**In the context of this course on terrestrial ecosystem ecology and Sustainable Development Goal 15 (Life on Land), what were the two most interesting ideas you learned from the documentary, and why were they so interesting to you? Please think deeply, but keep your answers concise.**

The two most interesting ideas I learned from the documentary are that nature always teaches us how to deal with “problems” by taking them into context (or simply observing), and that restoring soil and biodiversity is key to sustainable agriculture.

I think humans have for millennia tried to make order out of chaos. We have reached a point in agriculture where industrialization, the most ordered and regulated form, has become the main paradigm. Centuries ago, farmers would have seen constant environmental threats to crops, livestock, and human livelihood. The film documented some challenges with traditional farming, such as snails eating tree leaves or birds pecking at fruit. Another problem was a coyote destroying many chickens without eating them. By taking a “problem” into context, or into the food web, we can learn from nature. Realizing that their ducks could nourish themselves from the snails then fertilize the soil, or that owls would keep the starlings at bay, John and Molly solved problems with what was available around them. I think people search for the quickest and easiest solutions without slowing down and observing first. As for the coyote, although it had been killed, one can realize that all living things and people share the same universal needs such as food, water, and shelter. Observing nature and understanding our collective needs can reduce human-wildlife conflict, which I find so interesting because these problems are often solved forcefully. I think understanding natural processes at a broader context helps us apply non-violent strategies to grow our food, which applies to the SDG 15.5 Goal: “Protect, restore and promote sustainable use of terrestrial ecosystems”. I love how John and Molly created their farm by welcoming nature, like a tribute to previous place-based knowledge systems that we have lost through industrial agriculture.

Alan had said early on, “You need animals for a farm to be healthy”. As a child (like most), I had never considered a farm *without* animals, but today we have separated every component of biota and how they work together through monocultures. Separated plants and animals in industrial agriculture almost eliminates nutrient cycling. When animals are present, the plants that nourish them are fertilized in return by manure, and the soil builds organic matter to enhance water retention and support plant growth. I think this cyclical nature and understanding the spatial and temporal scales of soil formation and degradation, with biota involved, is necessary. Restoring soil by using animals (e.g. vermicomposting, with resulting nitrogen-rich compost and liquid, and then animal manure,) allowed vegetation to proliferate at Apricot Lane Farms. This attracted other animals, like owls, lynx, and badgers. Biodiversity loss was not only halted but improved by continuously restoring the soil. A large component of UN SDG 15.5 is to combat desertification – which as John and Molly proved, can be achieved through attention to soil water holding capacity by enhancing organic matter, roots, and soil microbiota. I find the concept of addressing soil quality first before starting a farm very exemplary, especially during drought in California! Though it required work to irrigate the soils, I learned it is possible to sustain and improve upon soil fertility through a diversity of crops and animals, which retains water in the end. I hope to see more abandoned farms converted this way in the future.

My first takeaway from *The Biggest Little Farm* is that farming is a continuous battle against the natural momentum of an ecosystem. As John and Molly began restoring the land and introducing new species, new predators (or ‘pests’\*) would appear, not long after. The introduction of fruit trees attracted snails, which ate the trees, and the introduction of chickens attracted predatory coyotes. In nature, it seems unlikely that primary producers would grow in total isolation, without being consumed, but this is essentially the state that farmers are striving for when fighting natural predators. For a farm to be profitable, the products must constantly be in surplus. To generate a surplus, the equilibrium state that terrestrial ecosystems naturally seek must be tipped in the direction of whatever species is being sold as product. John and Molly endeavored to create an entirely self-perpetuating and self-regulating farm that also generates profit from sales, but even with traditional farming practices, this doesn’t seem possible. A farm that produces economic profit is not a closed cycle; there will always be a large artificial output of biomass, so there must also be an artificial input. It seems that shifting towards sustainable farming means minimizing (but not eliminating) input and using the most sustainable means of input possible.

This brings me to my second takeaway from the film, which is that integration is key to maintaining balance in an ecosystem. In the film, many problems faced by John and Molly were solved with the integration of species. The couple planted “cover crops”, which they integrated with the orchard, eliminating the need for external input of fertilizer to enrich the soils. As another example, John moved their ducks from an isolated pond into their orchard. The ducks, which naturally feed on snails, successfully reduced the growing snail population that had been feeding off the fruit trees. Moving the ducks also served to reduce the algal blooms that had been forming in the pond, due to the excrements from the duck population. Species in natural terrestrial ecosystems interact; domination by one species is prevented by predation by another species. If you keep a farm sectioned off, you prevent species interactions that can help to restore equilibrium. This concept made me wonder about the economic cost-benefit ratio associated with monoculture farming. Monoculture reduces the immediate costs associated with planting and maintaining multiple species in one space, and the higher efficiency associated with tending to monocultures means greater crop turnover. However, in the long run, do these profits outweigh the costs of constant artificial pest management, especially as the soil becomes more and more depleted? What is driving the agricultural industry to persist with monoculture farming – is it the immediate profit (with lack of foresight or regard for future risks)? Perhaps climate change will drive future crop failures that catalyze change in modern industrial agriculture.

The two most interesting ideas from the documentary:

1. Soil is perhaps the most important element of the ecosystem and without it, it is nearly impossible to build a productive farm
2. Every native species has a role to play in the environment. Removing one, or not using it in the right way, could jeopardize the whole system

As we learned consistently throughout this course, soil is an integral part of any ecosystem. The documentary pointed this out as well. The very first thing that they tried to do was revive the dry and nutrient scarce soil. They used worm poop to add some nutrients back, then strived to achieve a high level of biodiversity so that the soil would flourish. They added cover crops so that immense rainfall wouldn’t significantly impact the topsoil, and animals were able to provide manure to fertilize the crops and add microorganisms back into the ecosystem. Once they were able to establish an equilibrium of nutrients being consumed and returned to the soil, the ecosystem was better able to function by itself. Hearing about the importance of the soil structure led to more questions. Could this indicate that there are large expanses of land that are unable to be used because the soil is too arid to support life sustainably? Is this land unusable because human interference and production of monoculture farms has limited biodiversity and consumes too many resources to sustain? At the beginning of the documentary when they were limited by a finite source of water they really struggled, but they were able to establish this equilibrium where the ecosystem collected and store water and nutrients. This shows that it is possible to generate productive ecosystems in damaged or unproductive areas. Is it now just easier to relocate farms to areas of high productivity instead of trying to revive old and long dead soil?

The idea that every species has an important role in an ecosystem, and that they shouldn’t be removed just because they are inconvenient to us or considered ‘pests’ is very relevant for me. I like that the documentary showed that just because they are not functioning in the ecosystem in the role they currently occupy, doesn’t mean that they should be removed, it means that they just need to be better used or relocated somewhere else. Like the ducks that were better suited in the orchard consuming snails, or when they killed the coyote and then realized that the coyote would have been helpful for population control with the gofers. I am from British Columbia, and I live up on the mountain in a beautiful area surrounded by lots of wildlife including bears, cougars, and coyotes. These animals are rarely dangerous and prefer to stick to themselves. However, it is becoming increasingly common for conservation officers to shoot first and ask questions later, even though it could have been avoided, and most of the time it was the people who did something wrong. There are far too many stories of a bear attacking someone and then being shot, only to have the real story come out later. Sometimes people send their dogs out to scare a bear cub off their property and the mama bear was just protecting her baby. Bears also get shot for simply being spotted in a residential area, but most of the time they are getting into garbage cans that were left out and unlocked when they weren’t supposed to be. While I agree that this behaviour may be considered ‘pesty’, I wonder what the consequences of killing these animals may be. Bears help to spread berry seeds and they maintain certain prey population sizes. Cougars consume prey species like deer and help prevent their overpopulation which, in turn, limits the amount of grazing. As described in the documentary, coyotes are important for rodent control, and even hunt other predators such as foxes and raccoons which can also be ‘pests’ to humans. We are seeing a rapid decline in the wildlife population as humans take up more of the mountain. The solution, in my opinion, is never to just kill whatever stands in our way; we should find a way to create a ‘manageable level of co-existence’ as the documentary said.

In *The Biggest Little Farm,* I specifically found the fruit trees to be a profound example of the challenges that are inherently involved with trying to balance environmental and economic goals. The Chesters considered it a failure when birds ate over 70% of the fruit produced on the farm. From an economic standpoint that’s certainly not ideal, but from an environmental perspective at this point the Chesters had succeeded in creating a biodiverse ecosystem. The challenge with sustainable development goals seems to be finding a way to maintain a balanced ecosystem, while still supporting human interests.

Before taking this course, I recognized that soil was necessary for plant growth and life at higher trophic levels, but I hadn’t much considered how healthy soil is itself reliant on plants and animals. After just two years, the Chesters’ farm was full of greenery and above ground life which could lead you to mistakenly conclude that the farm had healthy soil. However, it took around seven years for microorganism to return and awaken in their fields. The soil needed the plants and animals above to provide moisture retention, organic matter, aeration, and much more. This made me reflect on the complex interactions between the state factors and interactive controls that make up an ecosystem.

*“The soil was dead, and we had no idea how to bring it back to life”*

Despite the land being degraded in terms of quality and compacted to a point where the Chester’s were unable to use that soil for agriculture, they worked on improving the health of the soil by introducing plants, animals, and compost. Their efforts were successful and by the end of the documentary, their farm was supported by healthy soil. This particularly struck me as throughout the seminar presentations, I often thought about whether we have damaged the land to such a point, where we cannot do much for it, but this gives me hope that we may succeed in our efforts to restore land and protect biodiversity.

*“The objective is to emulate how natural ecosystems work”*

This is one of the first lines Alan York utters in the documentary, and it really meant so much to me. We have seen so many creatives be inspired by nature – from architects to artists, so why not implement how ecosystems regulate themselves to create more sustainable agricultural habits? The methods used by the Chester’s to emulate the natural world (such as using birds to manage pests!) were effective and showed that we do not have to be reliant on chemicals which may be detrimental to species that interact with crops, thereby protecting population sizes of vulnerable species (such as the burrowing owl in Canada which is threatened by pesticides).

(Side note, but I think reducing the use of insecticides/pesticides/herbicides should have been incorporated into SDG 15.)

When John and Molly first arrived at Apricot Lane Farms, the soil was so dry and compact with no organic matter they could not even break it with a shovel. However, with the help of Alan York, they set about enriching it. "Plants build soil," Alan said as he began to seed and build his cover crop. To gain healthier soil, they set up a state-of-the-art compost tea system and brought in so many animals to produce valuable manure and eat away at the cover crop. Towards the end of the film, after the seven-year-long drought, they were met with 18 inches of rain. While the other farm's soil washed away to sea, the cover crop the Chesters had been building was able to soak all the water, nourishing their crops while saving their soil. Soil is central; the farm's health circles back to the health of the soil. Apricot Lane Farms spent their early years putting the care back into the soil, and it paid off as the soil was rich was fungi, microorganisms, and bacteria that can turn life into death.

The goal of this farm was to achieve the "Highest level of biodiversity possible." They eventually reached 200+ crops, animal pastures, orchards, and a large vegetable farm. New wildlife finally returns, creating new pests and fostering more creativity. Alan promises that diversity will make simplicity, but John notes that "a simple way of farming is just not easy." During the moments when you can see the farm is struggling, I have caught myself thinking that wouldn't it be easier and more efficient for them to focus on one crop? That goes against the whole point of the film. Which made me think that few farmers have gone to the Chesters' lengths, but most don't need to. It was never clear in the film how much support they got from investors, although it must have been a lot considering their equipment and resources. What incentives and opportunities should be given to other farmers like the Chester's to traditionally farm? Perhaps a tax break per additional crop they farm? Throughout the film it was clear the diversity is critical but hard and worth it entirely.

Variation over uniformity

The first idea from the documentary which stayed with me was the importance of biodiversity as showcased by the ‘fruit basket’, their orchard which contained 80 different varieties of fruit trees and how it was planted in contour (to reduce rain and topsoil loss). It is a striking and direct opposition to commercial farming’s monocultures and straight rows and provides a great example of what sustainable farming practices such as traditional farming techniques and agroecology strive to do. To learn from natural ecosystems and to work in concert with nature to replicate natural ecosystems’ complexity which provides resilience to pest and disease and other threats through variation in diversity (of plants, of topography, of microhabitats, etc.).

Importance of interactions

 The second idea was the importance of interactions and that sometimes the best way humans may manage a degraded landscape is to allow nature to restore and balance itself. This is exemplified simply with the cover crops which were grown to feed and build the soil (while sequestering carbon, preventing erosion, and retaining water) as well as the grazing animals whose trampling and rotational grazing improves the health of the pasture. I liked how John emphasized the importance of taking the time to investigate interactions as solutions for problems such as using the ducks to eat the snails in the orchard, to allowing the owls take care of the rodents, and placing Greasy, the rooster with Emma, the pig.

**A healthy farm is an ecosystem**

Something that I thought was very interesting in the documentary was how half way through the film John (the farmer/narrator) changed from referring to the land as a ‘farm’ to referring it to a ‘ecosystem’. It was a very subtle change, however, I felt that this shift was very representative. For a piece of land to be healthy, as discussed throughout the duration of the semester, there are a lot of complex and dynamic interactions. As Alan (the mentor farmer), had said in the beginning of the documentary multiple things are necessary to bring back the health of the soil, such as crops, livestock, worms, microorganisms, water, and more. As such, referring to the farm as an ecosystem is a better representation of what the soil needed and how natural farming occurs. Albeit this isn’t something I learned purse from the documentary, but it is an alternate thought/perspective I had never considered.

**All problems could be a solution**

 A reoccurring theme in the latter half of the documentary was that problems could be used as solutions for other problems; because everything is so connected and relationships are so dynamic. For example, when an algal bloom occurred in the reservoir lake, the farmers moved the ducks (which had caused the bloom) to the orchards to feed on the snails which had been harmfully feeding on the citrus leaves. I think this concept is very interesting especially in the context of the Sustainable Development Goals were often times the goals are viewed as distinct entities. However, a beneficial viewpoint might be to see the goals are interdependent and related concepts.

**Interesting aspect #1:**

I thought it was interesting how the farm discussed in “The Biggest Little Farm” benefitted immeasurably from the knowledge of Alan, the family’s “mentor.” Alan was a unique part of this film because he was the keeper of a lot of useful, and obscure, ecological knowledge on this more traditional method of farming. He played a huge role in shaping this farm to be what it is now, played an important role in instilling the importance of “harmony” of the ecosystem in the family’s minds, and was fundamental in building this area of extreme biodiversity from previously neglected land. The title of “keeper of traditional knowledge” is often bestowed upon elders in Indigenous communities and is passed down to youth in the community for generations. In many communities, however, these knowledge keepers are not being given the same opportunities to pass on their knowledge, due to cultural losses, economic shifts, and language losses, so their irreplaceable ecological knowledge is often lost. We saw this in the film when Alan heartbreakingly passed away from cancer and took his knowledge with him. However, while the family would have likely benefited from his continued presence and guidance on the farm, his initial and significant input of knowledge allowed the farm to grow to be healthy, fertile, and in relative harmony with the world around it.

**Interesting aspect #2:**

The evolution of this farm from “somewhat neglected land” to microorganism-rich, fertile, beautiful land was astonishing to behold, especially because there were so many roadblocks along the way to the success and coexistence the farm achieved. In relation to SDG 15.3, “by 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world,” we can see that rejuvenating land is not as simple as planting cover crops and adding fertilizer to soil. Rather, the film stated that “observation followed by creativity” is humanity’s greatest ally and can be used to solve urgent problems such as desertification and ultimately lead to coexistence within the environment over time. This is important to keep in mind when deciding how to approach broad SDG targets, such as 15.3, as it shows us that uncompromising idealism is not easy to maintain, and rather these targets must be tackled with patience, creativity, and knowledge.