategies can you use to remind yourself of the two-eyed seeing approach?

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Chapter 16: Public Policy and Sustainability

SPENCER ELLIOT; KASSEM HOMSSY; WESSAM MONZER; JASON ROBERTS; TANJOT SOHAL; DR. BRENDAN BOYD; AND TAI MUNRO

Key Ideas

In this chapter, you will learn about:

- what public policy is and how it influences sustainability
- the importance of systems thinking for public policy
- the impacts of different levels of government on jurisdiction over sustainability policies

What is Public Policy and Policy Making?

Public policy is a term that is familiar but hard to define. Different situations lead to different interests and produce different perspectives. Public policy can include a wide range of activities, from specific proposals or decisions by government and the authorization of decisions such as legislation, to the actual outcomes of decisions and processes (Cairney, 2019). Cairny (2019) suggests that we can define policy as "the sum total of government action, from signals of intent to final outcomes" (p. 27).

Recommended Resource

Check out this video: Public Policy: Definition & Examples (Easy Explanation) (3:02) by Helpful Professor Explains for a quick overview of public policy.

Given the ambiguity in policy, policymaking is also a complex process. One of the best tools to help us understand policymaking is the policy cycle which is a simple model of complex processes that can support prescription — "how policymakers *should* operate, to make sure that their decisions are made in a systematic way" (Cairney, 2019, p. 57) — and description — describing how policy makers do operate (Cairney, 2019).

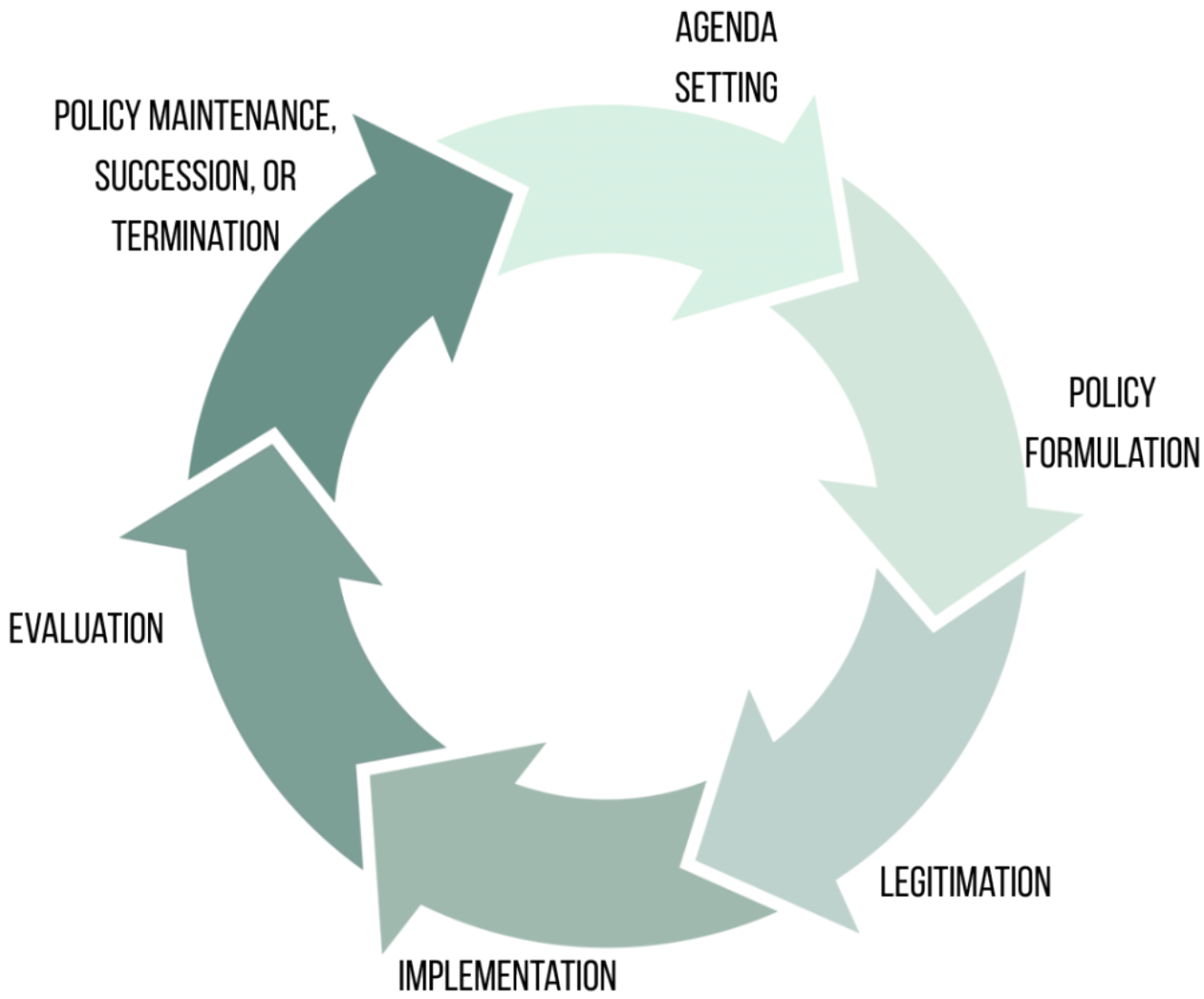

Image adapted from Figure 2.1 The generic policy cycle (Cairney, 2019).

Let's consider each stage in a little more detail.

- Agenda setting occurs by identifying issues that require government attention and action. This stage also requires that we decide which problems need attention first and define the actual problem.
- Policy formulation involves research and development of possible solutions to needs or problems, and estimating the cost and impact of different solutions, allowing us to make informed choices from the range of possible solutions and select the most appropriate policy instruments.
- Legitimation is about approval. Depending on the policy, this may include legislative, executive, and

judicial approval, consultation with other governments including First Nations and other levels of public government, consultation with interest groups, and public consultation through tools such as referendums, surveys, and town halls.

- Implementation involves determining roles, responsibilities, and timelines for implementing policy, and ensuring that the assigned implementers (whether individuals, agencies, or institutions) have the necessary mandate, tools, accountability, and authority to carry out their roles.
- Evaluation includes assessing the success of the policy, including whether it was appropriate, implemented correctly, and had the planned effect. Evaluation can include both formative (during) and summative (outcome) evaluations.
- Policy maintenance, success, or termination involves re-evaluating to determine if the policy needs to be modified, discontinued, or can continue as it is currently operating.

Activity 16.1 Personal Policy

Even though we are talking about public policy, which is the realm of governments, we all engage in policymaking in our own lives, both professionally and personally. Take a moment to think about a problem that you identified and had to figure out how to deal with in your experience.

- How did you decide which problem deserved your attention?
- How did you make the decision between different available solutions?
- Were there other people involved, if so, how did you ensure that they supported the chosen approach? If you were the only person involved, consider what made you decide that you were willing to implement the approach you decided on?
- Were you the one responsible for implementation? How did you make sure you had the resources needed to implement your policy?
- What kinds of questions did you ask to determine if the policy you implemented was working?
- Did you decide to keep, modify, or completely throw out your policy?

Let's look at a quick example. Remember back in Chapter 2, we looked at wicked problems. When we were doing that, we decided that waking up in the morning was not a wicked problem. But it is one that we could create our own personal policy about. The problem might be that you have trouble getting to your morning commitments on time, whether that commitment is getting to class, work, the gym, or maybe walking your kids to school. You decide that this is an important problem that you want to address, so you consider your possible solutions.

- You could start driving instead of biking or taking public transit. That would cut down on your commute time (maybe), but then you'd have to pay for parking, which would mean you'd actually have to work more shifts, and that might affect your ability to attend class.
- You could plan to get up with enough time that you can bike or take the train. This doesn't add any costs, as this is what you are already doing. But it might cost you some sleep.

In our example, you're the only person involved. Therefore, you decide that you are going to get up with enought time to ride your bike or take the train. Not only does the bike or train save you money, but it also helps you exercise in your day without having to spend extra time going to the gym.

What resources do you need to do this? Perhaps you decide that you want to try a wake-up light because you hate waking up when it is still dark out. Can you buy the wake-up light and where from? You also realize that the weather impacts your decision on whether to bike or ride the train. You set an alarm on your phone to remind you to check the weather for the next day, so you can prepare what you need before going to bed. You also decide that, since it will cut into your sleep a little, you're going to implement better sleep hygiene practices so that you can fall asleep a little earlier.

In a couple of weeks, you reflect back and think about how your mornings have been going. Have you been getting up on time? If not, what might be in the way? What changes do you need to make?

Indigenous Policy

> For over a century, the central goals of Canada's Aboriginal policy were to eliminate Aboriginal governments; ignore Aboriginal rights; terminate the Treaties; and, through a process of assimilation, cause Aboriginal peoples to cease to exist as distinct, legal, social, cultural, religious, and racial entities in Canada. The establishment and operation of residential schools were a central element of this policy, which can best be described as "cultural genocide" (Truth and Reconciliation Commission of Canada, 2015).

This statement opens the final report of the Truth and Reconciliation Commission of Canada. We must be careful, though, as we read it, not to fall victim to the assumption that these goals exist only in the past. There is a history of colonialism and paternalism that pervades public policy in Canada to this day. Active resistance from Indigenous Peoples across Canada, and indeed globally, is contributing to shifts away from assimilationist policies and towards reconciliation, self-determination, and rights recognition (First Nations Studies Program, 2009; Government of Canada, 2018). However, the actual effectiveness of these changes is frequently questioned (e.g., Reed *et al.,* 2022; Tsuji, 2022).

From a sustainability perspective, Indigenous governance and knowledge systems are foundational to sustainability. Cultural vitality, social justice, economic resilience, and environmental health have all suffered through the same colonial policies that have subjugated Indigenous Peoples. Practices such as traditional land stewardship and community-based resource management offer models for sustainable practices and policies. However, ongoing challenges–such as extractive industries on Indigenous lands, limited access to healthcare, poor living conditions on reserves, and paternalistic treatment of Indigenous knowledge and practices–continue to show that sustainability cannot be achieved without addressing colonial legacies and honouring Indigenous sovereignty.

Recommended Resources

There are a number of resources that can help you get started in investigating this issue further, including:

- National Centre for Truth and Reconciliation
- United Nations Declaration on the Rights of Indigenous Peoples
- Assembly of First Nations
- Indigenous Climate Action

Reflection 16.1

How might the principles of Indigenous sovereignty influence the topics discussed throughout this chapter? Where do you see opportunities or challenges for integrating these principles into sustainability frameworks?

Systems Thinking and Public Policy

You can probably already see how a systems thinking perspective might impact public policy and policymaking. Clearly, there are many interconnections between policies that impact topics like air pollution, transportation networks, and public health. This means that systems thinking can be particularly helpful in making decisions about which problems need to be addressed first and how they can be addressed effectively. Can you imagine what a cluster map might look like for the example that you thought about in Activity 14.1? And, you might have noticed that the policymaking model looks a lot like a feedback loop. That's because it is.

There is another systems thinking term that can be useful when we talk about public policy, and that is bounded rationality. The following is an excerpt from a forthcoming open textbook on Systems Thinking that is being developed by Dr. Tai Munro.

> Each person's limitations and biases relate to a concept known as bounded rationality. If you are familiar with Adam Smith's invisible hand, you may know that he argued that the free market economy would be guided by the invisible hand such that self-interested individuals would make optimal choices based on complete information. The result of these choices would "add up to the best possible outcome for everybody" (Meadows, 2008, p. 107). Bounded rationality contradicts this perspective.
>
> Bounded rationality recognizes that we make choices based on the information we have, but we don't have perfect information. In other words, there are gaps in our knowledge, which impact our decisions. Further, we don't interpret the information we do have perfectly. This occurs, according to Meadows (2008), for several reasons. First, we misperceive risk. We think that some things are much more dangerous and others much less than what reality tells us. This happens for many reasons, including how media reports some types of events, how people with a vested interest may exaggerate certain risks, and the temptation to downplay risks that require us to make big changes.
>
> Second, we privilege the present over both the past and future. Recent events get weighed more heavily

than past patterns. We also discount the future, often, at least in terms of sustainability, because we think conditions, usually available technology, will change and make the situation different. Related to this, but still a distinct challenge, is that we tend to focus on short-term versus long-term solutions. An example of this bias for the present and near future is the focus on carbon capture and storage. It, in theory, reduces atmospheric carbon dioxide now but does nothing to change the system to prevent future emissions from happening in the first place. Another example is electric cars, which allow us to maintain our current infrastructure and tweak what is under the hood.

Bounded rationality plays a significant role in public policy. As Cairney (2019) states: "it is not realistic to expect policymakers to (1) possess the organizational and cognitive capacity to gather and process all information relevant to their decisions and then (2) make clear, consistent, and well-ranked choices, in (3) a policymaking system over which they have full knowledge and control. While approaches like collaborative systems thinking may enhance capacity and make it more likely to include more relevant information, systems thinking reminds us that policy making will always be based on incomplete understandings and operate within complex systems that will behave in ways that we cannot predict.

Policy Influence on Sustainability

Sustainability includes social, economic, cultural, and environmental issues and problems. This has created new demands on public policy. Sustainability problems have particular attributes such as irreversibility, urgency, connectivity, complexity, cumulation, and uncertainty that make them different than some other areas of public policy. Let's look at one of these in greater detail.

Conflicting Timeframes

If we consider sustainability problems like climate change, they aren't ones that can be completely solved within a normal political cycle. This means that a current government may need to implement policies that have negative short-term consequences in order to achieve long-term benefits (Böhme, 2023). But, given the cycle of elections, their government may only be judged on the short-term consequences during the next election and may lose power.

Not every sustainability problem has every attribute listed earlier. And of course, sustainability isn't the only type of problem that may show these attributes. However, the most negative cases are likely to display more of these attributes in combination. As awareness and commitment to sustainability continue to become more apparent and relevant, existing policy processes will need to adapt.

Recommended Resources

There have been a number of international agreements developed that relate to sustainability and public policy. Although the agreements are not binding, they can serve as a framework for policy development. If you are interested in public policy and sustainability or law and sustainability, you may

want to check out one or more of the following resources. As you review these international agreements, consider how your local or national government has incorporated the principles of these agreements into legislation or policy frameworks. What barriers prevent your government from fully implementing the commitments made in these agreements? How do local priorities impact whether these international agreements are implemented locally?

- Rio Declaration on Environment and Development
- The Paris Agreement
- Convention on Biological Diversity

Public Policy and the UN Sustainable Development Goals

Public policy plays an important role in achieving the UN Sustainable Development Goals (SDGs). It creates the legal and regulatory frameworks necessary for their implementation. Policies at every level of government determine the allocation of resources, setting of priorities, and establishment of mechanisms to track progress. By prioritizing sustainability, public policy can facilitate long-term planning that is inclusive, equitable, and effective.

Of course, for public policies to effectively support the SDGs, they must be integrated and holistic in nature. Just like we have seen with public policy, the SDGs are also interrelated. Progress in one area often depends on achievements in others. For example, policies aimed at improving access to education (SDG 4) can also have a positive impact on gender equity (SDG 5) and poverty reduction (SDG 1). Policymakers must, therefore, adopt an integrated approach to policymaking that considers the interdependencies between different goals (Tosun & Leininger, 2017). As a result, systems thinking is essential to developing and implementing public policies that promote sustainability.

We might also consider here the importance of the policymaking process in achieving the SDGs. Recall from the model of policymaking that legitimation requires ensuring that any policy instruments to be implemented have support from both government channels and organizations and citizens, while implementation involves identifying or establishing who is responsible for implementation. Policies to support the SDGs, which aim to ensure that no one is left behind, should be designed to empower local governments, civil society organizations, and businesses to contribute to sustainability (Belaïd & Unger, 2024). This inclusivity can foster a sense of ownership and accountability, ensuring that the goals are supported across different sectors of society. Without active involvement and collaboration from all stakeholders, progress toward achieving the SDGs will be limited. In this context, the government must actively engage with both the market and civil society, as these entities play a crucial role in driving sustainability through innovation, resource mobilization, and community support (Belaïd & Unger, 2024).

Monitoring and accountability mechanisms are critical components of public policy for the SDGs and for sustainability more broadly. It is not enough to create policies that support the SDGs; governments also need to ensure that these policies are being implemented effectively and that progress is being measured (Tichenor et al., 2022). Transparency in policymaking and the use of data to track outcomes allow governments and international organizations to assess whether policies are working and make necessary adjustments. These mechanisms are essential for ensuring that progress towards the SDGs occurs and that gaps or shortcomings

can be addressed in a timely manner. Thus, public policy serves as both the framework for action and as a system for monitoring results to facilitate policy adjustments.

Should Sustainability Policies Stand on Their Own?

Whether sustainability should be a separate policy or incorporated as a principle into other public policies is a crucial consideration. Each possibility has advantages and disadvantages. On the one hand, the existence of a stand-alone sustainability policy ensures that sustainability goals are well outlined, prioritized, and assigned the necessary resources. In this way, governments and industries can set well-delineated targets for emissions reductions, renewable energy transitions, and environmental protection. Having a stand-alone policy also promotes accountability, as it compels companies to report on sustainability indicators, making it easier to monitor progress and ensure compliance (Dovers, 1996).

On the other hand, mainstreaming sustainability in broader public policies, such as energy, economic development, transportation, and labour policy, ensures that sustainability is integrated into decision-making at all levels and not treated as an isolated issue. This approach adheres to the principles of sustainable development, which emphasize the interdependence of economic, social, and environmental considerations (Belaïd & Unger, 2024). For instance, mainstreaming sustainability in energy policies can encourage investment in cleaner technologies while maintaining economic stability. Likewise, mainstreaming sustainability in labour policies can help safeguard fossil fuel workers by offering retraining schemes for the renewable energy sector. This method also prevents policy silos, thus mainstreaming considerations of sustainability throughout governance frameworks.

While a separate sustainability policy supports increased focus and accountability, folding sustainability into other policies ensures systemic change in all areas. The best model is probably a hybrid one, where sustainability isn't just a single priority but an embedded element in broader policymaking.

Reflection 16.2 The Impacts of Policies

Think about a sustainability change that you might want to make in your own life. What might be the policy that you make to support this goal? Some examples include:

- I will use public transit if the estimated travel time is less than 1 hour and the temperature is above -10°C (14°F)
- I will eat vegetarian meals with at least 80% local ingredients three times a week
- I will repair clothes when I can instead of replacing them

Now, with whatever policy you identified, think about all the parts of your life that it might influence. Does using public transit only affect how you get somewhere, or does it impact scheduling, budget, social (picking up friends), daily activity, etc.? A cluster map is a helpful tool for exploring all these interconnections. You will likely find that even though your policy is focused on being more sustainable, it impacts many areas of your life. The same is true for public policy. Even though the target of the

policy might be one narrow area, it is likely to have systemic impacts. As a result, collaboration across many areas is likely necessary for success.

Sustainability Policy and Levels of Government

Many countries feature different levels of government that have shared jurisdiction over sustainability domains. This creates an added level of complexity to public policy, which again highlights the need for a systems thinking perspective. We will use Canada as a case study to discuss this issue here, but you are likely to find your own examples in the jurisdictions where you live.

Canada is one of many countries worldwide that have implemented policies and regulations to achieve a more sustainable future. The federal system in Canada has a shared jurisdiction over the environment, meaning that each province and territory has its own jurisdiction over natural resources and Crown land (Boyd, 2024). This shared jurisdiction can lead to conflicts between the federal and provincial/territorial governments regarding which policies should be implemented and how they should be implemented. The federal government must bring the provinces and territories together to establish and maintain national policies (Boyd, 2024).

The federal government has different methods it can use to bring the provinces and territories of Canada together to create and maintain national policy. While each provincial/territorial government has its own jurisdiction over the resources and land within its borders, the federal government can employ several different tactics that generally fall into the categories of director, leader, and convenor to create nationwide policies. Similarly, each province and territory can play distinct roles in national policymaking. Provincial or territorial roles tend to be categorized as willing participants, conditional participants (they offer their support only based on other requirements, such as receiving something in return or the participation of other provinces), or hostile adversaries.

While the Canadian federal government has taken steps to reduce greenhouse gas emissions and promote sustainable practices, the shared jurisdiction over environmental matters creates complexities in policy implementation. The provinces and territories hold significant authority over their own natural resources and land, making collaboration essential for effective national sustainability policies. The federal government employs various strategies to encourage provincial and territorial cooperation, including legal mandates, financial incentives, and political pressure. However, the success of these efforts depends on the willingness of each province and territory to align with federal goals. Some regions may fully support sustainability initiatives, while others may only participate under certain conditions or actively resist federal policies. As Canada continues to work towards a more sustainable future, fostering collaboration between all levels of government remains crucial. By finding common ground and striking a balance between federal leadership and provincial/territorial autonomy, Canada can develop and implement effective sustainability policies that benefit both the nation and the global community.

Recommended Resource

The Government of Canada has identified 10 principles respecting their relationship with Indigenous Peoples. After reviewing these principles, consider how they might influence the topics discussed above.

Activity 16.2 Levels of Government

Think about an area of sustainability that you are interested in that will be part of public policy. This could include areas from social, cultural, economic, or environmental domains. If you don't know already, do some research to find out which level of government where you live has jurisdiction over your area of interest. Once you know who is responsible, see if you can create a cluster map that illustrates all the different areas of public policy that your target area might interact with. Are all of those under the same jurisdiction as your initial interest? Are there any examples that you can find of how different levels of government have interacted with each other? How would you classify the interaction based on the strategies and roles described?

Activity 16.3 Case Study: Policies in Alberta's Oil & Gas Industry

Oil and Gas are a primary industry in the province of Alberta in Canada. This next section will look at some specific aspects of the regulatory framework. You could take a look at an industry in your local environment if you would like something specific to where you are.

Public policies play a crucial role in regulating Alberta's oil and gas sector, ensuring environmental responsibility, industry compliance, and economic sustainability. The Alberta Energy Regulator (AER) oversees these policies. Thus, it provides an example of how sustainability considerations are integrated into provincial resource management. By enforcing standards that protect natural resources while supporting Alberta's energy economy, the AER illustrates the role of public policy in promoting environmental responsibility within the oil and gas sector in Alberta.

The regulatory framework governing Alberta's oil and gas industry is grounded in several key legislative acts. The Oil and Gas Conservation Act ensures responsible development and conservation of fossil fuel resources, while the Environmental Protection and Enhancement Act emphasizes the importance of minimizing environmental harm through monitoring and mitigation. In recent years, newer legislation such as the Geothermal Resource Development Act and the Mineral Resource Development Act reflect Alberta's expanding approach to sustainability, recognizing the need for regulation in emerging energy

and mineral sectors. These acts collectively empower the Alberta Energy Regulator (AER) to implement detailed directives that operationalize sustainability principles. The following policies and directives illustrate how such legislation is translated into practice within Alberta's oil and gas sector.

Key Policies & Directives

- Directive 020: Well Abandonment
    - Ensures that inactive and abandoned oil and gas wells are properly sealed to prevent environmental contamination and long-term damage (Alberta Regulation 151/1971, sec. 3.012).
- Directive 060: Flaring, Incineration, and Venting
    - Regulates the release of harmful emissions from oil and gas operations to control air pollution and greenhouse gas levels (Alberta Regulation 151/1971, sec. 3.062).
- Directive 083: Hydraulic Fracturing – Subsurface Integrity
    - Establishes safety and environmental standards for hydraulic fracturing (fracking) to protect groundwater and prevent subsurface damage (Alberta Regulation 151/1971, sec. 3.061).
- Directive 088: Licensee Life-Cycle Management
    - Requires oil and gas companies to be responsible for their wells and facilities from development through closure to prevent financial and environmental liabilities (Alberta Regulation 151/1971, sec. 1.250).
- Directive 007-1: Allowables Handbook
    - Regulates oil and gas extraction limits to prevent resource overuse and depletion, ensuring long-term sustainability (Alberta Regulation 151/1971, sec. 10.190).
- Directive 058: Oilfield Waste Management
    - Provides strict regulations for waste disposal and contamination prevention in oilfield operations to protect land and water resources (Alberta Regulation 151/1971, sec. 12.2).
- Directive 071: Emergency Preparedness and Response
    - Requires companies to have emergency response plans in place to manage potential environmental and safety risks in oil and gas operations (Alberta Regulation 151/1971, sec. 3.012).
- Section 9.040: Air Quality Control in Processing Plants
    - Enforces air quality standards for oil and gas processing facilities to promote cleaner energy production while maintaining economic stability (Alberta Regulation 151/1971, sec. 9.040).

Reflection Question

Given the policies listed, what are some potential gaps or areas for improvement in Alberta's oil and gas regulations to enhance sustainability and environmental responsibility?

Research Questions

1. How do Directive 020 (Well Abandonment) and Directive 088 (Licensee Life-Cycle Management) ensure that companies remain responsible for their oil and gas wells beyond active production?
2. Why is Directive 060 (Flaring, Incineration, and Venting) important for addressing greenhouse gas emissions and improving Alberta's environmental policies?
3. Directive 083 (Hydraulic Fracturing – Subsurface Integrity) sets safety requirements for fracking. What are the main environmental concerns related to fracking, and how does this policy address them?
4. How do Directive 007-1 (Allowables Handbook) and Directive 058 (Oilfield Waste Management) contribute to long-term sustainability in Alberta's oil and gas industry?
5. Section 9.040 (Air Quality Control in Processing Plants) enforces cleaner industrial practices. What are some of the economic and political challenges Alberta might face when implementing stricter air quality policies?
6. Why is Directive 071 (Emergency Preparedness and Response) crucial in preventing environmental disasters, and what role does industry compliance play in emergency response?

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1. Chapter 17: Sustainability Communication

CHAD RAPHAEL

Key Ideas

In this chapter, you will learn about:

- how communication is essential to our understanding of sustainability
- the purposes of sustainability communication
- how sustainability issues are framed
- areas of sustainability communication
- where you can study, and intervene in, communication for sustainability on your campus

Sustainability Communication

Humans and other species communicate about sustainability every time we send or receive messages about our natural, social, and built environments. For humans, these environments include everywhere that people live, work, play, or pray. Human messages are encoded in words, numbers, images, sounds, gestures, clothing, media and arts, architecture, landscaping, and more. Because we send these messages about our environment consciously and unconsciously – through complex texts such as this textbook and gestures as simple as a shiver – we cannot not communicate about sustainability.

The unavoidability of communication makes understanding it not only useful, but necessary. While the world exists independently of how we communicate about it, we can only know it in human terms through the signs and symbols with which we represent it. If there is dirt on the rug and lead in the drinking water, talk alone will not remove them. But we can only know if they are "clean" by applying a set of cultural standards for housekeeping or regulatory standards for safe drinking water, which are communicated symbolically.
Scholars study communication about sustainability for several purposes. Phaedra Pezzullo and Robert Cox (2018) have defined the goals of environmental communication, which we can broaden to include the economic and social elements of sustainability. In this view, the study of sustainability communication should do three things:

- It should address sustainability crises – such as climate change or species extinction – by diagnosing how they are caused in part by distorted and corrupted communication. For example, news coverage often assumes that the sign of a healthy economy is overall economic growth regardless of its consequences, rather than successfully providing for the basic needs of all people and other species.
- It should strengthen our collective capacities to respond effectively and justly to signals about the well-

being of environmental, economic, and social systems. For example, solutions journalism and speculative fiction (or science fiction) often focus on potential reforms that could advance sustainability, rather than simply diagnosing or denouncing our current problems.
- It should support efforts to heal the interconnections among humans and other species, so that people and nature can thrive together. For example, replacing a campus lawn with an organic community garden can transform an ornamental space that consumes a lot of water, herbicides, and synthetic fertilizers into a place that feeds people, plants, and animals, while educating the community about how to live sustainably through signage and tours.

Recommended Resources

To learn more about sustainability communication, you can review:

- Why Does Environmental Communication Matter So Much? (3:34) by the Environmental Communication Initiative
- How to Reframe Environmental Communication (3:14) by the Environmental Communication Initiative

These videos offer more examples of sustainability communication. The second one offers recommendations for rethinking environmental communication. Which ones resonate most with you?

Framing Sustainability

Framing is one of the most useful concepts for understanding messages about sustainability and designing your own. Framing an issue means defining its boundaries (the way a picture frame does), but also providing a particular way of looking at it. An issue frame often has at least four aspects (Entman, 1993):

- Problem: a definition of the problem
- Causes: identification of the underlying causes of the problem
- Moral Treatment: attribution of responsibility or blame for the problem, and identification of its perpetrators, victims, and heroes (who are solving the problem).
- Solutions: a single solution (such as a proposed law) or a class of solutions to the problem (such as legal, political, economic, or cultural solutions).

Consider framing in the kinds of signs that youth climate marchers have brought to recent demonstrations, some of which read “Killing the Planet Means Killing Us” and “If You Can’t Be Adults, We Will.” These signs frame the problem of climate change in generational terms: adults are making decisions that threaten to destroy the planet for today’s youth. The cause is adult irresponsibility (for children, other species, future generations). The moral of this story is that youth are innocent victims of adults’ choices, but also heroes who are taking the mature view of the situation and acting as society’s conscience. The solution is for adults to listen to youth by taking action to reduce and mitigate climate change.

As these protest signs suggest, framing carries high stakes for what we do to nature and to each other. For

example, we will arrive at very different public policy solutions if we frame climate change as a problem that threatens all people equally, caused by humanity's way of life, which is therefore an undifferentiated collective responsibility, or if we frame climate justice as a problem of how those who have reaped the greatest rewards of the fossil fuel economy should bear the costs of protecting those who are most vulnerable to floods, fires, droughts, heat waves, and other disasters worsened by a warming climate. Many universities' efforts to reduce their overall greenhouse gas emissions aim to mitigate climate change. A climate justice approach would lead universities to ask how to mitigate their impacts on the most vulnerable human and natural communities as well – for example, by refusing to purchase energy produced by evicting Indigenous peoples and endangered non-human species from their lands so energy companies can use it to produce oil, coal, and natural gas, but perhaps also hydropower, or lithium and other minerals used in batteries for electric cars.

Even a seemingly utilitarian document such as a campus map frames its subject. University maps typically assume that the problem of navigating a campus is best solved by directing people to where they should perform their institutionally-designated functions: to attend class, study, perform in co-curricular teams and clubs, use campus services, and pay their tuition bills. As moral documents, maps aim to enforce social order by instructing users about which activities belong where – science classes in labs, visitors' vehicles in short-term parking lots, protests in designated "free speech zones." Maps also contribute to the organizational culture of academic institutions by conferring honor on the namesakes of campus buildings and schools. These namesakes once earned their recognition by playing leadership roles at the school but now typically purchase it by making extraordinary financial contributions. In this way, maps integrate campuses into a larger economic system in which affluent people and organizations engage in branding many kinds of environments (physical and digital) to legitimize themselves, while institutions brand their spaces as worthy of attracting support from large donors.

Reflection 17.1: How Does Your Campus Frame Its Own Sustainability?

Choose a significant text or place that represents your campus, such as the campus map, or the university sustainability plan or strategic plan, or a landscape or building that is iconic to your school. How does this text or place frame the campus and its sustainability? Specifically:

- What problem does it seem to address? This may be implied, not explicit. You might need to work backward from the solution to discover the problem. What are the environmental, economic, or social aspects of the problem?
- What causes of the problem does it suggest or assume?
- What is the moral treatment of the campus? What values are promoted? Who or what are represented as potential victims, villains, or heroes?
- What are the solutions to the problem? What alternative solutions are not mentioned or rejected?

Areas of Sustainability Communication

Communication about sustainability occurs in many contexts, not only in the mass media or social media.

Below are snapshots of the main areas of study of sustainability communication, some characteristic questions they raise, and a few ways of studying them on your own campus.

Interpersonal, Group, and Organizational Communication

These areas examine sustainability-related beliefs, attitudes, behaviors, identities and relationships. How are they shaped by communication with our family and friends, by our sense of place and home, by the organizations to which we belong, and by our diverse cultural affinities? How do these relational dynamics influence whether people practice sustainability in their lives? The social sciences and humanities are especially well-equipped to help answer these questions.

On campus, one might analyze how communication in social groups and student organizations expresses and influences students' understanding of sustainability, and their personal consumption patterns and ecological footprints. One could also examine how the institution frames its own sustainability efforts to different audiences through its academic, marketing, fundraising, and planning documents (Barlett & Chase, 2004). Whose knowledge and culture about sustainability are reflected in educational resources (such as the curricula, library holdings, campus exhibits) and organizational resources (campus sustainability plans, signage, orientation and training, etc.)? How do the built and natural environments shape communication and culture among students and others, especially architecture (residence halls, classroom and administrative buildings, libraries, athletics facilities, dining halls, student centers) and landscaping (quads, fountains, sculpture, playing fields)?

Science, Technology, and Health

Students in the natural sciences, engineering, and health need to learn to communicate accessibly and ethically with policymakers and the public about sustainability issues, which can often be polarizing (Jamieson, Kahan, & Scheufele, 2017). Science and risk communication are crucial for responding to threats posed by infectious diseases, climate change, pollution, natural disasters, and other dangers. To be effective, such communication needs to be a two-way street, in which experts engage the public in a respectful conversation, rather than simply lecturing at them or dismissing their views (Groffman et al., 2010). In a democracy, the challenge is to ensure that people can agree upon a shared body of facts that is supported by the best available science, while making room for the public to discuss how policy decisions might be guided by different values.

Students can get ready for this work by examining how sustainability science, risk, and health topics are communicated across campus. This includes identifying who delivers these messages, who the intended audiences are, and the formats used—such as coursework, campus health services, official university messaging, and student media. It also involves considering how people interpret these communications and translate them into attitudes or actions. In addition, educational technologies like online learning platforms and artificial intelligence demand huge amounts of power and water, and shape how students experience education and social interactions. How do educators and campus health services discuss the risks and benefits of our digital and natural environments? User-centered research can improve how health and risk information is designed, especially for populations that are often overlooked or difficult to reach. These questions are closely tied to justice: effective communication should be accurate, inclusive, and sensitive to social inequalities, cultural perspectives, and differing values, while balancing open dialogue with evidence-based knowledge.

Public Consultation and Decision-Making

This area focuses on designing, facilitating, and assessing dialogue, deliberation, and conflict resolution related to sustainability (Hunt, Walker, & Depoe, 2019). Learning in this area helps students build communication skills and empathy that can reduce political and cultural divides.

Effective public consultation can support widespread participation in campus sustainability planning, construction, investments, student government, and partnerships with surrounding communities, including Indigenous groups on whose lands many campuses sit. Students can evaluate how well existing decision-making processes work by examining who participates, how evidence is shared and understood, the quality of discussion, and the effects on policies and governance. Students may also design and lead their own consultations using established participatory models (Kettering Foundation, 2008; Marin & Minor, 2017). A key challenge is ensuring marginalized voices are included by actively recruiting underrepresented groups, promoting equitable dialogue, valuing lived experiences, and presenting expert knowledge in accessible ways (Karpowitz & Raphael, 2014).

Strategic Communication

Strategic communication includes creating and assessing organizing efforts, advocacy initiatives, and campaigns on sustainability issues. These activities can draw on methods from the humanities, social sciences, public health, marketing, and social work.

Because campuses both generate and receive many strategic messages, students can study how sustainability campaigns operate online and in person and how they connect to broader campaigns across higher education and society. Coursework may explore student government campaigns, campus advocacy for fossil fuel divestment or ethical purchasing, and institutional efforts to encourage environmentally responsible behaviors related to energy, waste, and water use. Using surveys, interviews, and digital analytics, students can measure the effectiveness of this communication. They may also design their own campaigns by researching issues, developing messages, choosing platforms, and assessing outcomes, drawing on participatory, social marketing, and social movement-based communication models (McKenzie-Mohr, 2011; Carragee & Frey, 2016).

Media Studies and Production

Media studies help explain how the ownership, creation, circulation, regulation, and culture of media influence how sustainability is portrayed and understood (Hansen & Cox, 2015; Starosielski & Walker, 2016). Students can examine how these media shape attitudes and behaviors, as well as how campus groups use media to build shared identities, values, and lifestyles. How do these messages emerge and circulate, and how are they interpreted and misinterpreted? Media ecology perspectives also highlight how communication technologies affect lived experience regardless of their content, such as how phones and video conferencing connect people across distances while sometimes weakening local relationships. Media literacy is especially important in addressing misinformation and polarization about sustainability. How do media reinforce unsustainable or unjust perspectives and actions, and imagine better ones? How could pro-sustainability sources and views be boosted in public discourse and debunk falsehoods?
Courses in media production—including journalism, film, digital storytelling, games, social media, and immersive technologies—allow students to create original fictional and nonfiction portrayals of campus

sustainability issues. These courses can encourage students to experiment with sustainability-related genres and develop educational media, including interactive tools like games and virtual reality, that promote informed, inclusive, and meaningful engagement with sustainability on campus.

Like all aspects of sustainability communication, this area raises critical questions about access and power in communication: who gets to speak, which perspectives are included and treated as credible, and how is sustainability framed?

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Versioning History

This page provides a record of edits and changes made to this book since its initial publication in the MacEwan Open Books collection. Whenever the authors make edits or updates to the text, they provide a record and description of those changes here.

If the change is minor, the version number increases by 0.1. If the edits involve substantial updates, the version number goes up to the next full number. The work presented on our website always reflects the most recent version.

Version	Date	Change Details
1.0	August 28, 2023	Original Published version
2.0	October 18, 2024	Added material to chapter 3 systems mapping regarding how to draw causal loop diagrams. Fixed misattribution in chapter 5 for quote. Was indicated as John F. Kennedy, updated to Robert F. Kennedy. Added chapters on travel and urban transportation.
2.1	February 9, 2026	Fixed broken link on modern monetary theory in Chapter 4 Economics.
3.0	March 10, 2026	Added chapters on renewable energy, sustainability policy, the Arctic, and sustainability communication. Updated colours and author information.