

**This next piece** is essentially: what is outside of your boundary? The environment or the context of a system is the set of objects which still affect the system because, as I mentioned earlier, energy, material, and information still flows across your imaginary boundary. But, they are essentially still part of the system. Anything outside of your boundary as you've drawn it is your environment or your system context,; effectively, the milieu of the system.

**Scale**, as I've mentioned before, in terms of thinking about the notion of resilience or the adaptive cycle or, in particular, this idea of panarchy—which Francis will talk about more later, especially in social systems—is a really, really important piece in terms of thinking about systems.

**When we talk about scales**, we're really talking about the taxonomy of nested super and subsystems that make up a system. With any system of interest, it's usually useful to look at least one scale above, if not two, and one or two scales below. When you're describing a system, and especially if you're thinking about social change or social innovation, you don't want to fix only on the scale of interest. If you're trying to think about regional politics or changing a regional

system, you will likely not only have to think about that scale but you'll also have to think about the provincial scale and some of the pieces of legislation or other kinds of dynamics that impact your regional scale. Scale is a really important piece.

**Again, going back** to those ideas that I mentioned around resilience and the idea of a panarchy or in the adaptive cycle, those ideas of revolt and remember are across scale or dynamics in the sense that revolt are those kinds of dynamics that come up from the bottom and remember are those kinds of dynamics that come from above or the sub or super systems.

**Another piece** that I've already talked about is this idea of perspective or system type as it's often called. This speaks to the taxonomy of viewpoints from which the system can be viewed or studied. Again, I mentioned this idea that you can't describe the system without describing what your perspective or purpose is in describing it. Then the related idea that you really need to think about incorporating many perspective to allow you to enrich the picture of your system, that is, the taxonomy of viewpoints from which the system can be viewed.

**Again, I emphasize** this notion that you cannot describe the system without describing what perspective or purpose you're coming from. This idea of perspective or system type is really important. And, the related idea that, if you want to enrich the picture of your system, incorporating many viewpoints and many perspectives is incredibly valuable.

**The last piece** to think about when describing a system is this idea of purpose; that is, the reason that you're describing the system. This will heavily influence what you're seeing. If you're describing an ecological system, a woodland forest system for the purposes of extracting fiber, extracting wood, you will see certain things. In a different way, my former PhD adviser was a thermodynamicist by training, and he studied energy. When he was studying old-growth forests, one of the things that he found was that they were something like 97% efficient at pumping water and only 3% thermodynamically efficient at doing other things like creating biomass.

**So, if you're thinking about** extracting fiber, you're really only using 3% of the old-growth forest's thermodynamic efficiency. That just highlights the importance of perspective and

purpose when you're thinking about describing a system.

**Several of these** key pieces we're going to get you to try out in terms of a couple of simple examples or one particular simple example. I also want you to think about if you're approaching a particular problem or thinking about a particular social change or social innovation you want to foster, think about the system that it is nested within and start thinking about the variables or components, the structure, the system boundaries, the environment or the system context, the various scales that are involved. Think about at least one scale above your system of interest and a scale below.

**I want you to think** about your perspective or the type of system that you're emphasizing and the purpose for which you're describing it because those will all affect what you see. You may want to try out different perspectives. Think about a different purpose. because that will allow you to see different things.

**An example** I use a lot when I start to describe the system is something as simple—although it's not—as a farm. I often ask people in a classroom to describe the variables or components. It's probably easier

to describe the components rather than those measurable bits of a farm. When you think about a farm, what do you think about? You may think about a barn; you think about cows; you think about the farmer; you might think about the family; you might think about tractors and other pieces of equipment; other animals that might be on the farm.

**These are the kinds** of things that I usually get. When you talk about interconnections or structure, you might think about the family and the connections between the family, the farmer and his wife and children, other people that work on the farm; other kinds of connections in terms of being able to use what's growing on the fields, to feed cows for instance, and the excrement from the cows going back on the fields. They emphasize those kinds of connections or structures.

**Then I ask them** about a system boundary. They inevitably start talking about the property boundaries. When you start to map that out and you start to think about that—and I often get students to actually just draw that out for me: "*Draw me a system description of the farm thinking about components, structure, and system boundary,*" I usually get a very standard, frankly, southern Ontario kind of approach to what a farm is.

**Then I start to flag** some of these other ideas, this idea of environment or context. I point out the fact that the farm that they're describing is, in fact, in southern Ontario or many parts of the Eastern United States. In fact, there are many different contexts for farms. You can think about really large ranches or grain farms on the prairies or you can take it to an extreme and start thinking about farms in Sub-Saharan Africa or community gardens in some of the communities that I was mentioning earlier in remote villages in northern Ontario.

**These are very different contexts** and so the idea of a farm would manifest in very, very different ways. You would have different components, different structure, and a different system boundary.

**The next piece is the idea of scale** and thinking about farms across many different scales. Inevitably, in my classes, I teach a lot of environmentalist and people that are interested in social and environmental justice. Inevitably, they start thinking about farming and food systems at a global scale and they start talking about quotas and price fixing. They talk about the equity of food systems. Immediately, it goes beyond what we were describing earlier in terms of the

## Describing systems | Describing a system

barn and the farmer and the cow to global food systems.

**It goes across scales** immediately. This is a really useful way of thinking about farms, especially in terms of thinking about farms as a system. Again, scale being very important.

**This goes to the last** couple of pieces here around perspective and type, purpose and the goal. What is your perspective that you're bringing to this? I've mentioned some of my students will emphasize social and environmental justice. That is a perspective to take on a farm. You can also think about family and family dynamics on a farm. You can think about the economics of the farm. You can think about the policies that surround the farm. You can think about the farm as an ecological system, an agro-ecosystem, in fact, and how it uses nutrients or uses energy, for instance.

**Your perspective and purpose** are really, really important. Why are you describing the farm? If you're trying to describe the farm from an environmental justice perspective, probably very useful to describe it a number scales linking all the way up to the global. If you're trying to describe it to a four-year-old, you're probably going to start with those ideas of a barn and the cows and the farmer.

Your perspective and purpose are really, really important.

**So I want you to think**, when you're describing your system of interest, not only about the variables, components, interconnections or structure and system boundary, but also really think very carefully about why you are describing it and from what perspective, what scale or scales are relevant, and then what is the environment or the context in which you're thinking about your particular system.