Building Place-Based Stories About Climate Change Locally: Ecocultural Calendars

A Dissertation

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Abstract:

As climate changes in unprecedented ways, humans need tools to understand and adapt to this change. Observing and experiencing cycles and seasons of a place over time (*phenology*) represents a way to understand and practice adaptation through diverse cultural lenses. Biocultural stewardship is a framework that nurtures a sense of care-taking and experiencing in place through many modes and languages while examining critically more traditional academic concepts of natural resource science and management. Socially-engaged ArtScience practices represent a positionality and array of methods which seek to be inclusive of community knowledge, modes of expression, and partnership building. I focus on ecocultural calendars as a tool within these frameworks, positionality, and methods to explore the understanding, development, and practice of shifting climate change from a more mechanistic, abstract concept to one that is felt in place here and now. Specifically, ecocultural calendars, their analysis and development are a way for communities to identify and track important biocultural stewardship activities, and changing patterns within these relationships. They identify important embodied experiences that connect people with place by displaying seasonal rounds and culturally important plants' and animals' in relation to community practices, behaviors, and values. They are also a place-based tool for future adaptation to climate change through the collection and building of social-ecological memory in community to interpret how things might be changing. While ecocultural calendars have been used and practiced throughout various cultures, time, and space, they are not widely used or practiced as a climate change adaptation tool in "modern" society as a tool to connect to climate change in a present and local context. In this thesis, I (1) construct a theoretical frame, (2) examine positionality and methods of these practices in intermingling of academic and community spaces, (3) analyze observations collected from interviews to assess ecocultural calendar formation, (4) develop multimedia and educational approaches to highlight and promote ecocultural calendars. The project combines arts, sciences, and decolonizing methodologies and practices to develop participatory approaches to include diverse voices in knowledge production through the theory and

practice of ecocultural calendar development situated in biocultural stewardship frameworks and methods.

Table of Contents

Table of Figures and Tables

Chapter 1: Biocultural Stewardship as an Idea in Urban Contexts? Language, Academic Disciplinarity, Positionality, Environmental/Sustainability Sciences, and Healing[1]

Keywords: human and environment partnership, culture, biocultural stewardship, healing, language, Place, urban environments, story, phenology

Summary: Individual, cultural, and place-based positionality are important elements to thinking about partnership and the environment--particularly including erasures of Indigenous and other marginalized lenses. Language barriers and exclusion of culture that stem from western scientific validity and predominance of this framing within environmental sciences surface as a main limitation to building relationships, communicating across disciplines, and working beyond institutions. What does the western scientific imagination lack that might lend a lens on different relationships to Place and decision-making tools that inform our care of it? Biocultural stewardship of public spaces using an intermingling of ecological and cultural story-telling as a non-universal glue could drive a process of place-making that offers alternative lenses to partnership and the environment. Sustainability, agency, and knowledge production could take on different forms if we leave space for cultural lenses and healing in our partnerships with the environment. Urban areas in particular mark spaces where many cultural traditions come together in unique, but often underutilized, contexts to offer potential knowledge to novel human-environment partnerships. This chapter draws on framing within the history of science and Indigenous philosophy to see how broadly but

[1] This chapter was published in the Interdisciplinary Journal of Partnership Studies (2017) under a Creative Commons Noncommercial Attribution license (CC BY-NC 4.0)

intentionally including different cultural ways of knowing in particularized academic disciplines—especially in environmental sciences—might shed light on relationships of responsibility and stewardship to the land.

Positionality: Who/Where/How Is My Epistemology?

What does partnership and the environment look like? How to cross boundaries? This is an essay that seeks to ask questions rather than find definitive solutions. It is meant to question some of our knowledge production frameworks and reflect on our language and how we might move towards a healing place, particularly in urban environments.

How to start?

I would first like to thank my many teachers of all forms. Then I would like to acknowledge I am on Dakota homeland in Minneapolis, MN from a western European settler background and an Indigenous ally network. I grew up in Menominee Nation homeland (Menominee Indian Tribe of Wisconsin[2]) in what is now called Wisconsin. I did not know this growing up for many reasons but partly because I am a white person from a predominantly Polish Catholic community and my ancestry is "American," of a Euro-American settler descendancy. This Indigenous legacy had been erased from my education or knowledge system, or put into the past--versus a living past, present, and future. The land is still dotted with many Menominee names (Waupaca, Wausau), as well as those of settlers and colonizers (Stevens Point, Custer, Amherst--the last of the two you might recognize as famous Indigenous massacirists). I have studied sociology and forestry formally and practiced education in many PreK to Elder public and private educational settings. These educational experiences were prevalently positioned within a Euro-American lens. I also had the great opportunity to work with the College of Menominee Nation's Sustainable Development Institute[3] (SDI) on a community-designed place-based science education project POSOH (Caldwell et al. 2018), among other projects, for several years where I learned a lot about forestry and education from an Indigenous (and Western lens). I grew up in a small town that did not reflect a very

[2] https://www.menominee-nsn.gov/

[3] http://sustainabledevelopmentinstitute.org/

diverse population. I had not traveled, but then once I was in university and opportunities presented themselves, I have been to many places throughout the world. Of note, however, is that the first time I felt real embodied culture shock was when I went from what I had normalized at SDI and the way education to re-entry into a more classic academic system in my PhD. Specifically, I found the way education could work within a culturally-relevant and Indigenous-oriented education framework in relation to the human-environment partnerships and sustainability fairly absent from my educational PhD work and culture. Pockets do exist both internal and external in my new home in Minneapolis, MN and at UMN-Twin Cities, in which the intersection of cultural frameworks inform our relationship to the environment but it is not widely present in the dominant academic culture and higher education training regime, particularly in the natural resources. I would like to acknowledge the University of Minnesota's Native American Medicine Gardens, a decolonized garden that acknowledges its position on Dakota homeland based on principles of healing on the colonized space that represents the land grant university system, the Healing Place Collaborative[4]—an Indigenous and artist led group that uses collaboration and creativity to deepen ways that people can help repair a Place in need of healing and honor how the place can help to heal people, and the Institute on the Environment's Sustainability Education[5] which creates a vibrant and transformative community of students and faculty from across the University of Minnesota Twin Cities who work together to advance sustainability in society

These experiences have taught me to think deeply about and practice what partnership and the environment could *be* like from many lenses, as well as how to cross boundaries. I have a lot more to learn. My Indigenous and non-Indigenous friends and colleagues have challenged me to confront my identity, my reconciliation of my identity in our power structures that be, and what this process looks like, both on a personal and academic level. I do not wish to move towards settler innocence (Tuck & Yang, 2012), but I have also been told to think towards beyond-settler mentality.

[4] https://healingplacemn.org/
[5] http://environment.umn.edu/leadership/susted/

It is a co-creation of identity that checks in with myself and people that are coming from different backgrounds to know "Who is Kate? Should I be listening or saying? Do I have things to say? Have I listened enough? Do people want to hear those things? Have I earned enough respect in the community vs through academic credentialing to hold street cred, as you might call it?" I don't think it's appropriate to do this process without recognition of Indigenous people on whose land I am on. I encourage this collaborative identity pursuit. Where am I positioning myself and who am I positioning myself as? It is a question I will be continually working through as I think about partnership. These questions should be fundamental to any academic/education journey.

In my academic journey on questions that pertain to partnership and the environment, I have found these questions on self and identity strikingly nascent, especially within the environmental sciences.

Next, I would like tell a story, which serves as a metaphor for some of the challenges that may create some of the boundaries that exist in human and environmental partnerships and cultural transformation. I must admit I have been trying to write in a more academic format and just kept getting lost in justifying my thoughts within an academic speak and format, when I realized that was exactly part of the problem I was trying to address in response to the proposition within the call for papers that clarified "we need to communicate across disciplines and beyond our institutions to foster cultural transformation toward a sustainable—if not restorative—vision for our environment." (Jonee Kulman Brigham, call for papers May 2017, Partnership and Environment, Fall 2017 Issue of the Interdisciplinary Journal of Partnership Studies).

I was recently attending and co-presenting at a biocultural stewardship salon at Bushwick Inlet Park in New York City (NYC, 2017, see McMillen et al. 2020), and it reminded me of a story from several years ago when I lived in the Bronx. I was at my local grocery store and wanted to pick out a mango. However, having grown up in Wisconsin, I didn't quite know the proper techniques for getting a ripe one. I had spent some time in tropical locations but hadn't picked up on the languages of mangoes. Apples, I was good at. I had even expanded my horizons to avocados which don't grow

in Wisconsin. Mangoes, not so much. A man was at the mango section outside feeling different fruits and gathering a few into his basket. The normal hustle and bustle was going on around. Subway lines rumbling overhead. People zooming by. Cars honking. It was easy to get lost in the melee. However, the man looked like he knew what he was doing. *I should probably defer to him,* I thought.

I asked him, "Excuse me, how do you find a ripe mango?"

He looked at me and shook his head like he didn't understand. So I tried Spanish, "*Como se puede escojer un mango que es esta listo a comer*?" Rather than discounting my poor language skills, he engaged. It might not have been the perfect way to say it in Spanish (and here it is not written perfectly) but he broke into a smile and gave me some instructions. It turns out he was from the Dominican and had been living in NYC for a while. However, as we began to speak on language, Othering, perception, and a lack of cultural humility (though we may not have used those words), the Latino man began to tear up. I had been saying that I lived in a place where I did not speak the language or had a very rudimentary grasp of it. We noted it was hard when you had thoughts in your head but couldn't necessarily communicate them.

People might take you at a face value for what you could say within their constructs rather than trying to understand you as you because of a predominant lack of cultural humility existing within the fabric of many of our cultural systems. It becomes a mistranslation of identity and capacity that, for him, marginalized his participation and expression which he encountered as a daily, lived experience that brought him to tears. I did not have to deal with that weight on a daily basis.

Some might argue that it was his responsibility to learn the language in the country in which he lived, and perhaps that was true. We should probably all learn other languages and experience the challenge of not being able to speak them if we are talking about working across disciplines, as each discipline has its own language. But perhaps also English may not translate some of the complex ideas, and the lack of empathy for someone coming from another language is particularly problematic. There's many languages out there, in both human and non-human forms. There was an embodied emotion and othering implicit within the settlement and building of Place that did not

give space to many potential voices including his knowledge of mangoes, and many things different than mine, even in such a multicultural place as New York City.

I was reminded of that story because it serves as a metaphor for some of our challenges in building relationships and communicating across disciplines and beyond institutions that we brought up in our conversation at the biocultural stewardship salon in our relationships between Place, knowledge, and memory. We came to the idea that one of the largest challenges in doing cross disciplinary, community-engaged work is language—particularly the need to speak in a western science-validated way (see McMillen at al 2020 for greater articulation of biocultural workshops and framework).

As we were speaking about the role of traditional ecological knowledge with western science in the context of a project that represented a collaboration between SDI and the State University of New York Environmental Science and Forestry school called Learning from the Land, my colleague Laundi Keepseagle explicitly problematized language, colonialism, blood trauma, and the exclusion of Indigenous people and place from western science frameworks. Many of our relationships in decision-making contexts related to the environment are mediated through these frameworks, especially in urban environments, where it becomes easy to default to a language of objective, universal, apolitical, non-participation, separation of human and Place speak.

While this problematizing led to a long and fruitful discussion between the different people and lenses represented, I would like to focus on language (though I will layer in some of the other challenges). It was largely a professional audience. We had diverse backgrounds and identities and represented a multitude of institutions.

Some of the key questions that surfaced during our conversation from the dialog of the people present that I have been playing around in my head are the following:

- How do we reconcile old and new modes in a way that is positive and brings us beyond community participation towards community decision-making? Who is deciding and who is participating?
- What does local ecological knowledge look like in a city and how do we value and legitimize non-traditional knowledge of lived experience?

- Why is Western science the only, or at least the dominant way, to success and "rightness"?
- How do we build a contemporary urban stewardship ethic that honors all ways of knowing and can translate the rhythms of the city?
- How could we overcome language barriers, collection methodologies, and communication forms of academic science to include some of the non-textual components of people and place?
- How do we unlock the spirit of the place—whether it is a weed in a crack, a single tree, or an entire forest to find shared meaning versus hang-ups that disconnect us from Place or people within Place or idealized nature-scapes?
- How do we move towards justice for human and non-humans alike in our relationships?

Implicit within these questions are a critical reflection on language, Place, justice, and stewardship within our systems of knowing and validating our knowledge. In the vein of this problematizing and collaborative dialogue, I offer the following reflections.

I've found some helpful lessons applying biocultural stewardship models in urban places like the Twin Cities, MN, USA. First, listening to people is good. People have helpful suggestions. As professionals, we are limited in our worldview. Listening is an underrated skill in terms of leadership. Creating forums for listening, instead of telling, serves as a first step in culturally-relevant engagement. Second, acknowledging Indigenous homeland is important. Whose land are you on? What does it mean to acknowledge original people and more recent migrations of Indigenous people into urban environments. In this vein, urban areas also represent a coming together of many voices and are places that have undergone many social and environmental changes. Urbanization is often seen as a negative homogenizing global force that is detrimental to biocultural stewardship frameworks (Rozzi 2015). However, such diversity could offer potential to adapt to changing realities in Place. To surface some of this change, biocultural stewardship implies an idea of story-telling and relationality to Place, in which stories become woven into the very experience of Place.

For example, the Minnesota Parks Foundation is currently working on a park project called WaterWorks[6] near a location which represents one of the most highly trafficked areas in the Twin Cities and Minnesota. At a recent listening session in conjunction with the Indigenous and artist-led Healing Place Collaborative, designers, who are also members of the collaborative, were intentional about surfacing geographical, biological and cultural stories of Place. In particular, they asked explicitly how to curate a coherent experience for multiple stories told through various techniques in order to surface narratives from diverse audiences and make the space inclusive for the many cultural traditions present in the Twin Cities. Part of the emerging narrative included an emphasis on those that have been predominantly absent from interpreting and telling stories related to the land. This process and foci led to specific acknowledgment of Dakota homeland, narratives related to African American communities and the role of railroads in northern migration that is an important element of Minneapolis's industrial history, women activism in garment mills, and Japanese restaurant owners that drew on positive Japanese relationships to waterfalls to herald return to the waterfront after years of industrial use and identity, among others. These stories, as well as a vision for long-term community-engagement with diverse audiences, also led to story-telling techniques combining the intersection of humanities and sciences—including story collecting objects, interactive access, multiple languages, etched poetry, gathering places, site-specific installations, abstract and representational sculpture, nature-based features, sounds, events, video/projection mapping, and programs and tours. In essence, the focus on biocultural stewardship of public spaces using story-telling as a place-based glue that intermingles ecological and cultural senses of Place, drives a process of place-making that is more inclusive and long-term.

Place: Healing Language and Intention

Back at the biocultural stewardship salon in New York City, what was particularly interesting about the gathering was that it embedded itself within a different language and intentionality, and, in turn, allowed for a different conversation. I began my relationship

[6] https://mplsparksfoundation.org/Initiative/water-works/

with this group several years ago when I took a "Healing Wandern in How We Know" [7] to New York City because of the U.S. Forest Service's New York City Urban Field Station[8] work on restorative commons in urban environments (Campbell & Weisen, 2009). I was beginning to try and piece out what healing landscapes could look like, particularly in urban landscapes for my PhD process. Biocultural stewardship holds space for the intention of healing in our relationships to the land. It also surfaces culture in relationship to the *bio (life)* space as one word to facilitate a non-separation of humans from environment.

For example, Sophie Pitt highlighted her work on a Greening Greenpoint project which has an emphasis on Stewardship Trees and Community. From a biocultural stewardship standpoint, she outlined the Indigenous people who lived in the Place before EuroAmerican settlement, the strong Polish Catholic community that stamps a biocultural identity on the current landscape, and the more recent moves to gentrification. They also connected to the ways that these cultures partner with to broader human and non-human community. All these stories mark a lens that surfaces a diverse biological and cultural narrative that speak to human and environment partnerships.

As I have been attempting to work across disciplines and community partners within my most recent educational foray as well as continuing to think about the imagination of what human and environment partnerships could look like (rather than what they are), I question the language we use to both listen to and use to translate our relationship to Place. As ecologist artist Lippard (1995) notes when speaking to what place and homeland might mean, she points out that "Culture is what defines place and its meaning to people. The apolitical and 'culture-less' culture in which most live in the United States inevitably leave us placeless." (p. 127). Both the WaterWorks project and

[7] Flick, K. (2017) A Healing Wandern in How We Know. New York City Urban Field Station Notes from the Field https://www.nrs.fs.fed.us/nyc/pubs/blog_posts/resources/NFTF-AHealingWandernInHowWe%20Know-Flick01.pdf

[8] https://www.nrs.fs.fed.us/nyc/

the biocultural stewardship salon explicitly placed culture within its concepts of stewardship and relationships to Place and so, in a sense, did some placing of Place.

In doing so, we saw the exclusionary nature of many environmental partnerships. I have experienced a bit of culture shock in re-entering academia. I have been surprised at the narrow lens through which we see, interpret, and most importantly imagine things, and how this knowledge system, based on a legacy of what Eisler (1994) refers to as dominant-authoritarian structure, gets mobilized as a tool to implicitly set and control the narrative and possibilities of what could be. The culture, in general, especially in the environmental sciences, represents a fairly exclusive venture that does not include many voices. That means those voices are marginalized in their ability to be listened to, translated, heard, or participant in building relationships to Place. In our current societal constructs, our higher education in how we relate to the Place come from a very narrow-minded system. This context is problematic because this world becomes a semi-gateway to practicing decision-making and engagement on human environment partnerships.

In terms of language, for example, I will position a critique in my own culture in my PhD realm in natural resource science and management, the discipline in which I am situated, as an example for the limitations to working across disciplines and imagining partnership between humans and the environment from a linguistical and thus necessarily cultural standpoint. Implicitly, *natural* requires a separation of humans and the environment…natural being without humans. *Resource* has a connotation of commodification. *Science* has excluded many ways of knowing in favor of westernized validity. *Management* implies an element of control. The people who are legitimized within this context are often white, middle to upper class people, and functioning within it means one must speak through that "language," which can be marginalizing in an embodied way to people who might translate their experiences and thoughts to Place through other languages and values. It is predominantly seen and experienced through a lens both historically and presently derived of a patriarchal system that has othered many forms of cultural knowledge in favor of a western narrative. Further, the lens has often derived from origins in efforts to serve an economic value system whether explicitly

(funding source outcomes and needs) or implicitly (why management ecologies were developed). What does this framing limit in terms of relationship to Place and imagination? Let me look a little deeper into my academic cultural positionality in forestry, in which I have a master's degree.

Scott (1999) speaks to how the framing and subsequent intentions of forests have come to define what is seen and "known." He describes the translation process for legibility and simplification from forest to human intention as a process of abstraction for legibility and simplification that leaves out many human and non-human voices:

> In state fiscal forestry, the actual tree with its vast number of possible uses was replaced by an abstract tree representing a volume of lumber or firewood…to direct the needs of the state…From a naturalist's perspective, nearly everything was missing from the state's frame of reference. Gone was a vast majority of flora: grasses, flowers, lichen, ferns, mosses, shrubs, and vines. Gone too were reptiles, birds, amphibians, and innumerable species of insects. Gone were most species of fauna, except those that interested the crown's gamekeepers. (p. 12-13).

As we extrapolate this lens to higher education and how we build relationships to place in academic speak, we, ironically, lose sight of many cultural lenses and ways of care and potential partnerships with the environments in favor of a modernist state's worldview. Moreover, as that abstraction was translated to academia, the plot thickened, towards one of standardization and conformity in our relationships to knowledge production and land relationships.

In a critique of silviculture, the scientific translation of forestry, Puettmann, Coates, and Messier (2012) detail land management of forested landscapes through European and American historical lens. They explicitly link major social and cultural philosophical shifts to the treatment of the landscape as well as to the decision making tools, practices, and relationships to *being* in it within education—the most prominent of which was tied to economic liberalism and later industrialism circa the late 17th an 18th centuries. This philosophy assumed private self-interest, free trade, and capitalism as

goals and removed the oral and place-based traditions from the landscape in favor of a standardized school of thought.

Specifically, Puettmann et al. (2012) remark:

> Forestry was rather slow to adopt economic liberalism compared to other industries. But when it did, the view of the role of economics in the ownership of forests changed dramatically. The forest had previously been viewed primarily as a stable component of a regional economy and employment base. Management decisions were applied in this context. With the adoption of economic liberalism in the 19th century, came the notion that the purpose of forests was to maximize profits for landowners. This was a substantial shift in thinking and its influence on forestry research and management activities cannot be underestimated. To apply the notion of profit maximization in forestry requires new concepts and decision-making tools. (p. 5-6).

As profit maximization took center stage, forestry too and its purpose and practice changed dramatically. They go on to link knowledge production to land relationship. Up sprouted schools (the first of which was university of Freiburg in Germany in 1792) to institute and standardize these values, which were exported to other settings. Things like the Normalwald or normal forest (1826) became an ideal, which sought the goal of even-aged fully stocked stands with balanced age class distribution. This meant standardizing species mix, site qualities, tree densities, and qualities. Tools that emerged and which still influence most forestry today are inventory and planning, species mixtures and monocultures, stand and rotation, regeneration, thinning, as expressed through equations. This legacy mixes expertism and simplification for legibility towards implicitly assumed goals. It also embodies the educational cultural frameworks through which we still navigate many of our relationships to the environment.

It is a case of a hierarchical dominance relationship that has led in a broad-brush way to what academic civic activist Boyte (1999) calls the “cult of the expert:”

> A corrosive knowledge war that presents a fierce obstacle to civic politics... detached and technocratic champions of the singular authority of scientific and

> disciplinary knowledge—what might be called the 'cult of the expert.' Those of us in research universities are all too familiar with the posture of 'the best and the brightest,' bringing solutions to those viewed as ignorant, passive, needy, and pitiable. As we have come to better understand the inner workings of higher education, we have found that the expert cult is often a cover for deep insecurities—research faculty members are generally better understood as isolated and trapped scholars than as arrogant know-it-all experts. But the consequences of detachment are nonetheless dramatic. (p. 1-2).

Higher education as the language, articulated in a detachment context for translation to relationships with the environment, is challenged within this critique for its disconnection from civic, society, and place.

In fact, Indigenous studies and methodologies have been problematizing these areas within higher education frameworks, and our human experience in relation to the land, community, and Place for many years, so I draw heavily on these methodologies, epistemologies, and critiques. They are generally put under the rubric of decolonizing methodologies or Indigenous studies, which turn a critical lens on imperial thinking and knowing systems (e.g. the western epistemology in which our knowledge production systems in the United States are predominantly placed). There are other ways of knowing that do this critique as well, but I am most familiar with indigenous studies. They critique the positional superiority and cultural formations of Western knowledge that has been implicit in many of our ways of knowing and the institutions that set the rules for procedure, framing and practice--both explicit and masked. The western-dominant knowledge system itself is positioned as a colonial and imperial force.

As Smith (2013) notes:

> Research 'through imperial eyes' describes an approach which assumes that Western ideas about the most fundamental things are the only ideas possible to hold, certainly the only rational ideas, and the only ideas which can make sense of the world, of reality, of social life, and of human beings...It is a research which is imbued with an 'attitude' and a 'spirit' which assumes a certain ownership of the entire world, and which has established systems and forms of governance which

embed that attitude in institutional practices. These practices determine what counts as legitimate research and who count as legitimate researchers." (p. 56)

This positional embeddedness has consequences for who is included and what becomes "real" within Euro-American's knowledge. It also has consequences for both what we can imagine and who is included in this imagination in dominant western culture. Scheurich & Young (1997) further articulate this paradigm in outlining epistemological racism that stems from civilization racism: "The name for the Euro-American culture's construction of "the world" or 'the Real'…is modernism. Modernism is an epistemological, ontological, and axiological network or grid that 'makes' the world as the dominant western culture knows and sees it." (p. 7). While this modernist period has been present in academia, it seems to remain separate from "traditional" natural and environmental sciences in practice and curriculum, especially at the PhD level. The modern period comes with a host of assumptions that continue to dictate much of the epistemological methods and frameworks as well as the construction of the individuals, institutions, and knowledge and ontologies, which are produced. This excludes many potentials in terms of our relationship to the environment. While much of my practical education in these matters comes from lived experience—particularly working with the College of Menominee Sustainable Development Institute--some of the assumptions (and academic references) that pertain particularly to our partnership paradigms within culture and pedagogy, environmental sciences, justice, knowledge production, include but are not limited to this small list are:

- Superiority of the white civilization (Schuerich & Young, 1997, Smith, 1999)
- Particularized modes of control--prisons, ghettos, minoritizing schools, and policing to ensure continued white control (Tuck & Yang, 2012)
- Dehumanization of non-white people (Smith, 1999).
- Lessering of non-human forms of existence (Bang et al., 2014, Smith, 1999, Watts, 2014, Kimmerer, 2013)
- Fixed ontological assumptions that are rife with binary ways of viewing the world, which include human/nature, mind/body, time/space (Bang et al., 2014, Smith, 1999, Tuck, McKenzie, & McCoy, 2014, Kimmerer, 2013)

- Shift towards privatization of "problems" and illusions of choice into realms of personal responsibility and tactics of erasure/invisibilization of specific identities and histories from the public sphere (Quinn and Meiners 2009, Tuck & Yang, 2012, Smith, 1999)
- Transfer of control and power of economy, education, history, and political voice to an increasingly smaller group of Powerhouses couched in maximizing economic profit (Giroux 2009)
- Ownership of the entire world (imperialism) built on continued chattel slavery (Smith 1999, Tuck & Yang 2012)
- Truth methodologies for what is real based predominantly in objectivity, measurability, and rationalism--with a distance from community and subjective biases (Smith, 1999, Schuerich & Young 1997, Tuck & Yang, 2012, Quinn & Meiners 2009).
- "Nations" built on a system of rights versus responsibility, socially constructed geopolitical boundaries, and de-animation of life (Whyte, 2013, Kimmerer, 2013).

Summarizing and applying this concept to our relationships to the land and how we fundamentally think about relating to knowledge about land-relationships leads me to critique western dominant frameworks and methodologies in the natural or ecological sciences of higher education (e.g. to turn the lens on ourselves). *What is off with our frameworks and methodologies in which there are such problems with retaining community and individual diversity*? This critique is especially true in a multicultural urban context where scientists/researchers/policy makers/teachers often reflect a Western dominant culture either because they are forced to use the language to validate their views (which require being in an often uncomfortable environment) or because they have not experienced anything outside that lens.

It begets the question of *whose ideas are being left out?* and more *why*?. It also requires a critical self-examination process and application of healing metaphor in research frameworks that questions knowledge production paradigms: whose ontological views on reality guide the process, what epistemological views on how we think about this reality are employed, whose axiological views on values birth and direct the process,

and what are the methodological processes with which we gain more knowledge.

Towards Healing and Justice in Knowledge Production in Place:

Let's experiment with a shift from the science of management and abstraction to what Latour articulates in an interview as the science of care that intermingles politics, science, and narrative (Davis and Latour 2015). He points to the scientific revolution when data production and story-telling were put into distinct categories with several consequences including a depoliticization of knowledge production, public disengagement, a de-animation of life and processes into facts and objects, an uncriticalness toward language, and potential imaginations. Specifically, he turns towards an idea based in the science of care and questions, "So when it doesn't look like big science, and it doesn't look like basic science, and it doesn't look like fundamental science, what then? It's the science of care." (Davis & Latour, 2015, p. 45)

While the science of care provides a useful starting point and critique of how science itself is used and mobilized in social contexts, the flaw I see in Latour's argument is that he goes on to localize the science of care and its intermingling of science, politics, and narrative into a universalized Gaia and universalized knowledge system. This assumption diverts us back to a knowledge system of universalist assumptions that tends to "dehumanize" the narrative of the Place and the people, Other, and create a paradigm too large to feel a sense of agency.

In contrast, I turn to an important facet positioned at the center of the College of Menominee Nation's Sustainable Development Institute's community and academic-derived model for sustainability: a sense of autochthony (Dockry, Hall, Van Lopik, & Caldwell, 2016). It is a rather fancy term for having a sense of Place. Literally, it derives from a Greek concept of springing from the land. Rather than a universal "rightness or correctness," each Place would have a knowledge from which to speak. The Place itself has agency as we become first listeners and then translators of this unique set of memories "springing forth" through various forms of narrative, both human and non-human. Several dimensions of sustainability then circulate around this sense of Place including: (1) land and sovereignty; (2) natural environment (which includes human beings); (3) institutions; (4) technology; (5) economics; and (6) human perception,

activity, and behavior (Dockry et al. 2016). This model offers a more nuanced version of sustainability that is particular to Place rather than the universalized traditional three-stool model omnipresent in sustainability that includes social, environmental, and economic factors. Human translation would include not just political and narrative connection to Place but an embodied personal, spiritual, and more-than-political relationship to Place because there represents a responsibility to Place (Oliviera & Wright, 2016). Place becomes a character onto itself often translated through many forms of human and non-human memories and modes of expression. This sense of place is unique in all contexts so cannot be universalized and Place itself is animate.

As Watts (2013) encourages with her concept of Place-Thought:

> It is necessary to tease out what the land's intentions might be and how she tries to speak through us...To be animate goes beyond being alive or acting, it is to be full of thought, desire, contemplation, and will…The agency that place possesses can be thought of in a similar way that Western thinkers locate agency in human beings. It follows that if, as Indigenous peoples, we are extensions of the very land we walk upon, then we have obligation to maintain communication with it. A familiar warning is echoed through many communities, that if we do not care for the land we run the risk of losing who we are as Indigenous peoples. When this warning is examined in terms of original Place-Thought, it is not only the threat of a lost identity or physical displacement that is risked but our ability to think, act, and govern becomes compromised because this relationship is continuously corrupted with foreign impositions of how agency is organized. Colonization has disrupted our ability to communicate with place and has endangered agency among Indigenous peoples. (p. 22-23).

Broadly, she questions our communication with the land in a way that natural resource science and management or silviculture or even concepts of Gaia and their standardizing and move towards universal practices do not. As humans we have a certain agency, but so too does Place. This confronts Western notions of individuality as the giver of agency over land and lived experience and cultural traditions in our knowledge production systems that stem from a legacy of Othering. As we think about sense of place, place

having "sense" and animacy, and our relationship to it, agency requires a non-separation between humans and the world. Specifically, agency is defined by the ability to connect with, interpret, and act on the land's intention. Agency must also be situated not within the borders of an individual self, but instead within the relationship between the land and responsibility to all the relations.

For example, Potawatomi ethnobotanist Kimmerer (2013) questions geopolitical boundaries of nation states and our defining of becoming Indigenous to Place towards recognition of the Land boundaries that exist more broadly. She discusses a future in which we hear the Haudenosaunee Thanksgiving Address each day in school, rather than (or in addition to?) The Pledge of Allegiance. In doing so, she outlines a sense of agency that connects to a placement within a broader view of social and relationships. Specifically, Kimmerer (2013) articulates:

> I love my country and its hopes for freedom and justice. But the boundaries of what I honor are bigger than the republic. Let us pledge reciprocity to the living world. The Thanksgiving Address describes our mutual allegiance as human delegates to the democracy of species. If what we want for our people is patriotism, then let us inspire true love of country by invoking the land herself. If we want to raise good leaders, let us remind our children of the eagle and the maple. If we want to grow good citizens, then let us teach reciprocity. If what we aspire to is justice for all, then let it be justice for all of Creation. *We have now arrived at the place where we end our words. Of all the things that we have named, it is not our intention to leave anything out. If something was forgotten, we leave it to each individual to send such greetings and thanks in their own way. And now our minds are one.* Everyday, with these words, the people give thanks to the land. In the silence that falls at the end of those words I listen, longing for the day when we can hear the land give thanks for the people in return. (p. 117).

Moreover, as we think towards justice, tolerance and respect for others, these too must be founded in the land itself. The land has spirit (that drives agency), rather than being a material good such as a commodity or resource.

Watts (2013) furthers this point:

> What happens when soil is removed from territory? What happens when flesh is taken from the body? More importantly, what happens to the territory after its resources are excavated? Shopping malls and paper mills – a literal excavation of thoughts are forcibly transformed into objects of the colonial imperative. Those crops became their crops, that tree became their tree and so on and so on. Once the voices and thoughts of these two essential categories of creation (the feminine and land) are silenced and then corrupted, the acquisition and destruction of land becomes all the more realized. (p. 31).

Justice and possible relationship to the land also take on different meaning within this framework. Whyte creates a powerful bridge by locating and clarifying justice within a system of responsibilities, rather than the current system which arises from a point predominantly located in colonial policies meant to weaken tribal resistance and give power to dominant institutions to expand and erase. He pushes that justice should not be a tool for dealing with formal wrongs, but one which can be "forward" looking by placing itself within a system of responsibilities. The goal would be to build a justice system that supports *collective continuation*--meaning a community's capacity to be adaptive and flourish into the future, contest colonial hardship, and orient itself around the many relationships within and between communities so that when "understand[ing] how to fulfill one's responsibility for action, there also needs to be a forward-looking account of how institutions can serve collective continuance that centers on the interaction between institutions and the systems of responsibilities that constitute collective continuance." (Whyte 2013, p. 523)

This system of responsibility is founded in relationships. Relationships are diverse and include social and political relationships, elder- youth relationships, commercial relationships, relationships across species and with features of the land, relationships with important species, customs of child rearing, etc.

Further, Whyte (2013) clarifies that the relationships come to be through responsibility to others:

> These types of relationships are realized through the responsibilities incumbent on the parties to the relationships. That is, to be in a relationship is to have

> responsibilities toward the others in the relationship. Responsibilities refer to the reciprocal (though not necessarily equal) attitudes and patterns of behavior that are expected by and of various parties by virtue of the different roles that each may be understood to play in a relationship...systems of responsibilities are the actual schemes of roles and relationships that serve as the background against which particular responsibilities out as meaningful and binding. (p. 519).

These Indigenous scholars and models challenge relationships to Place and offer knowledge for, and opportunity to, form relationships to Place, but such notions have been predominantly left out of knowledge production systems that have to do with Place outside of Indigenous, cultural, or humanities studies. It is from this lack that I feel like needs healing in environmental and sustainability sciences. Instead, our knowledge structures seem to derive from a limited worldview and one which continues to replicate the imperialistic research structure without acknowledgment of the healing process needing to be had by participants.

In explicitly applying a healing metaphor to both higher education models and our relationships to land-people geographies which face crisis or challenge (many of which are vestiges of colonization), Cowell, Collinge, and Limerick (2009) assert that "…the word *healing* can force us to confront fully the reality that it is we who identify the patient—that the patient is not given to us automatically. This awareness can bring a renewed sense of insight and potential, and can even lead us to define the patient more productively." (p. 17) While discussing education, sustainability, and climate change at a leadership meeting for a collaborative science education project, the late Dr. Jerilyn Grignon (one of my elder mentors, an educational specialist and the first Menominee to get her PhD) said, "Communities must come together to change the way we produce knowledge." She was pointing to the intersection between justice, knowledge production, our relationship to our world, and the ensuing landscapes in the face of climate change. I believe she also thought Place and cultural relationships to it needed examination—particularly those that abstract trauma of colonial and other legacies.

Place itself has agency memory. It becomes a grounding force. If we open the door to cross-cultural contexts and diverse contributions to knowledge production, we

may unearth alternative ways of asking questions about, understanding, and relating to our world (Hassel 2014) that will provide tools to be communities with capacity—i.e. resilient, adaptive, and transformative within novel ecosystems or work towards collective continuation (Whyte 2013).

What are healing landscapes? Landscapes require us to think about a place-based time and space between and within eco-social systems and scales. This means landscapes represent big time and large space scales and include a composite of many things. We are reflections of the landscape and the landscape is a reflection of us. The landscape includes and is impacted by many social and ecological components. Using a landscape lens, we must recognize the past, look critically at the present, and think about the future. Healing landscapes are NOT prescriptive and must be responsive to each social-biophysical context. However, healing involves listening to the biocultural memory of place.

As we move towards engagement with place, justice and collective continuation within knowledge production, "natural resource management," environmental studies, and relationship to place, we must think critically about the paradigm from which it comes and in which it is centered. *Why not intention healing landscapes as the goal*?

In the vein, if we center what partnerships might look like and working across disciplines in Place, the patient might become western science. Its role as a predominant way to validate success, or "rightness," may need adaptations in healing efforts because it has been so challenged historically in applying the values of care. Stewardship is a much broader concept that implies the care of a Place. *Can we come to a shared meaning that values knowledge of lived-experience and that of western science (often not lived but researched as a transitory Other)? Can we accept and acknowledge traditional ecological knowledge as a form of knowing in cities that have a highly changed geography? What is their relevance? How about the other cultures that have migrated to a specific Place and bring their own forms of knowledge? Is it hierarchical*?

Indigenous studies scholar Wilson (2008) succinctly describes this intersection of knowledge production, positionality, and assumptions (e.g. the fabric from which knowledge grows) as a research paradigm with implicit "ologies" stemming from cultural

positionalities (most of the ologies at least in a "published" sense having come from a Western-dominant lens):

> A paradigm is a set of underlying beliefs that guide our actions. So, a research paradigm is the beliefs that guide or actions as researchers. These beliefs include the way that we view reality (ontology), how we think about or know this reality (epistemology), our ethics and morals (axiology) and how we go about gaining more knowledge about reality (methodology). (p. 13)

This articulation in thinking about *Research as Ceremony* in addition to academic production calls out how we know and our assumptions.

While Wilson goes on to apply these definitions to Indigenous research paradigms and their connection to our thinking and doing systems in current educational formats, they are also a "good place to begin" in understanding the positionality of our work and cultural transformation as researchers. In our own terrain of higher education's knowledge production systems—particularly those concerned with restoring the land (and people) to health in some form or another—we need to engage in more diverse processes and ultimately begin to heal from our own symptoms of exclusion in higher education research, over-specialization, disciplinarity, lack of civic engagement, etc. that limit our response to change. In times of novel change, we may be limiting the number of memories a Place can draw upon as we interact with it/her because we do not see outside our own limitations on what healing could look like. As researchers, we should probably see the many layered dimensions within our frameworks and methods from multiple lenses to vision partnership across disciplines and communities. This process requires (1) critical examination of the facts and assumptions behind the issues in order to clarify goals, and (2) recognition that a real problem often lies in unequal power relationships between groups (Cowell, Collinge, and Limerick 2009).

Particularly, while diversity has been recognized as being a tool for resilience in many fields--social, ecological, political, etc.--in practice the "natural resource" and sustainability knowledge systems remain relatively exclusive, expert-driven, highly-disciplinized, and lacking in diversity. As such, I problematize the assumptions of research paradigms from higher education and knowledge production models,

particularly those related to the health of Place, or of Land (and people), in an effort to heal and allow for a more civic-based approach to cultural and community knowledge creation that is diverse and responsive to unexpected and unknown change. The current lens is fundamentally limited.

Biocultural Stewardship as a Framework

Biocultural stewardship models provide a framework for asking about our "management" paradigm from a cultural fabric and individual and community relationship to the Place (Rozzi et al. 2015). This framework stands in contrast to the more objective, universal relationship to "resources" from which our more "expertized and universalized" visions of Place relations typically come.

Biocultural stewardship frameworks seek to recognize other ways of valuing and relating to relationships to the Place, especially concerning health. They explicitly put into language and value cultural manifestations of our relationships to place. They also require different methodologies for knowing about Place and Land. They are about personal and spiritual connection to the Land for survival, resilience, responsibility, and healing. They can come from many traditions but are specific cultural conceptions of relational understanding rather than universal knowledge. More than that, they are about acknowledging kinship relationships to the Land as an Elder and teacher to which we need to listen rather than control. They embrace the conversation between the spirit of the Land and the individual learner and their ancestry, as well as methods and ways of knowing which allow for this conversation in multimodal forms. They also value diversity, culture, community, and personal connection rather than monoculturalism, expertism, universalism, and objectivity.

Biocultural stewardship explicitly links cultural values and diversity with earth stewardship while acknowledging and accepting that there are many modes and fabrics in which people have spirituality and culture to relate to land and Place. Place in this context means surrounding social-environmental layers as well as relationships to context in physical, spiritual, emotional, and psychological realms. It seeks to give the Place itself agency in the vein of Place-Thought (Watts 2013). Importantly, it is a relational

paradigm based on partnership versus domination and control. Many stewardship practices and models can emerge and be co-present.

Biocultural stewardship strives to put academic and stewardship models into a culturally-relational context rather than objective or human outside-of ecological models. Specifically, rather than striving to take culture out of social-ecological interactions, it seeks to examine and ground in culture (particularly academic culture). Rozzi et al. (2015) introduce three core concepts that help shape biocultural stewardship:

1) **Biocultural homogenization**, is a a major, but little perceived, global driver of losses of biological and cultural diversity that frequently entail social and environmental injustices; such as linguicide, genocide, biocide, and increasing poverty.

2) **Biocultural ethics** considers –ontologically and axiologically– the interrelations between the habits and the habitats that shape the identity and well-being of the co-inhabitants.

3) **Biocultural conservation** seeks social and ecological well-being through the conservation of biological and cultural diversity and their interrelationships.

They employ these concepts to move from biocultural homogenization (which leads to the disruption of co-evolutionary interrelationships between cultures and land, in favor of a few cosmopolitan species, languages, and cultures and unequal power relationships between this homogenization and cultural and biological diversity) to biocultural conservation and stewardship models that ground in biocultural ethics.

Biocultural stewardship is a concept as well as mode of being to help reorient our ways of knowing and doing. It seeks to break down ontological divides built over centuries of dominant western European colonial ways of knowing and doing that split humans from the natural world and do little to recognize the cultural traditions that see diverse community in this sense in favor of universalism. Instead, they embrace seeing complex cultures that recognize a community of relatives (human and non-human). Finally, it focuses on tying ethics intrinsically to Place (i.e. not just human habits, but human habitats). These ethics go beyond a research position and even a "science as political" assumption. The ethics component attempts to create a greater investigation and

valuation of cultural and biological diversity, and the relational framework in social formational forces in education, policy, and knowledge production. It also serves to offer alternatives to biocultural homogenization and modes to counteract from biocultural homogenization (Rozzi et al., 2015).

Many of these concepts are old and go through many traditions, both written and oral, inside and outside academia. Some key references include Oliviera & Wright, 2016, Buizer, Elands, & Vierikko et al. 2016, Kimmerer, 2013, Rozzii et al. 2015, Whyte, 2013, Million, 2013, Cajete, 1999:

A semi "blue-print" for biocultural stewardship might identify the following:

- Building of physical, spiritual, emotional, and psychological as one paradigm.
- People as expressions of landscape/Place and landscape/health
- Long-term commitment and lens to being part of Place.
- Stepping outside our dominant worldviews to see biocultural heterogeneity.
- Integration of art, science, economy, religion, philosophy, etc. into planning.
- Going from human eco-centric to biocultural, which requires a rereading of the landscape.
- Relationships of reciprocity and responsibility grounded in biocultural stewardship.
- Place must be nourished and fed as an active agent who is kept in conversation and requires careful observation of Place to be understand.
- Non separation of humans/social and natural/ecological.
- Recognition of ethno-stress and felt theory.

While biocultural stewardship has been described in communities of practice who have lived in a Place for hundreds to thousands of years, understanding how this framework could function in urban environments with patterns of new migration are less understood. Often these principles have encountered trouble fitting with more recent urban migration and resiliency patterns of Indigenous people, instead focusing on these voices in less colonized places such as on reservations or other Indigenous strong holds. Less emphasis has been put on bringing these voices forward through decolonized practices in highly colonized urban and higher educational contexts. In fact, rural-urban

migration is seen as a major driving force of biocultural homogenization (Rozzi et al. 2015), rather than being seen as an opportunity for diverse biocultural stewardship models.

Specifically, while biocultural stewardship models have been studied, the practice of implementing them in multicultural urban environments is a novel idea (Buizer, Elands, & Vierikko et al. 2016). Urban environments represent a coming together of many traditions in old and new ways in patterns of adaption. Indeed, the theory based on biocultural homogenization does not do justice to these resilient and adaptive systems. As such, applying a biocultural stewardship model in multicultural urban environments requires a set of new tools and integrated methodologies to create this knowledge production system that intersect culture and the land. Application must also walk a line between cultural humility and cultural surfacing.

Moreover, while this biocultural stewardship approach has the potential to offer more diverse ways of knowing to our knowledge production, as well as the ability to create more inclusive environments where multiple forms of knowledge are acknowledged, valued and legitimized, it has encountered troubles in academia and subsequent community relationships. Creating trust between academics and communities is challenged by oversimplified human ecology models and narratives prominent in academia as well as top down expert driven models of education (Kingsland 2015). Moreover, many efforts towards stewardship through sustainability and inter-and trans-disciplinary frameworks remain entrenched within disparate content areas as legacies of disciplinary institutions and interpersonal relationships (Boyte, 2009, Caston, 2010, Kuhawara 2013). Environmental solution narratives often derive from an "external" expert academic rather than from the community themselves who interact with and inhabit a Place. Less attention is paid to nurturing cultural conservation fabrics. Biocultural stewardship approaches move towards putting civic agency in the hands of the people and encourage self-education through interactions with the environment that link with citizen's values and culture (Kingsland 2015).

So, in urban environments, particularly where everyone is representing many places, cultures, and background, it also requires a process of looking into how colonial

fabrics may marginalize other forms of knowing coming from different research paradigms now present in Place. What cultural views are left out in "management" sciences? What could healing from this exclusion look like? What could be the language? I have been thinking about phenology and its observation as a cross-cultural tool. Phenology is the study of cycles and seasons over time, especially related to climate, plant and animal life. It has been used as a tool to interpret, connect to, and engage in what is happening, when occurrences are happening ecologically, mismatches between species and climate change, and how these occurrences might be changing over time. Phenology has been used formally in ecological research as an indicator for climate change, in citizen science to engage in participatory data collection, and by land-use stewards to know when to perform different management practices (Miller-Rushing et al. 2012). However, it has not been used widely as an inclusive language to garner agency in urban settings. Importantly, the language of phenology is something everyone can do—from youth to Elder—and marks a tradition shared across culture and language to connect to Place. In a sense, phenology becomes a tool to engage in understanding adaptation in the past, present, and future through diverse cultural lenses (Ryan 2013). In this vein, biocultural stewardship becomes the framework and phenology the language, particularly in urban environments. That said, there are certainly other language potentials. *What have you been thinking about?*

Chapter 2: Climate Change Science and Inclusive Practices: Working for Frameworks, Methods, and Place-based Tools through Biocultural Stewardship

Summary: Scientists, and academics, often struggle with being taken up in a broader societal context in relation to climate change. Climate change is often framed through western scientific—particularly (socio)ecological or resource management—ways of knowing, which tend to avoid positionality, felt perspective, and Place. I come predominantly from the "natural resource" field but incorporate Indigenous studies, socially-engaged art practices, and cultural awareness studies. I use biocultural research frameworks to experiment with communication, different modes, and translations of observational, scientific, and community-based knowledge in relation to climate change. I ground in a fundamental problemitization within climate change formulations in that it often does not include in its formation and directionality community knowledge so that as a consequence it is often challenged in being taken up broadly within communities of practice. We then discuss frameworks for including positionality, cultural knowledge, community knowledge, and stewardship practices in Western scientific [socioecological] sciences around climate change. Place and phenomenology become important elements that go hand-in-hand with explicitly stepping outside the western science "fort" to understand researches' positionality and relationality to climate change. We use a critique of academic Traditional Ecological Knowledge (TEK) and why there have been opportunities and challenges for integrating TEK into western scientific frameworks as an example, while examining partnership and communication within research frameworks more broadly.

Introduction: Knowledge Production Differences

First, I would like to articulate and compare knowledge production models through a biodiversity-landscape metaphor in order to conceptualize some of the principles we are going to discuss throughout the chapter.

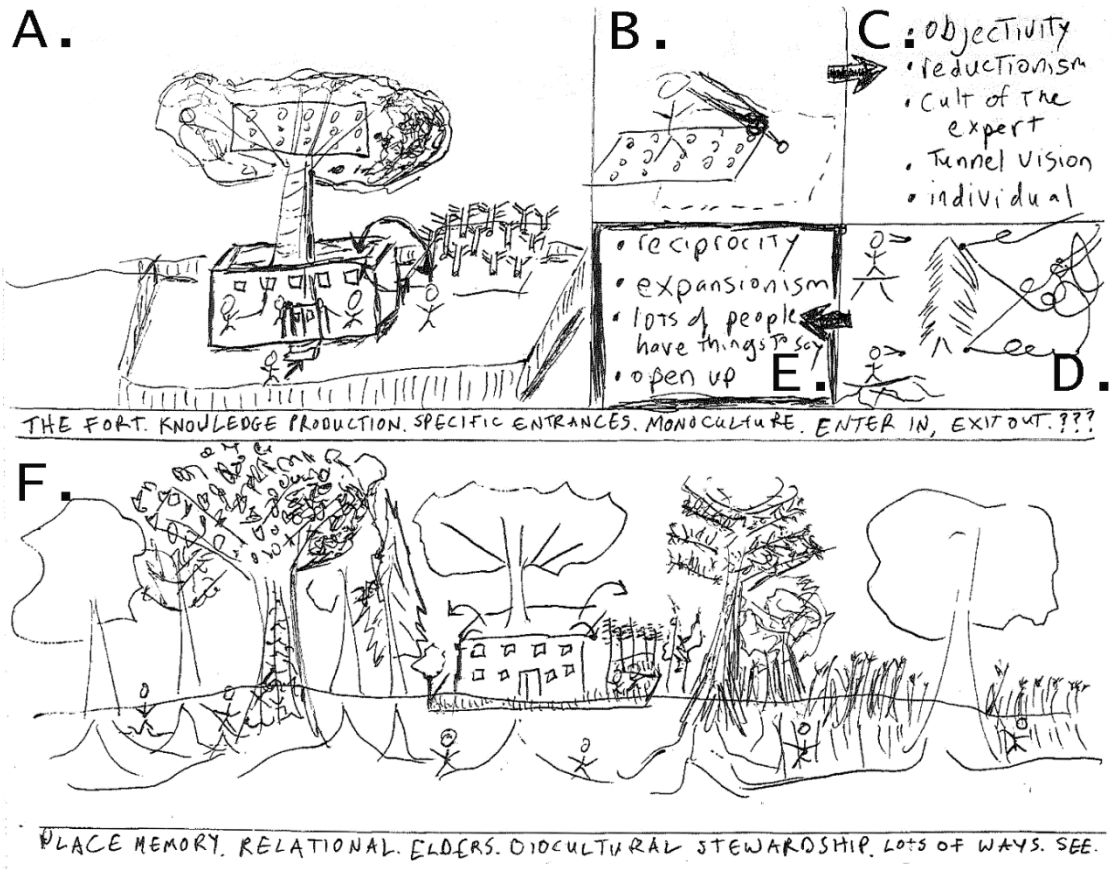

Figure 1 Knowledge Production Differences*: Provides a conceptual sketch of the colonial fort of knowledge production common within western scientific academia in climate change sciences towards a model of biocultural stewardship model "rooted" in community knowledge diversity.*

To understand *Knowledge Production Differences (Figure 1)*, I use a forest landscape as a metaphor for knowledge production—in which the growth of knowledge is similar to the growth of a diverse or non-diverse ecology and is a reflection of the landscape (Figure 1). The first frame (A), shows a walled fortress growing a fairly controlled and standardized monocultural grid of plants and trees (products) in a limited epistemology and ontology. People enter in and exit out through the gate to get into this fortress. The tree grows, as a metaphor for knowledge production, within a relatively monocultural framework. Each branch is a separate discipline and each discipline exists predominantly within its own sphere of leaves, flowers, and fruits (but they would reproduce the same species of tree with some variation in genetic make-up). On a "climate change" tree within this knowledge production landscape, ecological sciences might be the dominant stem, segmented into various "hard-science" disciplines that often use complicated

mathematical formulas and computer models to "know." Social sciences have begun to perhaps be a co-dominant stem. But in both cases, they still grow from and replicate a pretty-guarded and standardized monoculture of knowledge production. The landscape represents a fairly non-diverse sample—tending to ignore the roots (positionality) and ways of knowing (epistemologies and ontologies) within the fortress, compared to the variation that exists in the world.

Frame B then examines methodology in the fortress in which the individual researcher (who is an objective invisible entity that lacks recognition of positionality) narrows in to look at one tiny specific detail and his (his, predominantly, especially if you go back in time) questioning and answering grows from the monocultural grid in the fortress. Frame C uses the written word in some English language to describe the illustrated process of growth and knowledge production. Frame D begins a reversal of the reductionist knowledge production to begin to see the diverse ecocultures with an explicit calling out of difference, position, and perspective. In this knowledge production and growth, the individual can tunnel-in to a viewpoint but the knowledge has become relational in the sense that it originates from diverse knowledge systems, illuminates different aspects of the tree, and grows from and will grow from relationships between different knowledge systems. Frame E articulates in written word some of the methodological differences, including some key principles for how knowledge is produced. Finally, Frame F brings us to a biodiverse landscape, both in terms of knowledge production modes (epistemologies and ontologies) and roots (or positionality). In this broader perspective, we see knowledge production is actually part of a broader, much more diverse landscape. One does not need to go through the entry/exit of the academic fort (and subsequent ways of knowing mandates) to have valid knowledge. It acknowledges many knowledge sources and modes of expression. It grounds in Place memory, relational knowledge, many knowledge holders, and lots of ways to see and make sense of your world. We use a graphic novel-esque form of communication as it includes drawn visual elements to tell a story and doesn't necessarily need to be read left to right, top to bottom.

In the following sections, we experiment with recentering knowledge production and with an attempt to move towards a more biodiverse knowledge landscape. This process includes different knowledge systems meeting each other on two-row footing, grounding biocultural stewardship frameworks, a move to get out the colonial fort and frontier logics, peeling back painted-over layers of knowledge, history, and ontologies, epistemologies, and offering some thoughts and guidelines on this process. Specifically, if climate change requires diverse views of place and change, what does it mean to embrace non-western knowledges in discourse, learning, research, and education on climate change in a way that doesn't necessarily require worldview assimilation of "correctness" to be valid? We implicate and examine framework epistemologies and ontologies to examine how we know within climate change sciences and how we might create space to work between different ways of knowing.

Coming from the "natural resources," I seek to foremost push the western scientific frame in climate change conceptions, particularly those related to ecology or natural resources (while existing within them). I acknowledge it as beneficial, but not an all-encompassing, mode of knowledge production. I seek to appreciate and carve space for other knowledge production "libraries" and traditions from many sources regardless of race, gender, class, training, and other identity principles that have been marginalized from mainstream academia for various reasons (one of which is exclusionary historicity and methodology built over time by dominant cultures).

To extend the metaphor for climate change frameworks, we challenge the dominant prominent in western scientific frameworks and the educational institutions which are now moving to inter/trans-disciplinarity. We say "yes and" and propose strong trans/inter *cultural* work, as most climate change disciplines come from a zero point epistemology (which is one's or more broadly a knowledge production landscape's starting point or beginning ground) limited by western academic constructions of the world. Or we suppose an explicit "calling out" of exclusionary dynamics in an introduction being published in a western scientific journal, while offering space for different cultural epistemologies, ontologies, and methodologies. This introduction serves as a mode to challenge and demonstrate the exclusionary nature embedded in

many histories of western sciences meeting other knowledge forms, especially in relation to climate change.

Biocultural Stewardship and Decolonizing: A Framework Forward (Backward), Nonlinear, Recentering

Concepts of biocultural stewardship can shift frameworks to build tools to listen to, understand, and connect to place, which are highly relevant today within the scope of climate change, resilience, adaptation, and sustainability (McMillen at el. 2020). Biocultural stewardship employs a mix of ecological and cultural principles based in philosophical ethics that focus on surfacing and developing an intimate connection between "nature" and community, ecological and social, human and non-human--or rather, of seeing beyond those binaries of dominant culture, in the taking care of place, or Earth Stewardship (Rozzi et al. 2015). Specifically, in applying "re-centering" biocultural stewardship principles in diverse knowledge system contexts, McMillen et al 2020 emphasize biocultural stewardship as a practice to view cultural resources as equal to natural resources--moving beyond simply taking care of resources—and instead emphasizing the cultural systems of practice and (kinship) relationships within the larger social-ecological system. Centering in an Indigenous Hawaiian roots, they found several common themes among biocultural stewardship approaches for grounding in co-learning that were highly related to personal identity and place: Ki‘i ‘Iaka (personal, reflexive images), Ki‘i Honua (regional, communal images), Ki‘i Ākea (global, unifying images) (McMillen et al. 2020). As a framework, this reorients both the landscape itself and one's relationship to it.

Research and theory grounded in biocultural stewardship include ideas and practices of building healthy and equitable ways of knowing with respect to cultural "laws" to guide knowledge production based on relationships of trust and reciprocity (Kimmerer 2012). In biocultural stewardship, ethical relationships are emphasized versus the assimilationist, extractive, and ownership-based relationships to knowledge common in western scientific paradigms.

Non-assimilationist Practices and Creating Space Between

In one powerful example, Hill and Coleman (2018) speak to the original relationships between western ways of knowing and Haudenosaunee ways in how they were (and continue to be) navigated through the two-row Waupum-Covenant Chain Treaty. They share that the treaty represents one of the original western-based treaties in North America between nations, inscribed in both paper and beads. It speaks to teachings in times of challenge in which a new people suddenly appear (much like our globalization/colonization/climate change processes) to figure out how to exist together when there are dramatic changes on the horizon. This form of treaty also provides an example for how cultural laws in relation to knowledge production can be acknowledged and practiced between academic research-oriented western institutions and other ways of knowing outside western assimilationist paradigms. They ground in Haudenosaunee principles (which, of note, informed democracy as well as feminist suffragist principles originating in what is now New York state). They also recognize that various histories and migrations have brought "newcomers to North America, not just from Europe but also from Africa and Asia, and they too have brought with them a wide range of epistemological and cultural traditions. The ethical space between the two rows differentiates the two from the other, but it does not impose a uniform homogeneity." (Hill and Coleman 2018, p. 15). In a sense, it provides "guidelines" for interaction between different ways of knowing and operating while not imposing assimilation. In doing so, these practices propose a strong foundation in learning from one another and cultural principles. They also emphasize the ethical intermingling of space "between," on spiritual, ontological, and physical levels that acknowledge and respect different ways of approaching life, and in this context, knowledge, learning and research. In other words, by putting knowledge in a relational rooted and felt context, it might be translated kind of like, "*I can be a little bit my way. You can be a little but your way. Where do we come together and apart? What's the space in the middle and on the edges. How do I respect your worldview, root in my worldview, but learn and expand my fundamental ideas and knowledge about the universe? What are legitimate but different protocols for being a knowledge holder*? In a sense, it does not necessitate an assimilation into dominant

culture, but instead focuses on cultural relationships between cultures. Dominant culture from western sciences has historically had trouble doing this kind of reckoning; instead, gunning for a my-way-or-the-highway kind of attitude that may erase and invisibilize other forms of knowing and the knowledge holders within these societal constructs.

Place-Time Reconceptualizations: Seeing the Painted Over

In terms of climate change, place-time also can have other orientations to place and time outside the dominant narrative. The timeline of climate change can be told through non-Western academic timelines and alternative positionalities (roots). This perspective stands in contrast to dominant western scientific, artistic, and societal notions of climate change that focus on the overuse of fossil fuels cerca the Industrial Revolution as the starting point of climate change to create a phenomenon called (liberally) the anthropocene (IPCC 2014, Davis and Turpin 2015)—so embedded is this timeline that in the western climate sciences, we often do not see this implicit bias, let alone reach out beyond it.

However, knowledge production on climate change and sustainability can "start" in an alternative positionality. Many Indigenous (or pre-colonial in Europe) conceptions of time articulate that climate changes actually stem from a greater colonial legacy arc that signals a broader, more integrated social, political, economic, and environmental upheaval stemming from colonial legacies (Todd 2015, Blackie 2016, McMillen et al. 2017, Hatfield et al. 2018). For example, after speaking with five tribal communities about climate change broadly, Hatfield et al. (2018) found phenological changes to be of paramount concern to these communities (enough to shift the focus of the research); but these changes were originating from climate change defined more broadly to Indigenous relationships to place being replaced by colonial relationships to place which compartmentalize climate change into the Anthropocene:

> These [tribal perspectives on climate change and changing biocultural patterns] included changes resulting from a host of factors connected to the cataclysmic replacement of an Indigenous management system of the socio-political and natural environment in North America, with a Western management system. The latter system has brought assimilation pressures, economic upheaval, increases in

> invasive species, ecosystem changes, and climate change together. In other words, [in Indigenous knowledge] by not compartmentalizing climate change from other human-environmental changes, connections among human action and resulting risk to animal and plant species are more visible in a traditional ecological knowledge epistemological construction of climate change. (p. 8)

The recentering in this particular example, as well as all the previous examples, make changes, and the felt experience of them, more visible and interconnected. They center climate change(s) in the context of colonialism/imperialism—which embodies many kinds of extractive injustices—and is a precursor for later fossil fuel problems. Importantly, one critical problematization of western knowledge production within this starting point comes from lack of value and voice for the stewardship properties of feminine knowledge and ways of being and knowing (Watts 2013, Whyte 2016, Blackie 2016, Hall 2017). In summary, climate change(s) in terms of place-time represent a deeper problem in which the Industrial Revolution can be seen as a symptom, not cause of, of these larger colonial issues.

Being Place-Based Justice Work: The Language of Soul Animacy

This broader problematization means nurturing a different starting point, or zero-point epistemology, that focuses on justice towards other knowledge production systems in order to "grow our souls" towards biocultural stewardship (Boggs and Kurashige 2012). *Soul*, let alone growing it, has generally been left out of western scientific frameworks. In my limited language grasp, in many Indigenous languages concepts of life animacy make up a major language construction category on par with or more important than el or la in Spanish, der/die/das in German, abiotic or biotic in science, etc.

Biocultural stewardship, as we are interpreting it, nurtures justice work--connecting people to memories, relationships, and experiences of place (known as phenomenology) through a past, present, and future lens, as told in many languages. It leads towards an ethical and reciprocal relationship, subsequent tending of place and these relationships, and its human and non-human communities, for future continuation (Boggs and Kurashige 2012, Kimmerer 2013, Whyte 2013, Rozzi 2015, Olivera and

Wright 2016, Matteson 2016, Brown 2017, McMillian 2017, Hatfield et al. 2018). It embodies one's own deep, or developing, connections to place and relationships in an ethical way. A re-framing of these epistemological, ontological, and axiological assumptions means a questioning of methods and frameworks that move climate change science outside modernism's colonial assumptions and more towards "felt" and "rooted" relationships to knowledge (Wilson 2008, Smith 1999, Oliveira and Wright 2016, Hatfield et al. 2018, McMillen et. al 2018). Non-colonial positionality sheds light on different narratives and practices, especially in relation to climate change.

Relationality and Colonial Frontier Logics

Work of relationality means stepping outside (and inside) colonial frontier logics. Colonial frontier logics come from the operation of the colonial knowledge production systems in education that divide things according to race and gender, and that paint over many other knowledge sources based on built-in historical assumptions about where knowledge comes from and how it can be produced (Smith 1999, Donald 2012). For us as researchers in climate science, this process of positioning ourselves in an ethical lens means decolonizing work.

> Donald (2012) articulates strategies of Metisaje that are applicable:
>
> This concept of relationality instantiates an ethical imperative to acknowledge and honour the significance of the relationships we have with others, how our histories and experiences position us in relation to each other, and how our futures as people in the world are tied together. It is also an ethical imperative to see that despite our varied place-based cultures and knowledge systems, we live in the world together with others and must constantly think and act with reference to these relationships (p. 536)

Relationality takes center stage within an ethical focus. This relationality grounds in recognizing our own place-based knowledge and difference stemming from our worldview (which come from our culture and place-based knowledge systems) while, importantly, acknowledging the value of other worldviews (which come from different

cultures and place-based knowledge systems). Difference and tension become the pathway forward for growth in a future towards collective continuation and sustainability.

Donald (2012) uses three metaphors and an intermingling of disciplines to practice Métissage and disrupt colonial frontier logics: (1) deconstruction of the colonial fort, (2) *pentimento*, which is a term used in art that means a peeling back of painted over layers, and (3) an alternative braiding together within a researcher's particular context, and ensuing relational tensions, in order to ground in our different histories and develop an alternative historicism, present, and future. The colonial fort is a metaphor of a physical fort that is on the frontier of a landscape in order to command and conquer—to take from or extract. This fort metaphor pertains to our knowledge production system in academia, because in many cases, western knowledges have been and continue to be an extractivist fort from community knowledge. Stepping outside this fort means stepping outside our education system and the knowledge production grid from which it comes. *Pentimento* is peeling back layers of place and history that were painted over by colonial frontier logics as the fort extended. In an education and research context, it requires seeing one's own history and those perspectives that were rendered invisible by dominant knowledge production structures that perpetrated the painting over of rich knowledges (Smith 1999, Wilson 2008). An alternative braiding together weaves a new (or old) story of place and time grounded in recognizing this positionality and tensions that arise as different stories of Place and ways of interpreting them arise.

Main lessons within the space of TEK of academia being integrated into sustainability, natural resources and climate sciences include: (1) there are many forms of deep place-based knowledge that may not necessarily be written down but are deeply empirical and have legitimate knowledge to inform social-ecological interactions; (2) these forms of knowledge can offer insight into what is happening in the world between humans and their world (in terms of relationality), especially as we think towards resilience in both human and nonhuman communities; (3) simple knowledge accumulation may solve some problems, but there is also a moral and spiritual component in TEK that cannot be addressed through deductive scientific reasoning

(Folke 2004, Berkes 1993). As researchers and teachers within sustainability, we have an obligation to contribute to more complex social-ecological understandings of place by including TEK in our scholarly research and education practices (Kimmerer 2002).

However, TEK belongs to Indigenous people and Indigenous people should be cited as the authors who keep these knowledge systems alive. As a non-Indigenous person working in, learning from, and serving Indigenous communities, Wilkinson (2005) provides insight into the long struggle of Indigenous people and gives agency to their efforts to fight against the colonial/settlement system and regain sovereignty. In terms of natural resource management and TEK, he describes a moment when he was working with various tribes to gain flexibility to interpret the Endangered Species Act on their own terms. Tribes make decisions between development and security for their people (e.g. housing projects, casinos in high unemployment areas, etc.). and for their other relatives (e.g. rocks, plants and animals) in relation to their own activities and have been doing so for thousands of years. These decisions sometimes come into conflict with both large development projects that they fight against and environmental groups that fight against them if Indigenous people want to put in something like a housing project. In a long fight for agency for TEK, they wanted more flexibility as they have been managing the land for thousands of years.

Wilkinson (2005) reflects on his own participation in these Indigenous-influenced perspectives in broader legal-regulatory journeys within the United States system:

> I am left with many memories leading up to the joint secretarial order. My strongest impressions involve not the details of the negotiations (in which I participated) but the tribal leaders' informed, heartfelt viewpoints that, once understood by the federal side, made the secretarial order possible. Consider the first organizational meeting for tribal members and invited guests only, held in Seattle in February 1995. The language was notably different from that at Anglo-dominated meetings. Instead of generic allusions to 'forests,' 'rivers,' and 'species,' the discourse rang with specific references to eagles, hawks, ducks, geese, salmon and steelhead, suckers, sea lions, wolves, bison, ferns, wocus,

> berries, meadows, mountains, hillsides, rocks, soil, and other aspects of the natural world. Most of these references were not made with respect to some issue or conflict. Instead, they were made to illustrate how humans are connected to all nature, or were offered in an almost offhanded way, not to make any specific point but simply as an organic part of a statement by a person who knew the natural world and felt a part of it. Ted Strong, a member of Yakama Nation and director of the Columbia River Intertribal Fish Commission, alluded to this mutual gene, saying, 'That is something the elders speak about continuously—the idea of knowing something about where we come from, why we are here, and the appropriate names for species, suggesting a reverence for the reasons these species exist. (p. 325-326)

This quote exemplifies some of the challenges of TEK fitting into academia, natural resources, and sustainability education. These disciplines in academia exist within Anglo-dominant or dominant culture spaces. Something is lost in translation in these spaces as this way of knowing bridges into positionality and non-assimilationist paradigms, different conceptions of place-time and relationships to place-time, a broad sense of relationality (and seeing painted over non-binaries), and at its heart, soul animacy.

I hope to highlight what TEK is from an academic experience and a lived-learning experience. Most of us from dominant culture have little experience with TEK (and often other worldviews), especially in an academic context. Many folks would have had little relationship to non-dominant ways of knowing, especially in the sciences.

TEK struggles to be taken up in climate science because it is a different orientation and methodology to the world. To help understand some of these challenges, we are taking off our academic hat a bit and going to free-style what TEK is from lived experience and time spent working with Indigenous people from an Indigenous-ally perspective and then find citations to justify it (when we can):

- Give thanks and gifts in a reciprocal manner (Kimmerer 2013).

- It requires connection to where you are. We live in a Place. This Place has agency and we are products of her, not she us. It is an idea of Place-Thought (Watts 2013, Hill and Coleman 2018).
- The Indigenous language of the Place speaks to the land of that Place and has been developed over thousands of years of listening. It is more metaphorical between "things" happening in the environment and human experiences than standardized English. It offers insight into the relationships between biotic and abiotic factors (Lantz and Turner 2003).
- Water is life or animacy. For example, in Dakota this concept translates to M'ni with "ni" being the word for life animacy and water just gets a little "mmm" added on and becomes M'ni—not relatively known in M'ni sota, M'ni aepolis, M'ni haha falls. Or in Menominee a spring is Mōhkacīwan, or it flows forth which can be applied to other (human) activities as well that are fresh and like a spring flowing forth.
- We are all related (in a non-nuclear family sense and one that includes plant, animal, and other relatives). We have ethical responsibilities to these relatives for collective continuation (Whyte 2013).
- Ancestry is important in terms of knowledge production. We must consider our positionality, especially in a longer view. Elders should be respected as knowledge holders (Elders are rocks first, then plants, animals, and humans are babies. Human Elders went through extensive pedagogy processes that may not be western science academic. (Olivera and Wright 2016, Kelly 2017)
- Time and progress are not linear (e.g. the story may not necessarily follow a western storyline of beginning, middle, end…but cyclical, or more like a video game with layers of understanding…My friend and mentor Jeff Grignon (Menominee) likened it to a video game. Yes! Got to the next level. There are different epochs or worlds, and knowledge holders would know when you made it to the next level and layer in a same or different story/truth. This sense of time leads to a fundamentally different pedagogy and transmission of knowledge (Nabokov 2002, Kelly 2017).

- TEK is adaptive. There are multiple versions of one story, rather than one empirical fact reality. The world is not static. Institutions embrace this change and tribal institutions are adapted to the environment, not stamped universally on the land (Whyte 2016).
- There are gendered powers and roles but not in a repressive way…just a responsibility way (e.g. not equality but responsibility). Ladies are not seen as less than, but givers of life. Gender is non-binary (Watts 2013, Whyte 2016, Hall 2017).
- Orality can be more powerful, adaptive, and inclusive then written language; but peer-review exists through Elders. Don't forget to tell a joke somewhere in there.
- There is not a human/non-human (social-ecological) divide.
- Ceremony is important when engaging in knowledge production processes and the space "between" different worldviews (Hill and Coleman 2018).

I am learning, and this bullet point list offers a limited snapshot. But many of these TEK concepts do not fit easily into a dominant culture lens and would not be considered or translated through natural resources, sustainability, or climate sciences as it exists in academia.

Another main challenge is that educational institutions were (are) a genocide and assimilation tool (Wilkinson 2005, Kimmerer 2013). Native students struggle in western institutions so that Native voice in them is still limited and often exists in a more welcoming discipline of Indigenous studies rather than something like natural resources or "hard" climate sciences. Many Native students have a desire to study sustainability and natural resources and offer significant insight, but many find the discipline unwelcoming to their worldview. Some of the challenges were recently articulated by a panel of Native students in academia in Gervais et al. 2017. They include:

- A challenged pathway to college without role models, or being non-traditional students (e.g. with a family, older than 18+, serving in the military).
- Personal relationships to land and community as a motivator that goes unacknowledged by academia.

- Lack of faculty mentors who consider tribal lenses.
- White-dominant campus culture.
- Lack of instruction on tribal issues.
- Being asked to always represent tribal perspectives and be the teacher (or token).
- Financial support.
- Lack of social and cultural support (e.g. education making an "other" from community)

These challenges are real. However, without Native voices representing TEK in sustainability, natural resources, and climate sciences, there will continue to be challenges of translation.

Lessons from Working with Tribes in Sustainability in Climate Science Towards Biocultural Stewardship in Academia

Do we think that it's necessary for people working in sustainability and climate science to engage with tribes as important guides? Yes. These collaborative projects and processes do not come easily as it requires meshing very different worldviews, education and community structures. Tension will almost certainly be present (Donald 2012). Again, we draw on experience, but we also draw on Dockry et al. (2017) "Building Bridges: Perspectives on Partnership and Collaboration from the US Forest Service Tribal Relations Program" and Whyte et al. (2018) "Seven Indigenous principles for successful cooperation in Great Lakes Conservation Initiatives." The following is a summary to which it can certainly be added, and to which may apply to other marginalized cultural groups and ways if knowing.

As an individual:

Eat food with tribes. Go to a community event (even if you feel awkward). They'll see that you showed up. Go a second time. Have an event at your house. This process builds both formal and informal relationships that allow trust.

Be open-minded. That means you have to deal with trauma. If you've never done that before we recommend reading *Blood Struggle* by Wilkinson (2005) and *Decolonizing*

Methodologies by Smith (1999). You need to understand both the trauma and survival of tribes.

If you've only worked in dominant society, be ready to have you mind blown. Know you should be taking on a long-term relationship (that should be longer than your grant funding.) Tokenism always hurts. There's a long perspective in Indigenous ways that you can learn from. Everything you thought about the world may prove to be different or changed.

You're going to make mistakes. It's okay. They'll forgive you. It's a different way of being. You have to be open to that process and way.

Be ready to give gifts. If you're asking for something, then give something. Reciprocity.

Be open to different concepts of time in terms of process of the evolution. It's not necessarily linear. And it requires relationship building (These people have been genocided for 500 years…they're going to be skeptical of you).

Know the tribe(s) you're getting into. What is their history and story?

Be open to shared decision-making (e.g. it's not going to be "your" project.)

Knowledge should be mobilized towards what the tribes' want and need. The output should go back to the community, not a journal article (unless that is what the community wants).

As an institution:

- Uphold formal agreements.
- Build trust.
- Have leadership within your institution engage (you are working with sovereign nations).
- Collaborate in resource management.
- Have respect for self-determinism of the tribe.
- Consult tribes in the beginning of the project so they can be at the table to draw up and contribute to the plan.

- Make plans for intergenerational involvement including education to youth.
- Be sensitive to where you are coming from as an institution in relation to the tribe.

And there's always more to learn. There are some different protocols involved, which depends on the tribe, but if you're humble and respectful, you can find your way.

Don't be intimidated. Just do it! It's worth it and needed.

Why Biocultural Stewardship Versus Traditional Ecological Knowledge?

TEK and biocultural stewardship share many commonalities. The broad end goals are the same, it seems, for the most part—adaptive response to Place with a relational and ethical relationship to it. Both come from understanding embodied relationships to Place, especially in terms of climate change. Here is a personal and theoretical discussion on why we—as academics, educators, and learners—move towards biocultural stewardship in addition to TEK as a framework from which we hope to learn and grow, so we welcome adding to the conversation in a critical and different lens.

First, for us, one of the differences may be linguistical. *Bio* means life. *Culture* means the diverse ways of knowing, practicing, and being that have become from relating to the land and the world. *Stewardship* embodies an ethic of relational reciprocity to taking care of a place and people. That seems to be more appropriate for learning about diverse life ways that see humans and non-humans as equal contributors to society. *Traditional* is a word for something in Indigenous contexts which has much more meaning than academia presents or understands. In connotation of dominant society that values progress, "traditional" still gets translated to something antiquated, or often primitive. *Ecological* is a very limited worldview term loaded with academic hierarchy and situation that separates the world into social and ecological and doesn't see them as one and the same. *Knowledge* has also been loaded with people who have it and those who don't, still based on citation and senses of assimilation. If we are trying to think about human-environment concepts relationally and ethically-wise, in an educational context that exists within a dominant framework, we think biocultural stewardship may resonate more than traditional ecological knowledge linguistically to broader society.

Second, TEK does not teach methodology, especially decolonizing methodologies (Smith 1999), to researchers or offer it to students. It gives information acknowledging a different methodology. There are practices involved in TEK methodology that we think get lost to western scientific knowledge when thinking about TEK. There is a spiritual and embodied element, and ownership (non-ownership) of that knowledge, that has been stripped from much of the contributions of TEK to western scientific knowledge so that it has the danger of becoming a sort of tokenism or assimilationist tool. TEK feeds western scientific knowledge but does that western scientific knowledge feed it? This protocol is not implicit in TEK. Sometimes it is. But not always.

Third, we are allies and Indigenous perspectives trained in western science trying to do "research" in many contexts, including urban. We see that the colonial/settler legacy needs to be combatted. There are other groups that are non-Indigenous that also need to be nurtured and acknowledged in stewardship of place and natural resources, especially in urban environments where probably most people don't have access to TEK, or their TEK has been displaced by a new weird world. TEK can be exclusionary. It is an awkward fit to many people, even Indigenous, who live in urban environments and have not experienced TEK. We don't want to move towards a multiculturalism that erases culture, especially Indigenous, but we think biocultural stewardship may serve broader groups who have moved to urban areas and lack "traditional ecological knowledge" or the environment has changed so significantly that practicing a long-term place-based knowledge system is fundamentally challenged. That said, the principles of TEK still apply.

Fourth (in that vein), TEK, in its origin in academia, did not deal with critical race justice theory, ideas of colonialism, or why those voices might have been marginalized through history. It deals with management, resilience, monitoring, and ecology-oriented principles. That doesn't get to real TEK and the struggles it has within dominant culture.

Biocultural stewardship encourages, or at least leaves space for, different methodologies. We would like to reference a powerful book on methodology from the Hawaiian realm by Oliviera and Wright (2016). It speaks to not only including voices

but changing the methodology of research and how those voices are included. It normalizes using Hawaiian language and the concepts implicit within them. They recognize their lineage. They recognize the land. They do this acknowledgement in their research and how they do it: methodology. It has become published so now it can be cited and legitimized by both their voices and those of many others within academia. For example, one of the many contributors (Noelani Goodyear-Ka'opua) uses four dimensions for the "methodological ropes and research process." These include concepts of (and we may not get the translations quite right here, so go to the original text, or ask the authors directly, but that process is valuable in and of itself) *Lahui*, collective identity and self-definition (this is very different from dichotomous western way); *Ea* (sovereignty and leadership, but it also means breath and is a metaphor for volcanoes rising and extends to the birth of land itself, but also human being), *Kuleana* (positionality and obligations); *Pono* (harmonious relationships, justice, and healing). *Ea* in particular is a word that needs to be unpacked. Goodyear-Ka'opua looks to the roots of ancestral knowledge and the collective of knowledge ancestry.

> When I went to graduate school in Santa Cruz, CA, I felt like I was literally the dumbest person in every classroom. And yet the times when I felt certain enough to speak and to write were those when I was not speaking as an individual, but as someone with ancestors and a community who needed to be heard. (p. 4).

It represents a system of reclaiming. It also represents of system of recasting how Indigenous people are seen. They are not students, but teachers; they are scientists, not analysts or informants; they are the authors, not characters.

Chapter 3: The story of climate change from abstract to local: On developing ecological calendars

Research question(s): How do people connect to/notice climate changes in place?

How do you facilitate an ecological calendar of place that helps people in keeping track of climate change in their own place?

Summary: We think of climate change as a story to which we, as human communities, can relate. Ecological calendars are a localized tool to adapt to and anticipate climate change. They have been enacted mostly in specific Indigenous knowledge contexts which use past records and deep intergenerational place-based knowledge banks to unearth ecological calendars with researchers and community experts in a particular place with an existing knowledge production template. We went to 10 community events and analyzed 174 interviews, many with multiple people, in a camper converted to an audio recording studio named the Climate Chaser. We asked local community members about their perceptions of changes in the seasons and cycles and analyzed their responses to understand how interviewees were relating to climate change. Interviewees related to climate change in two broad ways. First, they understood climate change as something more abstract: a distant or ephemeral concept in terms of place. Second, people described it through stories of their own local and personal observations centered around climate change within place-based ways of knowing in their daily lived experiences through (1) seasonal cycles, (2) the activities in which they participate, and (3) plants and animals to which they observe and connect. We analyzed these localized observations and outlined patterns in the data to develop a template for building ecological calendars in urban environments to localize climate change.

Introduction: Ecological Calendars

Climate change is a societal grand challenge that requires many tools to understand, anticipate, and adapt—particularly locally-driven, place-based community tools and adaptation strategies (Folke et al. 2003, IPCC 2014, Aguilar et al. 2018, Thornton et al. 2019, Piggott-McKellar et al. 2019). Ecocultural calendars have been proposed and implemented as one such tool (Green et al. 2010, Prober et al. 2011, Ryan 2013, Ka‘ūpūlehu community et al. 2014, Cochran et al. 2016, Armatas et al. 2016, Kassam et al. 2018, McKemey et al. 2020). While versions of ecological calendars have been used throughout time by many cultures, they have more recently been codified and understood by research-community partnerships (1) to encompass localized knowledge systems, particularly the ecological and cultural happenings of those communities, and critical spaces, things, and events within those knowledge systems and (2) to serve as a participatory method, analysis, and product to engage in research and education grounded in diverse community perspective and knowledge production, particularly in relation to climate change and incorporation of traditional ecological knowledge into natural resource management (Ahas, Clarke 2009, Prober et al. 2011, Kassam et al. 2011, Ryan 2013, Ali 2014, Ka‘ūpūlehu community et al. 2014, Kassam et al. 2018, McMillen 2018, McKemey et al. 2020).

Ecological calendars are place-based calendars that shed light on important ecological and cultural relationships in peoples’ activities. They highlight connections to plants, animals, and their phenology as well as seasonal biotic and abiotic happenings through the organization of time. They organize time into place-specific “timetables” based on seasonality and celestial processes; but in a larger sense, they also encompass entire ontologies, knowledge production, and cultural practices based on careful observation of a particular place, often built over many generations (Clarke 2009, Prober 2011, Kassam et al. 2018). For example, Kassam et al. (2018) define ecological calendars as:

> Knowledge systems to measure and give meaning to time based on close observation of one’s habitat. They are comprised of seasonal indicators that

> include abiotic phenomena, such as the first snowfall or last frost, as well as biotic events such as the flowering of a certain tree or the arrival of a migratory bird species. These calendars differ from celestial calendars, such as the familiar Gregorian calendar, in that they do not rely solely on fixed cycles of the sun, moon, or stars. Unlike those cycles, the indicators within an ecological calendar respond to climate and other seasonal processes that directly impact livelihood activities. By referring to seasonal cues, the measurement of time becomes flexible with respect to celestial cycles, and communities can identify the optimal timing for their activities. Therefore, ecological calendars may enhance anticipatory capacity for climate change by enabling communities to synchronize their activities with their ecosystem to accommodate climate trends and increasing variability (p. 250).

In this sense, ecological calendars are a tool connected to communities' local and ecological senses of time grounded in place-based observation and *embodied* experience of cultural and ecological phenomena, which include a combination of experiential and sensory knowledge with cognitive and visual approaches, or phenomonology (Ryan 2013). In this article, we call this phenomenology daily, lived experiences. When practiced as a climate change adaptation tool, ecological calendars provide a way for communities to track how things might be changing as tied to ecological and cultural happenings in place—providing a framework for anticipatory adaptation in daily lived experiences (Ahas 2000, Prober et al. 2011, Ryan 2013, McMillen et al. 2015, Hummel and Smith 2016, Cochran et al. 2016, Fitchett and Ebouma 2018, Kassam et al 2018).

These ecological calendars can take on many forms and shapes and provide a sense of time and change based on cultural and ecological happenings synchronized to place-specific contexts. For example, in efforts to highlight or revitalize ecological calendars, one Australian Indigenous sense of time/place of the Nyoongar recognizes six, not four, seasons with important phenological markers tied to human activities and seasonal events following a circular organization (Prober 2011, Ryan 2013). In the mountainous region of Tajikstan, calendars show patterns but are regionally diverse, related to different phenological cues, and follow an orientation to the human body

tracking and relating to the timing of different events in particular microclimates (Kassam et al. 2011, Kassam et al. 2018). In three communities in the Delta region of Nigeria, timing of early spring phenological cues of important plants (such as cassava and rubber) and animals (frogs and insects) are used to predict rainfall in the following seasons (Fitchett and Ebouma 2016). In Northern Australia in south-eastern Arnhem Land in the Northern Territory, The Yuygul Mangi Fire and Season Calendar divides seasonality into cyclical senses of time related to fire management, with Dry Season--Time to Burn, Build Up and Wildfires, and Wet Season--Too Wet to Burn, with each having corresponding weather and biocultural relational indicators to denote this timing (McKemey et al. 2020). The Tukano ecological calendar in Amazonian Brazil works with Indigenous Agents of Environmental Management to correlate important phenological cycles of plants and animals with important cultural activities that follow a baseline in changing river levels, precipitation and constellations (Cochran et al. 2016). In Estonia, Ahas et al. (2000) calibrated a 24-phase phenological calendar of important plants and their phases (such as pollination, foliation, ripeness, and harvest) to changes in air temperature. In Indigenous cultures in the Pacific Northwest, human activities (bartering, ceremony, cooking, fiber-uses, etc.) relate to cultural keystone species to enhance the relational aspect of tending plants with the passing of time (Hummel and Smith 2016). In each case, each calendar looks different, serves different purposes, and emphasizes different biotic and abiotic relational happenings.

Ecological calendars represent various senses of place-time and locally specific ecological cues. They have several main characteristics in that they (1) define a place-specific seasonal round, (2) highlight important relationships to place-based abiotic and abiotic phenomenon and associated human activities, (3) remain adaptive annually to varying conditions and climates, and (4) are often non-linear. As Hatfield et al. (2018) articulate,

> Seasonality does not refer to the commonly accepted four seasons, but rather how annual environmental changes affect harvesting, monitoring, storing, and consuming of sometimes hundreds of plants, animals, and insects. Seasonal

> perceptions of climate change may be tied to detailed accounts of movements of plant, animal, and insect populations and conditions such as ice cover or water levels that differ from perceptions of climate change rooted only in changes of precipitation or temperature on a four seasons model of annual change…As such, time is then relied on, operated in, and based on a 3D construction rather than the westernized linear time system. (p. 3, 5).

In this sense of time, Place itself is embedded with agency and becomes the grounding organizational element in relation to various ecological and cultural happenings and changes in something akin to what Watts (2014) calls Place-Thought. Place-thought is "based upon the premise that land is alive and thinking and that humans and non-humans derive agency through the extensions of these thoughts." (p. 21). Agency (and change) is an expression of place. Time, as an important cultural construction for organizing human relationships to the world and deriving agency in place, could represent a powerful way to nurture ideas of Place-Thought and local adaptation strategies. Ecological calendars represent a relationality with place and time that is grown from the place itself and a community's relationship to it that can tune in to climate changes for the community as well as a tool to understand localized impacts of climate change more broadly. They can give agency to both the land and human communities to understand, anticipate, and adapt (Ka'ūpūlehu community et al. 2014, McMillen et al. 2018).

This concept of time differs substantially in its construction, seasonality, personalized relationship to a community, and place-specific relational variability to climate than Gregorian Western calendars. Specifically, this ecological time based on natural cycles differs from structural time common in more universal calendars (such as the common Gregorian Western calendar) that often reference a set of standardized dates in relation to societal regulation (Aveni 1995, Prober 2011, Ryan 2013, Kassam et al. 2018).

While structural time has taken many colonial forms throughout time, the presently common Gregorian Western calendar was standardized based on the solar year as well as political needs [like when taxes were due or when to the celebrate the birth of a

social figure that might be supplanting other local deity-like figures or traditions] by Pope Gregory in the late 1500s (Richard 2000). In many contexts, ecological calendars that were Indigenous to the Place were minimized, abandoned or forgotten--often through colonial practices--and replaced with a more place-less and universalized Gregorian Western calendar (Aveni 1990, Richard 2000, Kassam et al. 2011, McKemey et al. 2020). This [colonial] organization represents a fixed set of structural time that focuses primarily on universalized number dates, weeks, and months as well as specific universal holidays and events, which can be transferred to other landscapes regardless of place, seasonality, ecological variability, and diverse human activity. The universalized Gregorian Western calendar offers important contributions to peoples' sense of time, but not necessarily to their sense of place. For example, even when considering seasonality, the Gregorian western calendar typically divides the entire world into four main seasons based on solar relationships to solstices and equinoxes (translated as fall, winter, spring, and summer), which may not fit the actual seasonality of the place (Aveni 1990, Prober 2011, Ryan 2013, McKemey et al. 2020). This organization of time can serve to discount local knowledge and disconnect communities from their own localized sense of seasonality and ecological and cultural relationships and associated knowledge production structures.

(Excerpt: Sneak Peak to Practice-Based Component) Study Focus Inquiry and Methods

In this study, we wonder if ecological calendars could be adopted more widely by various communities to serve as a community-based and community-designed tool to observe and anticipate climate change locally, pass on intergenerational knowledge, and build social-ecological memory and resilience—particularly in highly colonial-dominant environments. While the Gregorian calendar has been adopted widely, by understanding the roles ecological calendars have played in the past and present, we can see how a more widely spread mobilization and adoption of ecological calendars by various communities could be an empowering knowledge production and transfer tool.

Our research is novel in that we focus explicitly on the potential of building ecological calendars in "new and old" contexts and diverse combinations of knowledge production systems to serve as an emerging local adaptation strategy that strengthens non-academic expert relationships to and stories of climate change. The product differs in that we seek to create a how-to-experiment for building an ecological calendar as a community tool in emergent community settings rather than researching a particular ecological calendar for a place that has an already established (if sometimes nascent) calendar and epistemology/ontology.

In the following, we categorize and summarize people's observations of change in the Upper Midwest, USA (with an epicenter but non-distinct border in the Twin Cities, MN) and experiment with applying this knowledge towards developing ecological calendars in a broader array of landscapes.

Methods:

The Backyard Phenology Project mobilized a converted camper called the *Climate Chaser* to serve as an audio recording studio at various events throughout the Twin Cities to create both scientific research and art products (and in and of itself was a socially-engaged art project). This analysis focuses on interviews of events occurring in the area in, near, and surrounding the Twin Cities, MN and includes archives of 174 interviews, often with multiple people, at 10 events. One recording session of MN State Fair included multiple days with replicating patterns so we reduced the analysis to include approximately one day of interviews. We used grounded theory (Charmaz 2014) to create a framework to explain the themes that emerged from peoples' narratives as a way to explore the potential need and ability to create ecological calendars as a local adaptation strategy and anticipatory adaptation tool in diverse community environments.

In interviewing, we used a semi open-ended format and framed the set of questions slightly differently pending the interviewer and the interviewee. Interview protocol was meant to facilitate a conversational environment in which people framed their own conceptions of how they perceived change. This protocol included adaptive questioning to meet the broad audience swath within their own framing of change. We

also asked interviewers to not use the explicit word “climate change” in framing the questions but instead to focus on peoples’ own observation of change in the seasons and cycles in their own place as they interpreted it through their own context. We first had people introduce themselves in relation to where they were from. “Where they were from” was not defined specifically and left to be interpreted by the interviewee. It could mean birthplace, current residence, multiple locations, or some sort of combination. We did not exclude anyone based on their defined place of origin or length of residence time. This could include knowledge about a place garnered from intergenerational relationships within a place, as well as a more transitory relationships of a few years or even months. We then asked interviewees to tell us about things they've noticed in their place or community that have been changing with the seasons and the cycles. Often times, there would be adaptive or clarifying questions to understand interviewees’ relationships to place and change.

Interviewers included project team members as well as a variety of volunteers. Interviewees represented a broad range of people attending the 10 public events. Specific demographic information was not collected but everyone was welcome to interview from children to Elders. There was no standardized “baseline” as all observations were considered relevant and valuable. We included recording at an array of public events to get a broad sampling of perspective regardless of age, gender, class, race, place-connection, etc. (see Figures 2: Table of BYP Interview Events). Events ranged from all-night art festivals, state-wide fairs, and community-specific celebrations. They include varied themes for the events from eco-spaces, climate change festivals, specific species celebrations, gardens and harvest festivals, and critical historical celebrations. Most events celebrated a seasonal occurrence or had a sustainability-theme and were free and geared to community members of all ages. The interviews range from two minutes to fifteen minutes with an average of about 5-10 minutes. You hear an edited sample audio clip of what it sounded like inside the Climate Chaser here.

Events:

Event	**Stories/**	**Approximate**	**Event focus**

	Interviews analyzed	**total people at event**	
MN State Fair – 12 Day EcoExhibit (2017)	20	10,000/day	Building at the State Fair dedicated to inspiring people to lead a more sustainable life with easy, everyday reduce-reuse-recycle how-tos and engaging, interactive exhibits on renewable energy, green technology, organic agriculture, transportation alternatives, healthy cooking, and clean air and water.
MN State Fair -- One Day Recording Session (2018)	19	~150,000	Dubbed the Great MN Get Together, the multi-day general state fair includes a broad swatch of visitors throughout the state of MN and beyond. We recorded interviews during one day.
Northern Spark Climate Chaos (2017)	46	20,000	Northern Spark, the nation's premier all-night, dusk-to-dawn experimental art festival. Themed Climate Chaos/Climate Rising, 2016 year's edition asks big questions about the human effects upon nature's systems by hosting artist projects that process complex climate data concepts and push participants toward action.
Fort Snelling (2017)	17	250	A city event at a National Park near the Mississippi River located by the historic fort associated with largest mass hanging of Indigenous people in the country and other forms of Dakota colonization and removal.
Macalester Campus EcoFair	10	200	This campus sustainability event included students and community in engaging in various sustainability issues at various global and local scales from energy, gardening projects, cultural shifts, etc.
St. Anthony Park Garden Tour	14	200	Walking the streets and alleys, we admire the front gardens, peek over the back fences and wonder what surprises are in between. But every two years, the St. Anthony Park Garden Club sponsors a garden tour in the neighborhood, and we have permission to enter the gate

			and enjoy the planning, hard work and happenstance that make up a beautiful garden (from Gregorie 5/22/17 Park Bugle: https://www.parkbugle.org/st-anthony-park-garden-club-will-host-biennial-garden-tour-june-3/)
Bruce Vento Pollinator Fest	9	75	The festival seeks to educate, inspire, and engage the community about pollinators, the importance of protecting them, and how they can help pollinators in their everyday lives and features music, ice cream, activities, and more.
Monarch Festival	28	350	The family-friendly Festival celebrates the monarch butterfly amazing 2,300 mile migration from Minnesota to Mexico with music, food, dance, hands-on art, native plant sales and plenty of opportunities to get up close with monarch butterflies, learn about their habitats, and what you can do to make a difference.
Silverwood Community Art-Nature Gathering	8	200	Nestled along the shores of Silver Lake, Silverwood Park is a unique natural destination devoted to supporting the practice, appreciation and awareness of creative interactions between people and the natural environment with the work of regional artists and poets along park trails and indoor gallery spaces. This event featured various art and community input mechanisms on art-nature intersections.
Frogtown Harvest Festival	4	75	Frogtown a community event featuring food, music, educational booths, and activities for all ages to celebrate the harvest season of a community-planned and operated urban garden site.
Total	174		

Figures 2: Table of BYP Interview Events

Results and Discussion -- Climate Change Observations:

People discussed climate change in two broad categories. In one major category, people described and related to climate change as abstract: a distant or ephemeral concept in terms of place. In another major category, people described climate change through

stories of their own daily lived experience to center local and personal observations around climate change within place-based ways of knowing. As we wanted to focus on localized experiences tied to daily lived phenomenon (and phenomenology) in efforts to experiment with developing an ecological calendar, we further found subthemes which included (a) seasonal cycles, (b) the activities in which they participate (divided seasonally) and (c) plants and animals to which they observe and connect in terms of (i) species composition and (ii) species timing. A roadmap of our results and analysis follows:

1. Abstract noticing: Distant from place, or ephemeral
    a. Information from others
    b. Ephemeral experiences in a highly impacted or vulnerable climate environments
2. Localized experiential climate change observations
    a. Seasonal round changes
    b. Changes in activities done regularly outside
    c. Changes in important plants and animals
        i. Species composition (who is present)
        ii. Phenological timing (when are things present)

Abstract noticing: Distant from place, or ephemeral

Interview participants often discussed climate change as something that happened in distant places not connected with their local environments or homes. The ideas and quotes in this theme showed that people talk about climate change as something disconnected from their daily, lived experience or place. Climate change in this theme remained distant from place, or was part of an ephemeral experience also located in a distant place. Interview participants indicated a general knowledge about climate change, but they saw it as something lived distantly. Climate change, according to interview participants, often remained a phenomenon associated with other places or something that was happening to other beings, not to oneself, and one's own relationships, in their own place.

In this theme, climate change is known through third party sources of information and often manifests as a distant charismatic Other, focusing on victims such as polar bears, coral reefs, glaciers, and island nations experiencing sea level rise. Even localized examples were often still mediated through science or news versus personal observation. They manifested in a charismatic Other. For example, in Minnesota, the conceptually abstracted observation has made importance of the moose:

> Now, I haven't noticed this, but I read about it, how the warmer seasons – the moose are going, they're leaving Minnesota. So, it just seems sad that something that's such a symbol of our state and of our history could be gone. And there had been a lot of trouble. They're getting all those fleas or some horrible bug that – I mean ticks that just swarm, thousands, and thousands, on one moose. There's kind of a sadness, mourning for what's changing. What we're losing.

The moose represents a charismatic Other suffering from a climate change narrative. The localized example does question a sense of Place and one's sense of being from a Place so we can see the implicit power of a localized connection. For example, climate change starts to become a "we" narrative rather than a "they" narrative. This interviewee became nostalgic for a symbol that was connected to their place-based identity, experiencing a sense of loss and strengthening the personal connection to climate change. In this case, the loss of the iconic megafauna, the moose, in Minnesota created feelings on Place. However, these observations are "read about," still lacking a grounding in one's daily lived experience. In this sense, the challenge of climate change and how people experience it, is known through science and reports, but this relationship manifests as an abstract problem that lacks daily lived contexts of experience.

An abstraction is the quality of dealing with ideas rather than personal events. As one interviewee noted:

> When you hear things like, 'Oh, I heard about the other day about the number of glaciers that have disappeared –' In Glacier National Park they used to have 120 or [1]30, I forget the number, and they're down to like 25 now. I mean the impacts of the climate change are very apparent.

On the one hand, climate change as an idea is very apparent to this person. They describe glaciers melting in a quantifiable manner, which is a very concrete example. However, the example is far away and outside one's lived experience so that climate change becomes a conceptual abstraction where interviewees filter information about a concept or observable phenomenon [symbolized Other] and select aspects which are relevant for an idea [climate change] with a subjective purpose. The implicit subjective purpose here is that climate change can be apparent; but its apparentness remains distant in time and space in relation to one's own lived reality. Climate change is Othered from one's own reality.

Part of this conceptual abstraction is a challenge in knowledge production in which one has trouble pointing to their own observations of climate change and instead relies on information produced by others and presented through third party sources. One interviewee questioned:

> Am I observing it? I don't know if I'm observing it. I see it on the media again. I see it on TV. They show different things that are occurring out there now, and I'm concerned about it; for instance, icebergs, the glaciers melting and all that kind of stuff. That's something that you have to really be concerned about. So, I know that the earth, it's gaining temperatures, it's going up, and then that's a cause for concern.

In this form of knowing, climate change is a reality known through other sources of information rather than one's lived experience. Many interviewees expressed concern for climate change happening and belief in the science but applying these concepts to *knowing* changes in one's own daily experience often remained harder to pinpoint and apply.

To move beyond an abstracted and distant knowing of climate change within this theme, we found some people connected to climate change through ephemeral moments but ephemeral moments that were again distant from ones' own daily lived reality. These short-term experiential learning moments included travel to charismatic Others or post-devastation climate change related events such as hurricanes or flooding. In contrast to

relying on third party sources of information, these moments built a lived-noticing. However, they still remained short-term and distant to one's own home or environment to limit localized adaptive capacity and agency.

> I was lucky enough to take a trip to Antarctica. And one of the discussions was to the western shelf and how it's disappearing. When we photographed penguins, one of the only penguins I really didn't get a good photograph of was the Adélie. And I was told that the Adélie is not adapting well to climate change. …Then about two months ago in the newspaper, I cut out an article and it said approximately 120,000 Adélie penguins had perished because sea ice had melted and blocked their way to their feeding grounds. So, when you travel and then you're a firsthand witness to what's going on, I feel it really impacts you.

This interview participant describes their experience with penguins on a trip to Antarctica and how the penguins are not adapting and suffering because of climate change. This interviewee had a short-term experience based on travel to climate change areas being impacted severely already. This person knew about climate change as a lived experience, even if only temporarily and the experience served to ground climate change impacts through a powerful experiential way of knowing through phenomenology. However, that fact that this knowing was felt in a distant place on a short-term time-scale implies that resilience and adaptive capacity to climate change in one's own place still remain fairly elusive and distant.

In summary in this theme of distant noticing, climate change for the interview participants was described as a distant phenomenon and can be understood in two ways: (1) as a conceptual abstraction (often manifesting in a charismatic Other) or (2) as a short-term experiential moment in which people travel and see climate change happening to Others. The conceptual abstraction forms of knowing are mediated predominantly by third party sources of information rather than one's own daily lived observation in place. Short-term experiential moments are powerful connectors to climate change but also serve to maintain a distance to the impacts of climate change away from one's own localized place and reality. This understanding of climate change as an abstraction that is distant or short-term is important for people's connection to climate change because in

both cases climate change remains something distant from knowing climate change as a daily lived experience that is localized. This way of knowing can limit forms of adaptation and resilience in one's own place.

Localized Experiential Climate Change Observations in Place

Interview participants also located their observations of climate change within daily lived experiences in their place (and could in fact have distant observations as well as localized observations). Several grounded theory themes emerged as people described (A) seasonal rounds related to place (divided seasonally in the results), (B) important ecological activities practiced in place related to those seasonal rounds (divided seasonally in the results), and (C) important plant and animal indicators for place-based observations of climate change. I further subdivided observations on important plant and animal indicators into (i) changes in species composition and (ii) changes in phenology (timing).

2a. Seasonal Rounds with Changing Weather: Entering the unknown.

One theme to emerge from the interviews related to observations of *weather and seasons in place changing*. In this theme, interviewees discussed weather or seasons changing from what they had known in the past. They referred to the character of the season (i.e. it's length, associated events, and patterns) and how seasonal characters might be changing broadly. Generally, interview participants most abundantly connected to seasonal rounds that are changing as an entry point into experiencing and knowing about climate change on a daily lived experience in their place. These observations encompassed rather general observations on what happens seasonally and changes in this norm of seasonal rounds.

Interview participants in our context typically identify four main seasons: winter, spring, summer, and fall. However, they recognized the character of these seasons changing, as well as associated big weather events, especially in relation to what was remembered from before (such as childhood or from first moving to the area) to a time of now. Broadly, these observational changes in seasonal character were accompanied by changing timings of start and end times of each season, changing temperature patterns, changing precipitation patterns, more unpredictability in timing and temperature,

erraticness, and more volatile weather systems. Figure 3 Table of Seasonal Round Change provides a snapshot of major observations in how the character of each season is changing and an example quote.

Season	Important Changes	Example Quote(s)
Winter	● Used to be cold, snow-covered, and long ● Shorter in length ● Milder temperatures generally, more erratic shifts and extreme swings ● Little to no snow cover ● Less blizzards ● More freezing rain	"Well, I grew up in the Twin Cities. And it definitely seems like the winters aren't as harsh as they used to be. I remember when I was real little just being outside pretty much all the time. And in the winter time, there was snow the whole winter. Started early and ended late in the season. And the ground was covered with snow pretty much through the whole winter season. And more recently, it seems like that's not the case anymore. We'll get years where the snow starts really late or it melts really early. And we just don't have the snow cover that I seem to remember. It still gets really cold, but it's not as consistent through the whole."
Summer	● Earlier arrival (especially of hot summer weather) ● Hotter in general with more hot degree days ● Greater humidity ● More "monsoon" rains	"I used to sort of brag to my family in Cincinnati that every day up here was no humidity, clear, blue skies, a comfortable 80 degrees in the summer, and I can't brag about that stuff so much anymore."
Fall/ Spring	● Fall lasts longer ● Spring comes a littler earlier ● Not the "nice" in-between seasons ● More flooding	"I do know that, yes, it's definitely getting warmer, much warmer than it used to be, and it seems like the springs and the falls aren't the nice, in between weather before it like – it goes from cold to hot and back to cold."

Figure 3 Table of Seasonal Round Changes*: Provides a snapshot of major observations in how the character of each season is changing and an example quote from BYP interviews.*

Winter in particular is an important season in the Twin Cities area and interviewees observed the most seasonal character shifts in winter in that it was milder and there was a lack of snow cover. Summer also played an important role in people's seasonal round observation in that it had distinct and identifiable changes towards hotter, more humid, and slightly less pleasant conditions. Observations on fall and spring served more as

book end seasons to the dominant winter and summer seasons in terms of seasonality. Importantly, in fall and spring observations, interviewees noted more erraticness and variability in fall's and spring's character and timing, which marked the passing to and from the more dominant seasonal characters.

As interviewees etched out changes locally through the seasonal round, they often began to develop a sense of nostalgia, tied to a place-based identity and experiential knowledge of climate changes.

> So, I think the big thing for me that I've noticed is that since my childhood – so, when I was younger we would have these really big snowstorms and I remember having snow days and having this snow that stuck around all winter and that's not something we see anymore here in Minnesota. We see some snow every once in a while, maybe some ice that sticks around for awhile, but we no longer get these big fluffy snows that stay for weeks and weeks and I miss that.

This nostalgia was intertwined with a remembrance of a past that was no longer reflective of seasonality experienced now. Interviewees saw patterns reflective of climates associated with places further south, not of their "past-known," more northern identity.

As predominantly good Midwesterners interviewees also loved talking about the weather. With talking about the weather, a good yarn was an essential component of story-telling in place. People loved telling stories related to extreme weather events. Of note, the stories seemed to be switching from blizzard stories of older generations to flooding stories of younger generations. One of the last winter storm stories that multiple people mentioned was a Halloween blizzard in 1991, whereas people mentioning flood stories become more and more regular in present times. For example, one interviewee described the switch to flood events.

> We may have had – since I was a kid we had probably three good snow storms. Now in Duluth just the weather alone, in the last three years they've had three – in the last 10, 15 years they've had three major floods that have almost wiped the

> city out on the lower half of the city. It killed a lot of the animals in the zoo up there. I don't know if anybody remembers, but it did.

The stories of big weather events more currently were leaning towards flood events rather than large snowstorms and pointed to significant changes in precipitation regimes. With these changes in climate events, interviewees also noticed more volatile storm systems, particularly related to how it impacts flooding. Rainstorms appear to be more intense and come all at once. Consistent, gradual, light rains were less present. These large storm events are notably different than the weather of past seasons. It is not only that storms are changing, but when they occur is also changing throughout all the seasons.

> Yeah. Well, one thing, I work on the Mississippi River. And every single year since I've started working there, the people who have been working there for a long time tell me, 'Oh. What an unusual year this year is.' And there's flooding every year that is at strange times, not in the spring. Or in the fall. Which historically is totally unusual.

Precipitation patterns are changing and people notice this phenomenon. Interviewees noted not just an increase in flooding, but that it could happen at any time and the flood cycles themselves were changing. They noticed that floods were more frequently on the scale of 1,000-year flood levels from geologic norms and that these large-scale 1,000 year floods were happen much more regularly. This changing narrative harkens to a different mode of relating to extreme weather and what extreme weather is in place. It signals a fabric shift in the weather that occurs within each season.

2b. Outside Activities Done Regularly with Seasonal Layers

Outside activities done regularly is another major theme that emerged from our interviews. This theme also represented a localized place-based connection to climate change from a daily lived way of experiencing climate change. It means that interviewees discuss *activities they do outside that have changed in their lifetime such as cross-country skiing, skating, or gardening*. These observations point to how people experience changes in the things that they do because of changes in the seasons and cycles.

In the analysis, every season includes some observed changes in which interviewees connected broad changes in climate patterns to changes in activities they actively do outside. In contrast to other ecological calendars that have been codified, many of the observations were recreational versus livelihood or ceremonial dependent, but in our framing we continue to follow the seasonal rounds. Winter again marked the largest category of daily, lived change observations; but in all cases, this theme points to a more nuanced and personalized understanding of broad patterns of climate change and started moving from very general to more concrete examples that could be observed in greater detail localized to one's own experience in place. In Figure 4: Table of Example Observations in Outside Activities from **BYP Interviews**, we provide the season (or seasons), noted activity, and an example quote for some of the major activities people notice changing and how they notice these activities changing.

Season	**Activity**	**Example Quote**
Winter	Ice-skating	So, the biggest thing I notice for myself is I look at – now, I have two children. My daughter's 13. My son is nine. And I look at what they have available to them compared to what I had available to myself at the same age. And I remember that we would have ice skating from basically Thanksgiving through February because the ice rinks would get cold. It would freeze. You'd go up there after school or after dinner. And you would skate until they kicked you out. And then you'd go home. And both of my children don't really have that function. Even though we have a park with a ice rink literally two blocks from our house. It's maybe open for true skating for about four weeks. And those aren't even good skating times. It's the ice is not good. It's not solid.
	Hockey	We used to play hockey outside. Course everybody plays indoors now, but back in the day we played outside and we would flood the rinks and maintain them. And you could play into March. I remember we would almost like trying to beat the sun. Some areas of the hockey rink would be wet, but some would be dry and we'd play on that area. But that was into March, and now there are a few outdoor rinks. There's one near our home. And boy, nobody skates on there in February. And it's the winter seems shorter to me. Now perhaps that more age than it is reality, but it seems to me that you couldn't have a hockey season anymore outside because you don't get ice long enough.

	Ice-fishing	You can't go ice fishing. Many people went through last year. And if you look, in the last five years on ice fishing, it's been so warm that they've changed the dates on when you pull your house off the ice. Way earlier…Last year was very dangerous. Many people went through last year. And if you look, in the last five years on ice fishing, it's been so warm that they've changed the dates on when you pull your house off the ice…Way earlier.
	Down-hill skiing	And the other big change I notice is downhill skiing in the winter and winter activities. The quality of the snow, the lack of snow, the warmth in the winter; I mean, that's a direct – I mean, skiing is a challenge because the snow quality is so poor.
	Cross-county skiing	I'm a ski coach. And so, I'm very sensitive to winter and snow and lack of snow. And more and more often, it seems we have winters where we have to rely on man-made snow to be able to ski. And at least based on my memory of – I've been here for 56 years and winters have just gotten milder and milder in the last 10 years really. 10, 15 years.
	General winter activities	Winter, I'm always out snow-shoeing, cross-country skiing, hiking, backpacking, camping, and all that. So, I notice it a lot more. I remember it was the – oh yeah, yeah, yeah. The winter of '11 and '12 when there was no snow at all. That was the craziest thing I've ever seen. Just walking just across campus and there'd just be a bunch of dead, brown grass, bare trees, and then a gray sky above it. It was the most depressing thing I've ever seen. Ever. So, I'd say that.
Winter/ spring	Gardening—Growing zones and plant selections	Well, I've grown a lot of native plants, because I learned to love them young. And at first, when I paid attention to zones – When I learned about growing zones, most of the Twin Cities was called a 3B. And if you wanted to spend the money, and be adventurous, you could buy a zone 4 plant and hope it made it. Or hope it made it a year or two, and then you'd have to replace it. And the change for me now is, I can be adventurous and buy some zone 5 plants and hope they make it. Or mulch them – winter mulch them carefully. And zone 4 is no problem. Or hasn't been. Now, if we get hit with a really nasty, cold winter, the back to the -20°s, like the winter of 1976/77, when it didn't get above 0° for like twelve days in a row in St. Paul. We hit one of those and we'll lose all those things that we've merrily planted.
	Gardening -- Seed starting	It's very frustrating because I have given up on trying to grow a lot of seedlings because you get them in the ground and then they die either because the ground's not moist enough, or it doesn't rain, or it rains too much and there's

Spring		flooding – so that's been really frustrating…And I've put tons of seeds in the ground but the ground was too cold and spring starts later or it starts earlier. It's just really unpredictable…It was more predictable when I first moved in, definitely.
	Finding spring ephemerals	Sure. Well, yeah. We go – every spring – we've done this for how many years? Oh, at least probably 20 some years…Yeah. Ever since we met, probably, we go looking for wildflowers…In the spring…When they all bloom. We noticed this year that they became early, they came early, and then afterwards, we saw – which we've never seen – I think there were about four or five different types all blooming at the same time, and usually you have them in succession, one after – you know, sometimes there's two of them blooming at the same time and then another one, and all of a sudden it was like way early, and we had ones that were blooming that normally wouldn't bloom until the other ones were already gone and faded away.
Fall	Hiking-- fall colors	One thing that I've noticed is I travel up north a lot to hike on the Superior Hiking Trail, and they always have peak fall times where the colors of the leaves are changing and it's really beautiful, and that's been happening earlier and earlier now. I notice that because I plan my trips based on that, and it's creeping up every year.
	Seed collecting	I do a lot of seed collecting out in remnant prairies because of the work that I do. And one of our target species this year is little bluestem, a warm season grass that two years ago we noticed blooming and setting seed in mid-September to late October depending on where we were in the state. And this year across southern Minnesota from, oh let's say, about Rochester or a little east of Rochester all the way over towards Windom, the plants had finished setting seed by the middle of August.

Figure 4: Table of Example Observations in Outside Activities from BYP Interviews*: Provides the season (or seasons), noted activity, and an example quote for some of the major activities people notice changing and how they notice these activities changing*

Winter: Similar to noticing about weather and seasons broadly, winter activities were the primary culprits in what interviewees noticed in relation to outside activities done regularly. In winter, the major cultural connectors related to changes in activities happened predominantly as a result of changes in snow and ice patterns. Major activities interviewees noted included ice fishing, ice skating, hockey, cross-county skiing, snow-shoeing, and down-hill skiing. While interviewees noted some mechanisms to adaptation

for these changes, there was a sense of loss for the changing patterns and landscape patterns, especially towards future generations.

Winter/Spring: In the spring/summer, interviewees noticed ecological indicators of climate change mostly in relation to gardening or planting and the flowering of spring ephemerals. Many of these changes related to (1) erratic springs with varying temperatures and variable precipitation cycles and (2) shifting growing zones which connected to changes in all the seasons but manifested most visibly in the spring and summer. For example, people that have been gardening for many years note the change from a heartier zone of 3B or 4 to a less hearty zone 5. These changes relate to the cycle of annual weather, particularly less cold winters, but the observations and activity adaptations, occur namely in spring and summer. The observations relate to plant adaptation to climate change and human response to them. Interviewees noted how they can grow a different selection of plants that now overwinter related to the milder winters, have success in different planting selection choices from warmer growing zones, and encounter challenges in spring particularly with seedlings because of the variability in precipitation, and earlier flowering dates.

Summer: Interviewees did not notice many drastic changes in their summer activities other than a potential season extension.

Fall: The ecological connectors are related predominantly to activities associated with hiking in fall color change and seed collecting. As in other seasons in which interviewees made observations related to gardening practices, these observations could potentially be augmented by harvesting and hunting dates.

2c. Connection to Specific Plants and Animals with Ecological Layers

In another theme, "plants and animals" refers to *locally observed plants and animals that people noticed changing from their childhood/growing up/aging experiences*. Some interviewees have an affinity to broad ecological patterns as well as observations about specific plants and animals. They cued into noticing changes in these plants and animals that weren't necessarily related to specific activities but to the plants or animals themselves. This kind of observation required building a relationship with something

non-human. There are some ways interviewees can cue into these species to make both general and specific observations about larger climate change patterns and they provided a particularly powerful mode to strengthen place-specific ecological calendars related to changing climate patterns. More specifically, this noticing took form predominantly in (1) species composition changes (what is present) and (2) timing changes of important plant and animal events (when things happen). Importantly, noticing changes in plants and animals served to deepen and broaden the community of species included in affected change.

2ci. Species composition changes (What Is Present)?

Interview participants described observations about species' composition changes which related to climatic changes in the environment and both indicate, and drive, larger community changes. In the northern hemisphere in the continental Upper Midwest, these observations in species composition changes took form predominantly in both individual species and ecological cover types shifting ranges. Important drivers in this noticing included increased invasive species and missing species. Many of these observations were interrelated with other habitat shifts such as land development and we do not suggest an in-depth analysis of the ecological hows and whys of species composition shifts. Interviewees could and still did observe patterns in species composition changes without knowing the specific ecology, and this analysis will only highlight some of the observations.

Figure 5: Table of Species' Composition Changes from **BYP Interviews** summarizes major species composition phenomenon that interviewees have identified with an example quote. Major areas of observation included specific animals migrating from southern ranges, specific plants migrating from southern ranges, new animals overwintering, previously non-perennial plants now over-wintering successfully, pests and diseases migrating north, increased invasive species, shifting ecological cover types, and shifting large-scale crop ranges. Each of these areas pointed to significant shifts in ecological patterns associated with changing climates: vegetation cover changing, different species overwintering and surviving, changing behavior patterns, and a general

migration of what exists in the communities moving north. Understanding these species composition shifts provided useful indicators for climate changes to which interviewees did (and could) connect locally and could be integrated into an ecological calendar.

Species Composition Change	**Example**
Specific animals migrating from southern ranges	And, of course, some of the animals have come up here, like the possums and stuff that never used to be up north. I think they were considered more of a southern animal, and now they're all over the place up here.
Specific plants migrating from southern ranges	When I had a fall through spring, breakaway from St. Paul, Minnesota, living in Northwest Arkansas, I admired the redbud trees. And always wished I could grow one. And now you can… So, big difference and if you drive straight down 35 to Northeast Arkansas, you know how long that trip is, so you realize what a change – If we can grow some of the plants that they enjoy regularly in the spring time, what a difference it is.
Pests and diseases migrating north	Well, so here's my observation. I am a veterinary technician, so I work in the animal community, and one of the things that we have noticed in our own clinic …we test for Lyme Disease and tick-borne diseases in our pets. There's a – there's one called Ehrlichia that we don't see here very much in Minnesota, and in the last few years we've seen some more positives in our pets. A majority of those came from the south, which makes sense, because that's where they have it more, however, we are starting to see that morph into animals that have not come from the south, have not been brought up here by our Humane Societies to be adopted. We're seeing some more positives, so we notice that change in that we're maybe impacting our community, some of the things that we're bringing up here. The other thing that we've seen a lot – and, again, this is our own observations in our clinic the last couple years, we've seen more fleas, which, everybody has fleas, but the southern states, because we don't have our wonderful Minnesota winter…It kills a lot of those parasites, which is one of our positive things that we've seen more of that as a persistent problem..
New animals overwintering	And then I just notice things like the robins didn't leave last year until November, December. I'm not sure some of them ever left. And I thought that was really strange.
New biennial plants now overwintering	And also plants. I've noticed just in my own yard plants that are not supposed to be coming back that come back. I've got a kale plant that came back. I didn't plant it this year. It just came back. I don't know if the ground didn't freeze.

Increased invasive species	Well, I've noticed like Japanese beetles – a lot of those things flying around. Those seem to be attacking trees. So, our trees seem to get – the leaves get brown and a lot of the plants around that tree start to kind of turn black. So, that seems to be that pest. That Japanese beetle has really impacted some things. Don't see a lot of Monarch butterflies that I used to remember seeing. I seem to see less butterflies, more of those beetles.
Shifting ecological cover types	One of the ways I see it in Minnesota is you look at the coniferous versus deciduous trees. We used to have pine trees down to, what? A third of the northern state. And now they're retreating.
Changing large-scale crop ranges	I grew up in Traverse County, Minnesota, Reep, Minnesota, and I started farming in 1964. I farmed for 33 years. In that 33 years of farming, we had about a two week longer growing season. Since I've left the farming we picked up another week of growing season… I guess the thing I've noticed, when we're growing up in the early years of farming, is we were kind of the north edge of the corn belt…Corn was raised north of us, but it was pretty much for silage. Now they're raising grain corn in southern Canada…It's shifted north considerably.

Figure 5: Table of Species' Composition Changes from BYP Interviews*: Summarizes major species composition phenomenon that interviewees have identified with an example quote.*

Specifically, on a localized landscape level, interviewees noticed changes in ecological cover type—both broad forest composition (leaning towards more deciduous vs. coniferous regeneration) and agricultural cover (longer growing seasons and shifting crop belt ranges with a shift towards homogeneous cover).

Many interviewees also noticed an increase in invasive species as affecting species composition. They saw an increase in invasive species as a challenge to species composition and associated climate change. Some prominently mentioned species include buckthorn, Japanese and Asian beetles, earthworms, sawfly larvae, and zebra mussels. The increased presence of these species had consequences for local flora and fauna and interviewees were particularly concerned about these species' characteristics because they do well in changing climates and lack natural predators. Invasive species' stories are usually tied to some form of introduction related to non-climate events and other ecological characteristics in which invasive species are better at competing in changed environments. With invasive species taking a more prominent role in the landscape ecology, interviewees raised concerns about the impacts on native plants and

animals, and this noticing did seem to provide a gateway of raised awareness towards other species composition changes.

One of the noted consequences of these species composition changes (who is there?) is also who is NOT there…something we identify as missing species. Interviewees noticed some things are no longer present or were projected to be no longer present soon. Figure 6: Table of Missing Species and Phenomenonological Impact from BYP Interviews describes some specific examples of identified missing species and the phenonomological impact to one's ecocultural relationships. Often this species loss goes implicitly or explicitly with a real sense of loss and nostalgia. The consequences of missing species are severe and can be categorized by intergenerational stories or experiences changing, sensory loss, loss of species within one's own lifetime, regular activities changing, historical symbolism disrupted, and senses of fear and concern.

Missing Species	**Quote**	**Ecological Feeling/Phenomenon**
Meadowlark	So, I'm older than Katie, and certainly with my grandparents' farm being on grasslands and wide-open areas, species like meadow larks, I not only heard my grandparents and my aunt and uncles, but I also notice you don't hear them, you don't see them.	Intergenerational stories or experiences changing, sensory loss
Moose	Living in northern Minnesota, the moose population has tanked, it's dropped. Now, there may be many reasons for it but one of those reasons even though folks at the state level do not wanna talk about it, it's climate change and we will lose most of the moose in the State of Minnesota in my lifetime, which is a shame.	Loss of species within one's lifetime, historical symbolism disrupted, senses of fear and concern
Loon	This is not gonna go away. And even looking at, for instance, the Minnesota State Bird, the loon. Looking at future projections of how this bird is going to be able to survive, there may be a time, not too far into the future where Minnesota is no longer a home to a loon, that you're not gonna see them here.	Historical symbolism disrupted, sensory loss, loss of species within one's lifetime
Birch trees	Well, I do a lot of driving up the North Shore and what I've noticed in the last I'd say five to	Regular activities changing, loss of

	ten years are the birch trees dying. I think the birch trees are dead along the North Shore. And there's just these skeletons of the birch trees.	species within one's lifetime
Frogs	One of things I noticed this year, which is really terrifying, is that every year, we would sit and listen in the evening to the croaker frogs. And they would play all the time. And as soon as they heard a noise, they'd stop. And as soon as they felt safe, they'd start up again. And this year we have not heard them. I have not heard one. And so, that concerns me greatly because where would they have gone?	Regular activities changing, sensory loss, intergenerational stories changing, senses of fear and concern
Fireflies	So, one thing that – so, I grew up Eagan and I have this incredible memory of being a child and being outside at night and just the sky being lit up by the stars. And then the field being lit up by fireflies. And just everything that's romantic about a warm summer. And I noticed two summers ago when I was home visiting my mom that there were no fireflies. And I said something to her like, "Well what's going on? Haven't you noticed this?" And she's like, "Oh no. I didn't notice it all." And last summer, same thing. No fireflies. And we're actually staying with my parents right now. And maybe four nights ago I was outside and I saw one lone firefly.	Regular activities changing, sensory loss, intergenerational stories, loss of species within one's lifetime
Monarchs	They [monarchs] migrate to Mexico, and the population count is taken in this area and Mexico because they are congregating…so they can do a count. And it seemed, in January, that their population had doubled. It was still much, much lower than it's been for a long time, but it had doubled, and so they're optimistic. And then, in March, there was a historic storm in Mexico that hit them harder than ever, and my concern has always been about habitat and having enough habitat with the monarchs, and I know climate change and extreme weather events and how that all changes things. But it really brought things home because they never had a storm like this hit in the way that it hit and this late in	Regular activities changing, sensory loss

	the season, and they don't even know how many died, but a good 50 percent of the population and maybe more, when they had thought everything had risen. Anyways, last year, we saw a lot of monarchs in our yard, and this year, nothing so far. Well, I did see one, but it kind of skipped over and went someplace else.	

Figure 6: Table of Missing Species and Phenomenonological Impact from BYP Interviews*: Describes some specific examples of identified missing species and the phenonomological impact to one's ecocultural relationships*

More than other observations, the implications of missing species go beyond ecological interactions to phenomena that were felt and embodied on a personal level and connected to very powerful climate change stories and relationships. Honing into these felt phenomenon, and associated feelings, could increase the strength of ecological calendars.

2cii. Timing changes: Phenology

In terms of *timing* of specific plants and animals, interviewees noticed variability in the phenology of when things happen with specific plants and animals. Phenology seems to serve as some of the most powerful (i.e. very specific examples of climate change phenomenon) but also most elusive (i.e. far less common and requiring a more nuanced relationship to specific plants and animals) observations in terms of ecological calendars relating to anticipatory climate change. Changes in phenology provided specific examples in how plants and animals are adapting to climate change in relation to the past and present and can cue into responses in the future. By focusing on ecological calendars, we hope to present a tool for people to make these specific observations more regularly in order to cue into local patterns of change as told by phenological phenomenon, which is common in ecological calendars, generally derived from place-based knowledge strongholds.

In our context, the most observed changes in timing occurred in the spring and when things emerged, budded out, flowered, or migrated. Interviewees noted that these occurrences were generally happening earlier. Erratic springs were of concern because of hard starts with early wakeup times or "false starts." This points to spring as a key relationship-building season to notice climate change in the Upper Midwest. In this

section, we do not highlight what interviewees noticed so much as how they built connections to noticing these timing differences and the diversity inherit within these observations.

In Figure 7: Table of Building Phenology Change Observations Connected to Experience from BYP Interviews, we highlight several major ways interviewees built relationships to phenology changes. All had the common theme that the phenology observations were connected to something in their daily lived experiences. We broke this construction of careful observation through experience as a form of important knowledge production into several major categories: (a) building individual species' observation, (b) building multiple species' observations, (c) building social relational traditions, and (d) building long-term ecological datasets. Within each of these major categories, we highlighted noteworthy modes of connection and provided an example quote. The first two related more to *what* people observe and the second two related more to *how* people observe and to what they build connections, though none are mutually exclusive and both are important in terms of nurturing observational relationships.

What: Building Individual Species' Observations	
General observations	"The flowers come in earlier – the tulips, daffodils."
Specific observations	"Okay. So, one that I have is – and I don't know exactly when the red-winged black birds come back, but that's always a phenological thing that I look for and really enjoy in the springtime. And I actually just looked back through my email before we stepped in here to find out the exact date, but I saw, or I heard a red-winged black bird on March 7th this year…We were at a doctor's appointment. We were like, "What the heck! It's way too early!"…I know. And I almost slammed on the brakes. I mean, my head whips around. It was warm. We had our windows open. So. Yeah. That was pretty cool."
Tended plants	"Oh, yeah, well, I'm also an organic gardener at home, and grow a little ginseng patch out in Wisconsin, and notice things starting to warm up, on average, about a week to two weeks earlier than we have seen over the past years."
Wild/native plants	"I harvest and collect wild and native species and woodland species. And I've been doing it for the past three years. And I've noticed that a

	lot of different species have been coming in super early, especially this year."
Individual species, connected to Gregorian Western calendar date	When I was a kid, my mother, every year for Memorial Day [late May], we'd cut Siberian Iris and bridal wreath – *Spiraea prunifolia*– and go out to the cemeteries to put vases on her parents' graves, and our grandparents' graves. And so that was always very typical, that vanhouttei spiraea was blooming on Memorial Day weekend. This year it was blooming on Mother's Day [mid May] weekend, which was two weeks earlier than normal.
What: Building Multiple Species' Observations	
Multiple species in one specific moment of the seasonal round	"Where I live, some of the first signs of spring are the skunk cabbages that rise in the swamps. And then unfurl to release their beautiful yellow flowers. And we're also part of the flyway. So, we have birds that come in. Early summer birds are – the biggest ones are grosbeaks. And there are lots of other things I'm sure. In my gardens, I grow primroses. So, they're early bloomers. And continue for quite a while. But they're the little bright shining stars in a very gray landscape for a long time."
Tracking various species throughout the growing season	"On a yearly basis, year by year, I notice when my first crocus comes up. And this year it was earlier than normal. I pay attention to when my raspberries ripen, and my raspberries are ripening a week, to two weeks, ahead of schedule. I usually don't really see something until early part of July, and this still too early for me to be seeing the red on my raspberries. So, it's things like that, that I'm noticing. And earlier lilac bloom, or you know, something that is just out of what I would call "kilter".
Multiple species connected to Gregorian Western calendar dates (intergeneratio nal knowledge)	"Yes. I have. In fact, this spring I was thinking about that. We have a large lilac bush in our backyard. And my parents also had one in the house I grew up in. And I was thinking about this spring because I remember as a kid, it seemed like the lilacs always bloomed around Memorial Day [late May] weekend here. And this year I noticed, and it's been a pattern, our lilac bloomed at Mother's Day [mid May] weekend this year. So, that was about three weeks earlier than what I had remembered historically as a kid. Even like the fruit trees. The crabapple. The apple trees. It seemed like as a kid, those used to flower around Mother's Day [mid May] weekend. And this year, that was more late April-ish. So, again, probably two, three weeks earlier. Even, we have some crocus and tulip bulbs in a garden bed on the front of our house. And even in the 10 years we've been at our house, it seems like the crocus are blooming earlier this year in February when we had some warm days. And in the sunny spot, we noticed

	there were crocus coming up and starting to bloom."
How: Building Social Relational Traditions	
Keeping intergenerational traditions	And I can remember, yeah, being a kid and being on camping trips with my grandparents. And we wouldn't have started going on our weekend camping trips probably until May. And I have a vague memory of then it was, "Oh. The red-winged black birds are back. It's springtime." Now we're watching for this whole other set of birds that follow the R.W.B.s.
Starting traditions	"This year in particular, we noticed – I've got an ornamental cherry in my backyard that I actually planted for my boyfriend's birthday. He's sitting right over there. And his birthday is May 20th and it usually blooms right around May 20th. And it bloomed in the first week of May this year. It was done blooming by the time his birthday even rolled around. So, this year everything feels three weeks early."
Adapting traditions with memory connected to Gregorian Western dates	"I know the growing season – definitely, I've noticed – we always have had gardens, like – growing up we had gardens, and we really never, ever planted anything until – at least – Memorial Day [late May]. And this year – and last year – now we have a really big garden in our backyard; we've been planting like, the first weekend in May, and with no problem whatsoever in growing – like, all of our lettuce is available by early June – which my kids are psyched about, because they get to have vegetables earlier."
How: Building Ecological Datasets	
Personal connection related to external longer-term records	"And he had found in Japan at this one temple that's south of Osaka there, and Kyoto – I'm blanking on the name at the moment -- But, they had kept phenology records of when the cherry trees were flowering there. And it was a 1,000-year record. And when he plotted the data out, moving 5-year average what he saw was just really impressive. The time you see industrialization going up, that's when the dates become much earlier. And we've even seen that during some visits to Japan. My wife has family over there. And even when we were going the first time back in '96, '98, we saw cherry trees were still coming out early April, sometimes a little earlier. I mean there's variation. In recent years it's been much earlier, and it's been really surprising hearing from our relatives there that the cherry trees are blooming in mid-March, or even earlier."
New datasets, personal	"And one of our target species this year is little bluestem, a warm season grass that two years ago we noticed blooming and setting seed

connection to one's own scientific observation and/or restoration practices	in mid-September to late October depending on where we were in the state. And this year across southern Minnesota from, oh let's say, about Rochester or a little east of Rochester all the way over towards Windom, the plants had finished setting seed by the middle of August... It means that we couldn't do the work with it that we had planned to do this year. But it wasn't just the little bluestem. At our experimental plots, we have in one area populations of several different species planted all in the same environment. And both of the prairie clovers, the white and the purple prairie clover, seeded and were ready for harvest much earlier this year than usual. And the same with wild bergamot and thimbleweed and sideoats."
New datasets, mobilizing others' to build their own dataset connected to more complex ecological interactions	"And I work out at Minnesota Valley National Wildlife Refuge. I'm working on setting up phenology trails there. And so, I've been kind of monitoring different species as well. At least this year we noticed a lot of things happening early. We had a warmer spring. Some 80 degree days in March. And one of things that we noticed was when we had a big melt going on, some of the wasps started going out and searching. They left their wasp nests. And a couple of days later, we had a big freeze again. And so, kind of the biologists there were alarmed. They're like, "Oh no. We're gonna lose a lot of those wasps." And we get a lot of birders and things that come out. The idea is a lot of them probably would have frozen out. They can't handle the freezing. They need to be in their nest. And so, they go out looking thinking that it's spring time, but it was middle of March. Yeah. And I mean, that's just one example of a lot of different species who come back to the refuge when there was kind of a freak incidence like that. And then they think, "Yeah. Spring's here." But they've come too early. The plants that they're looking for aren't there yet. And so, they come back too early and starve. And it's a chain effect. When effect one part of an ecosystem, it ripples out."

Figure 7: Table of Building Phenology Change Observations Connected to Experience from BYP Interviews: *Highlights several major ways interviewees built relationships to phenology changes.*

Building important species' observations seemed to be a starting point for *what* to observe. These observations ranged from fairly general (e.g. "*The flowers come in earlier – the tulips, daffodils")* to much more specific (e.g. "*I don't know exactly when the red-winged black birds come back, but that's always a phenological thing that I look for and really enjoy in the springtime. And I actually just looked back through my email before we stepped in here to find out the exact date, but I saw, or I heard a red-winged black bird on March 7th this year…We were at a doctor's appointment. We were like, "What the heck! It's way too early!…I almost slammed on the brakes. I mean, my head*

whips around. It was warm. We had our windows open. So. Yeah. That was pretty cool.") In both cases, people honed into specific species that held significance to their daily lived experience because of relationships they had with those individual species.

How interviewees built those relationships were quite complex. Some interviewees had relationships with tended plants over a growing season:

> On a yearly basis, year by year, I notice when my first crocus comes up. And this year it was earlier than normal. I pay attention to when my raspberries ripen, and my raspberries are ripening a week, to two weeks, ahead of schedule. I usually don't really see something until early part of July, and this still too early for me to be seeing the red on my raspberries. So, it's things like that, that I'm noticing. And earlier lilac bloom, or you know, something that is just out of what I would call "kilter."

This person noted the changes they have observed with plants he/she/they tended over the whole growing season but valued specific focal areas of plants tended.

Some interviewees took species' relationships to build an ecological picture that painted an ecological landscape of timing with one specific moment.

> Where I live, some of the first signs of spring are the skunk cabbages that rise in the swamps. And then unfurl to release their beautiful yellow flowers. And we're also part of the flyway. So, we have birds that come in. Early summer birds are – the biggest ones are grosbeaks. And there are lots of other things I'm sure. In my gardens, I grow primroses. So, they're early bloomers. And continue for quite a while. But they're the little bright shining stars in a very gray landscape for a long time.

This interviewee valued the moment of early spring and has tuned into multiple species in that moment and includes plants tended as well as larger ecological happenings.

Some interviewees built long-term relational traditions to phenology that included social memories tied to a Gregorian Western calendar date, which created a powerful way

to notice climate change locally. These traditions could grow from a point in which one started their own tradition, or they could include intergenerational practices that included keeping traditions alive. In each case, these traditions were imbued with building social-ecological memory. Some interviewees drew on intergenerational experiences that were culturally significant.

> When I was a kid, my mother, every year for Memorial Day [late May], we'd cut Siberian Iris and bridal wreath – Spiraea prunifolia– and go out to the cemeteries to put vases on her parents' graves, and our grandparents' graves. And so that was always very typical, that Vanhouttei spiraea [bridal wreath] was blooming on Memorial Day weekend [late May]. This year it was blooming on Mother's Day weekend [mid May], which was two weeks earlier than normal.

In this example, this interviewee discusses an intergenerational memory related to specific plants and how this intergenerational tradition built an acknowledgment of the timing of things shifting locally. Some interviewees drew on starting their own traditions of observation and noted how these could serve to cue into climate change locally.

> This year in particular, we noticed – I've got an ornamental cherry in my backyard that I actually planted for my boyfriend's birthday. He's sitting right over there. And his birthday is May 20th and it usually blooms right around May 20th. And it bloomed in the first week of May this year. It was done blooming by the time his birthday even rolled around. So, this year everything feels three weeks early.

In both these examples, observations were related to building traditions of observation that noted significant changes in the timing of thing. Particularly powerful in this observational tradition, is the idea that people have tied a tradition to a Gregorian Western calendar date. Even without keeping annual records of phenology, tying a phenological observation to an important tradition that is based on Gregorian Western calendar time serves to provide powerful examples of changes in ecological time.

Another way that interviewees built connection broadly to phenology observations and climate change was by building long-term ecological datasets. Datasets provided another very powerful way to connect to climate change in relation to ones' experience. Importantly, these datasets all required a personalized connection to ones' own experience. The dataset could be a personal connection related to external longer-term records but finding meaning in something personal:

> And he had found in Japan at this one temple that's south of Osaka there, and Kyoto – I'm blanking on the name at the moment -- But, they had kept phenology records of when the cherry trees were flowering there. And it was a 1,000-year record. And when he plotted the data out, moving 5-year average what he saw was just really impressive. The time you see industrialization going up, that's when the dates become much earlier. And we've even seen that during some visits to Japan. My wife has family over there. And even when we were going the first time back in '96, '98, we saw cherry trees were still coming out early April, sometimes a little earlier. I mean there's variation. In recent years it's been much earlier, and it's been really surprising hearing from our relatives there that the cherry trees are blooming in mid-March, or even earlier.

The datasets could also be related to livelihood.

> And one of our target species this year is little bluestem, a warm season grass that two years ago we noticed blooming and setting seed in mid-September to late October depending on where we were in the state. And this year across southern Minnesota from, oh let's say, about Rochester or a little east of Rochester all the way over towards Windom, the plants had finished setting seed by the middle of August... It means that we couldn't do the work with it that we had planned to do this year. But it wasn't just the little bluestem. At our experimental plots, we have in one area populations of several different species planted all in the same environment. And both of the prairie clovers, the white and the purple prairie clover, seeded and were ready for harvest much earlier this year than usual. And the same with wild bergamot and thimbleweed and sideoats.

In this example, it is person (probably a scientist or outreach worker) who relies on things happening at a certain time to be able to do their work.

These *what's* or *how's* are not all encompassing or mutually exclusive but provide some examples for building phenology observation skills connected to one's own experience. Phenology is a powerful language to understand how things might be adapting and changing so we have spent some time organizing these important phenomena related to climate change into modes that can serve as a framework for how to encourage this important language of understanding. They include simple observations, moments of ecological time that are important, traditions built intergenerationally or new traditions, and connection to larger datasets and forms of time-passing.

Discussion:

Climate Change Agency and Knowledge Production: Ecological Calendars in Non-traditional Contexts

In this analysis, we saw the potential of ecological calendars to be a localized tool to understand, anticipate, and adapt to climate change. We wondered if this tool could be applied as a community knowledge production tool and as a participatory research and education method in diverse contexts, such as peri-urban and urban. In terms of community knowledge production, most documented "traditional" ecological calendars currently derive from participatory projects in Indigenous knowledge systems or rural livelihood-dependent places. These communities often have extensive place-based ontologies that surface in an ecological sense of time that is rooted in many cultural activities and related observations.

The modern peri-urban/urban setting differs from that of many known ecological calendars as an amalgamation of knowledges from different places. Sometimes peoples' connection to place are not necessarily livelihood dependent, can often be characterized by high mobility, often lack long-term intergenerational knowledge about place, and exist in a place that is highly human-dominated and changed with infrastructure. That said, people in these environments are often much larger contributors to climate change and

would benefit from tools to personalize the climate change story to something that is part of their daily lived experience.

Importantly, we found that there was a need to localize the climate change story. Acknowledging the observation of climate change as a distant or abstract phenomenon is important for our research in mobilizing ecological calendars as anticipatory climate adaptation tools (Hulme 2009, Kassam 2018). In terms of how people connect to and know about climate change, a clear pattern emerged in which many interviewees' connection to climate change remained distant and occurred through the news, scientific reports, and other sources of information or through short-term experiences in other places. In this distant form of knowing, climate change often remained something that is happening to Other victims (those disconnected from one's daily lived reality). It also implicitly become a phenomenon happening in other places where climate change is something being done to Place, rather than being a phenomenon to which Place and its human community members can respond and adapt locally with their own empowered form of knowledge production. This distant noticing and lack of local agency indicates that there is a need to build tools to localize the climate change story (Aguiar et al. 2018).

Second, to increase a sense of agency towards climate change knowledge production on a local level, we looked at localized observations to understand if we could, and how we might, build an anticipatory adaptive tool for and with place in an "unorthodox setting" via ecological calendars and interviewees perceptions of change. We found that there was significant potential within existing knowledge and ecological and cultural phenomenon to begin etching out what a calendar might look like in these settings. As such, ecological calendars could be a tool to translate climate change from something happening distantly towards something happening in a daily lived way of knowing.

Importantly, in these contexts lacking personalized phenomonology or representing mobile and/or disrupted baselines of deep intergenerational knowledge and close ecological and cultural relationships in place, it might be helpful to place an emphasis on building ecological and cultural traditions in place and associated social

ecological memory. By developing these local tools and practices, we belief we can leverage climate change understanding towards place-noticing that nurtures people in observing climate change through their own observations. This noticing can build agency to develop localized resilience and adaptation strategies. In terms of building ecological calendars, we believe these daily lived experiences tied to important ecological and cultural phenomenon can begin to empower one to be a director in the climate change story (e.g. how are my activities changing?) as well as empowering non-human actors in a localized place to be powerful characters in the narrative (how are plants and animals changing and how is place adapting?).

The Combination of Gregorian Western Time and Ecological Time

Of particular note, while we have been critical of the Gregorian Western standardized calendar, events connected to structural time, or specific non-adaptive annual calendar dates (in our case, the Gregorian Western calendar). We found that ties to such events such as birthdays, holidays, yearly activities, etc (highlighted in Figure 7: Table of Building Phenology Change Observations Connected to Experience from BYP Interviews: Highlights several major ways interviewees built relationships to phenology changes) were particularly powerful in relation to timing changes and people's development of ecological calendars. People notice specific annual timing of a plant or animal occurrence in relation to a particular day of the year that is important. Combining these two senses of time, provides a baseline for not just what is happening when, but how it is has changed over time. Similar to other timing changes, these observations can run the gamut in terms how people are noticing; however, the "locater" of the annual holiday occurring on the same date of a Gregorian calendar can help to increase certainty and knowledge of variability in the timing observations. These observations can manifest on a short-term time scale and align to individual events and observing differences on a year-to-year basis or they might relate to childhood memories and remembering the timing of particular plants and animals around these particular calendar days. Marked ecological activities can become intergenerational in terms of observation of larger timing changes as ecocultural activities become recalibrated to newer generations and develop trackers to mark the changes intergenerationally. This intergenerational time-

keeping of ecocultural activities can also help to symbolize and understand adaptive practices related to timing changes and climate change intergenerationally while nurturing biocultural traditions. By tying the occurrence of specific plant and animal happenings to special days that happen on a Gregorian calendar, people hone into changes on a more precise basis. This tracking can bolster an ecological calendar's power and, to borrow from statistics, help to increase the level of significance.

Constraints and Opportunities for Applying Ecological Calendars

We would also like to acknowledge some of the constraints and opportunities inherent in this slightly different "non-traditional" context. This framework and series of questions provides a strategy for building place-noticing strategies and traditions in contexts that have rich ecological and cultural knowledge sets painted over (pentimiento) and mashed together into a highly human-dominated place. These places can represent a diverse coming together of many ways of knowing and cultural traditions so offer a unique opportunity for building ecological calendars as a tool to understand and anticipate climate change locally. Rather than focusing just on collecting and acknowledging these ecological and cultural relationships in place, more emphasis might be placed on building up, strengthening, and adapting these relationships.

These ecological calendars might look very different than those that have been documented or reinvigorated in other contexts. First, in our setting, the seasonal round was highly dominated by a Gregorian western sense of structural time of winter, spring, summer, and fall and "classic" seasonal portraits and weather patterns. Critically, the analysis suggests that backdrop of the seasons themselves are changing. This seasonal definition provides the framework for all other place-based activities (human and nonhuman) so it is fundamentally important. In our context, seasonality was traditionally divided into four distinct seasons of winter, spring, summer, and fall with a set of weather events to go along with them. However, this definition is being challenged by citizen observation in our place. There have been other criticisms of four seasons predominant in the Gregorian Western Calendar (Prober 2011, Ryan 2013). We encourage developing a more nuanced seasonal round. It may be interesting to think outside a four-round

seasonality, particularly around the bookends of fall and spring bleeding into the larger seasonal characters of winter and summer. Climate change disrupts cues for how and when things happen but most people in our context still speak to winter, spring, summer, and fall, and weather oddities within them. We encourage a disruption of this socially constructed seasonality to a more nuance place-specific seasonality. For example, could there now be greater distinctions of the seasonal characters such as fall colors changing, fall/winter brown with no snow, ice winter, snow winter, late snow winter, heavy rain spring, early hot and humid summer, drought summer, late fall, hot/cold fall? In various calendars from Indigenous lenses in the area, seasonality is sometimes divided in shorter periods based on a moon-based keeping of time. Months include things such as "crusty snow month" or "strawberry moon" which are more descriptive of that particular monthly character (which have also been changing and may also need to updated) versus a generalized four season format. Moreover, the big weather events within the seasons need careful adjustment (weather vs climate). Understanding seasonality is paramount to the work of translating how people notice climate change in a place-noticing format if we are to empower people to be directors in their localized climate change story.

Second, activities that interviewees identified were often recreational in nature (vs livelihood dependent) with observed changes being colloquially tracked with a general timeline of "back then" (e.g. childhood) to a timeline of "now." People did exhibit adaptations in their behaviors such as creating artificial snow, shifting planting decisions, changing the times when they do these activities, etc. This noticing could take a more precise form of understanding and tracking in order to develop a more precise calibration that could become part of the ecological calendar (e.g. days to ski without man-made snow, ice-fishing days, skating days, planting times, planting choices, when you see fall colors) or the development of new traditions. Moreover, in these urban settings, there is usually ready access to long-term weather and climate records that could make these observations more precise and extend over longer periods of time. We suggest collecting stories related to these activities to pass on to future generations who may not experience the same realities as many interviewees already began to feel a sense of nostalgia and lack of opportunity to do many of the same activities.

Finally, plants and animals in urban environments are different than plants and animals who might appear in more "intact" ecosystems. The set of characters prominent in an urban setting may be rather different than the set of characters in more traditional contexts but there were many key cultural species that did take on more fanfare, so to speak. Finding ways to connect these key cultural species to peoples' activities and long-term records could prove powerful. Importantly, these place-based noticings rely on past, present, or future relationships people form between their activities and associated plants and animals. These observations run a continuum of general to specific and could take many forms of how relationships and corresponding observations are performed.

Critique on Methods

In this study, we represented a collaboration between various academics and community members interested in a wide variety of issues related to climate change. The community story recording approach through artistic and scientific lenses worked strongly in conjunction with ecological calendar development. Importantly, we gathered a wide swatch of open-ended perspectives on community members' observations of changes in the seasons and cycles at public events. This methodology worked well in the sense that the interviewee audience was broad and representative of "public" perspective. As researchers, we were able to use the public event forum to connect to non-discriminate perspective and see that indeed there is need and potential to nurture ecological calendars in non-traditional contexts as a localized climate change tool. However, in the context of ecological calendars and cultural diversity present in urban environments, a supplementary approach might include targeting specific ecological and cultural relations present and community-experts that have existing ecological and cultural relationships to seasonality, activities, and plants and animals. We also see value in doing next-step workshops (potentially targeting educators, practioners, and community research partnerships between academics and community) that are focused specifically on ecological calendars modeled in a framework similar to that which we outlined above. From an academic standpoint, one goal of this research would be nurturing and building place-based noticings grounded in daily lived experience as a product and recommend socially-engaged and critical educational pedagogy in

methodology. Our future work, for example, will focus more specifically on this implementation.

Conclusions

While our observations from which we analyze the potential of ecological calendars in fairly urban/semi-urban, human dominated, and culturally amalgamated place(s) come from the place-specific context of Midwest, U.S., we believe this template can be adapted to other locations and that there is significant need. In defining seasonality, associated activities, broad ecological shifts, and important plant and animals in that place, the particulars would change. However, this set of place-noticing strategies represent a format that could be localized to many different places. In places characterized by diverse stories of migration and intergenerational memories, or environments themselves that have experienced rapid change (urban/peri-urban), it provides a framework that does not rely only on long-term stories of a place but rather focuses on flexibly building, strengthening, and nurturing the development of ecological relationships in a present day context (though greatly benefits from long-term knowledge!).

By nurturing these practices, communities can engage in place-specific observations to (1) notice ecological happenings that relate to activity-based traditions (2) broaden the community to include more nonhuman plants and animals and (3) create a socio-ecological memory of events correlated with ecological happenings in the past, present, and future. These practices can encourage building and adapting to climate change by making activity-based observations (particularly phenological observations) a usual practice, building intergenerational stories of change, and nurturing new/old traditions.

Chapter 4: Building Ecocultural Calendars

Summary: I explore how socially-engaged art practices can contribute to localizing climate change, and knowledge about it, into our Place(s) in the here and now. In practice, I focus on the potential of building ecological calendars in new contexts and diverse combinations of knowledge production systems to serve as an emerging local adaptation strategy to strengthen non-expert relationships to stories of climate change. Specifically, I wonder if this tool could be applied in diverse contexts which are dominated by highly changed environments, amalgamations of old and new transplanted knowledge, and often non-livelihood dependent ecological and cultural relationships. This work attempts to strengthen Place-based Community Memory, creates a tool for anticipatory climate adaptation, and experiments with a framework for building ecocultural connections. I situate the practices within various levels of the knowledge production "fortress" of western education systems but namely implement them within the pre-K12 environmental education realm and teacher professional development. This practice-based PhD component follows strongly from socially engaged art as the practice while incorporating other forms of knowing within an interdisciplinary context. I explore and reflect on an application of ecocultural calendars as a way to explore, learn, know about, and keep track of climate change as a local phenomenon. In the practice, I co-create a sustainable forestry education outreach context via the Wisconsin Center for Environmental Education's LEAF—WI K12 Forestry Education Program.

Introduction to Socially-Engaged Art Practice: Multiple Ways of Knowing and Doing in Relationship Building and Illuminations on Moving from Symbolic Towards Actual Practice

When does something move from symbolic towards actual in a practice-based realm and how does it have a life of its own (Helguera 2011)? This question is especially pertinent in a concrete product-driven knowledge production system. How do we translate knowledge to practice? Often in a PhD realm, it is through the publication of this document, the dissertation and its defense. This section describes the movement of an

accumulation of ideas from symbolic to actual but "actual" being represented by only a small portion of concrete form in this thesis within a socially-engaged art viewpoint.

In the following, we will reflect broadly on what socially-engaged are practices are, highlighting some diverse examples. We then apply these concepts to our work from Backyard Phenology Interviews as community-informed perspective from the Twin Cities region, USA to imagine building an ecocultural calendar. We put this framework into practice via a virtual K12 professional development series for educators through the Wisconsin Center for Environmental Education and reflection on its implementation and emergence. Finally, we circle back to a larger reflection on carving out space for and implementing a socially-engaged art practice/product situated within a more conventional USA PhD pathway with a final call to challenge who and how is included in climate change knowledge production.

I want to emphasize here that much of my practice-based work functioned on the premise of relationship-building which does not have a consumable product persay. Instead, it "become[s] a platform or network for the participation of others, so that the effects of the project might outlast the ephemeral presentation." (Helguera 2011, p. 12)

Here is an ephemeral presentation.

Socially-engaged art practices are a relatively recent field in the arts, however they have existed in human society since time immemorial. Socially-engaged art practices are broad in definition and emergent but in essence focus on using creative and intentional social engagement and art practices to draw critical attention and thought to and of its participants to various societal injustices and modes of working. In an art-discipline context, the origin story emerges from the 1960s with Alan Kaprow incorporating feminist education theory into art practices, as well as an emphasis on performance pedagogy with notable practitioners including Suzanne Lacy, Charles Garorian, (Helguera 2011). Others date the origin story earlier to Duchamp in *Rotary* Glass *Plates* and Kruger's *Responsive Environments* (Gard 2017).

Moreover, in the art world, socially engaged art tries to pull work out of the museum in which we might think about art in the classic sense and into a liberated community space that recognizes that all people have nuanced knowledge and experience to contribute to social action. This knowledge may take very different forms and shapes. It fundamentally nurtures relationships between artist and community. In doing so, it also takes steps to defy the category of artist and community, teacher and student, expert and non-expert in order to grow collaboration. This inclusion of multiple ways of knowing is part of the art.

Equally, there are multiple ways of doing also included in the practice. In socially-engaged art, practice marries philosophy.

One of my favorites is Mierle Laderman Ukeles, who did many things but one of which was tied to creating a dump-truck with a mirror on it, acknowledging both human rights of the unseen workers and a reflection of that which we waste and don't acknowledge in both social-economic and physical trash forms. It also focuses on the importance of what has now become dubbed maintenance work and ironically but awesomely into a Museum Exhibit in Queens (2016) (https://www.bloomberg.com/news/articles/2016-11-29/the-maintenance-art-of-mierle-laderman-ukeles).

Another includes Robin Kimmerer's work which she writes about in Braiding Sweetgrass: creating black ash baskets (Wisgaak Gokpenagen: A Black Ash Basket), growing and tending for goods in The Honorable Harvest, and her educational work teaching students various life lessons in Sitting in a Circle (Kimmerer 2012). Of note, the art is her doing the work with community (human and non-human), not the reflective essay about it.

Values can become translated out in socially-engaged objects or crafts. Object is not a painting in a museum (though could be). To expand the definition of object, a useful starting point is a small book, Social Objects: Essays, Interviews, Projects, and Interventions on Socially Engaged Craft (Socially Engaged Craft Collective 2017). The essays reflect on and question:

> What power do objects carry in our lives? How do they influence our everyday experiences, create connection or encourage resistance? Throughout the trajectory of human history, we have used objects to contain meaning and to build relationships (Social Art Library, April 4, 2021).

They emphasize problematizing injustices (social and environmental) while also thinking about the relationship one is building through the work. These are some key points drawn from the series of excerpts in the work (Socially Engaged Craft Collective 2017).

- "mak[ing] the audience aware of basic core injustices by looking deeply at the divide that exists in our culture." (Hannesian, p.63), "a symbol of humanness in an increasingly inhumane world (Strand, p. 74.)
- "[objects] are meant to be used, as opposed to many art objects which do not reference a utilitarian origin" (Waldman in an interview with Baumstark, p. 18), or a non-separation of beauty and utility and the embedded memories that come from the use process (Karle 2017), vessels as memory carriers (Gard)
- Empathy (Crissman, Karle and Gard)
- Questioning Roles: "Who gets to be an artist? Whose histories inform our knowledge and practice? Who is the audience of contemporary art and craft objects? What is the economy of this work? How do we build a more accessible…community." (Evans, p. 49) or enlisting alternative narratives (Gugliolittie 2017)
- Action and community (all, but most prominently Zickefoose 2017)

Imagining the Practice: Building Place-noticing Strategies Theoretically from Community Informed Perspective Taking

Building a place-noticing strategy for ecocultural calendars requires a sense of tuning in to place and experiencing its character. We all live in a place; however, the level to which we connect to seasonal cycles, important ecological and cultural activities, and specific plants and animals (as experiential forms of a climate change story) varies widely but can serve to localize climate change. In *Figure 3: General Observations of*

Place-based Observations of Climate Change, we create a visual for our framework that emerged from listening to and categorizing interviewees place-based observations of climate change (derived from Backyard Phenology interview analysis…see Chapter 3). These observations can run from general to specific but all connect to one's daily lived experiences. They begin by etching out the seasonal rounds as a driver for more concrete experiential examples that surface in (1) activities done regularly throughout the seasonal round and (2) plant and animal changes. Plant and animal changes are further divided into noticing (a) species composition changes (what is present) and (b) phenology changes (when are things present).

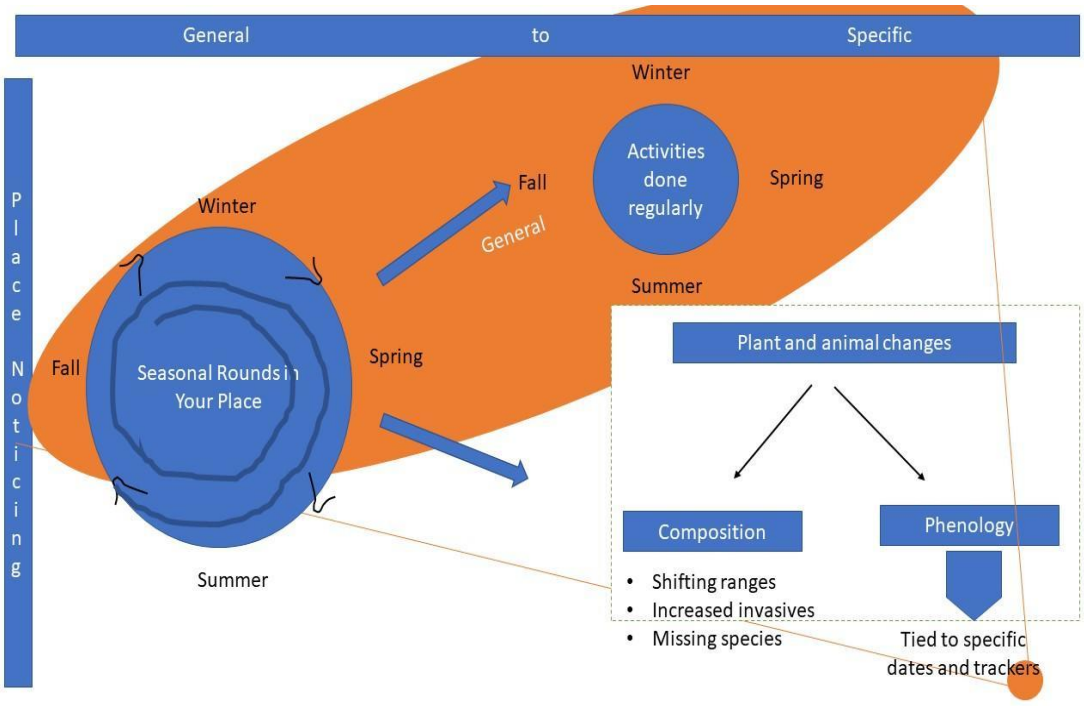

Figure 8 Conceptual Framework for Place-Based Observations of Climate Change: *Highlights various place-noticing strategies (what people notice) that run from general to specific (how people notice)*

Figure 8 Conceptual Framework for Place-Based Observations of Climate Change highlights various place-noticing strategies (what people notice) that run from general to specific (how people notice). In putting this framework to practice based on the interview model and in a linear fashion, I would suggest first etching out the seasonal rounds in terms of identifying the seasons are and how they might be changing (the backdrop for the climate change story). As a director (which we're imagining every person in a place can be in

order to take cues from their daily lived experience within their climate change story), each season would be a different set design. While one doesn't have control of the general story arc of climate change (script received and accepted), one does have control on how many seasonal sets they identify, their level of detail, and the general setting for what is important to their climate change story in terms of place-based set design. Questions include: *What are the seasons in your place? What is the seasons' character in relation to climate and weather patterns? What are the big weather events which would characterize major changes in the set?*

Second, after people have grounded in their seasonal round, I suggest taking a walk through the seasonal round and identifying important activities that they do outside and how their activities might be changing or adapting. Highlighting these activities provides a personalized "I" script for action taking place within the seasons.

Third, I encourage identifying important non-human actors (plants and animals) that make appearances on the stage as main characters in the localized climate change story. These include identifying species composition shifts that are changing (who is present) and their phenology (when they are present). Questions might include: *What are important plants and animals to which you connect? How do you connect? Have you noticed changes in who is present? Are ranges shifting? How? Are behaviors shifting? Are their missing species? What do those changes mean for your connection? Have you noticed changes in when things are present, or their timing? What are those timing changes? What does that mean for multiple species' interactions? How do you connect to those timing changes or how do you know? Can you relate that timing to any Gregorian Western calendar dates or events to track long-term change? Can you connect those observations to external long-term ecological records or begin to build your own?*

Ecological Calendars "Placed" in K12 Professional Development Settings:
The following is an email to Chris Baeumler in response to a practice-based planning document.

For the PhD with a completed project, I will develop an educational suite to encourage ecological-cultural calendars by June 30. The practice-based component of my PhD process emerges from findings of themes and patterns derived from the Backyard Phenology interviews (can be seen in, in-progress published article). Main themes for local climate change knowledge production related to ecological calendars include:

1. Defining and grounding in the local seasonal round.
2. Locating important ecocultural activities.
3. Identifying plants and animals that are important and noting
    a. Species composition shifts, or what is present or not with change (particularly missing species)
    b. Phenology changes, or when are things present or not

Background: Time is a fairly large and important cultural construct in how we organize ourselves and our activities. This project represents a shift towards ecological time vs. structural time as a change agent for understanding, anticipating, and adapting to climate change locally. Ecological time requires a tuning into Place. We take structural time for granted because it is omnipresent (e.g. you get off on December 25, taxes are due on April 15). This structural sense of time serves important functions, but does not highlight important ecological and ecological-cultural relationships to Place or climate change. I would like to work collaboratively to strengthen and redevelop a sense of local ecological time for people who are disconnected from ecological reality and climate change.

Aims and Objectives:

- Collaboratively design a "educational suite" and supporting materials for communities to develop their own ecological calendars as a standards-aligned storyline and anticipatory climate change adaptation tools, with attention to K12 audiences and educators as agents for change and implementation. This work includes the creation of a lesson on ecological calendars following the LEAF format. Specific components include: a nutshell, big ideas, objectives, subject areas, background information, vocabulary, materials list, teacher prep, and procedures.

    - Main pulses would have students:
        - Describe their knowledge of the seasonal round (like PLT Tree Ring Activity).
        - Locate important activities done outside
        - Identify important plants and animals
        - Interview an Elder in their community about those questions
        - Identify similarities and differences with particular attention to changes in ecological time
- Develop an accompanying audio (maybe animation) on how to tune into local changes and ecological calendars that can be used in the classroom.
- Start building a "recipe book" of activities to do on ecological time. Based on the school year, activities include amplifying ecocultural relationships such as spring and fall indicators (e.g. maple syrup, garlic mustard pesto with invasive species control, red-winged blackbird arrival, community tree map connections, seed collecting with important species like milkweed that relate to charismatic monarchs). These seasons are also some of the more variable and indicative of climate change, so represent great opportunities for understanding climate change locally.
- Imagine (and eventually implement) forms of interdisciplinary team-based professional development for facilitating ecological calendars as a localized anticipatory adaptation tool for climate change. This work for the PhD would include a workshop outline.
- Locate banks of local long-term ecological records for comparison.

Research Questions/Problem:

- What do ecological calendars look like on the local level when they are implemented and designed by the community (in places rather disrupted by colonial influences of time)?

- How can we facilitate the creation of ecological calendars as a tool to understand and adapt to climate change and deepen our sense of ecological (not structural) time?
- How can we mobilize educators to teach the development of ecological calendars within their communities in order to localize climate change in their own place-based knowledge production?

Research Context:

- Place-based education provides an important tool for social change and engagement around climate change. It connects to educational systems and standards, forestry and energy, and green and healthy schools.
- We work in K-16 environments to facilitate the development and practice of ecological calendars as both an educational and community-change tool.

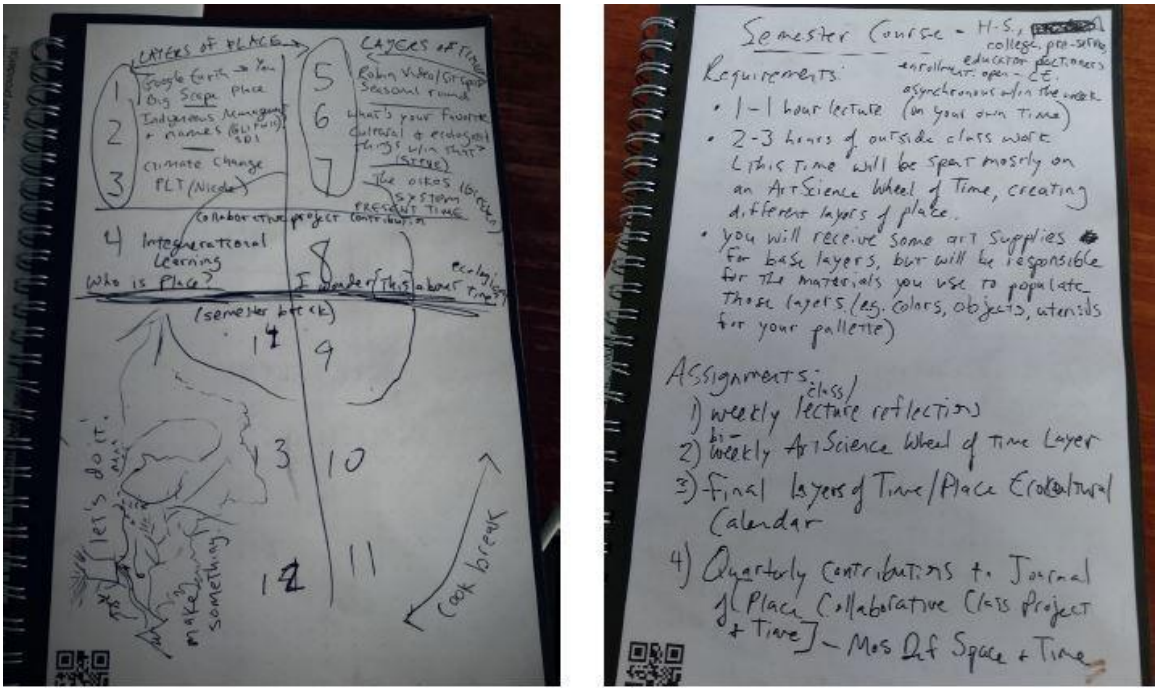

Figure 9: Climate Change and Ecocultural Course Professional Development Planning

I imagined this could be a semester professional development course. Things happened. The presentation context changed as CoVID continued to evolve. We modeled the series after a Get Outside Power Hour that I had created in the fall as a way for educators to get

together as CoVID and changing education norms were emerging. It focused on the development of a recipe book.

Towards Creating Ecocultural Calendars in Education Communities: The Actual Iterative Imperfect Process

In actual practice, LEAF staff and I are co-created the Tea and Tapas Series as a professional development opportunity in forestry education offered through the Wisconsin Center for Environmental Education. It evolved into a monthly series, committing to one hour per month. It also aligned themes, communications, and activities of LEAF professional development.

We created a google drive "library" with some references: https://drive.google.com/drive/u/2/folders/1y6tPAWBbsFW3tS24uzEeVWsqo5V-QNKm

I provided the base structure and folks commented during planning. I hosted two Tea and Tapas sessions which both took on very different characters but included thought toward content, participation, co-creation with guest speakers, and a performative nature. One could think of it as a Variety Show or something like 60 minutes but in this case, connected to ideas LEAF would have been going over that month with other events, communications, and themes. See Description below but the series combines ideas of biocultural stewardship and learning outside as a way to start nurturing ecocultural calendars in place. It features seasonal plants and animals (that you can sometimes eat! respectfully) as a way to build connections to broader educational storylines. The co-creation element will become particularly more pronounced in the April and May sessions as I step away from being a lead facilitator. The April session on ArtScience at this moment sounds like it will be really cool as both artists and educators took the description and notes from our planning document and are going to run with it.]. The idea of a project having more than one champion, or rather a team, is important take away here. It also allows for emergent strategy practices that align with seasonal happenings.

Description:

LEAF Get Outside Tea and Tapas: Join us for a virtual Tea Time and Tapas and be inspired to teach outside on your school site and community and build seasonal connections--whether you're a beginner or an expert! Each month, we will explore seasonal bounty in our Tea and Tapas that you can share with your students and connect to other highlighted lessons and resources. Hear inspiring stories and practical educational examples from guest experts. Find space for discussion and networking to enhance outdoor learning places. Have a cup of tea, relax, and share!

Observations Outdoors and Building Respectful Relationships- Coniferous Tea and Tasties: In this session, we'll connect to white pines and other important habitat trees, as a way to think about species of special concern and habitat restoration projects. It's easy to use something like understanding one tree, its needs and benefits, and our relationship to it as an anchor to many different inquiry pathways. February 16, 2021 4:00-5:00 PM

Fire, Succession, and Creating Outdoor Memory Storylines- Raspberry Buds and Spring Syrup: In this session, we'll connect to seasonal memory classics of tree syrups and berries to explore storylines of fire and ecological succession. These memories can form relationships to places that stick with you and students for a lifetime. March 16, 2021 4:00-5:00 PM

Teamwork and Storytelling Through ArtScience--Dandelions and Other "Weeds": In this session, we'll connect to urban lettuces like dandelions and forest shoots like nettles, to get creative together in all our home ecosystems—or oikos. Learn how to use art and creative inquiry as a method and practice to tell place-based stories through multiple literacy lenses. April 13, 2021 4:00-5:00

Creating Educational Stewardship Communities:
In this session, we'll connect to garlic mustard (a
forest understory invasive) and
other spring herbaceous understory plants as a way to think about all the distinct species in our ecosystems. We'll explore how we can build diverse and resilient stewardship communities.
May 18, 2021 4:00 PM-5:00 PM

Event 1: Tea and Tapas February - Habitat, Species of Concern, and Forest Management Issues:

Title: Observations Outdoors and Building Respectful Relationships (full session recording)

In this Tea and Tapas session (among other things), we feature Eastern white cedar (*Thuja occidentalis*). We learn about cedar as:

- Tea
- Important Later Succession Species
- Migrant
- Habitat for the Pine marten (*Martes americana*)

It features LEAF 7/8, Lesson 4: Forest Management Issues Forest Management Case Study in Iron County (meet the marten and golden-winged warbler).

  - 19:54 - LEAF Forest Management Issues Intro
  - 21:33 - Forest Management in Iron County Case Study

Also featuring:

- Zach Wilson, Iron County Conservation Specialist as Marty the Pine Marten

- Kate Flick, LEAF K12 Sustainable Forestry Education Outreach as Goldie the Golden-winged Warbler.

Podcast:

As the pine marten and golden-winged warbler both represent species of concern, I also developed a climate change connection related to backyard phenology theme of missing species. Originally I featured this kind of storyline of missing species narratives' but found it too gloom and doom.

Backyard Phenology Missing Species: Take 1- https://drive.google.com/file/d/1EG2hZVW9f5nfM4GCSh1VF9geH6BURv_z/view?usp=sharing

Backyard Yard Phenology Missing Species: Take 2: Observations Outside and Building Respectful Relationships: https://drive.google.com/file/d/1gcPGBmZ5oasgzHqF8eZRxZ-_rkx9qWeE/view?usp=sharing

More Resources: https://drive.google.com/drive/folders/11acY1Kb_ikAJj85gNM5OEz9bqWTdF10g?usp=sharing

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Action Reflection: First Tea and Tapas complete on 2/16/21. The socially-engaged art practice was a virtual zoom platform in a zoom fatigue world. Following a critical discussion of the practice and method with Chris Baeumler things were adapted for the next Tea and Tapas on 3/16/21.

In the morning of 3/16/21 I sent the following email as a capture of a moment on what happened in the Feb Tea and Tapas, the big ideas coming up in the next session, and seeding an idea to build a community of practice:

Hello Tea and Tapas Participants:

We look forward to seeing you today! As a belated follow up to the last session in February featuring cedar and white pine tea, here's the mentioned Tea and Tapas Google Drive with featured resources on the lessons, themes, and tea and tapas that related to

habitat, species of special concern and building respectful relationships. I especially invite you to check out some of the extra marten resources provided by our guest Zach Wilson. We will also continue to collect resources that we share during the session and stick them in here for future reference. If you missed the last session, you can also find the recording on our youtube channel here: https://www.youtube.com/watch?v=_pA_25PVfPM&t=3175s.

We are excited about our upcoming session which will include fun resources and exercises on the tale of two very different successional systems in our tea and tapas: raspberry/pine and maple. Yummm...what a delicious seasonal bounty! While it is super cool ecology, we will also explore the creation of storylines as a general idea with students, intergenerational connections, and more via tree saps (not just sugar maple) and then more specifically with a NGSS lens from Random Lake high school science teacher, Natalie Weeks, who has developed a Fire and Our Forests Storyline that she is prototyping with students right now.

Also, we realize that zoom fatigue is real and the era of CoVID is getting old. However, we invite you to engage in this series as an opportunity to build a community of practice around some of these big outdoor education ideas. Feel free to introduce yourself via flipgrid ahead of time (should just be a button click and record and also offers a cool student engagement tool to try out 🙂)!

Please let me know if you have any questions and we look forward to seeing you! If you need continuing education credit for the series, do not hesitate to reach out and we can work out a game plan.

Kate

We had the second Tea and Tapas live on March 16, 2021 and also posted to the WCEE Youtube Channel.

Event 2: March Tea and Tapas: Outdoor Storylines via Maple Syrup, Raspberries, and Ecological Succession (WCEE Youtube Channel)

Description:

Raspberry Buds and Spring Syrup: In this session we'll connect to seasonal memory classics of tree syrups and berries to explore storylines of fire and ecological succession. These memories can form relationships to places that stick with you and students for a lifetime.

0:00 Welcome and Tea and Tapas

1:50 Seasonal Reminders -- Tea and Tapas featuring Raspberry buds, leafs, and fruits, Maple syrup, and Deer venison

8:50 General Themes

9:37 Tea and Tapas Storyline Example: - Inquiry as a driver to understand Place

14:00 Place-based Storyline: General Intro

16:00 Next Generation Science Standards Intro (Natalie Weeks): "students become part of the story"

18:30 A Tale of Two Systems and Ecological Design

19:40 Be a Tree and Apply Storyline Concepts to You

21:09 Succession: Where in the succession line-up are you?

22:04 A Multi-disciplinary Maple Nation Storyline Example

23:00 Maple: Intergenerational Ecocultural Relationships -- Maple Grove Example

27:10 Maple: EcoCultural Storylines -- Diverse Roots (EuroAsian, Menominee)

28:50 Maple: Indigenous Land Acknowledgment -- older Place-storyline

31:13 Maple: Techy option (WI Community Tree Map)

31:51 Maple: Building Place Storylines--Tap a Tree Anywhere!--urban street trees to thick woods

35:00 Maple: Syrup Producers and Climate Change

35:33 Maple: Forest Products Storyline

37:30 [Transition] Other Spring Storylines

39:25 Justice Break--www.muchcitylove.com/teaandtapas

44:14 The Big Scale: Fire Case Study--A Story of Time and Change (via Raspberries) and Succession

44:47 Geologic Glacial Time Scale

45:09 WI Fire Disturbance Cycles

46:14 Succession Definitions

46:22 PLT Nothing Succeeds Like Succession

46:45 Shade Intolerant/Shade Tolerant

47:14 Disturbance

47:28 Fire Scale Factors at Different Scales

49:28 Wildland Fire Kit

50:15 NGSS WI Fire and our Forests

More Resources: https://docs.google.com/document/d/1kg77Tao-pr2_V86ERWJZTk5RTLZuy16dgF2DkMbRSg4/edit?usp=sharing

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In this sense, the Tea and Tapas represents a kind of method. Its very structure and themes are built from seasonal happenings tied to food that embody ecocultural relationships. It represents a seed for what I've been thinking about in my thesis work and practiced in an applied educator professional development arena. While Tea and Tapas isn't the full-blown BIG picture aim, it is a successful variation with high potential for continuing into the future or using parts of it in other professional development opportunities or curriculum bundles. It definitely includes important ideas on translations

of ecocultural calendars in a place-based education context. It also helps me continue growing the idea in iterative and co-created contexts.

Action-Reflection on the Larger Process

In this practice-based voyage translated to dissertation form, I would like to apply self-reflection methods in one example of how socially-engaged art work is enacted through the practice and how the iterative nature allows co-creation. This uses the written form as a space for documenting the events, and more broadly, for reflection—action reflection. It does not take a form of typical academic written article and is informal at times.

For me, a big idea in reflection is to take a look at where I began and see where I'm going. So the beginning:

I set out at the University of Minnesota with the intention of understanding "healing landscapes." This is not a central or dominant "I" or "my" or "me" but a recognition of my positionality as an artistic change agent (see Chapter 1).

Here was the starting point (from my admission essay):

> While discussing education, sustainability, and forests at a recent leadership meeting, one of my elder mentors, Dr. Jerilyn Grignon—the first Menominee to get her PhD—said, "Communities must come together to change the way we produce knowledge." Correspondingly, my long-range career objectives seek to facilitate the use of multicultural permaculture landscapes geared specifically toward public education and learning designs in the face of novel climate change ecosystems. The learning would focus on the understanding of healing landscapes, complex systems science and other ways of knowing. Understanding, and being deliberate about, the link between the environment and human actions (practices and values) is crucial in recognizing patterns to reciprocity, sustainability, health, and equity (Kimmerer 2013) in relation to climate change scenarios—biogeochemical, sociopolitical, as well as cultural.

In this sense, I believed in constructing the problem as a spatial and participatory knowledge production problem, making it visible in a major knowledge production epicenter, academia.

I was coming off a stint as Sustainability Education Coordinator with the College of Menominee Nation where I had been practicing facilitating learning environments. From my admission essay:

> My proudest moment as a mentor, however, was during a presentation given by my undergraduate Sustainability Education Intern at the State University of New York's College of Environmental Science and Forestry. In her words, "I learned how to become the director of my learning and take steps to connect that directorship with my community and the world." I am so proud of this comment because I am something of a learning nerd. I don't mean learning in general, but "learning" as an active concept that facilitates people, spaces, groups, and institutions to embody engaged participation and responsibility. This includes:
>
> - how to systematically facilitate more engaged relationships in a learning system which functions on differences of perspective and that fosters breadth (rather than one "right" answer in a technical area of expertise)
> - applying, experimenting with, reflecting on, and experimenting with again the creation of adaptive learning environments that couple ways of thinking with ways of doing.

By sharing my own starting point on the thesis journey as an introduction, we can relate it to what emerged/is emerging through practice, iterative cycles, and co-creation at the end of the thesis journey. In the meantime, I had become redefined as an educator and artist—at least for a class presentation.

Specifically, I was introduced as an artist, educator and PhD candidate in a week whose theme was wildfire and drought. I used fire succession and outdoor memories to create a practice-based virtual education workshop. I had been thinking about change (lessons from stories of place, forests, and succession), seasonal storylines, and ecocultural

connections in my practice which most recently included Tea and Tapas sessions (see above) and Climate Change, Justice, Literacy: Ecocultural Calendars (Flick, WI Water Week Conference, 3/8/21, https://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/programs/convention/2021/default.aspx). Following a storyline on being a socially-engaged artist/educator—a practitioner—also meant critical reflection upon implications for defining my practice to others. The need: a whole audience of undergraduate students that had been/would be getting exposed to different ways of making sense of climate change through art, science, and place-based lenses.

It was also a full circle manifestation of the PhD process as the class itself was a "product" of some of my work as sustainability education graduate assistant. I connected some folks, TAed, helped develop the syllabus, and now it's gone through a few iterations. Here's the syllabus course description:

> Course description: It is widely understood that the 'grand challenges' facing humans must be addressed by collective action, i.e., concerted efforts across a range of societal sectors. Therefore, a critical question is this: how can society build capacity for collective action? Such capacity can be construed as 'collective agency', i.e., the ability of a group to freely choose a course of action, to marshal power to implement the action, and to collectively evaluate and learn from the outcomes of action.
>
> In this course, together we will explore the role(s) of artistic/humanistic ways of knowing, in interaction with scientific ways of knowing, as tools for creating collective agency to address grand challenges. We will focus on how artistic/humanistic ways of knowing can enable groups to make sense and meaning in the face of grand challenges. By integrating disciplines and perspectives that focus on the "how and what" of grand challenges (including but not limited to science), groups are better able to make sense of, and determine the meaning of, grand challenges in their inherent complexity, and thereby to choose a course of action, implement it, and evaluate and learn from outcomes of action.

> By putting grand challenges such as climate change into a place-based and agency-focused perspective via the integration of scientific, artistic, and cultural ways of knowing, we will expand our understanding of how humanity might address grand challenges. This expanded understanding builds a foundation for a life in community that does not shy from grand challenges, but instead strives to engage and address them.

So how could I define my practice to these students who were an emergent version of a course I helped create and represented a reflection, in part, on my PhD process? I find generally, when a person introduces their practice/work to others, it can pose a continuum of difficulty in terms of explanation and the other person/people understanding the practice/work—from easy to hard and everything in between. Defining a practice, or career, as a socially-engaged artist is a little more difficult in the sense that it is not so well-defined or widely known, but none-the-less relevant for working in many different fields and disciplines. When you're growing up, you don't encounter a lot of people saying, "I want to be a socially-engaged artist." Doctor, teacher, lawyer, farmer…those come a little bit easier (though I recognize there is ample nuance in practice within those more common categories). That said, I find it can be powerful to think of oneself as a socially engaged artist and put a label to this work. When people ask what I do, I would like to officially add "socially-engaged artist" to the potential lexicon and explain what this means to me as an example of iterative practice. So:

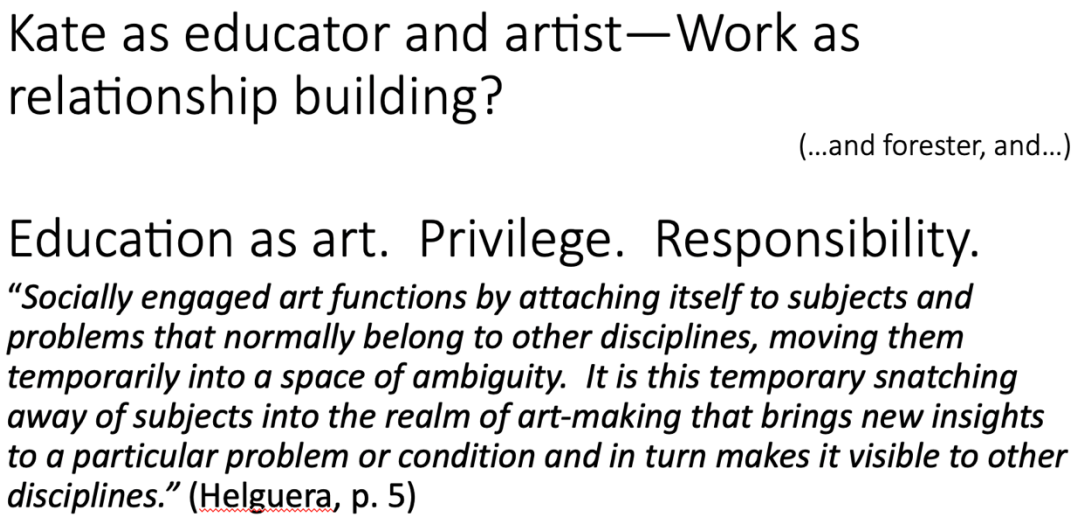

Figure 10: What is my practice? From Making Sense of Climate Change Class Presentation – 3/18/21

Having to fill the spot as an educator and artist was a perfect description as I had to think about what being an artist and educator meant. I am still thinking about it. I threw out the idea of relationship building as one of the main foci of the works. (For this presentation, I was also drawing on my forester knowledge so also included that.) What was my work, reflectively? When considering myself a socially engaged artist or practicing socially-engaged art, I reflected on my practice in November 2019 as part of my written preliminaries.

> I consider myself in my practice probably most strongly an educator/learner. This is not a teacher (as my family might interpret my work) in the traditional sense. To be an educator, I feel I need to be a nerd and social/environmental activist who thinks outside the industrial model of education and is open to the many realities that exist in our world (both human and non-human). I need to be a healer, as we need educators and learners to teach ways of being that are outside our destructive colonial lens.

While wearing a hat as a PhD student this looked something like this, reflective of my positionality as a PhD graduate student working in sustainability education, as a

researcher, and a teaching assistant to various classes. While I wear the hats in different fashions, this positionality also stays embedded in my work.

A Call to Challenge Who and How Is Included in Climate Change

For a felt-perspective critique of non-diverse knowledge production in the form of spoken word, Listen HERE. It is reflected above and derives from citation. The written version is included in Appendix 1, but it is highly advised to listen as that was the form intended. I seek to acknowledge the felt exclusionary nature of studying climate change sciences in academia's knowledge production. I would also like to point out the historicity of the western scientific knowledge production scheme and implications for the past, present, and future of what we know. I use a spoken word communication format to play with and push ways of knowing, expressing, and gaining legitimacy in academia in climate change sciences.

In fact, as we think about climate change, most people, regardless of race, class, age, training, etc. can observe and produce knowledge on climate changes in their world. See Exhibit 2: What is Backyard Phenology? here: (https://www.youtube.com/watch?v=-AjrqO-emjY). This audio-animation stems from an artscience collaboration, the Backyard Phenology Project, that collected over 600 interviews in a camper converted to an audio-recording study dubbed the Climate Chaser. It had many volunteers and traveled to various community events to understand about what people have been noticing changing in the seasons and cycles. I used a small sample of these recordings with hand-drawn animation to express the idea that bicultural stewardship and knowledge production about climate changes in one's environment are not excluded to a small worldview to produce knowledge about and for climate change. In fact, it is something to which we all can connect--especially through the language of observing Place and felt phenomenology, often nascent from western science. The animation presents a different way of understanding legitimate knowledge production and community power within climate change discourses and academia.

Now [present moment], in a co-creative and iterative fashion, I am co-wearing a K12 sustainable forestry education outreach specialist hat but thinking about similar

climate change, community knowledge production, and co-creation—just practicing with a slightly different audience and a slightly different professional purpose.

Now, I was thinking about socially-engaged educational art practices as a generative storyline with "ah ha" moments and phenomenon to explore, linked to national K12 standards. For example, in March Tea and Tapas, Natalie Weeks shared a place-based Fire and Our Forests Storyline (Next Generation Science Standards) as one example of a scientific storyline based on student inquiry and interpretation of multiple forms of data; but I also was interpreting storyline more broadly—almost as a call to place-based animacy.

Specifically, an educator/learner *practice* places an emphasis on the craft of both learning and sharing information. Or said, more reflexively: [especially in an "information age"] what information becomes the most important for me to translate through socially engaged education art practice? The "pursuit of education" as art can become braided to place and values, so that education itself is a privilege: to be in a learning environment in which you are gifted teachings that grow and can be passed along in your own learnings and value practices. It also becomes a real responsibility to do justice to the work and its manifestation in facilitated educational practices. For me, the responsibility really came in when thinking about my work being an amalgamation of community knowledge and honoring those teachers and those teachings, and to keep learning and practicing myself! When education is seen as an art, this respect and responsibility becomes central.

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Appendices

Appendix 1: Spoken Word

Kate's account:

So here's a little piece. While I'm PhDing, critiquing. My experience, and how I lived it. I ask you, to talk back and tell it. Biocultural stewardship. How's it? Share your voice. What's your choice? What does it mean, outside the lines? Relational nature. Community structure. Ethical stature. What lacks here?

Hear. Here. Here's me.

My name is Kate. I'm from the lakes. Wake up. Not woke up.

It's a process, against colonial progress, I try to transgress. Not an end, or a trend, but an assess. Where I'm at, who I be, in relation…Trying to see. Climate change tracing.

Climate change is, a grand challenge, that needs lenses, to understand and adapt (IPCC 2014). Yet, many approaches, remain grounded in past fact, a single way of knowing: the Western science framing, with a value-training based, predominantly, on disciplinarity, objectivity, reductionism, and the "cult of the expert." (Smith 1999, Boyte 2009).

Academic speak. What is we? Or…see…

Knowledge production, and who is inclusion—particularly, in terms of, gender, race, and different ways--impact what we make, what we see, and how we trace. Knowledge production in this western scientific reduction has been dominated by white male deduction which comes implicitly and explicitly from that worldview, those few.

There are many views and ways of knowing. Growing. In one, limited, but powerful example, just a sample, ~~Baum and Martin (2017) sample a recent article by Courchamp and Bradshaw (2017)~~ that describes the "100 Top Articles Every Ecologist Should Read," these other people critique, say and see, what's that? Wait a sec. Who's telling it. ~~They found in their critique that~~ . 97 of the 100 suggested citations, are written by white males, two (ranked last) first-authored by females, and one, first-authored, by a person of color. Colored more by

a view, that 22 of these few are first-authored by only three white dude true. What's that for a worldview?

These limitations lead to a foundation that lacks. It's slack. Or whack. Mmm that…be sick. A non-diverse listdom, that lacks wisdom of much potential ways, of seeing-being-facing climate change that requires diverse views of place and change-making.

So, let's move a bit outside the frame of knowledge translated and gained—a way towards orality as a succinct reality. An experiment of movement. A critique, eek. of western science, where sustainability lies.

A limit, of western ways, to grasp and respond to climate change, because of its small worldview that abstracts humanity and collects from a few.
To put it simply, we be living unsustainably. The status quo. Whoa.
Our ways of knowing, educating, producing knowledge are not cutting it.
The planet?...It's got it.
We're talking humanity, futurity,
and all that's lost in our progressive greed. Ethical shift, is what we need.
Knowledge now. Wow.
It's destructive. Self-deductive. It's distressed. Sssss…Cuz it…
Has a moral underpinning, a beginning,
Of Adam and Eve. Of what we conceive. Heaven and Hell.
Right and wrong. Eve bring us down. Oh well.
Dichotomous. Like that suits most of us.
There be the snake. Devilish wake. You think you're immune? From your objective room?
Jesus was white? cuz brown wasn't quite,
Human.
Is that, really? True man?
Then why is it true, when we look at you. Those who are you.
Are white,
men.
Mostly. Truly.
Knowledge production. Power construction.

Must I be you?
See…I got a different way of speaking, knowing, doing, learning, including,
Truing.
You. You.
Don't listen.
Lacks citation. Oh well. That be assimilationist hell.

What if, oh well,
I know plants.
For humans who lack
Healing.

Burn me? (witch).
Exterminate me? (Indigenous).
Or better yet, put me in chattels, cuz of your fact tells. Slash that whip. Oh well.
Knowledge builds. From these legacy guilds. But what shall we do? To include them?

You, you. Up in your room…don't think it's true. But exclusion is you.
I got, to…
talk like you, walk like you, fact like you?
You, you. There in your fort, in which I consort. Must I be you?
True Ecology. Sustainability. Reality.
Has many sees. In me,
Climate changes, are me.
Traced in Place. Give me some space.
Here's how I feel, feel, feel. In your assimilationist reel, reel, real.
But, maintain your systems. Keep up with the symptoms.
Knowledge production. Power construction.
Must I be you?

You, you. Up in your room.
You got me angry critiquing.
Must I be you, then? Can't I be healing?