

Evaluation of GLISA's Small Grants Program

2011-2015



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GLISA
A NOAA RISA TEAM

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About GLISA

The Great Lakes Integrated Sciences and Assessments Program (GLISA) is a collaboration of the University of Michigan and Michigan State University funded by the National Oceanic and Atmospheric Administration (NOAA). GLISA is part of a national network of NOAA Regional Integrated Sciences and Assessments (RISAs) that focus on adaptation to climate change and variability. GLISA is the NOAA RISA for the Great Lakes region.

RISAs act in the space between climate research and climate services. GLISA integrates information from a wide array of scientific fields, develops collaborations between entities with similar goals, and lends climate information support to decision makers. We connect users of climate information with generators of climate information.

Glossary

- **Great Lakes Integrated Sciences and Assessments:** one of 11 Regional Integrated Sciences and Assessment (RISA) teams—part of the National Oceanic and Atmospheric Administration—that focus on producing action-oriented information related to climate change. In the context of the Small Grants Program, GLISA primarily serves as funder, as well as provider of project-specific climate information. In the Adaptive Boundary Chain Model, GLISA also serves as a boundary organization.
- **Adaptive Boundary Chain Model:** the ABCM (Figure 1) links several boundary organizations to co-produce usable climate information with practitioners (Lemos et al. 2014). The main goal of the ABCM is to decrease the often high transaction costs associated with sustained practitioner engagement (time, logistics, financial/human resources, trust and legitimacy). For further background, see *The Building of a Model: How the Idea of Boundary Chains Emerged* section (page 4).
- **Boundary Organization:** a group or organization that sits in the “boundary” between science producers and practitioners (Kirchhoff et al. 2013). In the ABCM, these organizations effectively serve as a bridge, translating science into usable knowledge through the co-production process.
- **Practitioner (or User):** groups and individuals that sit at the end of the boundary chain—such as local governments and natural resource managers—who use knowledge in actionable applications for climate mitigation and adaptation. In the context of the ABCM, practitioners co-produce this knowledge with boundary organizations.
- **Co-production:** the process of knowledge creation through a two-way relationship in which both parties provide input. In the ABCM, boundary organizations and practitioners co-produce knowledge together: boundary organizations provide expertise and resources, while practitioners drive how knowledge can be made more usable in real-world decision-making.
- **Embeddedness:** the strength of the relationships between GLISA and boundary organizations and between boundary organizations and practitioners, as well as the proximity of the relationships during a project (i.e., GLISA only contributed funding in one instance, or was directly involved in personal interactions in the project in another). Embeddedness can also refer simply to the number of connections between organizations within a network, with a higher number of connections translating to higher embeddedness.
- **Complementarity:** how closely related the work of boundary organizations is to the work of practitioners (i.e., both may work directly in the field of climate adaptation in one instance, while only one may work in the field in another project). This also refers to skill sets: organizations with complementary skill sets may gravitate toward working with one another to leverage the other’s skills.
- **Resources:** the resources available to boundary organizations and practitioners (social, financial, and political capital, personnel capacity, strength of motivation, existing climate knowledge).

Overview

Co-producing Climate Knowledge in the Great Lakes Region

Since 2011, the Great Lakes Integrated Sciences and Assessments (GLISA) has competitively awarded small grants to regional organizations (hereafter “boundary organizations”) committed to increasing the use of climate information in support of decision-making that addresses our larger mission of reducing the risks of climate variability and change in the Great Lakes region. These organizations often stand at the boundary between the production of climate knowledge by GLISA’s universities/partner scientific organizations and practitioners making decisions about adapting to climate change impacts. In the Small Grants Program (hereafter “the Program”), each boundary organization receives US\$50K one-year grants to address concerns related to climate adaptation and mitigation across a diversity of sectors, geographies, and disciplines.

Within GLISA, the Program has two main goals. The first is to scale up our presence and impact in the Great Lakes region by partnering with other organizations that help us to efficiently increase the breadth and depth of the RISA co-production model of interacting closely and frequently with practitioners across sectors, geographies and disciplines. By partnering with these organizations, we can reach a broader number of practitioners and other stakeholders, as well as manage several projects at the same time. The second goal is to test an experimental funding model, the Adaptive Boundary Chain Model (“ABCM,” Figure 1), which links several boundary organizations to co-create usable climate information with practitioners (Lemos et al. 2014). The main goal of the ABCM is to decrease the often high transaction costs associated with sustained practitioner engagement. These costs include time commitment, logistics, as well as financial and human resources – but especially the high and often intangible cost of building trust and legitimacy in an interconnected chain of scientific institutions, boundary organizations, communities, and individuals. By putting funding into the hands of boundary organizations with existing relationships with practitioners, the tasks of network building, further building adaptive capacity, and co-producing knowledge is made easier – and costs are shared throughout the chain.

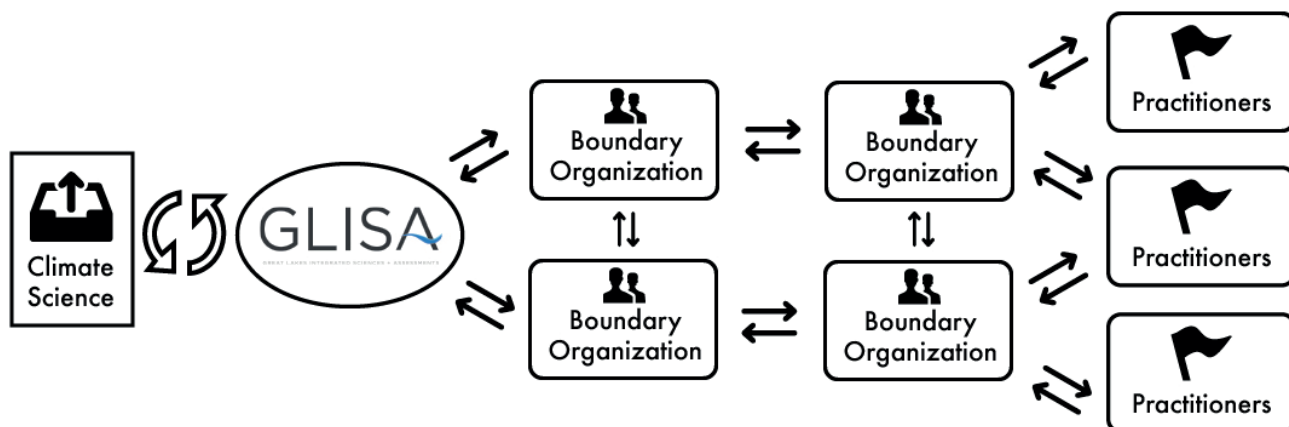


Figure 1. The Adaptive Boundary Chain Model. GLISA translates climate science – as well as supplies funding – for boundary organizations (who in turn share knowledge with GLISA), with these organizations co-producing usable climate knowledge with practitioners.

To evaluate this experimental model and individual project outcomes, principal investigators (and other relevant organizational contacts) for 16 grantees were interviewed following the completion of projects for the years spanning 2011-2015 – exploring what worked, as well as what could be improved in future iterations of the small grants program. A second round of interviews were carried out in the summer of 2019 to further understand longer-term impacts associated with the projects. These interviews focused on the unique characteristics of each organization and project: the amount of hands-on assistance GLISA provided, the strength of already established relationships between boundary organizations and practitioners, the amount of resources each organization had at their disposal, and the nature of the work and outcomes involved. The aim of both sets of interviews was to understand the circumstances in which the ABCM yielded the most successful outcomes, what role each organization played in achieving those outcomes, and what lessons could be learned to inform the implementation of future small grant competitions.

At the heart of the experimental Adaptive Boundary Chain Model is the idea that while the co-production of knowledge can yield more usable climate information, the costs of sustained interaction for organizations, producers and users of knowledge who engage in co-production are high. To lower these costs, the ABCM links boundary organizations that sit at the interface of science and policy, bridging the gap between scientists and those that use the science, i.e. practitioners – such as local governments and natural resource managers. These boundary organizations rely on their previously established relationships with practitioners to build or maintain critical trust and legitimacy during and after the Program, while also leading tasks such as training, workshops, and engaging stakeholders throughout the projects. In this way, the ABCM lowers the costs of performing day-to-day tasks while leveraging established relationship ties, thereby increasing the opportunity of producing usable, salient climate knowledge with long-term impact.

To evaluate the ABCM through the Program, we focus on three dimensions of co-production between organizations (Ostrom 1996, Kirchhoff et al. 2015): embeddedness, complementarity, and resources. This report examines the importance of each driver's role in specific GLISA small grant projects, and seeks to ascertain how each one impacts project outcomes. Definitions for these drivers can be found in the Glossary (page 1) section of the report.

This report is a synthesis and analysis of both sets of interviews for the 16 2011-2015 small grants projects and seeks to answer the following questions:

- *How do interview findings support or refute the effectiveness of the boundary chain model?*
- *Did the organizations awarded grants demonstrate the characteristics of effective boundary organizations?*
- *To what extent did these organizations foster and deepen climate information use by decision-makers?*
- *Did organizations build relationships through the linked chain model?*
- *Are more embedded organizations more likely to share information?*
- *Were organizations with greater resources (i.e. human, financial, social capital) more successful at employing the boundary chain model?*
- *Did boundary organizations that had previously established expertise in climate science and information (i.e. were more complementary) have greater positive project outcomes than organizations with fewer resources?*

The Building of a Model: How the Idea of Boundary Chains Emerged

When GLISA was created in 2010, one of our biggest challenges was the need to rapidly understand not only whether—and how—practitioners in different sectors were addressing the need to mitigate and adapt to climate change in the Great Lakes region, but also how we could further support them in their mission. The fact that GLISA's established geographic reach included eight U.S. states and the Canadian Province of Ontario posed significant challenges to the initial team in designing an approach that would allow us to reach every state – as well as the numerous sectors projected to be exposed to climate impacts. Right from the start, the idea of carrying out a broad needs assessment across the whole region and the two countries seemed daunting and potentially very costly; rather than limiting ourselves to a few sectors and geographies, we instead focused on a two-pronged strategy to engage our stakeholders.

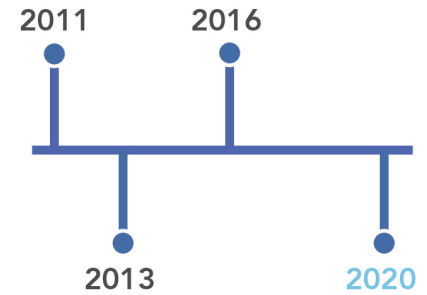
First, we carried out extensive documentary research to understand what stakeholders had already told us they needed in the region. This initiative, in collaboration with two other RISAs (the Western Water Assessment [WWA] and the Carolinas Integrated Sciences and Assessments [CISA]), yielded important information about sectors and communities that were already mobilized to respond to climate change impacts in the Great Lakes region (Dilling et al. 2014).

Second, within GLISA, we brainstormed different opportunities to leverage resources that were already mobilized in the region in order to extend our reach. One idea was to identify climate change research projects (e.g. scientific assessments) that were already happening, funding stakeholder interaction in these projects to increase the usability of the knowledge produced (see description of First Generation Grants below). While this was a promising idea, it did not yield the expected outcomes, especially because many of the projects funded had little experience with working with stakeholders or did not produce knowledge that fit stakeholders' needs.

However, among those projects funded in the first generation, there was an outlier (led by the Huron River Watershed Council) whose main goal was to create a network of users rather than to create knowledge. The outcomes of this project were much more positive in terms of usable knowledge than the others, and taught us valuable lessons (Briley et al. 2015). By focusing on stakeholders rather than knowledge, the project pushed us to think “outside the box” and focus on the boundary between knowledge production and use as a valuable asset for co-production. From this point on, we realized that complementarity could be an important dimension in meeting our goals for the Great Lakes region: treating GLISA as a producer of climate knowledge, with other boundary organizations as brokers—and bridgers—of this knowledge to practitioners. At face value, we hypothesized that we could both increase our reach by partnering with other organizations and take advantage of their already existing relationships with stakeholders – decreasing our costs of organizing while building trust and legitimacy with them. But because we did not know who these boundary organizations were and could not fund them all, we designed a funding competition that would allow these groups to concurrently self-identify and compete for our limited resources.

Through the implementation of this model, we are changing our approach adaptively, learning from the outcomes of each competition to organize the next. In the following section, we describe each generation of the Small Grants Program competition.

Timeline



First Generation: 2011–2012

The first two years of the competition (2011, 2012) funded 11 boundary organizations, five of which are included in this evaluation. In this first iteration of the competition, GLISA sought to build its network of boundary organizations in the region by broadly soliciting projects to “support scientific assessments...with the goal of identifying and understanding the potential impacts, responses, vulnerabilities, opportunities, and barriers to adaptation to climate variability and change...” The call for proposals required the boundary organizations to engage decision makers during the project, but did not advise how those interactions should occur. The call also did not constrain GLISA’s expertise or capacity to support the project. Most grantees were universities proposing more traditional academic projects.

Second Generation: 2013–2015

The next three years of the competition (2013, 2014, 2015) funded 12 boundary organizations, 10 of which are included in this evaluation (one organization was funded for two projects during this time). Learning from the first generation, GLISA focused the competition more on engagement and problem solving rather than ongoing scientific assessments. GLISA narrowed the call for proposals accordingly to “fund organizations to engage networks of stakeholders in science-grounded processes to identify, assess, and/or resolve climate-related problems or management issues.” Notably, the 2014 competition funded both new partnerships (Emerging Action awards) and previously funded grantees (Sustained Assessment awards). The call also detailed what types of climate information and general project support GLISA could provide. While some grantees were academic institutions such as in the first generation, several were non-profit organizations.

Third Generation: 2016–Present

The most recent GLISA small grant competition funded 11 boundary organizations in 2019 to “sustain and strengthen GLISA’s network of boundary organizations, foster close interaction between and among GLISA knowledge brokers and grantees, learn what GLISA products are ready to scale-up in the region and beyond, and to increase our impact in the Great Lakes.” Having completed most of this evaluation before conducting the competition, GLISA again adaptively changed its approach by offering only three ‘GLISA Services Categories’ from which grantees could choose. Each category was based on an existing type of service GLISA knew had been previously successful, offering sub-categories within each service paired with examples of tangible results. This was intended to not only scale-up GLISA’s impact in the region by applying already developed frameworks to other sectors and geographies, but also to streamline GLISA’s participation in each project by clearly defining what information and support GLISA can, and cannot, provide. Finally, the call for proposals required grantees to build on existing stakeholder relationships and engage early and often throughout the project. Notably, the call did not allow grantees to require new stakeholder relationships to carry the project as illustrated in the first and second generations: one-year projects were not long enough to cultivate new, trusted relationships. Grantees include academic institutions, non-profit organizations, and state agencies in the U.S. and Canada. These projects are not included in this evaluation as the projects are still ongoing.



Project List

Sleeping Bear Dunes National Lakeshore, Michigan

A total of 16 projects were included in the 2011-2015 evaluation of the Small Grants program. This total does not include all Small Grants projects conducted during the evaluation period; only those that had principal investigators interviewed and for which data was collected. For more information on any of the projects below, please click on the project title to be taken to that project's page on GLISA's website.

First Generation (2011–2012)

- [Decision Support and Great Lakes Lake Whitefish in a Changing Climate \(2011\)](#)
- [Great Lakes Evaporation: Implications for Water Levels \(2011\)](#)
- [Mid-Michigan Heat Model \(2011\)](#)
- [Winter Adaptation Measures for the Chicago Climate Action Plan \(2011\)](#)
- [Assessing Climate Risks for the Michigan Tart Cherry Industry \(2012\)](#)
- [Huron River Watershed Council: Creating Climate Resilient Communities \(2012-2013\)](#)

Second Generation (2013–2015)

- [Tribal Climate Change Adaptation Planning \(2013\)](#)
- [Toward Extreme Weather and Climate Resilience in the Region of Peel \(2013\)](#)
- [Making it Personal: Diversity and Deliberation in Climate Adaptation Planning \(2013\)](#)
- [Helping Marina and Harbor Operators Respond to Climate Change \(2013\)](#)
- [Twin Cities Transportation Study: Adapting to Climate Change and Variability \(2013\)](#)
- [Climate-Informed Ravine Management \(2013\)](#)
- [Ready & Resilient: Climate Preparedness in Saint Paul, Minnesota \(2014\)](#)
- [Implementing Forest and Water Climate Adaptation Solutions to Build the Resilience of Two Northwoods Communities \(2014\)](#)
- [The Climate-Ready Infrastructure and Strategic Sites Protocol \(CRISSP\) \(2014\)](#)
- [Assessing and Mitigating Municipal Climate Risks and Vulnerabilities in York Region, Ontario \(2014\)](#)

Background

Co-producing Knowledge in Boundary Chains and Evaluating Outcomes

For the scope of this paper, peer-reviewed and grey literature on co-production of knowledge focuses in large part on how that knowledge is created, how co-production processes (or lack of those processes) impact the availability and usability of knowledge, and how climate information is used in decision-making processes. Current concerns over co-production relate to the rate and scope of scientific information in climate change decision-making being below expectations, the chronic gap between the amount of climate knowledge produced and the amount used in decision-making, and the rate of climate information use severely lagging behind the need for that information's use.

The Adaptive Boundary Chain Model (ABCM) specifically addresses these challenges for co-production by focusing on lowering barriers, especially related to trust and legitimacy, to effective collaboration between curators of climate science (GLISA) – and practitioners. Hypothetically, this results in knowledge co-production, as well as an increased uptake of climate information into decision-making. In support of this theory, Meadow et al. (2015) argue that a lack of co-production could be negatively impacting the type of climate science and information used in decision-making, with insufficient planning and collaboration as the main cause; they posit multiple “modes of engagement” between researchers and stakeholders to address this, which mirror many of the tactics employed by GLISA and boundary organizations during the projects in question.

Critical to the co-production process is the importance of establishing a broker between academic researchers and practitioners (Reed & Abernethy 2018). In the ABCM, boundary organizations act as these brokers, bridging the gap between science creators and users of that science. When properly executed, this facilitation can result in the two-way transfer of knowledge between parties – a process which is seen as critical for informing creators of climate science with the usability and practicality of specific information, as well as the unique on-the-ground needs of local users (Howarth et al. 2017).

The ABCM establishes a process by which many of the aforementioned challenges can be comprehensively addressed, especially related to trust and legitimacy, in keeping with many of the best practices outlined in current literature examining collaborative research projects (Djenontin and Meadow, 2018). Because practitioner perceptions of trust and legitimacy are often time and cost-intensive to build, they represent one of the biggest impediments to resource-constrained processes of co-production. In our interviews, boundary organizations with established practitioner relationships that used robust stakeholder engagement methods were integral to helping lower these costs. In the literature, the approach to trust and legitimacy costs is seen in attempts to bridge cultural differences, embedding researchers in processes close to decision-making (one of the chosen variables for this evaluation), and questions around the resources involved in building trust (Cvitanovic et al. 2015).

Building on these ideas of trust and legitimacy, a definitive conversation surrounding the impact of the ABCM on transaction costs can be found in a 2015 special issue of *Climate Risk Management*. The special issue defines these types of costs as “...the level of effort invested by each organization for co-production and for forming and sustaining connections between scientists and users” (Kirchoff et al., 2015). The issue cites a series of case studies (Lemos et al., 2014) showing how connecting at least two boundary organizations into a chain leveraged the combined strengths and resources of each organization; this in turn reduced barriers to co-production of knowledge, increased trust and legitimacy among practitioners, and helped to more evenly share costs across the entire chain.

The special issue also critically touches on early conceptual frameworks for evaluating outcomes related to the use of boundary chain models (Kirchhoff et al., 2015b). The evaluation framework in the issue is based on how effectively the boundary chains are able to create synergy, a combination of two conditions mentioned previously that form the core of this report: complementarity and embeddedness. By combining these two factors, the authors of the special issue created an early conceptual framework for evaluating the efficacy of boundary chain models. This report builds on that work, building a robust evaluation model that includes complementarity and embeddedness factors along with other considerations such as a boundary organization's resource availability.

Boundary Organizations

Literature on the role of boundary organizations in co-production processes currently addresses the role and definition of boundary organizations, the most effective ways of evaluating work involving them, formalizing the use of these types of organizations, and the analysis of different scales of boundary organization use in governance. Currently identified challenges and questions associated with boundary organizations are the high cost of sustained engagement (Kirchhoff et al., 2013) between academic knowledge producers and users of that knowledge (especially related to human capital and trust-building), and whether boundary organizations can decrease those costs by leveraging established relationships. Further, this high cost of interaction often results in projects that only reach high capacity users, creating a barrier to entry (and thus successful co-production) for under-resourced users – as well as those that might lack expertise in the chosen field.

These high interaction costs can be partially alleviated by the introduction of boundary organizations as intermediaries between the creators of climate science and end users (Bednarek et al., 2015), with the recommendation that these types of organizations may be formally institutionalized into governance/organizational structures (Bednarek et al., 2018). There are also questions of the efficacy of boundary organization at different governance scales, with a previous lack of evidence of success at the local level due to a lack of co-production between regional organizations and local users (Dannevig & Aall, 2015). A possible solution to this challenge of local co-production is two-way knowledge transfer between community partners and boundary organizations (Fudge & Hiruy, 2019), which has shown success in blending top-down solutions and information with local credibility and knowledge. Also highly relevant to this challenge is how to successfully introduce traditional ecological knowledge into decision-making by way of a boundary organization structure, with these types of organizations allowing the navigation and mediation of often uneven power dynamics between different actors (Gray, 2016).

Evaluation

Among the literature on the topic of evaluation regarding co-production and the usability of climate science, there are a few concepts that are of primary relevance to this study. Wall et al. (2017) developed a suite of indicators on how best to evaluate co-production, with indicators falling into six broad categories: inputs, process, outputs, outcomes, impacts, and external factors. Meadow et al. (2015) also describe a variety of different approaches to the subject of evaluation of co-production, including using a set of metrics created by the National Research Council (NRC) to focus on the process involved, or conversely focusing on outcomes by looking at the strengths and nuances of the relationships between science creators and practitioners.

Not adhering strictly to any specific evaluative framework, this report uses a mixed approach to understanding which factors best drive success in boundary chain models – focusing not only on the unique processes (i.e. the interactions of engagement, resource allocation, and organizational expertise) present in each project, but also on how relationships were formed, evolved, and had lasting impact.

Project Snapshot

Huron River Watershed Council

Making Climate Resilient Communities

Huron Bridge Park, Ann Arbor, Michigan

The Huron River Watershed Council project, funded by a 2012 Small Grant with roots that can be traced back to GLISA in 2011, was a first generation project that showed the true potential of the Adaptive Boundary Chain Model. HRWC assembled key stakeholder groups in three different sectors over a six-month intensive period to provide a better understanding of climate impacts. Through a series of GLISA-supported workshops, the working groups published guides for adapting forests for the watershed area, as well as management strategies that can be adopted to enhance resiliency.

“There was no way we would have gotten where we did without the information GLISA provided. It was the foundation on which we built all of our strategies. It was the information that allowed folks to think about the implications for their work in real terms.”

HRWC is currently distributing the planning kit across other watersheds and natural systems management groups to strengthen their capacity to adapt land and forest management based on climate information. In addition, the Washtenaw County Water Resources Commissioners Office revised their stormwater rules to require additional onsite infiltration of stormwater after vulnerabilities were identified during input from community experts and GLISA’s analysis of heavy precipitation trends for the watershed.

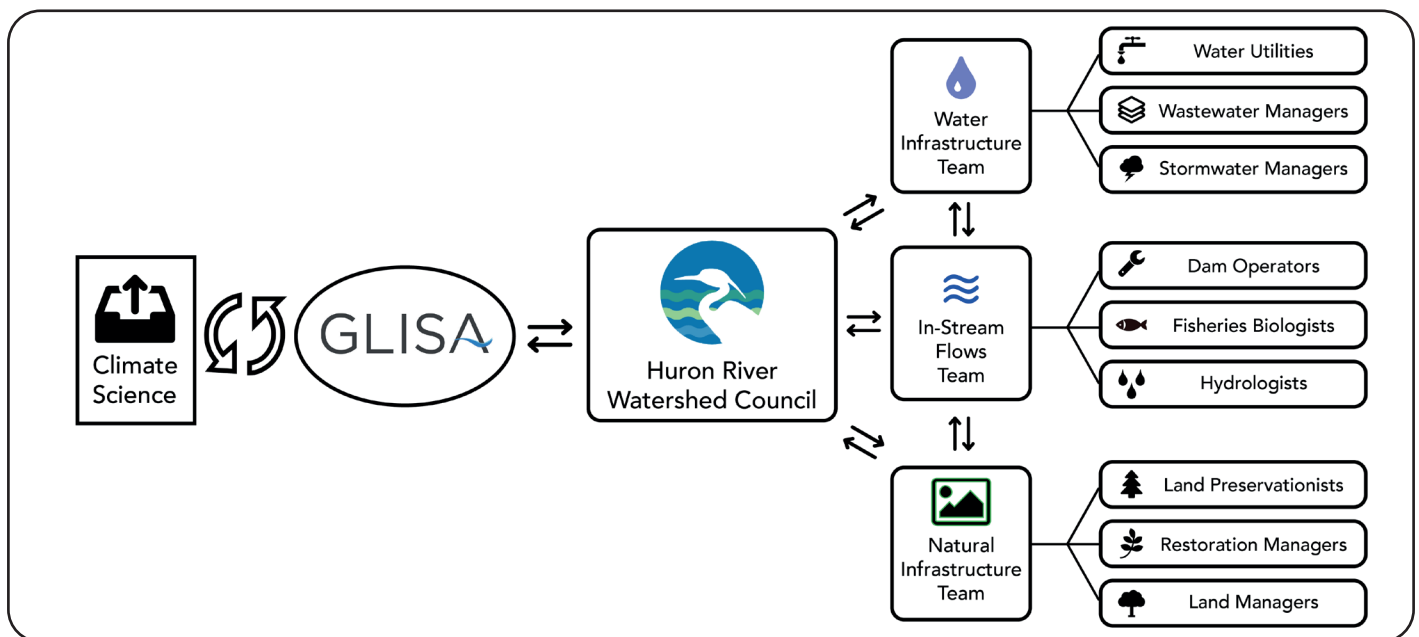


Figure 2. The Adaptive Boundary Chain for the Huron River Watershed: Creating Climate Resilient Communities (2012-2013) project.



Methods

Scott Falls Park, Michigan

Interviews for each of the 16 projects were conducted in two rounds by a GLISA graduate student: shortly after project completion with the principal investigator of the boundary organization (round one), and again in the summer of 2019 (round two). For the second round of interviews, all efforts were made to interview the same contact(s) as in round one; however, due to time elapsed between interviews and internal boundary organization restructuring, first-round contacts were not always available. In those cases, a contact involved with the project that remained at the organization was interviewed. One project was unresponsive for the round two interview, and no organizational contact could be reached: that project is included in round one data analysis but not round two.

First round interviews involved asking a multitude of questions with few probes, while second round, follow-up interviews asked only a single question for each project variable (embeddedness, complementarity, and resources) while employing many probes to deepen understanding of project outcomes. Following the second round interviews, both sets of interviews were qualitatively coded to identify main project themes and outcomes; those results are presented in the preceding Findings sections.

A specific set of initial codes were developed prior to the process of coding and were subsequently identified in all first round interviews (Table 1), with inductive coding techniques used to reach a more granular understanding of specific sub-factors depending on the content of individual interviews. These broad factors represented three main drivers and two outcomes: complementarity, embeddedness, and resources (drivers), and continued collaboration and results and successes (outcomes). The drivers were designed to build on existing work found in previous evaluation articles (Lemos et al., 2014; Kirchhoff et al., 2015b) and advance understanding of the critical factors that drive boundary chain outcomes.

For first round interviews, the continued collaboration and results and successes factors include project outcomes, with sub-factors concerning negative (i.e. *failures or challenges moving forward*) and positive (i.e. *increased capacity, increased credibility, and reduced costs*) outcomes. For simplicity of analysis, the main driving factors in the project–embeddedness, complementarity, and resources–were often compared against a grouping of seven positive outcomes to highlight patterns and trends within the data.

Coding for second round interviews (Table 2) built on the foundation of the first round, streamlining and expanding the codes for both drivers and outcomes to reflect the expanded interview questioning. Because second round interviews focused on the lasting effects of each project, the continued collaboration factor was examined in the main driving factors (embeddedness, complementarity, and resources) instead of as a standalone. The results and successes factor was expanded to include 12 sub-factors, as the round two interviews were lengthier and more outcome-oriented in nature.

Codes

Factors and Outcomes

Round One Interview Factors and Outcomes	
Factors	Sub-factors
Embeddedness	B.O & Prac. established relationship
	B.O & Prac. Work closely
	B.O. & Prac. New relationship
	GLISA & Prac. New relationship
	GLISA & B.O. established relationship
	GLISA & B.O. Work closely
Complementarity	Do not work in climate adaptation
	Interdisciplinary
	Work in climate adaptation
Resources	B.O. lack of resources
	Practitioner lack of resources
	Motivation
	Personnel
	Political capital
	Previous knowledge
	Previous relationships
	Stakeholder climate knowledge
Outcomes	Sub-outcomes
Results & Successes	Challenges moving forward
	Failures
	Increased capacity
	Increased communication & engagement
	Increased credibility
	Long-term impact
	New knowledge networks
	New project or working network formed
	Reduced costs
	Reorientation of organization
	Future implementation of boundary chain
Continued Collaboration	Continuing relationship
	No continuing relationship

Table 1. First round interview coding factors, sub-factors, outcomes, and sub-outcomes.

Round Two Interview Factors and Outcomes	
Factors	Sub-factors
Embeddedness	Continued Prac. & B.O. collaboration
	Project impact does not still exist
	Project impact existence is uncertain
	Project impact still exists
Complementarity	Little attempt at network building
	Network does not still exist
	Network existence is tenuous or uncertain
	Network expanded
	Network still exists
	No network expansion
Resources	Project utilized already existing network
	Clear end user communication of needs
	End user conservative political climate
	End user disorganization
	Existence of other grants during project
	Existing high financial resources
	Existing lack of financial support
	High end user org. turnover
	Lack of access in end user communities
	Lack of B.O. finances for follow up evaluation
	Lack of expertise to carry project forward
	Lack of trust in end user communities
	Previous B.O. climate knowledge
	Previous Prac. expertise
	Previous end user climate knowledge
	Project allowed work not otherwise possible
Project valuable but expensive	
Outcomes	Sub-outcomes
Results & Successes	Grant was impetus for future work
	Lessons learned
	Personal network expanded
	Potential integration into long term plans
	Project brought disparate end users together
	Project built comfort to take on similar work
	Project built credibility & legitimacy
	Project empowered Prac. or shifted culture
	Project helped translate into understanding
	Project was end user goal specific
	Theoretical or methodological success
	Uncertain or unquantifiable impact

Table 2. Second round interview coding factors, sub-factors, outcomes, and sub-outcomes.

Findings

First Round Interviews

The strength of relationships and processes of relationship-building (embeddedness) were the most common themes from interviews with project principal investigators following the initial completion of each project. Cited most often out of any factor, embeddedness played an integral role in the practical functioning of the Adaptive Boundary Chain Model: all projects (16 out of 16) mentioned some element of the factor, with interviewees at boundary organizations often mentioning their close relationship with GLISA as an important factor in executing the project (11 out of 16 projects). Previously established relationships and/or close working relationships between boundary organizations and practitioners (8 out of 16 projects for both) were also mentioned as an important consideration in executing the projects.

In interviews, many boundary organizations described how the Adaptive Boundary Chain Model facilitated relationship-building beyond that of a usual donor-grantee connection:

“We turned to GLISA because of the funding at first, and it was a surprise how much they approached working with grantees as partners. At first, it was about funding. I wasn’t aware ahead of time about how much richer the partnership would be than with our typical funder.” (Implementing Forest and Water Climate Adaptation Solutions to Build the Resilience of Two Northwoods Communities, 2014)

The levels of “richness” of relationships was a common theme described throughout the interviews, with boundary organizations referring to their partnership with GLISA as “unique,” “critical,” and “instrumental.” As part of the project design, we tested how different levels of embeddedness (i.e. previously established relationships, new relationships, close vs. distant relationships, etc.) might be connected to project outcomes, with embeddedness levels matched to measures of results and successes that were questioned in second round interviews. Our hypothesis was that higher levels of embeddedness would lead to more substantial project outcomes.

For instance, in the example of the Northwoods Community Project above, there was a high level of embeddedness between GLISA (the funder), Model Forest Policy Program (the boundary organization), and Red Lake Nation/Menominee Conservation District (the practitioners). GLISA provided not only funding, but also coaching, training, and in-person support to both the boundary organization and the practitioners. Given this level of embeddedness, the design of the theoretical model would expect that project outcomes would reach a similarly robust level – both in terms of qualitative indicators and the strength of those indicators.

The data from the first round interviews support this hypothesis, with projects that often mentioned close working relationships between GLISA and boundary organizations—and boundary organizations and practitioners—showing a higher number and strength of positive project outcome indicators than projects with fewer mentions.

Interviewees also cited the importance of complementarity between GLISA and their boundary organization in regard to the nature of their relationships in the experimental model. Though the indicator was not nearly as strong as embeddedness, all but one project mentioned it during first round interviews (15 out of 16 projects). Complementary work in climate adaptation by boundary organizations was cited in a majority of cases (9 out of 16 projects), while work in a field other than climate adaptation (6 out of 16 projects) and an interdisciplinary approach to co-production (2 out of 16 cases) were mentioned less often.

One organization described how tight-knit the regional climate adaptation community is and how it helped foster working relationships inside and outside of the small grants program:

“We’re all involved in the climate adaptation community. I see [GLISA] at the adaptation forum in St. Louis. There have been communications on and off because of our overlapping interest and work in climate adaptation.” (Ready & Resilient: Climate Preparedness in Saint Paul, Minnesota, 2014)

Though not as qualitatively strong as embeddedness, project data shows that complementarity was the second-most mentioned factor in interviews, correlating positively with indicators of positive project outcomes. Further studies are required, however, to build more robust evidence on exactly how the nature of complementary work—and non-complementary work—between boundary organizations and practitioners impacts project outcomes.

Finally, out of the three main project factors, resources was the least mentioned in first round interviews – surfacing in both a slim majority of interviews (10 out of 16 projects) and showing the highest number of coding sub-factors (i.e. categorized interview responses). Interviewees mentioned some sort of previous knowledge aiding them in the project as the strongest sub-factor (4 out of 16 projects) with end user lack of resources, motivation, personnel, political capital, and previous relationships all displaying the same low-level occurrence (2 out of 16 projects). Finally, boundary organizations operating with a lack of resources and a presence of stakeholder climate knowledge were each mentioned in a single project.

Though it was the least mentioned factor, there are many interesting and illuminating findings about how organizations leverage their resources for projects, as well as how existing resources dictate project outcomes. For instance, one project mentioned having facilitation expertise on their project staff, something not all boundary organizations had at their disposal – leading to questions of how critical this skill is for organizations working within the model:

“One of my colleagues who is experienced in facilitating, planning meetings, brainstorming meetings worked with Macalester and attended and assisted with the community climate adaptation conversations.” (Ready & Resilient: Climate Preparedness in Saint Paul, Minnesota, 2014)

Another project mentioned perhaps the most integral component of a project’s successful outcome in regard to the usability of knowledge – the motivation of practitioners to engage in the work:

“We could have had all of the localized information that we wanted [from GLISA] but it wouldn’t have worked if the tribes didn’t bring themselves together. That’s probably the most critical piece – that the tribe wanted to work on the project.” (Tribal Climate Change Adaptation Planning, 2013)

Finally, projects that included communities and groups with fewer resources and/or legacies of under-representation showed the challenges associated with creating lasting change in the process of co-production without providing funding past project completion. For many of these projects, project funding allowed for a critical step in adaptation planning or action to be completed and for different types of capacity to be built, though continued project-specific action stopped once funding was completed. One project in particular highlights these challenges:

“Each of the communities is resource constrained. We had applied for continuing funding so they could pay for staff to continue working on things. We didn’t get it. I know there are great applications but I know that for [the practitioners], because they didn’t get funding from this stream and other streams, they’re back to doing their core work and integrating climate into it, but they’re not pushing on some of the things that we were supporting last year.” (Implementing Forest and Water Climate Adaptation Solutions to Build the Resilience of Two Northwoods Communities, 2014)

Taking a holistic view, resources embody the most variable element of this analysis, and it is the driver that requires the most further research. While this analysis provides critical insight into the complexity and importance of resources as a

driver for successful co-production, critical questions have also arisen: what are the specific characteristics of boundary organizations that make them likely to be successful in projects involving a linked chain model? In general, how can we best measure the resources of a boundary organization? Do certain kinds of resources matter more than others in terms of dictating outcomes?

Apart from the three main study factors, interviewees also mentioned immediate longitudinal outcomes: half (8 out of 16 projects) of the interviewees mentioned some form of continued collaboration following the project, whether it was between GLISA, the boundary organization, end practitioners, newly formed networks, or a combination of the four. A more robust account of the long-term status of the projects was canvassed in the second round interviews, but first round interviewees mentioned these continued collaborations unprompted; there was no specific question in first round interviews about long-term impacts. In particular, those that spoke of some form of project continuation mentioned how they still leverage the network they built during project, and how the work they're doing now is sometimes indistinguishable from the original project:

“Through the years, the lines blur as to what is our project and what is ongoing collaboration.” (Helping Marina and Harbor Operators Respond to Climate Change, 2013)

Though only a portion of the projects mentioned continued collaboration soon after project completion, the presence of the factor outside of an interview prompt pointed to its importance. Initially, at least, the research question of “did organizations build relationships through the linked chain model?” could be answered affirmatively.

Finally, interviewees mentioned project outcomes (results and successes) more often than any other subject in interviews as an absolute measure, with each interview having on average nine references to some sort of project outcome (15 out of 16 projects). Increased communication and engagement was cited most often as an outcome (13 out of 16 projects), especially the boundary organization's role as a translator of climate science into usable information – a critical goal in the Adaptive Boundary Chain Model:

“We were able to take climate information [from GLISA], which is pure science, and translate that for our municipal partners into more robust risk assessment instruments and tools... The money we got from GLISA actually helped us kickstart the implementation of [an] adaptation strategy.” (Toward Extreme Weather and Climate Resilience in the Region of Peel, 2013)

Long-term impact was a critical part of the study, and was mentioned during first round interviews in a majority of cases (10 out of 16 projects). Relatedly, an outcome such as a new project or network—another measure of long-term impact—was also mentioned in 10 out of 16 projects. New knowledge networks (8 projects), increased credibility (8), and increased capacity (7) were also mentioned often, with reorientation of future organization project plans (4) and reduced costs (2) mentioned infrequently.

Negative project outcomes were also mentioned infrequently, with challenges moving forward (5 out of 16 projects) and failures (3 projects) as two sub-factors. Challenges cited by interviewees involved difficulties raising additional money for organizational needs, lack of organizational capacity to follow up on projects, and trouble creating momentum to keep the project moving forward. Failures included two separate mentions of boundary organizations receiving climate data from GLISA that wasn't specific enough, and a project that sent a final deliverable to a large city bureaucracy that never used it.

Project Snapshot

Resilience for Peel, Ontario



Caledon Agricultural Region of Peel, Ontario

One of the first Small Grants projects to work across the U.S.–Canada border, the goal of the Climate and Extreme Weather Resilience for the Region of Peel, Ontario project was to provide case studies of vulnerability and risk analysis methods to inform actionable strategies for increasing climate resilience. Two main boundary organizations were involved: Ontario Climate Consortium supported by Toronto and Region Conservation Authority. These organizations worked with the regional government of Peel in two main stakeholder areas: the agricultural region of Caledon,

“It was step one of a much larger process in the region. I think it was a very powerful base to start from.”

and within the harbor infrastructure of Port Credit. The project primarily focused on building local capacity for understanding and managing climate and extreme weather risks, convening multiple workshops with practitioners in both project areas. The main final outputs were risk assessment tools created for the Region of Peel – customized for the specific practitioners in the area. Supporting materials were also created, such as three video documentaries, workshop collateral and exercises, and a website detailing project information/partners.

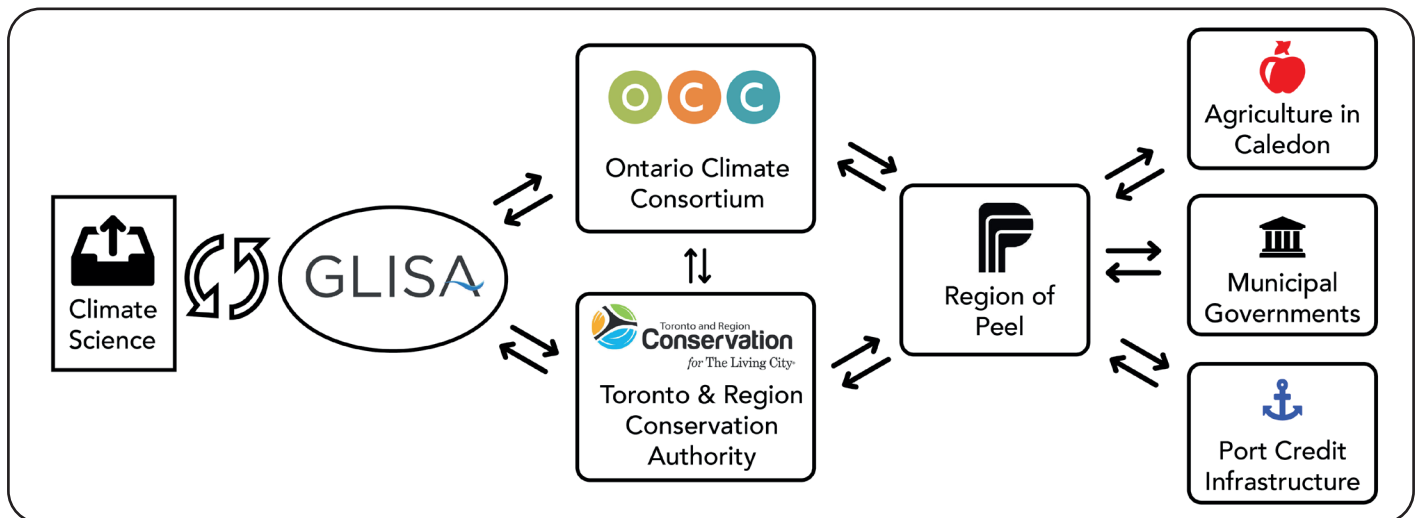


Figure 3. The Adaptive Boundary Chain for the Toward Extreme Weather and Climate Resilience in the Region of Peel (2013) project.

Findings

Second Round Interviews

Interviewees from each project were reinterviewed during June–August 2019 about current project status, as well as the state of main project factors. These interviews focused mainly on ascertaining where each project stood many years after completion, if there was a lasting and/or ongoing long-term impact associated with each, and what circumstances of each project might have influenced that long-term impact.

First, interviewees were asked about the current state of the project (a reflection of the embeddedness factor), and whether there was a long-term impact and/or the project impact still existed. A majority of interviewees stated that an impact of the project still existed (10 out of 15 projects), with a third stating a tenuous or uncertain long-term impact (5 out of 15). Only one project stated definitively that an impact from the project did not still exist.

For projects that mentioned a long-term impact, a general theme was that the initial project created a foundation for work that came afterward – whether it was forming networks that organizations continue to rely on or creating a spark for future ideas. One organization spoke of the difficulty inherent in evaluation work while describing the long-term relationship-building aspect of the project:

“We have relationships with those organizations and those individuals that we worked with, and we continue to have those relationships, so in some ways what has continued on is our general collaboration and work together. I’d say that is the impact -- it’s hard to know if, you know, we worked with hundreds of individuals, if they’re climate literacy has improved, but I think the bigger impact is that we’ve created these relationships, and we continue to work together on climate and environmental projects.” (Diversity and Deliberation on Climate Adaptation in Saint Paul, 2013 & 2014)

Many projects mentioned that the small grants projects represented the first foray into climate adaptation work that communities or organizations continue to pursue, and therefore represented an important structure to work off of:

“In Gary, Indiana, where the CRISSP was kind of pilot tested, it has been the starting point for a whole lot of work on climate adaptation.” (The Climate-Ready Infrastructure and Strategic Sites Protocol (CRISSP), 2014)

“It’s been used as a foundational document for about five or six vulnerability assessments that have been completed... So it was kind of step one of a much larger process in the region, but I think it was a very powerful base that they could start from in a good way.” (Toward Extreme Weather and Climate Resilience in the Region of Peel, 2013)

“I think you could say that your grant was sort of the inception of some of those [climate adaptation] ideas.” (Helping Marina and Harbor Operators Respond to Climate Change, 2013)

For projects that did not mention an ongoing impact, there was a commonality that most were strictly research-based (instead of action-oriented) with a specific, temporary need for funding:

“...you [GLISA] provided the funding to keep those sites going for a couple more years. So the funding was to provide the means to continue the field work to keep those measurements going... since the funding has ended, we don’t have any more funding to go out there and do field work.” (Great Lakes Evaporation: Implications for Water Levels, 2011)

Projects that were uncertain about long-term impact struggled with internal evaluation, citing a lack of time or resources to follow up on exactly how the end products of the small grants projects were currently being used, or even if they were being used:

“I think at one point I wanted to follow up and just find out, like, ‘hey, how’s the city used this information at all?’ and I just can’t remember if we ever heard back... I guess I wish that I knew if that information is being used.” (Winter Adaptation Measures for the Chicago Climate Action Plan, 2011)

“I would say that we have not specifically followed up with them and found out where they stand with their projects and how they’re doing. (Implementing Forest and Water Climate Adaptation Solutions to Build the Resilience of Two Northwoods Communities, 2014)

Interviewees were also asked about complementarity, specifically whether the networks that were formed during the small grants projects still exist, and/or whether the projects expanded/utilized previously existing networks. Almost half of interviewees stated that networks formed during the project still existed (7 out of 15 projects), with a few projects explicitly acknowledging that the organization realized this was a larger objective of the project/experimental model:

“...it formed this external network. And I know that was one of the exclusive goals of these grants, and I think that worked really well. So the initial partnership(s)... those have all stayed very strong and expanded.” (Tribal Climate Change Adaptation Planning, 2013)

Many organizations and individuals were uncertain or tenuous about continued network existence (6 out of 15 projects), echoing some of the capacity issues in relation to evaluation that came up in the second round question about embeddedness/long-term impacts:

“I can’t say whether or not they have been interacting around this topic or others, you know, since the end of the project because I don’t really have the capacity to kind of go and monitor that.” (Mid-Michigan Heat Model, 2011)

Three out of 15 interviewees stated that project networks did not still exist during the second round interviews. These instances, as with the initial embeddedness question, were mainly research-based projects that utilized the small grants project for temporary funding and did not focus on network-building.

The final consideration with respect to complementarity was querying network expansion and utilization, with six out of 15 interviewees citing network expansion, one mentioning no network expansion, and four out of 15 mentioning the project utilizing an already existing network. Interestingly, one organization spoke of how the project reoriented their network building toward climate-related groups:

“So we strengthened relationships [between] jurisdictions, between the different subgroups, and then in terms of expanding relationships, we really I think focused – and will continue to focus – on expanding relationships related to climate change expertise.” (Climate-Informed Ravine Management, 2013)

One recurring theme in the second round interviews was that many of the early small grants projects—most of them during 2011, when the program first started—were research-based, and these projects display most of the “negative” or neutral project outcomes related to relationships, long-term impact, and network-building. This provides a critical window into the Program’s evolution. These outcomes are likely the result of the types of projects funded: research-based vs. more network-oriented projects are likely less able to generate the most “positive” networking outcomes of co-production. It also could have been a matter of the Program/ABCM being in its infancy and not yet running at full capacity.

Regardless, the most important takeaway is that the ABCM was always designed to be an experiment, and the transition to more network-oriented projects over the Program’s different generations shows that GLISA adaptively shifted toward more successful co-production strategies over time. “Negative” outcomes, especially in initial projects, served as vital learning opportunities to frame future requests for proposals, steer funding decisions, and generally make the Program more effective in later generations.

Lastly, interviewees were asked about resources, with a wide range of answers that largely echoed the findings from the round one interviews. While the total breadth of responses is likely too broad to completely report here, main sub-factors mentioned were existing/ongoing lack of financial support impacting the project (5 out of 15 projects), lack of expertise and personnel to carry project forward (3 out of 15), and the fact that the project allowed work that might not have been done otherwise (3 out of 15). However, the subject of resources surfaced in interesting ways during second round interviews. One project mentioned that they had designed their projects to be inherently well-matched for lower-resource situations, and in fact that was a “strength” because it caused it to be more accessible for users:

“Yeah, well that was the whole idea, basically to develop a project that could be deployed with very small resources... So the tool that we developed, the whole idea was to use it with small resources, or low resources, and as a matter of fact try to use that even as a strength, because then we can – by having something that is low tech or you know, that’s easily accessible that is user friendly – well, then we could empower the civil workers from the city, and get them directly involved, instead of having something that is only accessible to engineers or scientists.” (The Climate-Ready Infrastructure and Strategic Sites Protocol [CRISSP], 2014)

This in particular is a window into how co-production can evolve into unique processes over many scales of interaction in the face of constraints: a lack of resources drove the project design, with the needs and unique circumstances of practitioners heavily informing how the boundary organization approached the development of their tools. One question that arises from this example is: was intentional project design the reason this particular project succeeded with limited resources while other projects cited a lack of resources as an impediment? The question of resources, easily the driver with the widest breadth of responses in interviews, is the subject most in need of further—and dedicated—research.

Conclusion

Analyzing the entirety of the first and second round interviews yields a comprehensive view of how the Adaptive Boundary Chain Model has operated over the span of five years and 16 projects. Distilling the analysis in this report yields a few main takeaways:

- Embeddedness is, by far, the most important driver among those analyzed, with the intensity and amount of interaction between GLISA/boundary organizations and/or boundary organizations/practitioners strongly correlating to positive co-production outcomes, relationship-building, and long-term impacts;
- The ABCM is likely least effective in research-based projects that are relying on temporary funding as part of a longer-term undertaking, rather than a dedicated co-production process;
- Resources are the subject most in need of further research, as the complexities/difficulties inherent in analyzing/measuring an organization’s capacities and capital make isolating correlations to outcomes challenging.

Finally, many organizations were almost completely uncertain about where their former projects stood during the second round interviews. Based on initial results from this evaluation, the reframing of the 2019 Small Grants Competition to necessitate project structures related to evaluation was an important decision. With the relative lack of literature on evaluative frameworks related to co-production and data from this analysis, this is an area acutely in need of further attention, and GLISA’s more recent approach to the Program should make the next round of evaluation more streamlined. Overall, this evaluation provides evidence that the ABCM and Small Grants Program adaptively shifted approach to draw more robust outcomes out of the co-production process. Just as critical, however, is the role that it can play in providing key information for the further growth and adaptability of the Program to help meet the evolving knowledge requirements of practitioners dealing with the impacts of climate change in their communities.

Project Snapshot

Diversity and Deliberation in Saint Paul

Downtown Saint Paul, Minnesota

Funded across two Small Grants Program cycles, the *Making it Personal: Diversity and Deliberation on Climate Adaptation* in Saint Paul, Minnesota was a collaboration between two boundary organizations: Macalester College and the Science Museum of Minnesota. The project specifically examined how climate vulnerabilities are unevenly distributed across races, ethnicities, classes, ages, incomes, and genders. Aiming to include voices that are often left

“This helped establish a good relationship with the city as a partner. When we started this project several years ago, the city hadn’t put into place a climate action plan. Now there is one, and we moved from having this sponsored by the sustainability program to having a chief resiliency officer – with this project in his suite of programs.”

out of climate change adaptation and mitigation planning, the project trained community partners to help conduct a series of four Consensus Conferences on concerns and actions in response to climate impacts on local neighborhoods in Saint Paul. Out of these conferences, local residents were able to present their findings to city officials and one another, helping to further inform climate policy decision-making in the city.

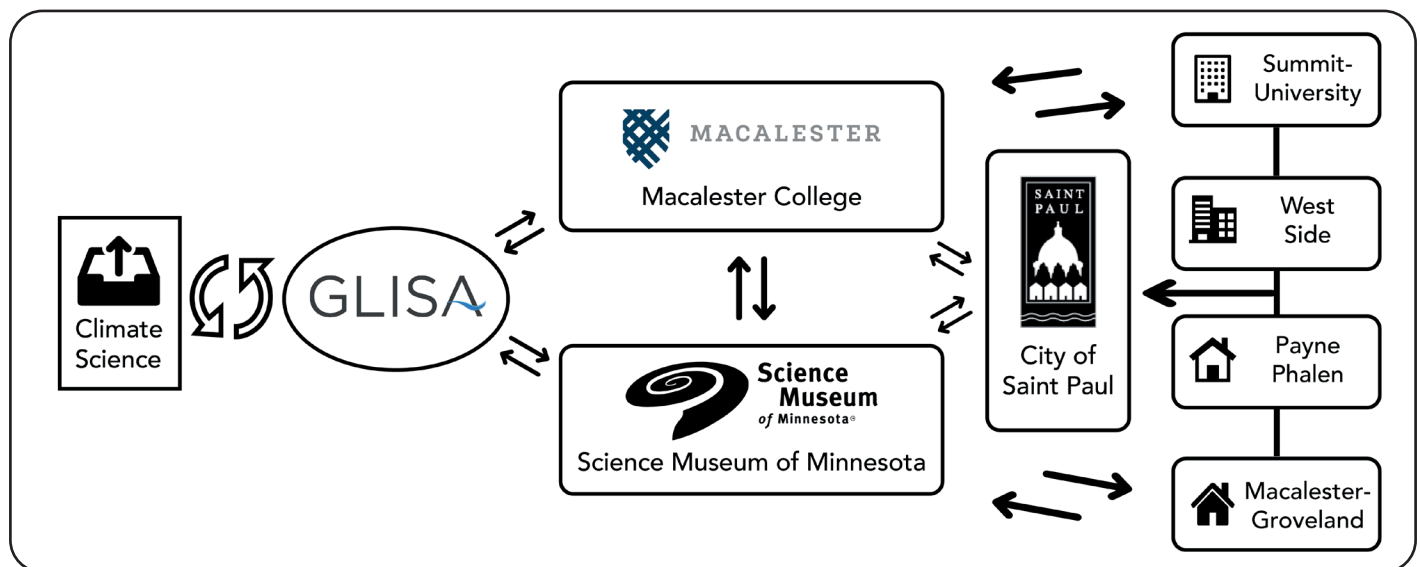


Figure 4. The Adaptive Boundary Chain for the *Making it Personal: Diversity and Deliberation in Climate Adaptation Planning* (2013-2014) project.

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