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A WATERSHED APPROACH TO CO-CREATING JUST SUSTAINABILITIES: REFLECTIONS FROM THE LAKE SUPERIOR LIVING LABS NETWORK

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Abstract

Campus-community partnerships are well-positioned to play a role in advancing social and environmental justice in the context of our rapidly changing and increasingly inequitable world. Across the Global North, post-secondary institutions, civil society organizations, and communities are partnering to establish living labs by integrating research, teaching, and community engagement to advance regenerative social-ecological systems. Living labs aim to co-create innovative solutions to complex challenges through interdisciplinary, placed-based experiential learning and community-engaged action in the built and natural environments. In this paper, we focus on the potential for living labs to establish connections between people and communities and increasing the impact of place-based activities focused on social and environmental justice and sustainability, also known as just sustainabilities. We reflect on our collective experiences working with the Lake Superior Living Labs Network (LSLLN), a nested network of living labs collaborating across the Lake Superior watershed. The LSLLN was established in 2018 as a platform to connect academics and community groups across Canada, the United States, and multiple Indigenous territories, with the goal of developing and expanding partnerships and place-based collaborative initiatives grounded in the Lake Superior watershed as a social-ecological system. Drawing on these insights, we consider the possibilities for a watershed-based approach to living labs. We conclude with a discussion that suggests that nested and networked living labs have the potential to enhance relationships and increase the impact of place-based social justice and sustainability-related activities, while pointing to several limitations of working within existing institutional structures.

Keywords: environmental justice, Lake Superior, living labs, social justice, sustainability, watershed, discontinuity thinking

The most prominent challenges of the 21st century are complex and interrelated. Issues such as the climate crisis, poverty, and health inequity cannot be understood outside historical and contemporary socio-ecological relationships, the conditions of capitalism, and settler colonialism, as well as the fractured relations among human and more-than-human communities (Whyte, 2018; Marya & Patel, 2021; Stone et al., 2021). Overly simplified solutions risk reproducing and intensifying existing power dynamics along with subsequent vulnerablization of particular communities (Bryson et al., 2006; Lawrence, 2010). Narrow and siloed ways of thinking have shaped the resultant cultures of action and inaction in societies across the globe (Haiven, 2014). Addressing these issues necessitates an interconnected approach rooted in interdisciplinary and intersectoral relationships and social and environmental justice.

Campus-community partnerships are well positioned to play a role in advancing social and environmental justice in the context of our rapidly changing and increasingly inequitable world (Hall, 2009; Levkoe et al., 2017). Across the Global North, post-secondary institutions, civil society organizations, and communities are partnering to establish living labs by integrating research, teaching, and community engagement to advance regenerative social-ecological systems (Leal Filho et al., 2019). Living labs aim to co-create meaningful solutions to complex challenges through interdisciplinary, placed-based experiential learning and community-engaged action in the built and natural environments (Soetanto & van Geenhuizen, 2011; Graczyk, 2015). In a broad scoping review of the scholarly literature, Galway et al. (2021) identified that living labs with sustainability-related goals aimed to "test and experiment with place-relevant social and technological solutions/transitions" and are "creating learning environments/spaces and opportunities for collaboration among diverse participants" (p. 7). While most living labs work within a particular place, some are becoming increasingly involved with collaborative networks across geographies (Leminen, 2013;

European Network of Living Labs, 2022). While this is an evolving area of practice, there has been little scholarship exploring how these networks function along with the values and theoretical foundations underlying their work.

To address this research gap, our paper focuses on the potential of living labs to establish connections between people and communities and to increase the impact of place-based activities focused on social and environmental justice and sustainability, also known as just sustainabilities (Agyeman et al., 2003). We reflect on our collective experiences working with the Lake Superior Living Labs Network (LSLLN), a nested network of living labs collaborating across the Lake Superior watershed. The LSLLN was established in 2018 as a platform to connect academics and community groups with the goal of developing and expanding partnerships and place-based collaborative initiatives grounded in the Lake Superior watershed as a social-ecological system. The LSLLN aims to increase the impact of sustainability-related activities with a focus on issues at the nexus of water, land and food, climate and energy, and individual and community well-being.

The authors of this paper are LSLLN Steering Committee members and are active in community-based research, teaching, and action through one or more of the hubs across the Lake Superior watershed. The research for this paper is based on engagement with relevant scholarly literature, our personal experiences as well as a collective review of LSLLN reports, newsletters, annual participant surveys, and ongoing reflective conversations among the authors. The content of the paper evolved from several virtual meetings where the authors shared reflections on their experiences, the materials reviewed, and discussed emerging themes. We each prepared different sections of the paper and shared them with the other authors for comment, editing, and revision through several drafts. We write this paper using a collective voice based on our shared reflections and experiences. For more on the theory and practice of collective writing within academic scholarship, see Peters et al. (2021). Our intention is to describe the work of the LSLLN and how it functions as a nested network of living labs along with

the values and theoretical foundations underlying our work towards just sustainabilities.

Our approach to the theory and practice of collaboration through partnerships used in this paper draws on research and practice of living labs and community campus partnerships. Living labs have been developed to address a wide range of issues and are generally understood as an approach to bringing people and organizations together to engage in collaborative research and action focused on a particular set of sustainability-related issues or opportunities (Puerari et al., 2018; Bronson et al., 2021). Purcell et al. (2019) highlight the importance of collaboration: "A 'living lab' is defined as a situation or circumstance where real-world sustainability challenges are formally addressed in *stakeholder partnerships* . . ." (p. 1345, emphasis added). In a scoping review, Galway et al. (2021) point to co-creation as a common and central feature of living labs. This refers to the ways partners work together to create and share knowledge and take action. Taking this even further, Omrcen et al. (2018) suggest that a living lab "provides a focal point around which stakeholders can work together, generating communities of interest that may well outlive and transcend the living laboratory itself" (p. 161). These approaches to living labs align closely with community-campus engagement and the value of meaningful and mutually beneficial partnerships that have real impact for communities (Cronley, 2015; Peacock et al., 2020). In this paper, we expand on the living labs and community-campus engagement approaches with a focus on watershed-based partnerships across nested scales and apply them to our study of the LSLLN.

In the following section, we describe the context for our work across the Lake Superior watershed. To move beyond discontinuity thinking - that is, disconnection, categorization, and siloed approaches focused on control and profit - we explore scholarship focused on building meaningful relationships through living labs, engaging just sustainabilities, and co-creating nested partnerships. We then present an overview of the LSLLN and describe its structure along with examples of various projects and activities. The first set of examples focuses on projects that highlight place-based

collaborations in each of the four hubs; the second set of examples describes cross-hub activities that bring the people and places together across the Lake Superior watershed. Drawing on these insights, we consider the possibilities for a watershed-based approach to living labs for countering discontinuity thinking. We conclude with a discussion that suggests nested and networked living labs have the potential to enhance relationships and increase the impact of place-based social justice and sustainability-related activities; however, we point to several limitations of working within existing institutional structures.

Context of the Lake Superior Watershed and Moving beyond Discontinuity Thinking

Lake Superior is the world's largest freshwater lake by surface area and the most northern of the Laurentian Great Lakes. Spanning Canada, the United States (US), and several Indigenous territories, it collects water from more than 200 tributaries (see Figure 1). The expansive coastline and more than 2,500 islands support a diversity of wildlife including rare and endangered species of birds, amphibians, and mammals, along with more than 30 native species of fish (The Lake Superior Partnership, 2016; Langston, 2017). The region is a transition zone between mixed boreal and deciduous forests along the southern shore and predominantly boreal forest on the northern shore of Lake Superior (Goldblum & Rigg, 2010). For many Indigenous and settler communities, the Lake is a vital part of their identity, sense of place, cultural heritage, wellbeing, and livelihoods. People living in the region depend on the Lake for food, drinking water, economic development, transportation, ceremony, and recreation. However, Lake Superior is under significant ecological stress from chemical contaminants, several substances of concern (e.g., microplastics and mercury), overfishing, invasive species, habitat degradation, and climate change (McLaughlin & Krantzberg, 2012; The Lake Superior Partnership, 2016).

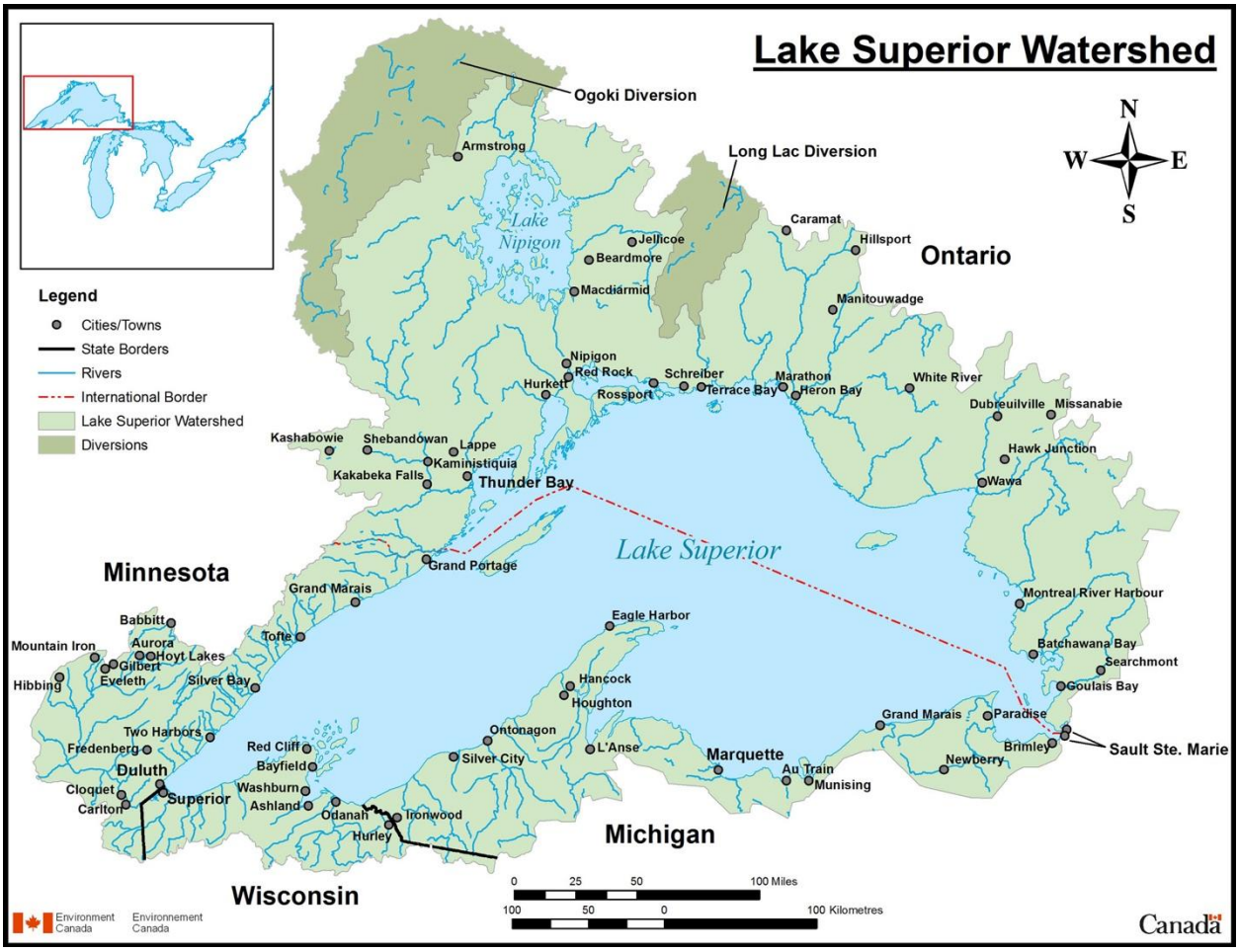

Figure 1: *Lake Superior Watershed*

Source: Environment and Climate Change Canada. Note: This map was developed by the Canadian Federal Government and represents a settler perspective of the Lake Superior watershed. The authors recognize that the map fails to represent Treaty areas, Indigenous reserve lands and/or traditional territory. For more information about Indigenous territories, language, and lands, see https://native-land.ca/.

The anthropocentric and technocratic management of the Lake Superior watershed is heavily impacted by discontinuity thinking - that is, disconnection, categorization, and siloed approaches focused on control and profit. This dominant approach is rooted in capitalist and settler colonial logics and subsequent policymaking that has led to land dispossession, social inequities, and the destruction and degradation of ecosystems (Berkes, 2010; Snelgrove et al., 2014; Nunn, 2018). Discontinuities are embedded in dominant systems of policy and decision making and are used to maintain power and control for select groups (Swadener & Mutua, 2008). The ongoing settler colonial

project depends on the separation of people from each other and from nature (Dockry et al., 2016). Hunt (2014) refers to these landscapes as "colonialscapes" governed by a series of political structures and institutions through a division of labor and capital. This is incongruent with Indigenous ways of knowing that conceptualize human and more-than-human communities as integrated wholes that share a reciprocal obligation to care for one another (Jostad et al., 1996; Johnston, 1990).

The lands and waters that were once connected by kinship have been increasingly divided by private property and political boundaries (Daigle, 2018). Within the Lake Superior watershed, discontinuities such as jurisdictional borders, private property designations, and conservation efforts that ignore the relationships between people and the more-than-human world serve to segment and segregate land, placing control within state regulatory and legal structures. For example, in Canada, First Nation land is limited to federally controlled reserves as part of the 1876 Indian Act (Indian Act, 2019), thereby allowing colonial access to resources in the wider, non-reserve traditional territories. In the US, the complicated, contradictory, and often neglected legal and political adjudication of American Indian Law has allowed governments, companies, and institutions to access, extract, and degrade tribal reserved lands and resources over the past century (Deloria & Wilkins, 1999). Nevertheless, Indigenous communities continue to defend state recognition of their legal authority to hunt, fish, and forage in treaty lands beyond reservation borders (Gagnon, 2016; Lowitt et al., 2019). Further, Indian residential schools located in the Lake Superior watershed (Steeves, 2022) forcibly separated children from their cultural roots, land, families, and communities (Shingwauk Residential School Centre, 2019). These activities have been a central part of physically removing Indigenous people from their territories and replacing them with a settler population while undermining culture and cohesion more generally.

Pollution of land and water have resulted in devastating impacts on the ecosystems and the people who depend on them for survival. Extractive industries such as mining and logging have not only left chemical toxins in the soil and water but have also cut off

access to land and threatened species' ability to produce, forage, and harvest foods (Daigle, 2018; Nunn, 2018). The Great Lakes Water Quality Agreement (Government of Canada, 2012), initially established in 1972 with subsequent amendments, led to the identification of several Areas of Concern (AOC) in the Lake Superior watershed for environmental Remedial Action Plans (Jackson & Brander, 2000). For example, the St. Louis River AOC in Duluth, Minnesota was a result of pollution from wastewater and landfills that contaminated sediments with mercury, dioxins, polychlorinated biphenyls (PCBs), and polycyclic aromatics hydrocarbons (Environmental Protection Agency, 2022). The Torch Lake AOC near Houghton, Michigan was a copper mining centre that produced waste products related to industrial milling, smelting, and leaching operations, as well as large volumes of finely crushed rock called stamp sands; additional containments in Torch Lake include heavy metals, PCBs, and polycyclic aromatic hydrocarbons (State of Michigan, 2022). Contaminants in steel mill and paper mill effluent, wastewater, and stormwater runoff created the St. Marys River AOC in Sault Ste. Marie, Ontario (Bi-National Public Advisory Council, 2022). An AOC near Thunder Bay, Ontario has been caused by water contamination from the forest products industry, waste disposal, and urbanization (Environment and Climate Change Canada, 2022).

Several health impacts and inequities have been attributed to resource extraction activities such as industrial development, mining, and forestry (Tobias & Richmond, 2014) and have been justified through discontinuity thinking. Mercury contamination (International Joint Commission, 2015), aerial spraying of herbicides (White, 2019), oil pipelines (Jonasson et al., 2019), and mining (Kemble, 2013) are just a few examples of ways that communities have been threatened, disrupted, and dispossessed. According to Nunn (2018), these activities have also contributed to ongoing intergenerational trauma among Indigenous peoples and increased numbers of Missing and Murdered Indigenous Women, Girls, and Two-Spirit peoples. Furthermore, the boom-and-bust resource economy has left many people struggling to make ends meet (Lankton, 2010). Lake Superior once had an active fishing industry, but currently, there are only a few commercial fishing enterprises left, with most of the harvest exported

to the United States (Lowitt et al, 2017). Fish stocks across the Lake have been reduced significantly due to overfishing, pollution, and presence of invasive sea lamprey (Hienrich et al., 2003).

These challenges, created and amplified by discontinuity thinking, are interrelated and wide-reaching. As such, solutions require approaches that build and grow partnerships with diverse communities, integrate different perspectives, and are rooted in the historical and modern context of specific places and relationships (Snelgrove et al., 2014). We point to three possibilities to counter discontinuity thinking that are especially relevant to our collaborative work in the Lake Superior Watershed: 1) Building meaningful relationships through living labs; 2) Engaging just sustainabilities; and 3) Co-creating nested partnerships across watersheds. Following the description, we apply these possibilities to the work of the LSLLN by sharing a series of place-based and cross hub examples.

Building Meaningful Relationships through Living Labs

Individualism and isolationism are at the foundation of discontinuity thinking. As people and organizations work in a segregated manner, they engage in processes that ignore the broader influences and implications of their activities (Snelgrove et al., 2014). Addressing complex social-ecological problems requires interdisciplinary (e.g., involving multiple types of people with a range of experiences, areas of interest, and knowledge), and intersectoral approaches (e.g., collaboration between different types of organizations and areas of focus such as health, education, research, and social services). Research demonstrates that meaningful community-campus partnerships can play a role in breaking down these kinds of barriers and creating mutual benefits for all those involved (Buys & Bursnall, 2007; Butcher et al., 2011). Recognizing the sordid history of academic-community relations that have privileged academic researchers, some current community-campus partnerships are intentionally collaborating in ways that resist the seclusion of post-secondary institutions from the "real world" (Bortolin, 2011). One promising way this is happening is through living labs.

Living labs are a way for researchers and community partners to conduct research and action projects *in vivo*, based on learning-by-doing and an integration of research and innovation in real world situations (Svensson et al., 2010; Galway et al., 2021). Instead of engaging in projects in an isolated, de-contextualized setting, living labs are intended to create dynamic spaces where ideas and solutions can be co-created through partnerships between interdisciplinary scholars and communities in real world environments to foster meaningful relationships, learning and action (Folstad, 2008; van Geenhuizen, 2013; Dell'Era & Landoni, 2014). They aim to build long-term relationships through collaboration, experimentation, and co-created innovation rooted in place-based learning and doing. Living labs have been used to improve sustainability-related infrastructure and address institutional sustainability goals and social responsibility, among other goals and objectives (Evans & Karvonen, 2014; Evans et al., 2015). Examples of methodologies utilized within living labs projects include participatory action research, social network analysis, and context mapping-based approaches (Svensson et al., 2010; Budweg et al., 2011; Dell'Era & Landoni, 2014). University faculty and staff have typically acted as primary leaders for living labs, because they tend to have the resources, infrastructure, and stability necessary to generate new models of collaboration with community partners over time (Soetanto & van Geenhuizen, 2011; van Geenhuizen, 2013). Despite these advancements, a scoping review from Galway et al. (2021) demonstrated that living labs aimed at addressing sustainability-related challenges and involving universities as key collaborators have also been limited in their work around interrogating governance, implementing co-creation, and working towards social and ecological justice.

Engaging Just Sustainabilities

Beginning in the 1960s, environmental justice (EJ) evolved from the civil rights movement as Black communities in the US argued that the distribution of hazards disproportionately and unjustly impacted marginalized (often racialized) populations (Mohai et al., 2009). There have been concurrent EJ movements of racialized communities mobilizing to protect their health and wellbeing, namely Chicano/a and

Latino/a farming communities fighting unjust exposure to pesticides, and Indigenous movements fighting to protect their fishing, hunting, and gathering rights; sacred sites; and sovereignty from fossil fuel pipelines, mines, nuclear testing and waste sites, and military development (Agyeman et al., 2016). Importantly, the EJ movement demonstrates that disproportionate environmental and health impacts on marginalized populations were the result of capitalist, colonial, and oppressive ideologies along with policies that continue to increase the vulnerability of those already marginalized (Grant, 2017). Over the past five decades, the EJ movement has continued to use grassroots organizing to challenge the unjust and unsustainable realities for people, while the environmental and sustainability movements simultaneously rose to prominence to protect the environment (Agyeman et al., 2002; Schlosberg, 2007).

It was against this backdrop that Julian Agyeman and colleagues argued that environmental advocates needed to recognize the interconnections among the social injustices that accompanied ecological degradation – in other words, the sustainability movement needed to embrace *just* sustainabilities (Agyeman, 2008, 2013; Agyeman et al., 2002, 2016). Agyeman et al. (2003) describe just sustainabilities as "the need for a better quality of life for all, now and into the future, in a just and equitable manner, whilst living within the limits of supporting ecosystems" (p. 5). The use of sustainabilities (in the plural) makes the case that sustainable and socially just solutions to challenging problems will not be one-size-fits-all, but rather "…acknowledges the relative, culturally, and place-bound nature of the concept" (Agyeman, 2013, p. 5). Just sustainabilities is an approach to addressing social and environmental justice that provides guidance for working together across sectors and disciplines to challenge discontinuity thinking.

Co-Creating Nested Partnerships Across Watersheds

A third approach to countering discontinuity thinking involves co-creating nested partnerships across watersheds. Watersheds are spatially bound geophysical units, also known as drainage basins or catchments, where water from tributaries drains to a

common water body, providing natural boundaries between different drainage areas (Morrison et al, 2017; Jenkins et al., 2018). Watersheds provide settings that often require trans-jurisdictional, trans-disciplinary, and intersectoral collaboration to accomplish goals related to shared resources, challenges, and opportunities (Morrison et al., 2012; Parkes, 2016; Jenkins et al., 2018). Typically, watershed collaborations have been focused on water resource management, engineering, and ecology to respond to challenges related to shipping, hydropower, development, flooding, drought, recreation, restoration, and biological and chemical pollution (Morrison et al., 2012; Morrison et al., 2017). More recently, interdisciplinary scholars have suggested that watersheds should be conceptualized and utilized as settings for health, sustainability, and justice (Kolok et al., 2009; Bunch et al., 2011; Morrison et al., 2012). In this way, watersheds can also be conceived as social-ecological units and shared settings for collective work, co-creation, and learning (Parkes, 2016).

Although conceptualizing watersheds as social-ecological units is underdeveloped (Morrison et al., 2012), the idea of flow and movement and the upstream/downstream characteristic of watersheds provides a framework for examining and addressing interrelated issues of just sustainabilities. Watersheds have nested networks of smaller watersheds within larger watersheds and offer multiple spatial scales to understand and address complex challenges. This nested characteristic also offers a link between local, regional, and transnational human scales, and the more-than-human. Because watersheds are largely determined by geological and ecological processes, larger watershed boundaries are slow to change (without human interference) and therefore provide a timescale that is intergenerational. Understanding watersheds as complex social-ecological systems demands the recognition that "humans are part of the system and not external to it" (Scown et al., 2017, p. 5). These characteristics point to watersheds as an ecologically relevant setting within which to address multiple environmental, social, and health objectives and to provide a basis for collaboration across many boundaries (e.g., disciplines, sectors, and scales).

The Lake Superior Living Labs Network

While there have been previous attempts to develop meaningful civil society networks in the Lake Superior watershed, partnerships are complicated by discontinuity thinking that manifests in geographic, institutional, and cultural boundaries. The LSLLN was established in 2018 with the explicit intention of building meaningful relationships, engaging just sustainabilities, and co-creating nested partnerships to increase capacity for regenerative social-ecological systems across the Lake Superior watershed. The LSLLN's overarching goal is to move beyond discontinuity thinking by establishing infrastructures to enhance collaboration through exploration of existing activities, sharing of successes and challenges, developing new joint initiatives, and establishing relationships across time and space to understand the lived realities of people and more-than-human life across the watershed.

The LSLLN evolved from relationships among several individuals and organizations that were actively engaged in community-campus partnerships. Currently, the LSLLN has four hubs: Northern Hub in Thunder Bay, Ontario; Eastern Hub in Sault Ste. Marie, Ontario; Southern Hub in Houghton, Michigan; and Western Hub in Duluth, Minnesota. The LSLLN partners represent postsecondary institutions, non-profit organizations, and Indigenous organizations (see Table 1).

Table 1. *Composition of the Four Lake Superior Living Labs Hubs*

Hub	Active Organizational Partners in 2022	Key Sectors Represented	Key Areas of Activity
Northern: Thunder Bay, Ontario	26	• Academic Research and Teaching • Artists • Campus Sustainability Office • Environmental Organization • Food Systems Organization • Food Policy Network • Municipal Sustainability Office	• Climate Action • Food Sovereignty • Health and Wellbeing • Land Based Education • Sustainable water management • Seed Sovereignty and Agroecology
Eastern: Sault Ste. Marie, Ontario	12	• Academic Research and Teaching • Environmental Organization • Regional Innovation Centre • Research Institute	• Food Literacy • Food Sovereignty • Climate Action

Southern: Houghton, Michigan	8	• Academic Research and Teaching • Environmental Organization • Regional Development • Research Institute	• Food Sovereignty • Environmental Justice • Geoheritage
Western: Duluth, Minnesota	20	• Academic Research and Teaching • Academic Extension • Agricultural Network • Artists • Campus Sustainability Office • Environmental Organization • Folk School • Municipal Sustainability Office	• Climate Action • Food Sovereignty • Just Energy Transition

Together, LSLLN participants work to develop collaborative capacity through experimentation with relationship-centered processes and projects that enable meaningful regional partnerships and action (see Figure 2).

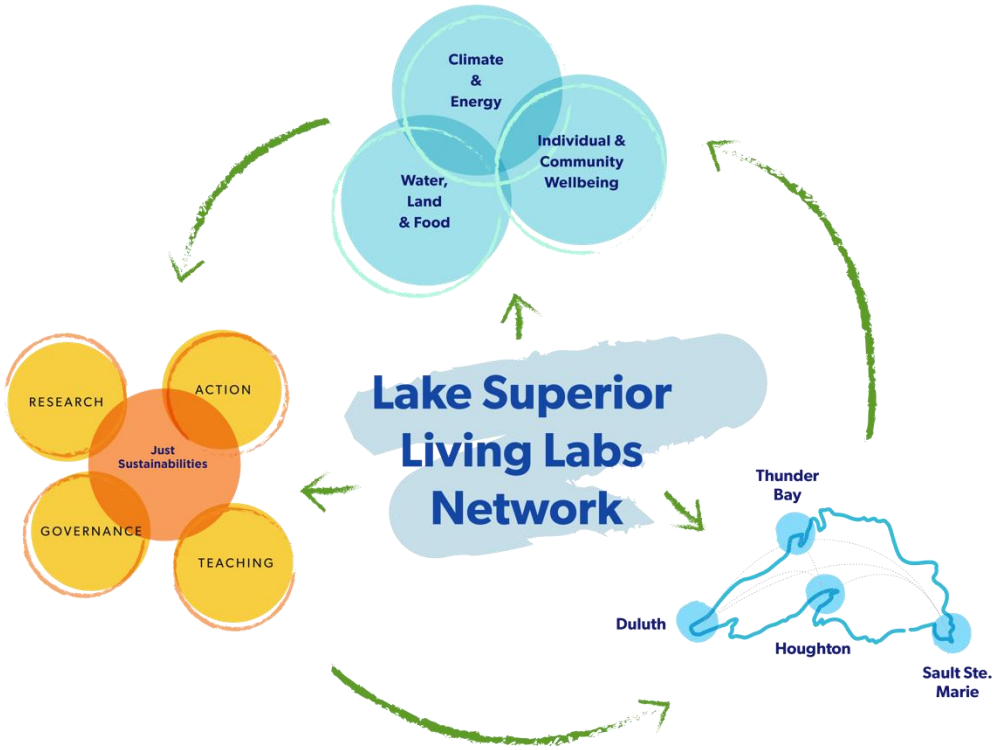

Figure 2. *The Lake Superior Living Labs Network*

The LSLLN adopted a decentralized governance structure, meaning that each hub has full decision-making control of its own activities and is coordinated by one or two academic hub leads. Additionally, an academic network lead and a network coordinator support the LSLLN by convening meetings, coordinating events, creating public and internal communications, and completing administrative tasks. A steering committee made up of the hub leads, the network lead, and the network coordinator meets bi-monthly to provide a point of contact and connection. At steering committee meetings, the hub leads provide updates about regional activities, help to coordinate networking tools, and plan network-wide initiatives and activities (e.g., meetings, events, knowledge dissemination, research, and funding applications). Hub leads host regional meetings with their partners to build relationships, coordinate hub and network-wide projects, and enable knowledge exchange.

The LSLLN has received several small grants in coordination with partner organizations. In 2019, the team received funding from the Social Science and Humanities Research Council of Canada to develop the network. This funding helped to support a paid coordinator, research and knowledge exchange efforts, and community-focused events and travel. Additional funding has been received for projects and initiatives. Decisions about how to use and share the funds are made by the steering committee in coordination with the expressed needs and interests of each hub. In 2019, the Steering Committee developed a Terms of Reference document to outline the goals of the LSLLN, roles and responsibilities of partners, and guidelines for overall governance. This document was shared with all LSLLN participants for feedback and approval and is available on the LSLLN website, https://livinglabs.lakeheadu.ca/. It is a living document, growing and changing with the network over time.

Hub Activities

Each LSLLN hub has its own activities, projects, and events that are organized and developed by the participants with support from the steering committee. Many of these projects existed prior to the establishment of the LSLLN and the network has served to support, amplify, and expand these ongoing projects. This approach aims to

embrace ideas of relationship building, co-creation, and just sustainabilities. In this subsection we provide an overview of select projects taking place within each of the hubs.

The Northern Hub of the LSLLN is led by academics working with Lakehead University (located on the traditional land of the Fort William First Nation—signatory to the Robinson Superior Treaty of 1850, in Thunder Bay, Ontario) in partnership with a wide range of regional non-profit organizations. The *Agroecology and Seed Security in Northern Ontario* project is one of the living labs projects that began in 2019 and built on the relationships among university faculty, staff, students, and several regional, provincial, and national non-profit organizations. The project's goals included increasing access to ecological seed varieties adapted to northern Ontario's agro-ecosystems through participatory, farmer-led research and improving knowledge, skills, and capacity to produce healthy and sustainable food in the region. The work focused on establishing partnerships, research planning, and planting and maintaining plots for farmer-led ecological and locally adapted seed trials (e.g., carrots, spinach, radicchio, and *gete-okosomin* squash). Partners with the Northern Hub also co-created a *Digital Sustainability Storytelling* series to highlight regional just sustainabilities initiatives, share learnings, and synthesize a place-responsive understanding of what sustainability means in northwestern Ontario. The video series was crafted to share stories, encourage reflection, and invite community engagement. Additionally, the Northern Hub supported the design, development, and implementation of the *Lakehead Climate Action Park*. Located on the Lakehead University Thunder Bay campus, the park is part of a broader initiative within the community aimed at restoring and retrofitting greenspace for climate action and education (see Figure 3).

Figure 3. *The Lakehead University Climate Action Park. (Photo, Ledah McKellar)*

The Eastern Hub's efforts to build relationships with several community partners are led by faculty at Algoma University. Algoma University is located on the traditional territory of the Anishinaabe; home of Garden River First Nation, Batchewana First Nation and the Métis Nation, signatory to the Robinson-Huron Treaty of 1850, in Sault Ste Marie Ontario. The theme of food systems figured prominently, with the main projects being the establishment of a *Food Forest* and expanding the *Peoples Garden* on the University's campus (see Figure 4). Existing relationships were maintained and new partnerships formed through the LSLLN. The Algoma University campus is the site of former Indian residential schools, specifically the Shingwauk and Wawanosh Industrial Homes and the Shingwauk Residential School (Shingwauk Residential Schools Centre, 2019). The original plans for the living labs projects changed to respect a ground

penetrating radar search for possible unidentified remains of children on the campus site, which is still underway. As a result of these developments, new relationships were established to collaborate and help guide the project. For example, the *Food Forest* which was originally planned as in-ground, changed to a mobile set of potted plants, shrubs, and trees. New *People's Garden* beds were originally foreseen as raised beds built directly on the ground but changed to elevated beds so they did not disturb the underlying earth. Engaging with just sustainabilities remains a central pillar of the hub's activities, with efforts toward creating regenerative growing projects on campus, collaborating with multiple partners, and supporting wider decolonization efforts (Algoma University, 2022).

Figure 4. *The People's Garden at Algoma University*

The Southern Hub is housed at the Great Lakes Research Center at Michigan Technological University in Houghton, Michigan, located on the traditional territory of the Ojibwa homelands and established by the Treaty of 1842. Projects in this region have been created with wide-ranging community partners dedicated to research, teaching, and community engagement; themes for this work include food sovereignty and food pathways, the cultural and economic impacts of mining waste on our communities, and place-based education efforts focused on watershed literacy and stewardship. The Hub partners with the Lake Superior Stewardship Initiative (LSSI), which brings together schools and community partners to prepare students to become knowledgeable citizens with a connection to the Lake Superior watershed, actively engaged in stewardship projects in their community. Projects include invasive species monitoring, beach clean-ups, and the development of school gardens and farm-to-table school lunches. LSSI educators are offered continued mentorship, support, and opportunities for professional development including summer field institutes that explore local issues of concern such as industrial mining impacts on the community, climate change, and food sovereignty. *Local Literacy Modules* were created to center local and visitor learning on the characteristics that make this region unique, inclusive of the Lake Superior Basin geology and Indigenous histories and contemporaries that are foundational to the landscape. These resources have been used by students and faculty at Michigan Tech in a variety of courses and as a means of orienting themselves to campus. They are also broadly used as a teaching resource for K-12 educators and informal audiences. *Geoheritage* explores the varied relationships people develop with landscape and considers how geology influences politics, culture, economies, recreation, and our sense of place (see Figure 5). Geoheritage place-based learning experiences support intergenerational and multicultural learning about the Keweenaw landscape, its stories, and geology. Educators, K-12 students, community partners, and Great Lakes knowledge holders have gathered for numerous events to read the landscape and share reflections on our varied relationships within the watershed.

Figure 5. *Geoheritage Summer Field Experience - Reading the Landscape Together, Intergenerational Learning about Place*

The Western Hub, housed at the University of Minnesota-Duluth, had a focus on just energy transitions. One of the main living lab projects was the Duluth Power Dialog (DPD) that used a responsive pedagogy to empower a new generation of university graduates to become environmental protectors and community-economy innovators for the Lake Superior region's transition to renewable energy. The DPD was an annual spring event open to the public that involved civic conversation with energy experts and activists to share information about the transition from fossil fuel to clean energy. The first session in April 2016 was part of a nationwide movement of university students, faculty mentors, and the public to launch a civic conversation about local action to move forward on just, sustainable energy transitions and techno-ecological synergies. In 2020 the DPD focused on the costs citizens are left holding when utilities build new fossil fuel plants or invest in distant hydropower rather than transition to solar, wind,

and battery storage in the local region. In 2022, the students worked with a local street puppet troupe to create a giant owl puppet, to celebrate the DPD emerging from the zoom platforms of the pandemic lockdown (see Figure 6). The puppet, which represents the civic voices of future generations, will allow students to write annual "scripts" for the puppet and work with the university's street theater club to bring an additional storytelling dimension to the complex technical and political issues that students raise in the interdisciplinary civic conversations they host through DPD. The project has become a living lab where students study the changing relationship between their generation of climate-conscious citizens and their region's energy system in the Lake Superior watershed.

Figure 6. *Duluth Power Dialog Giant Owl Puppet*

A second living lab project in the Western Hub connected climate/energy solutions to regenerative, relocalized food systems. The *Northland Solar Commons* project is a living lab where university and community partners co-designed and tested socio-ecological-technology tools that included a new community trust ownership model for solar energy assets and a digital dashboard that enables all parties to the trust to work transparently to govern the sun's common-wealth funds. The project engaged university faculty and students along with members of the Bois Forte [Band of Ojibwe] Food Sovereignty Group (BFFSG). The project aimed to supply BFFSG with an estimated $70,000 annual revenue stream from pooled solar savings of a 500kW solar array that powers a local, privately owned manufacturing plant near the Bois Forte Reservations. Thanks to a Solar Commons Agreement among the parties, the sun's common-wealth funds will support the dedicated food sovereignty work on the reservations for the 20-some-year life span of the solar panels. Research presentations and publications from the project will make these tools available for energy-transitioning, food-sovereignty engaged communities around the Lake Superior watershed and beyond.

Activities Across the Watershed

Building on the projects in each of the hubs, the LSLLN developed a series of activities connecting people and communities to enhance and expand their work focused on building relationships, engaging just sustainabilities, and co-creating nested partnerships across the watershed. In October 2020, the LSLLN hosted a sustainability summit, *Just Sustainabilities Across the Lake Superior Watershed*. This was an opportunity to celebrate the first year of the LSLLN and connect with people and groups across the Lake Superior watershed including current LSLLN partners and others interested in the collective work. The summit brought together 75 participants from the hubs and additional guests from across North America. The event included a keynote discussion hosted by Dr. Julian Agyeman about just sustainabilities. Participants engaged with Dr. Agyeman and each other on a range of ideas and examples of what just sustainabilities means and looks like in practice and explored opportunities to work together across the Lake Superior watershed.

Another LSLLN activity implemented across the watershed was the *Climate Action Field School (CAFS)*, a week-long experiential program in summer 2021 that provided hands-on training for the next generation of climate champions to explore and enhance knowledge and skills to pursue climate action. CAFS was organized by the LSLLN in collaboration with a wide range of academic, Indigenous, and community partners. It used a hybrid design of hubs hosting a unique set of in-person site visits and events for their participants along with virtual workshops connecting participants across the watershed. CAFS used an experiential, problem-based pedagogical approach developed through co-creation and co-learning with LSLLN participants.

The CAFS Northern Hub events included sessions focused on Indigenous teachings, city planning, climate activism, rainwater retention and shoreline restoration, pollution release into an AOC in Lake Superior, and urban agriculture. Eastern Hub events included sessions about geocaching, composting, hunting and fishing, a medicine walk, and an interactive tour of Whitefish Island, part of Batchewana First Nation Territory. The CAFS cross-hub virtual events included an interactive discussion about climate action (see Figure 7), a panel discussion with Black and Indigenous youth climate leaders (See Figures 8 and 9), and a Postcards for Climate Action event where each participant wrote targeted messages on hand-crafted postcards to a variety of people including family, friends, politicians, participants in other hubs, and/or community leaders. The hubs also re-engaged with the participants through continuing events in Fall 2021 and Spring 2022. Outputs from the CAFS were shared across the Lake Superior watershed, including recordings of virtual panel sessions, images produced by a graphic facilitator, digital stories with participants and organizers, and interactive 360-degree virtual tours.

Figure 7. *Graphic Facilitator's Image of What is Climate Action? An Interactive Discussion*. Artist: Corrina Keeling

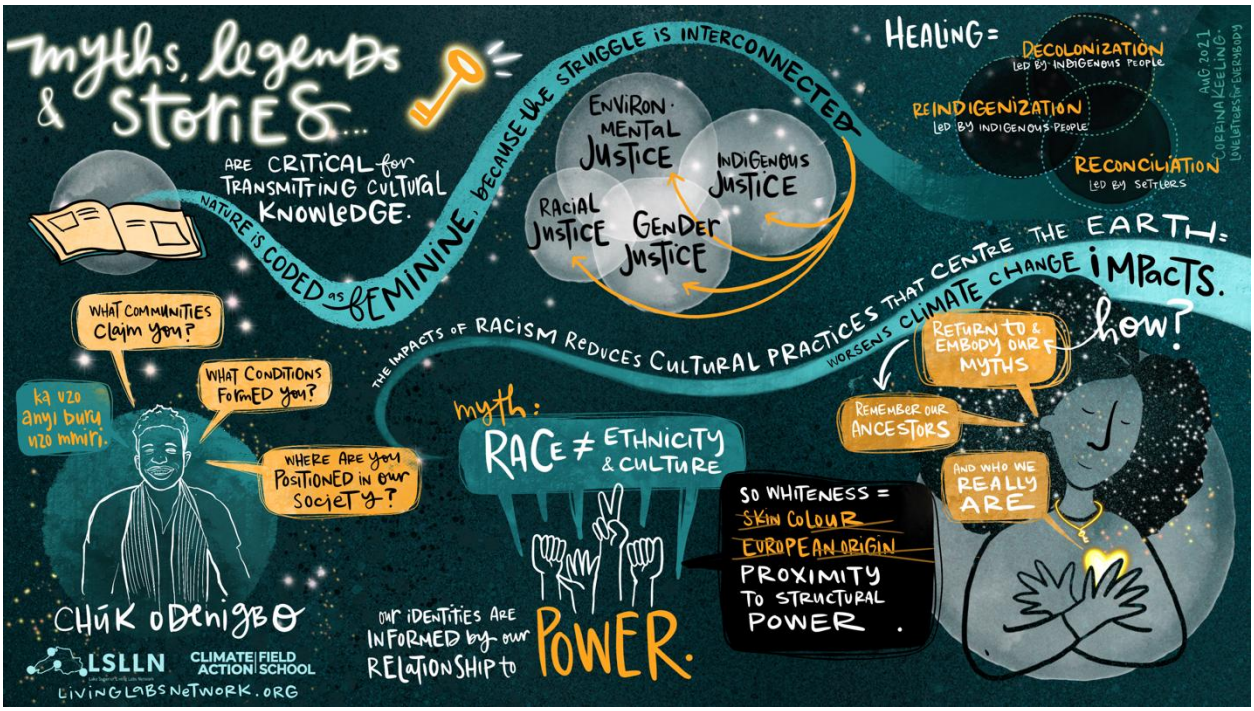

Figure 8. *Graphic Facilitator's Image of Experiences with Climate Justice around the Lake Superior Watershed*. Artist: Corrina Keeling

Figure 9. *Graphic facilitator's Image of Experiences with Climate Justice around the Lake Superior Watershed.* Artist: Corrina Keeling

Mini Meet-Ups have been an additional way the LSLLN has worked to build connections across the watershed and a source of experimentation of collaborative processes. These monthly events highlight regional projects and encourage connections among LSLLN members in different hubs. *Mini Meet-Ups* are 50-minute virtual meetings intentionally designed to be informal participatory opportunities to learn about the various projects across the watershed and make connections with other participants. To date the LSLLN has hosted 26 *Mini Meet-Ups* with two or more presenters from different hubs sharing learnings from their work within a similar sector, such as:

- Climate action and justice through design,
- Overcoming infrastructure barriers between communities and Lake Superior,
- Exploring sustainability efforts in postsecondary institutions,
- Sustainable agriculture and seed saving,
- Indigenous food sovereignty and fisheries in Batchewana First Nation,
- The Duluth Power Dialog,

- Slow Food's Ark of Taste, and
- Climate change and health.

Discussion: Reflections on a Watershed-Based Approach to Living Labs Work

The LSLLN was established to challenge discontinuity thinking by creating a structure and process to enhance and expand existing partnerships, but also to create new partnerships across the Lake Superior watershed. By developing a platform to support these relationships, the LSLLN aims to create more connected and reflective collaborations at the local and regional levels. This is demonstrated through the descriptions of place-based hub projects and cross-hub initiatives at the watershed scale. As existing and emerging living labs initiatives are shared and new projects are developed across the hubs, the LSLLN works to have a greater collective impact on pressing social and environmental issues. The evolution of the LSLLN with defined but flexible structures and expectations has enabled a more meaningful engagement with people, organizations, and communities. It also provides opportunities for interaction with people and ideas through the web platform, virtual and in-person gatherings, social media, and newsletters. In this final section we return to the key possibilities for watershed thinking to reflect on the opportunities for a watershed-based approach to living labs. As discussed above, there can be great value in conceptualizing watersheds as social-ecological settings within which to build meaningful relationships to support collaboration, co-create nested and networked partnerships, and engage just sustainabilities related goals.

The flows of tributaries across the Lake Superior watershed are place-responsive, adaptive, and at times meandering towards a common meeting place. In our attempt to emulate these kinds of flows, the people, places, and relationships involved in the LSLLN create their own connections across discontinuities. Our ongoing interest in bringing diverse people and perspectives together through living labs work in the context of a watershed means traversing a range of political and ideological borders. At the postsecondary institutional level, relationship building occurs across academic

disciplines, people (e.g., staff, students, and faculty), and different institutions. At the hub level, relationship building occurs across city regions, postsecondary institutions, community organizations, non-profit organizations, and regional development. And, at the watershed level, relationship building occurs across national, state, First Nations, and tribal territorial borders. Building meaningful relationships through living labs is at the heart of the LSSLN's work. The structure of the LSLLN was deliberately established to create a reliable platform for collaboration but also to be flexible and adaptable to the flow of people, ideas, and energies.

While many benefits have flowed from the LSLLN, transcending jurisdictional and ideological borders is complicated, as many post-secondary institutions outwardly support these kinds of collaboration but provide few resources or capacity internally to ensure their success. In fact, there tend to be more limitations than benefits at the institutional level to **build meaningful relationships**. For example, few funders support network building in their grant streams, and academic institutions tend to prioritize and reward principal investigators and solo-authored publications above partnerships. In addition, many institutions and organizations demand ownership over projects, which complicates participation by their members. The COVID-19 pandemic limited the ability of people to travel across borders and in many cases to meet in person. While several new and evolving tools to facilitate virtual collaboration have been developed, the vast majority of LSLLN partners lamented the loss of face-to-face meetings, activities, and events. At the time of this paper's publication, there are still many LSLLN Steering Committee members and participants who have never met in person. Even outside of pandemic restrictions, the cost and time for transportation between semi-remote locations create additional challenges to coordination. These kinds of limitations act as constructed blockages that reinforce discontinuity thinking.

Flow and movement of tributaries, along with the upstream and downstream characteristic of watersheds, provide an opportunity to look at pressing issues affecting the region in new and more connected ways (Parkes, 2016). As described through the concept of just sustainabilities (Ageyman, 2013), addressing issues in isolation or from

a narrow perspective can limit the impact of solutions, and in many cases reinforce the underlying causes of social and environmental problems (see also, Wardani et al., 2022). Drawing inspiration from watersheds can inspire and guide place-based, nested, and interconnected ways of thinking and doing. Just sustainabilities emphasizes the deep interconnections between social and environmental justice and reminds us to be conscious of our own positionality and biases in the process of developing projects and building relationships. Despite these insights, LSLLN hub participants have consistently pointed to the ongoing challenges of working within existing institutional structures. For example, the time needed for relationship and trust building among community partners and researchers does not often correspond with academic schedules and grant timelines. Furthermore, there are rarely resources or other incentives available for this kind of collaborative work, especially among the non-profit and private sectors. This makes it difficult for some people and groups to participate in LSLLN activities.

As a complex social-ecological system connecting water, land, air, plants, humans, and more-than-humans, watersheds can serve as an inspiration for co-creating nested relationships (Morrison et al, 2012). Working within and across multiple spatial scales to understand and address complex challenges is an essential part of building meaningful relationships and engaging just sustainabilities. The LSLLN was established to emulate this nested scale approach with the aim of connecting local, regional, and transnational human and non-human actors and their ideas and actions for just sustainabilities. At postsecondary and hub levels, hub leads mobilize partners to support and strengthen existing projects and establish new sustainability-related initiatives. At the watershed level, the LSLLN serves as a platform to connect participants from each of the hubs so they can extend the learnings from local initiatives to the regional scale. Further, this nested scale structure offers opportunities to develop new partnerships and engage collaboratively in innovative thinking and design across disciplines, sectors, and geographies, on issues of social and ecological justice and sustainability across the Lake Superior watershed. The LSLLN's collaborative, networked, and nested approach draws on the knowledge, skills, and experiences of a wide and diverse range of

participants to strengthen existing projects, build new relationships, and advance capacity for regenerative social-ecological systems.

Conclusion: From Discontinuity to Confluence

This paper has provided an overview of the challenges facing the Lake Superior watershed and an overview of the LSLLN that aims to build meaningful relationships through living labs, engaging just sustainabilities, and co-creating nested partnerships across the watershed. Adapting the concept of a living lab at the watershed scale to guide its processes and decision making, the LSLLN aims to increase the impact of sustainability related activities at the nexus of water, land and food, climate and energy, and individual and community well-being. The approach of the LSLLN builds on existing projects and the scholarly literature by presenting a nested network of living labs in the context of constructed and imposed divisions of Lake Superior's watershed. The LSLLN cuts across physical and conceptual borders, positioning it to enhance relationships and increase the impact of place-based social justice and sustainability-related activities. We offer these reflections as a contribution to building just sustainabilities theory and action and to practitioners working to build connections across boundaries constructed through discontinuity thinking toward confluence. Moreover, this paper contributes to living labs literature that primarily focuses on urban centres and technocratic solutions by offering a model for spatial and scalar distinctiveness rooted in relationships. While there are multiple challenges that arise in this work, collaborative efforts through co-creation and co-learning embedded within the living lab's approach is essential. Future research could evaluate these insights and efforts from the LSLLN in respect to their impact on participants, as well as exploring the connections between living labs in other places that are working to establish connections across geographic, institutional, and cultural boundaries.

As a group of scholars and practitioners, we have learned much from the humans and more-than-humans making up the Lake Superior watershed as we pay attention and become attuned to its presence and evolution to guide and inspire meaningful ways of

learning and working together while striving to move beyond discontinuities. Through ongoing processes of research, action, and reflection, we continue to challenge discontinuity thinking and establish collaborative watershed-based approaches to our work.

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