Final report for G-1808-275561

FLAG CALUMET KIT

empowering residents to contribute to habitat restoration of the Calumet region

This final document was created by researchers from the IIT–Institute of Design to the Arts and Culture team of the Kresge Fountaion as a final report of a year long fund received for the G-1808-275561 research project. December 31, 2019

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EXECUTIVE SUMMARY

The Calumet Region encompasses the southeast side of Chicago, south Cook County and northwest Indiana in the United States. Because of its strategic position in the country's geography, the Region was once the industrial heart of the Midwest, attracting investments that increased access to transportation, open spaces, and the presence of skilled workers.

However, prioritization of economic growth over environmental responsibility led to high level of pollutants from industrial effluents and waste that compromised the integrity of the land, water, dunes, and other elements of the ecological landscape of the region. After years of disinvestment, a patchwork of different types of brownfields was unintentionally created, and the current inadequate solutions for re-injecting life into those properties increase complexity for restoring the region.

A brownfield is a previously developed property on which expansion, redevelopment, or reuse may be complicated by the presence or perceived presence of a hazardous substance, pollutant, or contaminant. Conventionally, the redevelopment process is planned, led, funded, and

implemented by linear processes, involving multiple agents, including organizations, developers, and advocates that lack expertise about the patterns of daily life of those living in its immediate surroundings.

As a result, the impacts and outcomes that result from such processes are not as fragmented and linear as they might seem in the planning phase; they often cause unintended consequences, such as disruption of local economies and the spark of gentrification processes in the neighborhood where the property is located.

As the region builds on these assets toward a vibrant future for people, wildlife and businesses, the IIT-Institute of Design (ID), and the Calumet Collaborative (CC) are collaborating to co-design interventions that support transitions towards more sustainable and equitable regional development.

This work represents the third stage of "The Future of Brownfields" research project, an ongoing partnership between ID and CC, with the support and active collaboration of the Keller Science Action Center, located at The Field Museum of Natural History. It does so by iterating and advancing on the concept of the Flag Calumet Kit,

an infrastructure being designed for habitat restoration through creative placemaking based on the integration of its hard and soft dimensions.

On its hard dimension, a modular installation is designed at the intersection of art, science, and computer science, and it serves to facilitate interactions between local residents and the environment.

On its soft dimension, handson experiences designed as complementary activities for residents of the Calumet region embody three main principles: (1) reflect the resident's identity, (2) increase the resident's capacity to claim ownership of their surrounding environment by accelerating its ecological regeneration, (3) contribute to revitalize local economies.

This document is a final report of a year-long proposal, funded from december 2018 until december 2019 with the overall goal to run micropilots, based on the development of the Flag Calumet Kit as a new offering for restoring habitats through creative placemaking. In this project, we leveraged design frameworks and methods at the intersection of art, science, and computer science

to empower local individuals and organizations in the Calumet Region to develop and proof a resident-driven model for cooperatively building this new infrastructure.

Overall, this proposal reflects the widely shared belief that collaboration offers the potential to generate interventions for habitat restorations and local economy revitalization that could not be designed by isolated efforts. In order to make progress in alignment with our goals, the research, analysis, and iterations of the Flag Calumet were conducted by interdisciplinary research teams, and through cross-sectorial engagements. Rather than improving and reinforcing current approaches for brownfield redevelopment, the Flag Calumet emphasizes the importance of a broader ecosystem of individuals and organizations participating and being impacted by brownfields redevelopment efforts.

By considering a broader set of constituencies, the Flag Calumet also expands its contributions for creating new synergies between dispersed groups, and network effects between them to support innovation ecosystems to emerge, consequently increasing value through collaborative advantage.

CONTENT

| BACKGROUNI | D Habitat Restoration a |
|--------------------|--|
| CONTEXT | The Socio-Ecologica A Patchwork of Br |
| STRATEGY | Brownfields Redevel Revitalizing of Local |
| APPROACH | New Infrastructure for N |
| METHODOLO | GY Alternative Approach Creative Placemak Design as a Struct |
| FLAG CALUMI KIT | ET Flag Calumet: An Infr Phase 01 Conceptua Phase 02 Prototypin Flag Calumet KIT Phase 03 From Inf What makes the F Why will it create w How will it be made Who is it for? What should be created When will it be use |
| SCALING UP | |

REFERENCES

APPENDIX



IIT Institute of Design (ID) is a graduate design school with a history of innovation. ID pioneered the development and dissemination of modern design from its founding in 1937 as the New Bauhaus in Chicago. Experimentation, rigorous methods, systems design, and strategy support ID's current focus of preparing individuals and organizations to take on the world's complex, fast-changing, and unpredictable problems such as competitiveness, digital media and learning, health and wellbeing, social innovation and more.



The Calumet Collaborative is a bi-state nonprofit organization dedicated to achieving inclusive regional prosperity and improving quality of life in the Calumet region through sustainable development. The NGO catalyzes innovative partnerships between Illinois and Indiana stakeholders to advance a thriving Calumet region with a focus on (1) Livable Communities, (2) Economic Opportunity, (3) Environment, (4) Culture and heritage.

| n as a 21st Century Challenge | 7 |
|--|----|
| cal Condition of the Calumet Region | 11 |
| Brownfields in The Calumet Region | 15 |
| ate Change and Social Justice Initiatives | 19 |
| velopment as a Critical Path for al Economies | 21 |
| e for New Interactions | 25 |
| r New Infrastructures | 29 |
| aches for Integrated Infrastructures | 31 |
| aking as a Means for Redevelopment | 31 |
| cture for Creative Placemaking | 33 |
| nfrastructure On The Making | 39 |
| ual Infrastructure | 43 |
| ping Infrastructure | 47 |
| | 55 |
| nfrastructure to a Kit | 55 |
| Flag different? | 61 |
| e value? | 62 |
| ade real? | 63 |
| | 64 |
| created? | 65 |
| seful? | 67 |
| nard and soft dimensions | 71 |
| | 85 |
| | 88 |
| | 90 |

Alkaline water pH 14: Most living creatures cannot survive if pH is above 9, or bellow 5.

Steel slag: a by-product of steel making present in most of the Midwestern United States

> Purple loosestrife: invasive specie pushing out most other species in wetlands

BACKGROUND

HABITAT RESTORATION AS A 21ST CENTURY CHALLENGE

Public awareness about deteriorating environmental conditions, including climate change, and high demand for social innovation, including social justice, is promoting major transformations in processes of regional planning. As existing planning processes are increasingly challenged by large volumes of data, technological innovations and cultural change, many institutions are searching for alternative pathways to contribute towards a more sustainable and equitable processes, opportunities, and outcomes at a local level.

Without adequate approaches for understanding the complex network in which humans are engaged and the environment in which action is taken, current organizations are struggling to understand how these forces should be incorporated into their own practices, and often fall short in integrating considerations of a diverse set of agents, including small and local organization, into the development of sustainable and equitable solutions. Even though successful initiatives are being developed in different regions across the country, the challenge of scaling and adapting them is highly expensive and yet to be overcome.

Several efforts have been made worldwide in the light of assessing. understanding, communicating, and even reframing the degenerating conditions of contemporary ecosystems with the underlying assumption that more information can lead to better interventions. One of the most relevant initiatives was led by the United Nations at the turn of the 21st century.

The Millennium Ecosystem Assessment (MEA) was an international program that expanded previous notions and understanding of the ecology of natural systems because it highlighted the dependency that the well-being of humans have on their environment interactions. The initiative not only presented a reframe of contemporary production and consumption systems, but also provided a structure for individuals and organizations to understand how ecosystems supported human's health, happiness, and prosperity. Four categories of ecosystem services were provided to support and track this linkage: supporting, provisioning, regulating, and cultural services [1].



The underlying assumption of the MEA being developed at higher paces within the last decade, many others contain and other socio-ecological studies is multiple levels of contamination and that when ecosystems are functioning well, they are able to provide a slew can blight not only their immediate of services that are strongly linked surroundings, but also negatively to the well-being of people, enabling impact the future of an entire societies to live in physical security, region. Indeed, there are a myriad of while satisfying their basic needs for governmental agencies, NGOs and forfood, water, shelter, as well as individual profit organizations that are involved health and social interactions [2]. in clean up and redevelopment of sites. Yet over the years, there has been only a slight change in the number of unproductive and contaminated land overall [5].

Recent studies have confirmed these assumptions by yielding substantial scientific evidence about the positive association between human health and This report describes the efforts made well-being [3]. Yet, the unsustainable in the past twelve months by the IITuse of ecosystem services have provided benefits to humans at the cost Institute of Design in partnership with Calumet Collaborative, and in of more than 60% of their degradation [4]. When ecosystems services are collaboration with the Field Museum. transformed, the well-being of human the National Wildlife Habitat Council, and non-human agents becomes and other local NGOs, for advancing on the exploration of existing technology endangered. into the design of context-informed Nowhere is this more obvious than in interventions that can expand the context of rust-belt cities in the US opportunities and accelerate existing Midwest where industrial production processes of habitat restoration, while activities declined or moved away, supporting the revitalization of local leaving behind large swaths of vacant economies in the Calumet Region.

land or highly contaminated areas that lack economic activities, business interests, and social capital.

While some of these properties are clean parcels or former agricultural land



CONTEXT

THE SOCIO-ECOLOGICAL CONDITION OF THE CALUMET REGION

The Calumet Region encompasses the southeast side of Chicago, south Cook County and northwest Indiana in the United States. As a post-industrial bi-state area covering over 900 square miles, the Region boasts proud and diverse communities, important natural ecosystems, and a powerful industrial and cultural heritage.

The area includes over 70 municipalities that represent diverse socio-economic and socio-cultural population within their own boundaries. As of 2010, the overall population of the Region is 1,328,707, composed by 4% Asian, 21% African Americans, 53% White, 20% Latinos, and 2% Others. The Illinois side has a majority of minorities being 6% Asian, 24% African Americans, 43% White, 25% Latinos, and 2% Others¹.

Because of its strategic position in the country's geography, the Region was once the industrial heart of the Midwest, attracting investments that increased access to transportation, open spaces, and the presence of skilled workers. However, prioritization of economic growth over environmental responsibility led to high level of pollutants from industrial effluents and waste that compromised the integrity of the land, water, dunes, and other elements of the ecological landscape of the region.

In addition to environmental issues, complex social challenges are also present in the Calumet Region. With the decline in industrial activities, many companies went bankrupt. And with them, many workers and residents instantaneously lost their jobs. While several residents accepted similar job opportunities for the half of the financial compensation being offered by the same companies, many others didn't.

Ever since, very few families moved up in their social class, and many lost their quality of life, moving out of the region in search of new jobs. In this process, residents abandoned their property, even if they were renting or owning it. The lack of financial system, or a service, to accommodate such needs, at a scale that was necessary, brought several implications to the region beyond the impact on the individual's life.

Today



Operating under the logic of the economic burden resting on the shoulders of property owners, banks, real estate and other organizations lost the opportunity to play a significant role in both maintaining or even improving the daily life of many low-income and marginalized residents, as well as contributing to restore Calumet's degraded ecosystems.

As a consequence, alternative value systems that once were not recognized within current economic system became more apparent, and started to shape new economic transactions. For example, residents of the Region constantly leverage resources other than money to create and acquire value for their own community. By volunteering, participating in social events, organizing and supporting local practices for restoring the environment, low- income and marginalized residents crafted their own businesses and social ties.

Contemporary approaches to habitat restoration suggests that collaborative efforts, and the use of people's time, abilities, competences, soft skills, among other resources, have been recognized as legitimate practices within their own realm of impact. Yet, the underlying economic opportunity is yet to be explored, given the rise of new technology in financial services, and the unsustainable structure of the current economic system within which residents of the Calumet Region live in.



A Patchwork of Brownfields in **The Calumet Region**

After years of disinvestment, a patchwork of different types of brownfields was unintentionally created, and the current inadequate solutions for re-injecting life into those properties increase complexity for restoring the region as a whole.

Brownfields are previously developed properties on which expansion, redevelopment, or reuse may be complicated by the presence or perceived presence of a hazardous substance, pollutant, or contaminant.

Conventionally, the redevelopment process of a brownfield is led, funded, and implemented by multiple agents, including organizations, developers, and advocates that lack expertise about the patterns of daily life of those living in its immediate surroundings.

The processes typically follows a linear path: first funding to survey the site is secured by the owner of the land or by developers interested in the property. Then, the site is surveyed for hazardous substance, pollutant, or contaminant by organizations with high level of expertise and specialized equipment to perform such activities. Once enough information about the ecological composition of the site is gathered and analyzed, new funds are secured to

create and implement a remediation plan. After cleaned, the property becomes available for redevelopment and productive use, which then require another funding cycle [6].

In each one of these stages, different stakeholders are involved, and different agents assume leadership based on their ability to access and mobilize different types of resources, including knowledge, money, political influence, specialized equipment, among others. Although redevelopment processes tend to increase the value of the land, and directly impact their immediate surroundings, current approaches have been disconnected from the local dynamics, especially those of lowincome and marginalized populations, and community-based organizations.

Many key decision-makers who are designing large-scale interventions in these properties operate on a site-bysite basis, and do not involve residents and small organizations in the Calumet region in their processes.

As a result, the impacts and outcomes that result from such processes are not as fragmented and linear as they might seem in the planning phase; they often cause unintended consequences, such as disruption of local economies and









the spark of gentrification processes in the neighborhood where the property is located.

When brownfields are redeveloped through fragmented and linear processes, many of the unintended consequences become harder to be foreseen because the individualistic focus prevents a broader, systemic perspective towards the socioecological issues at hand.

Even though incremental improvements are regenerating the ecological conditions, economic attractiveness, and unproductive manufactured resources within the properties, there is still an underlying opportunity to promote systemic changes without replicating the disruption of local practices and the degeneration of other types of resources across the region, including human and social capital, and cultural practices.



Barriers to Climate Change and Social Justice Initiatives

The unprecedented impacts of the industrial revolution legacy in the Calumet Region require that both its society and ecosystems are prepared for the necessary adaptations posed by the accelerations of a worldwide changing climate. Brownfields are properties that negatively impact the health conditions of both social and ecological systems, and therefore, pose significant barriers in advancing climate change initiatives in the Region and beyond.

Although the environmental challenges have been more intensively discussed, the social obstacles are still underexplored, and require greater attention. During the FY16, the EPA funded initiatives in almost 19.537 brownfields sites across the U.S. 14% of all people of color, 9% of all Latino, 10% of all minorities, and 12% of all households below the poverty level live within a 0.5 mile of these sites. By widening the site boundary to 3-mile radius, these numbers increase to 55% of all people of color, 47% of all Latinos, 49% of all minorities, and 49% of all households below the poverty level [7].

Thus, brownfield redevelopment processes necessarily impact the health and the lives of low-income and vulnerable populations, and their resilience to cope with the impacts of climate change.

Without the incorporation of the dynamics of local populations in brownfield redevelopment processes, many initiatives tend to intensify socio-economic issues in the pursuit of cleaning the environment, and therefore, miss the opportunity to promote greater impact towards climate change [8].

The state of environmental degradation of the Calumet Region indicates that ecosystems distributed in the territory need human interventions to be restored at the speed and scale necessary to become functional again. Likewise, the increased social disparity suggests that local economies need to be revitalized, including capacity building and the creation of new jobs.

STRATEGY

BROWNFIELDS REDEVELOPMENT AS A CRITICAL PATH FOR REVITALIZING OF LOCAL ECONOMIES

Instead of embracing the entire Calumet Region as a field of intervention, we first identified several patterns of brownfields that existed throughout the territory. Out of several patterns identified, we focused on four archetypes due to their distribution and direct impact in both its immediate surroundings and the Region as a whole: vacant residential buildings, abandoned industrial sites, former landfills, and contaminated natural areas.

Rather than screening different properties considering their physical condition, or the space they occupy, we focused on exploring them through the different experiences they shape and provide for different set of agents interacting with them, including local residents, government agents, potential investors, scientists, environmentalists, educators, among others.

Such an approach opened new opportunities for us to creatively explore how could brownfields be transformed into new places within the Region, and contribute to the well-being of people and the broader ecosystem they live in.

A critical and distinctive feature to be highlighted in taking such an approach

New approaches are necessary to support the multiple agents participating in the different stages of brownfields redevelopment processes to:

(1) recognize the multiplicity of resources they activate and mobilize through their activities;

(2) enable more creative pathways to address the systemic issues in the Region, including those related to more inclusive and equitable strategies for advancing on operational and technical processes in restoring local habitats and revitalizing local economies.

Without taking more holistic approaches, new complex problems will continue to emerge as existing sites are remediated. And with them, new isolated, fragmented solutions will continue to increase complexity for more sustainable solutions to these unproductive properties, and the socioecological conditions of the Region as a whole [5]. is to recognize that there is a physical, geographic space that determines the boundaries of a brownfield; or its three-dimensional realm within which activities take place according to how people navigate the area, and order their understanding of it.

But, there is also the abstract dimension in which people order their experience; or a portion of the space appropriated by individuals according to their emotions, memories, and perception of its value and potential [2].

While significant advances have been made in the former, we realized that more creative pathways to uncover elements, patterns of aspirations, related problems, and socio-ecological needs of multiple agents of the latter could add value not only to the Calumet region, but to reimagining the opportunities through which brownfield redevelopment have been framed.

Early explorations enabled us to recognize that each one of these archetypes demanded a unique understanding of its complexity because they resulted from different processes, and led to different challenges in both the entire Region and in their immediate surroundings.

21

For example, a former landfill results from economic, social, and ecological processes that are different from those leading to the rise in the number of abandoned residential buildings. From this perspective, brownfields became not just as problems of contaminated and unproductive land but as sites where multiple systems intersect - such as housing, environmental protection, public safety, education, mobility, insurance, public health, zoning, among others. In each of these systems, underutilized assets related to remediation processes in the regions were identified, and prototyping methods were used to explore how these assets could be strategically (re) activated to revitalize local economies.

Upon researching different archetypes, we were exposed to complex situations in which available products. services, and strategies to tackle habitat restoration seemed limited in considering how the flows of different types of resources. We considered a resource any stock of material. attributes, elements, and components that can be drawn by agents in order to maintain a function of a system [5].

Thus, in addition to conventional approaches to resources that consider financial, capital, and manufactured capital as resources, we considered human knowledge and health, cultural practices, political access, and social networks as resources that were both influencing the dynamics of local interactions, and being compromised by conventional brownfields redevelopment processes.

In the search for more collaborative and democractic efforts to integrate considerations of these and other resources, we were often constrained by the infrastructures shaping the access and availability of them.

While in some cases, available resources were only accessible by a certain set of agents (e.g. concentration of knowledge and financial capital), in others the lack of resources to all agents involved constrained the potential for impact that multiple agents intended to create (e.g. political capital to influence change in hazardous material management policy, including in active private companies along the Lake Michigan front, and the Calumet river, health services for low-income population, among others) [2].

Instead of advancing on specific products or new services that would improve current offerings, we prioritized approaches that could render visible this paradoxical conditions of existing infrastructures.

And in doing so, unequal and unsustainable distribution of resources and related opportunities to restore local habitats and revitalize local economies became elements for more rigorous and open debates during our innovation processes.

23



APPROACH

NEW INFRASTRUCTURE FOR NEW INTERACTIONS

Technological advances made during the 19th and 20th centuries in the Calumet Region led to an extended period of rapid development and growth of different types of infrastructure.

Roads, lighthouses and lakefront management programs, electrical grids, sewers, health care institutions, telecommunication systems, among others, and all modern technical systems created after them, became the means through which individuals, communities, and organizations make decisions about their own life, and advance towards the future of the Region.

Conceptualized and built to last decades if not centuries, these infrastructures consolidated and perpetuated patterns of flows of resources within and across systems that influence brownfields redevelopment (e.g. remediation processes, public safety policies, mobility systems, etc.). Nowadays, they became critical elements that connect social networks by providing the context for how people can or cannot work, learn, play, and live with others [2].

Yet, because they are considered mature elements upon which

social activities and environmental performance fundamentally depend on, the existing infrastructures in the Calumet Region are usually perceived as given, and unchangeable.

Overtime, knowledge about how to intervene in infrastructures evolved with a distinction between two dimensions: on hard infrastructures, which relates to tangible and material aspects, and the other, on soft infrastructures, which relates to institutions, intangible aspects, and social behavior.

The first one usually results from the design efforts of engineering and natural science disciplines, and it includes mostly technical and technological aspects of physical elements, including products and their mechanisms and engines of operations.

The second one is the center for the fields of social sciences that explore human interactions, services, and networks as infrastructures of a system, and therefore, take considerations of multiple perspectives towards unfolding new dynamics in systems [2,9,10].



Both carry agency and meaning because infrastructure can be the physical elements being intentionally designed but also the relation between them, consequently actively orchestrating under specific goals how individuals and institutions activate and mobilize resources based on their interactions.

While significant efforts have been made in social sciences for conceptualizing the role of infrastructure in enabling large scale transformation, such as those needed to improve the health condition of lowincome and marginalized populations, many of them have focused on isolated analysis of single domains; rather than creating alternative infrastructures to underpin the multiple values they bring to society.

Without considering how the relationship between modern infrastructures and the activities of daily life of diverse agents determine the flow and allocation of different types of resources, efforts to restore habitats in the Region will not only continue to be led and operated by specific groups that bring different agendas than those living in the territory, but also be limited in contributing to the well-being of diverse agents and the environment in which these infrastructures exist.

This work focused on providing an alternative approach and solutions to brownfield redevelopment based on the opportunity to contribute to local economies by providing new infrastructures for restoring diverse ecosystems in the Calumet Region.



BROWNFIELD REDEVELOPMENT NEW INRASTRUCTURES THAT CREATE BOTH SOCIO-ECOLOGICAL AND SOCIO-ECONOMIC VALUE

CREATIVE PLACEMAKING

Assumptions for New Infrastructures

The Calumet Region's ecosystems and the services they provide were transformed by the industrial activities during the 19th and 20th centuries. The demand and need for habitat restoration, land reclamation, and natural and social capital regeneration continues to be extremely high in the Calumet Region. As the speed and scale of these issues are not being met by the infrastructure available, and the processes and solutions being presented, the well-being of human and non-human agents currently living in its territory became endangered. Moreover, the workforce necessary to provide ecological services to restore ecosystem is highly specialized.

Only individuals with formal and academic training as engineers, chemisists, geographers, physicists, among others, tend to directly engage with remediation processes due to chances of hazardous materials. While it is important to maintain safety as a primary concern, when the intelligence of service provision is embedded in individuals (not in the infrastructure within which they operate), brownfields redevelopment processes ended up having high transactions costs and barriers for entry for individuals and organizations with limited resources. The underlying assumption of this work is that, overtime, such condition reduced the sense of ownership and agency of residents towards the ecosystems they live in, as well as their knowledge about how to integrate considerations of ecological concerns into daily choices also reduced.

Consequently, habitat restoration efforts became something apart from the dynamics of daily life in urban areas, and the interactions between human agents and non-human biological agents become a byproduct of humans decisions. We considered brownfields underutilized and often unrecognized assets that can be leveraged to create both socio-ecological and socioeconomic value for the diverse set of agents that live in the territory where they exist.

The intersection of these two opportunities for value creation provides a possibility to embed part of the intelligence of restoration processes into infrastructures that contribute to reducing unemployment in the Region, especially in lowincome and marginalized population. Additionally, we believe this work brings approaches that can open new segments in the Creative Placemaking industry.



METHODOLOGY

ALTERNATIVE APPROACHES FOR INTEGRATED INFRASTRUCTURES

Creative Placemaking as a Means for Redevelopment

In order to explore alternative processes to recover and activate unproductive territories, we took an experimental approach to uncover and investigate opportunities at the intersection of Creative Placemaking and brownfields redevelopment in the Calumet Region. Creative Placemaking brings a variety of approaches to equitable community development through the planning, intervention, and management of art-driven adaptive and responsive solutions. The approach defends a community-defined outcome, consequently enhancing the sense of place.

We focused on leveraging critical principles underlying Creative Placemaking practices, including the engagement and involvement of lowincome and marginalized individuals and organizations into decision-making and creative future thinking processes, as a mechanism for increasing agency of residents in deciding for the future of their surrounding areas, and for challenging conventional narratives around redevelopment processes.

Most of the vexing problems around brownfields redevelopment can't be met by reductive processes at the heart of environmental engineering,

economics and other traditional fields involved in habitat restoration in urban areas. As previously mentioned, many of the unintended consequences are related to social displacement of lowincome and marginalized populations, and the disruption of local practices and culture.

From this perspective, Creative Placemaking became the foundation for integrating inputs from different agents, transferring them into new strategies, concepts, and refined prototypes that reflect the collective identity of those involved in the activities for brownfields redevelopment.

We considered the action of framing a problem and integrating considerations of multiple and diverse groups bring within its set of activities a system of values, beliefs, and criteria that shape choice-making in the process of identifying solutions.

Underlying this logic is the principle that knowledge about the problem at hand is socially constructed and created within specific contexts. Different agents embedded in these contexts have deep, yet different, complementary, and often conflicting expertise about the space of problems being faced. By creatively integrating them into problem-framing processes, emerging practical solutions can have higher chances of contributing towards sustainability and equity of the place of intervention.

However, because brownfields redevelopment are characterized by high levels of uncertainty about how to design creative and meaningful positive change that reflect the broader context where they exist, agents involved in the process of defining interventions tend to rely on their own competencies and expertise as a source of reference to what can be done. Moreover, the lack of agency that residents have towards brownfield often prevents them to have a clear point of view about the future of territory [5].

Hence, the need for proper tools and frameworks to structure the interactions between diverse agents impacted by redevelopment processes. Such mechanisms should be a support for uncovering unidentified needs, so that bias that have been historically transferred into solutions through creative processes and be challenged, and future interventions can reflect the reality of those living close to the site.

Design as a Structure for Creative Placemaking

We then hypothesized that for Creative Placemaking to expand its contributions in such complex situations, largely present in many post-industrial regions in the country, it could benefit from a discipline capable of supporting collective diagnosis, management of conflicts of interests during innovation, and creating new lines of communications between dispersed networks, so that future actions can be representative of different interests and expectations. As a situated practice, Design brings rigorous approaches to collective engagement and creative processes.

The field of Design has a variety of tools, frameworks, and methods that can be leveraged to create meaningful change in situations involving multiple agencies and stakeholders with independent agendas, organizational norms, politics, implementation strategies, and instruments. As a discipline driven by the logic of the possible, design can contribute to unlocking current unsustainable practices and enabling paradigm shifts towards a more equitable and sustainable approaches to brownfields redevelopment [5].

Throughout the processes of applying design as a structure through which **Creative Placemaking activities** happened, we used a set of tools, frameworks and methods intended to support individuals and organizations in their choice-making during innovation processes. Yet, given the novelty of this venture. we also had to create new tools and frameworks based on reliable theories and methods from other fields that could be used at scale. with evidence they have potential to be effective, could be understood and used by others, and could contribute to greater impact, while also furthering research and knowledge creation in the field of Creative Placemaking.

For example, we created the Innovation Lenses framework, bringing eight different lenses (natural, financial, manufactured, digital, political, cultural, social and human) as a means to integrate different perspectives and resources into the design of a specific, creative intervention [2,5].

The application of this framework in Creative Placemaking activities helped us to map how multiple social, ecological, and technical systems hinder or support brownfield redevelopment processes, and identify

Innovation Lenses Framework [5]

traded.

SOCIAL

| HUMAN | SOCIAL | CULTURAL | POLITICAL |
|---|---|---|--|
| The ability and capability of individuals to produce, and manage their well- being. It includes individual health, knowledge, skills, and motivation. | The professional and social connections among agents. It includes partnerships and collaborations, as well as informal gatherings. | Values and beliefs inherent in social practices, or incorporated by communities, that determine patterns of behavior that are encouraged, discouraged, or tolerated by individuals and organizations over time. | Governing structures in organizations that determines how decisions are made and power is distributed. It involves hierarchy, inclusion, equity, transparency, access, and participation. |
| ECOLOGICAL | TECHNICAL | | |
| NATURAL | FINANCIAL | MANUFACTURED | DIGITAL |
| Comprises natural resources, both renewable and nonrenewable. It also includes fauna and flora, as well as their life-supporting systems. | The productive power in the resources of other types of capitals. It includes the resources and assets of an individual or entity translated in the form of a currency that can be accessed, owned or | All material goods. It includes human- made elements such as physical infrastructures, roads, artefacts, and machines. | Digital infrastructure and data. It includes digital platforms, as well as the mechanisms of data collection, analysis, and storage. |

underutilized assets in the regions in each one of these systems. In doing so, we were able to expand our opportunities for value creation, and explore how these assets could be creatively activated to restore local economies.

Combined, new and existing design tools and frameworks served a means to structure conversations and rigorous debates around the underlying and disruptive forces shaping the complex issues at the intersection of habitat restoration and revitalization of local economies in the Calumet Region.

Unlike other creative approaches in which leading individuals and organizations tend to hold control and ownership of the process and results. our approach focused on ensuring greater involvement and collaboration between all parties, including the organization and preparation of activities, analysis and synthesis of data, and validation of the outputs [2].

In order to do so, we organized prototyping activities that supported diverse groups to co-create and visualize multiple ideas, making them less abstract than when represented in words alone. By rendering ideas and concepts visible, such an approach

have expanded dialogue around what kinds of interventions are needed, why will they create value, how they can be structured, where and when they can be created, and ultimately who are the beneficiaries and responsible for promoting the desired interventions.

Participants of prototyping activities were identified within the network of collaborators of each partner organization, and in their extended networks. They were selected based on their knowledge and experience in the challenge at hand and their experience mobilizing resources we were interested in.

Beside their technical expertise, (1) diversity in demographic representations (e.g. gender, ethnicity), (2) institutional representation, including sectors (e.g. public institutions, private sector companies, NGOs, and academia), institutional role or rank (e.g. directors, managers, analysts, etc), (3) state representation, and (4) personal experiences and backgrounds were also considered valuable contributions that directly or indirectly inform the design of future interventions.



The use of multiple criteria to strategically involve the diverse groups increased the rigor towards surfacing and codifying the different perceptions that individuals and organizations had regarding approaches that contribute to equity in capacity building of residents and sustainability in institutional practices and habitat restoration efforts [5].

Our approach rendered visible the paradoxical conditions of redeveloping unproductive lands. On one hand there are ecological and economic values that tend to be regenerated. On the other hand, their redevelopment continue to extract value from the social systems surrounding brownfields.

The integration of these aspects tend to be overlooked and often hidden in creative activities, such as the development of new golf course, parks, hotels, industries, etc. But if properly done, new opportunities to create and regenerate different types of value for individuals and communities, as well as for organizations, and for the natural environment, can be created.

By engaging and involving diverse groups, learning about their perspective of the context, doing research with them, testing hypotheses and concepts

together (associated with products, infrastructures, platforms, and knowledge), and exploring alternative futures through the co-design of conceptual, visual and physical prototypes, we were able to leverage design as a mechanism to expand the perceptions that participants had about the issues at hand.

The rigorous application of methods and frameworks during Creative Placemaking activities provided a common vocabulary and structure to surface and discuss hidden assumptions about the historical precedents of brownfields, as well as the future of the region, including what alternative narratives could be created for specific sites, and how should different groups go about shaping interventions for more sustainable and equitable futures in their surroundings.

FLAG CALUMET KIT

Spring 2018



FLAG CALUMET: AN INFRASTRUCTURE ON THE MAKING

The "Future of Brownfields" is a partnership between IIT Institute of Design and the Calumet Collaborative. The collaboration examines how might Design contribute to the sustainable (re) development of the Calumet Region.

The project began in Spring 2018 and has undergone 3 distinct phases (Jan-May 2018, May-August 2018, Jan-Dec 2019).

The "Future of Brownfields" research project started with the focus on multisystems integration as a strategy for regional regeneration. Through prototypes, participants uncovered common challenges in redeveloping former landfills, vacant residential buildings, abandoned industrial sites, and contaminated natural areas, and surfaced five strategies to inform regional redevelopment [5,11]: involve residents, leverage assets, empower science, strengthen the local economy, and build integrated infrastructures.

Once new strategies were created, we explored how they could be integrated into four conceptual infrastructures [11]. The first, Flag Calumet, was a collectively built modular art installation that also gathered data about environmental conditions to increase local residents understanding of and connection with the local environment.

The second, Mini Calumet, was a simulation designed to support local youth to explore alternative governance systems capable of dealing with the socio-ecological challenges of the Calumet region.

The third, Act Calumet, was a digital platform for civic empowerment that mediates interaction among residents to optimize local resources.

The fourth, Value Calumet, was a new production system for local markets that integrated materials extracted from former landfills and other by products of current economic system as a value-added to new products.

In this final report, we present the progress made for the first conceptual infrastructure, Flag Calumet, and how it became a Kit capable of supporting different agents in the Calumet Region.



The five strategies became principles through which we made choices and progressed in our efforts. This means that whenever resources allowed, we prioritize the integrity of the first four strategies as a means to create the fifth: an integrated infrastructure.

Involve residents: incorporating local dynamics of daily lives into interventions at any given system, including making ethical choices for preventing the displacement of people;

Leverage assets: unlocking the potential of existing initiatives in the region, as well as uncovering underutilized resources that could be activated for regenerating the Region;

Empower science: increasing local leadership capacity in applied scientific research so that new means for tracking and understanding interactions between socio-technical and socio-ecological systems can inform alternative evidence-based decision-making processes;

Strengthen the local economy:

recognizing economic activities and ambitions of local residents for them to directly benefit from and take ownership of new activities;

Build integrated infrastructure:

integrating the hard (tangible) and soft (intangible) dimensions of existing and new infrastructures to unlock current unsustainable practices [5,11].



Phase 01 **Conceptual Infrastructure**

The Flag Calumet emerged as a displacing native animals. Phragmites response to the lack of ownership and can grow very easily in and near accountability of residents of the region wetlands that have been disturbed, to the ecosystems they live in. including marshes and swamps, along streams, lakes, ponds and The sense of agency and understanding roadside ditches. They also grow along of ecological dynamics are both commercial and residential areas which significantly low across different have expanded roadways, parking agents: being low-income individuals, areas, etc. Spreading easily, Phragmites social activists representing are very difficult to control and to get marginalized populations, high level rid of. A traveling motorist can easily executives of large corporations spot it because of its height and fluffy operating in the region, government seed heads.

representatives that tend to be focused on their own judiciary boundary, or leaders of community-based organizations representing a specific social need.

For example, when engaging with individuals of different groups, we learned that most of them perceive the presence of Phragmites as aesthetically pleasant. Many of these agents, including landscape designers, use Phragmites in their gardens, and landscape compositions.

However, the non-native Phragmites, also known as common reed, is an invasive species causing significant harm for the wetlands and other ecosystems in the Region. This aggressive, perennial wetland grass out competes native plants, consequently

While the relationship between people and nature is individual because it depends on previous experiences. collective actions can also suggest new pathways for exploring alternative cultural practices. Many organizations are searching for alternative solutions for the rapid spread of the plant, including NASA [12] and the Great Lakes Phragmites Initiatives [13]. But, our interactions with local agents suggested that a significant part of this misconception resulted from the lack of voice that the environment currently has in people's daily decisions, including those made by large organizations creating significant impact in local dynamics.

Our research suggested that existing and new initiatives are likely to promote greater long term impact if centered around the different agents and their dynamics of daily life. As a result, we leveraged the presence of Phragmites as an entry point to reframe the perceptions that individuals and organizations had about their





REFLECTIVE INSTALLATION

Reflective components move organically with the wind and contrast with the natural environment to attract visitors and bring attention to environmental causes.



AR STORYTELLING

AR components provide necessary information and enable real time communication with local scientists. Users become aware of actions they can take to be a part of the solution.



MONITORING COMPONENTS

and natural interactions that take place around the installation. Data collected will be communicated with visitors and scientists.

surrounding environmental conditions, and contribute to new infrastructures that would allow them to act upon it.

action of "Flagging" a territory could become an anchor point through which people could increase their sense of ownership and care for the Region.

Additionally, we also explored how the



Phase 02 Prototyping Infrastructure

During the Summer of 2018, the collaboration advanced the findings through rigorous and more refined prototypes capable of integrating these five strategies into real-world interventions.

Prototyping experiences of this phase were centered around integrating the five strategies to inform both the advancements being made related to new infrastructures themselves, and for the process of developing them.

While there is no single approach, The collaboration ran three prototyping researchers found in hands-on experiences based on three concepts activities a proper response to developed during the first phase: integrate consideration of these Mini Calumet, Act Calumet, and Flag leverage points. Yet, the experiences Calumet. All of them benefited from were designed considering other direct involvement of communitydynamics represented in the system in based organizations, local residents, the next page. and community leaders.

Although all of the three prototypes were matured enough to advance micro-piloting, this work focused on advancing the Flag Calumet concept into a Kit that resulted from the exploration of new engagement models through micro-piloting initiatives.

Participation and involvement of the Field Museum in both phases unlocked promising pathways for structuring new engagement models for creating a



more sustainable, long-term design-led interventions in the Calumet Region.

We started by creating a visual representation of causal loop diagrams based on the multiple variables shaping the underlying dynamics supporting Phragmites. This exercise led us to key points to be leveraged, including: perception of the problem, access to information (about environmental conditions), and support for action.



tidal restrictictions, berms, remant

(B): Data: Soil nutrition, composition and hydrology, genetics analytics.



The overall goal of this phase was to explore how might we engage residents of the Calumet region on larger socio-ecological challenges. Because leveraged the Calumet Is My Backyard (CIMBY) as an assets to be leveraged, the infrastructure prototyped suggested a curriculum for engaging your, so that the installation was a learning experience.

The Flag became an installation assembled by youth residents of the Calumet region to entice other residents and visitors to learn about the environment. Modular components were interconnected through digital technology that gave support for new interactions between humans and their surrounding environments. The technical core was pre-integrated into the installation, and composed of sensors and digital elements. It's function was to provide a voice to the environment. The installation, on the other hand, was designed as a metaphor of Phragmites, considering three properties:

1. Height: Growing up to eighteen feet tall, Phragmites obscure views as well as their tinder-dry vegetation increase the potential for fast-spreading fires.

2. Density: With up to 60 stems per square foot, Phragmites disrupt and displace the natural biodiversity in the area.

3. Spread: Phragmites seeds spread easily through the air, through its stolons above the ground and through its rhizomes under the ground.

We envisioned the Flag Calumet being the center of gravity to integrate three curriculum in youth programs: art, science, and digital technology. During different programs, instructors from each one of these domains can rely on the issues of Phragmites as a background for content creation and knowledge transfer. The diagram on the right suggests a path for each one of the curriculum, considering the building of the installation as the applied learning experience.

We prototyped the installation with several organizations that are active in habitat restoration efforts. These experiences provided insights about how to reconnect residents of the Calumet Region with their natural environment. Individuals in positions of leadership of different organizations were interested in exploring alternative ways in which the installation could be incorporated into their programs.



They not only saw the value of learning by assembling the installation, but also how the intersection between artcomputer science-science manifested in a specific artifact could spark new ways of thinking about and acting upon environmental challenges. For them, the installation became a mechanism through which they could better understand nature because sensors embedded in the piece, the digital technology and the coding allowed for new information to be accessed, and therefore, new ways of understanding the interdependency between social systems and ecological systems.

Among the learnings from prototyping activities with various organizations, participants engaged in educational programs also learned about new career paths they could explore as a next step in their professional journey. In addition to conventional alternatives in science, they also became interested in learning about Design, including the field's capabilities and know-how to overcome environmental challenges.

Prototyping experiences of Phase 02 suggested that by integrating considerations of art, science and technology into a hands-on experience, the sense of environmental ownership in the local population increased considering the following objectives:



Expose the youth population to environmental challenges in the Calumet region.



Increase the sense of ownership through educational programs focused on Phragmites.



Build new infrastructures in which unhealthy environmental conditions can be identified and monitored.



Raise public awareness about the impacts imposed by nonnative Phragmites.



Involve local residents in actions towards the environmental conditions of the region.



Collect and make it accessible year long data so local residents can have new references during decision making processes.



Harness art to strengthen connections between youth and the natural world.



FLAG CALUMET KIT

Phase 03 From Infrastructure to a Kit

The positive feedback encouraged us to advance on our efforts, and explore pathways to mobilize actions for increasing the interactions between the local population and the natural environment.

This meant that the resources received from the Kresge Foundation's seedfunding became allocated to advance on the Flag Calumet infrastructure into a Kit that could work as a platform to help different agents, including educators, to overcome their own barriers, and accelerate habitat restoration efforts while also contributing to revitalize the local economy.

While the former focuses on representative modes of participation, the latter expands the instrumentalities for it to happen. The current version of the Flag Calumet Kit reflects the effort of creating local assemblages that have at their core interactions between residents, government agencies, NGOs, private companies, and academics.

Before we present in detail the current version of the Flag Calumet Kit, we would like to share how the resources received from the Kresge Foundation were allocated, and the impact we were able to create. Unlike traditional approaches that try to search for all information available before taking any action, design is a discipline that makes progress through a dialectic process of making and reflecting. Since we leveraged design as structure to engage diverse agents embedded in the situation of interest, we were able to create interventions that already impacted the situation we were working in, even though we are still developing the Flag Calumet Kit. Thus, the impacts described in this report are mostly related to those made in the development process.

It is critical to notice, however, that the impact created didn't follow the logic of what could be probable, but rather what was possible in a reasonable time, given the available resources.

The iterations on the Kit and the impact made in each one of the engagements resulted from inferences openly discussed and collectively made about unobserved causes, and explanatory reasons of the observed dynamics during prototyping of Creative Placemaking activities.

Design brings a unique value to Creative Placemaking: an ability to create impact and move forward with ambitious ideas in the face of uncertainty.

55









COLLABORATOR

student

COLLABORATOR & SUPPORTER



7 engagements*

150+ youth of the Region were exposed to the Flag. 20+ engaged in activities.

Focus

Incorporate youth concerns for increasing awareness and connection with the environment;

Understand the mindsets and motivations of the around Habitat Restoration;

Gather & incorporate perceptions, impressions and feedback of the Flag Calumet Kit.

Highly interested. 2 Kits were implemented

COLLABORATOR & **SUPPORTER**

WILDLIFE HABITAT COUNCIL

5 engagements

5 Visits to restored lands in industries. 10employees were exposed to the Flag. 4 engaged in activities.

Focus

Understand the relationship between the WHC and the industry;

Situate the Flag in private sector activities;

Map opportunities for the Flag to integrate dispersed networks;

Gather & incorporate perceptions, impressions and feedback of the Flag Calumet Kit.

Highly interested. 1 Kit was implemented.

COLLABORATOR



2 engagements 2 prototyping activities in collaboration with 51 Futures. 15+ residents engaged in activities.

Understand the

motivations of the

mindsets and

around Habitat

Restoration data

Calumet Region

impressions and

feedback of the

Flag Calumet Kit.

particularly from

adults of color.

more. 1 Kit was

implemented.

residents:

perceptions,

marketplaces among

Gather & incorporate

Focus

3 conservation sca association 2 engagements 1 site visit and 1

> volunteers, 5 NGO leaders were exposed to the Flag.

Focus

Understand diverse motivations for engaging in ecological activities and services, while codifing tree planting experiences:

Learned about existing technology being deployed, and the value of the Flag.

Gather & incorporate perceptions, impressions and feedback of the Flag Calumet Kit.

Interested in learning more. No kit was implemented.

3 prototyping activities, 1 presentation in an art class in a public high school, 1 full day of workshop activity in the Environmental Leadership Initiative (ELI), final presentation of the CIMBY program, final presentation of the ELI.

shadowing. 20+

Interested in learning

In order to evaluate our efforts, we created a formative (process-oriented) and summative (outcome-oriented) evaluation strategy. Both considered how our decisions regarding the progress made in the Flag Calumet Kit were aligned with the five strategies we initially proposed.

For the former, we created prototyping protocols, and a rigorous methodology for codifying the engagements. The overall goal was to capture data about the interactions so that others, including participants of the activities, would also participate in the cocreation and refinement processes in a more transparent, effective, and inclusive manner than conventional prototyping approaches. Information captured included data about the technical aspects and data referring tacit knowledge from immersive experiences in the field. (Appendix A)

For the latter, we created the table on the left page that summarizes the number of engagements, the amount of people exposed to the Flag in each one of them, and the amount of people who directly engaged with the prototypes.

A criteria for prioritizing these engagements over potential others the participation and involvement

of diverse residents of the Calumet Region. the involvement of educators in the refinement of the integrative curriculum, including art teachers from high schools located in low-income and marginalized neighborhoods and scientists working in the Region.

We were also interested in exploring different types of data that could be relevant to residents, but were not on the radar of scientists, including air guality that could support residents with Asthma.

In the last row of the table, we present the interest of each one of these groups in incorporating the Kit into their program, and the number of kits completed and assembled during our process.

After every engagement, we had followed up conversations with key agents from the organizations involved, and a few small focus groups to get their impressions, feedback, and understand how the Flag could better contribute to their efforts.

On the next page, we provide a table summarizing both process- and outcome- oriented aspects that enabled us understand if our actions were aligned with the intended impact.

| Strategies | Prototyning the Integrative | Concent of the Flag as an Integrative |
|------------------------------------|--|---|
| | Infrastructure (process-oriented) | Infrastructure (outcome-oriented) |
| Involve Residents | We worked with students from the Field Museum, leaders of national NGOs based in the Region, teachers of public high schools, computer science experts, employers of private companies, and residents. | Youth, parents, teachers, leaders in community-based organizations, leaders in educational programs, companies operating in the region, foundations, unemployed residents. |
| Leverage Assets | We ran experiments in collaboration organizations already operating in the Region, including the Field Museum, the Student Conservation Association, Boxville, and Wildlife Habitat Council. We also engaged with STEM Grow Lab, the Great Lakes Phragmites Collaborative, the U.S. Geological Survey - Great Lakes Science Center, and the U.S. Foresty Service. | In addition to existing programs in the region, the Flag intends to leverage other assets that could benefit from new ecological services. These require new types of engagement between people and the environment to increase their impact, and include owners of brownfields, neighborhood parks, lake beaches, schools, etc. as well as private companies. |
| Empower Science | Upon leveraging existing initiatives, we learned about what environmental data is critical to be collected. During prototyping, participants engaged with installations that had sensors to collect data, and camera. They were able to engage with and learned from the environmental conditions based on the data being collected. Most of the partnerships were formed based on the criteria of science-based initiatives. | Through sensors, cameras, and digital technology, the Flag empowers science-based initiatives by facilitating interactions between people and their environment, and by providing granular data at the local level. It is intended to leverage science through art and computer science mechanisms for both lay people and scientists and other experts in specialized fields. |
| Strengthen the Local Economy | Besides the logistics of the project, in which the majority of services and materials were acquired from local providers, the prototyping process provided a valuable learning experience to programs at the Field Museum. Many students mentioned the Flag was their best activity, and became curious to learn how can design contribute to habitat restoration. Several of them considered the discipline as a professional path. | In addition to have its parts purchased and pre-assembled locally, and the long-term impact provided by better educational experiences, we envisioned several ways in which the Kit can contribute to strengthen and revitalize the local economy. These include but are not limited to (1) train local leaders to use the Kit as a facilitator tool for community engagement, (2) create a marketplace for maintenance and habitat restoration efforts for residents to be hired, (3) a sponsorship model in which organizations operating in the region can contribute with the materials and the implementation of the program, while benefiting from marketing materials, as well as brand value. |



"The assembling experience presents an unique opportunity for bonding because it can be easily integrated with other interests that people might have. For example, music, food, sports and other activities that are already focused on understanding the communities better"

Educator from the Field Musem

This installation provides a new way to evaluate problems and be critical about ideas to restore the environment. It enables one to better evaluate a problem in order to solve it"

Environmentalist leading habitat restoration efforts in the Region

"If many Flags are implemented, I would be able to access data, and be better prepared to deal with my Asthma. Right now, the symptoms start to show up, and I don't even know why."

Low-income and marginalized teenager.

"Assembling the Flag made me understand that we are collectivelly buidling a working model, to then be able to build many solutions on top of that."

Adult resident of the Region.

What makes the Flag different?

The Kit conveys a leap innovation, standing for the ambitious need to move away from the centralized models of habitat restoration, where the technical expertise of highly qualified professionals is recognized as superior to tacit knowledge of residents, to an approach centered around the participation and involvement of diverse agents.

Underlying the Kit in the conceptual idea that a new mechanism is needed to mediate interactions between diverse agents, so that habitat restoration and revitalization of local economy can happen.

The Kit was designed to accelerate change from a bureaucratic mechanism of redevelopment, traditionally and conventionally organized into silos that bring into reality impacts of collective interests, to an infrastructure where different agents can interact with themselves and the environment in which they live in.

Ultimately, it enables flows of different types of resources, and provides support for creative solutions that are collectively constructed.

WHY WILL IT CREATE VALUE?

Empower local residents to contribute to habitat restoration

- Local Residents who need meaningful jobs and healthier living conditions
- Scientists who need data about local environmental conditions
- Brownfield owners who need to remediate and develop their lands
- Educators who need a better tool to facilitate learning experiences
- Local artists who need opportunities and support to express their work
- Remediation and environmental restoration entities who need to increase efficiency in their work
- Local Schools who need to provide an exciting activity for their students

HOW WILL IT BE MADE REAL?

- Providing economic opportortunity for local residents
- Infrastructuring a marketplace for ecological services
- Increasing the ecological literacy in the region

WHAT SHOULD BE CREATED?

Flag Calumet Kit:

 Matchmaking digital platform to connect supply and demand of ecological services:

 Modular installations that capture data about environmental conditions;

 Curriculum for mediating socio-ecological interactions between local residents, key stakeholders, and the environment.

The diagram on the left presents an overview of the Flag Calumet Kit, and it provides a structure to better understand the alignment between this project's intent, the core competencies necessary to make it real, the main offerings invoved in the Kit, and who is the Kit intended to serve.

On the following pages we will provide more detail about each one of these aspects of the Flag Calumet Kit.

Why will it create value?

We assumed that the implementation a new infrastructure such as the Flag will require a flexible design of a new supply chain, forming an ecosystem of business that can grow organically. The diagram below shows where values and resources are being exchanged between key agents participating in the Flag ecosystem. Arrows indicate resources, offerings, money, and other types of value. Each of these interactions holds an opportunity for education and action around an habitat restoration in the Calumet.

COMMUNITYaccess to res volunteers, comm BASED ORGS sidents LOCAL activities ENVIRON. SERVICE PROVIDER CONSERV. GROUPS LOCAL ENTERPRISES RESIDENTS N THE REGION FLAG SERVICE cess to land + \$ fee for services + \$ for data opp. to accomplish goal support, guidance, connections PROVIDER nediation services, data CITY CALUMET access to rem GOVERNMENT COLLABORATIVE RESEARCH LABS (FIELD MUSEUM, 5 es + (% \$ of sold data) SCIENTISTS) DATA MANAGEMENT SCHOOLS IN LOCAL COMPANY THE REGION MANUFACTURER

How will it be made real?

When venturing into ambitious projects such as the Flag, new competencies are needed to enable large scale impact. The diagram below describes the core competencies that organizations interested in implementing and scaling up ecological services will have to





Who is it for?

Rather than defining users through traditional scientific research, which tends to categorize people by demographic group, we define them in the context of their aspirations. On this diagram we provide a high level view of users terrains (in pink),

which are intended to show a way of understanding of what really motivates people, and the organization's territory (in green), which indicates the opportunity space for the Flag Calumet Kit to create value for all of them.

What should be created?

The Flag Calumet Kit conveys a system of offerings that has its parts being interconnected by the overall goal of the infrastructure. We explored this system considering people, objects, environments, messages, and services that constitute the experiences of





users and providers. The diagram below provides a highlevel overview of how these different parts are conceptually integrated. On the following pages we present a series of actions that are enabled by this system, and what specific parts are activated by them.

Environments



There might be Ecological to disseminate the Flag and educate early adopters on how to use the platform, find a job, or leverage the infrastructure to accelerate habitat restoration efforts.

Messages



pop-up centers literacy: a new curriculum for mediating socioecological interactions between residents, key agents, and the environment.

> New job opportunities.

Services



Habitat restoration. iob creation. placemaking



When will it be useful?

To cope with the dynamics of and intervene in complex systemic phenomena, such as habitat restoration and local economy revitalization, new infrastructures have to accommodate a diverse set of activities [2].

Ranging from human daily choices to institutional arrangements to ecosystem dynamics, interventions in systems tend to be divided into four different levels, or imaginary scales: micro (products and services), meso (platforms), macro (infrastructures and policies), meta levels (systems).

People experience different conditions of the whole system and develop unique knowledge about them depending on the level within which they are embedded. This challenges traditional approaches to expertise in habitat restoration and in efforts to revitalize local economies, consequently requiring new infrastructures to enable different agents to recognize and understand the diversity of experiences and knowledge that each agent builds overtime [2].

While the design of new infrastructures must recognize that activities at each level need certain autonomy to increase efficiency and effectiveness, they also need to be connected and integrated with the choices and activities happening at the other levels.

Without proper alignment, the chances of unintended consequences might increase because a choice made in one level invariably will be made based on the unrealistic assumption that the other levels will support or are capable of adapting accordingly.

Not knowing how to engage with the interconnectivity of realities and with the constraints of each level represent barriers to sustainability- and equityoriented design practices, such as the Flag Calumet Kit.

The scenario on the left shows several activities that the Flag Calumet Kit enables, and how different agents engage and benefit from them.

On the following page, we show another set of activities, and a diagram presenting features, affordances, intended impacts, and desirable goals that informed the design of the Flag Calumet Kit, considering two early adopters: land ownders and service providers.

For each activity shown in the scenarios of this report, a different path is created, connecting these different elements (Appendix B).





| Cultural | Political | | | |
|--|--|--|---|--|
| anufactured | Digital | | | |
| LAND OWNER | | | | |
| Beart Derests for Contract | Redule calle why PVC Pper | | | |
| AFFORDANCES | Tanganay | sensor puting Nethodon manual Spiarp | and a | |
| IMPACTS | Autonomy | | Pag Mt | |
| | Pohance self guvenaria | Decentralization | Periatik kallery | |
| Create jobs for local reakterns Region | n n entrepresentation | Ownership | Shipping and delivery | |
| hyperfect cers GGALS | Reconnect were the environment | Pecilion | Property diagnetical mechanist Divine secure payments | |
| Engover ynch and materialson to take witter | hack locally managed whomental canditions | Optionality | Revenue Maarti Runsugh date | |
| IMPACTS feedbacks | hteraction | Toole (from) | t locker | |
| AFFORDANCES | Setta | Reserve sent trough sentce | | |
| PS Green job Green jy Yeining opportune | Loof Neitdents Dem | | | |
| FEATURES | STREET | | | |
| GREEN SERVICE PRO | WIDER | | | |

- -

INTEGRATION OF THE HARD AND SOFT DIMENSIONS



In order to develop this version, we worked close to experts and residents, incorporating their explicit and tacit knowledge, experiences, and diverse expertise into the Flag Calumet Kit.

As a result, the Kit became a productservice system that could be of use to such a diverse user group. In other words, the Kit brings a constellation of products and services designed to jointly cope with the needs and demands of various agents in a more efficient way. It was designed to add greater value to both the provider as well as to the user of the Flag.

Unlike traditional approaches that implement the entire infrastructure at once and force people to adapt accordingly, the Kit, as a productservice system, allows for the infrastructure to grow organically because it will be collectively built. The infrastructure will be a result of people coming together for assembling, activating, and using the Flag Calumet Kit across the territory. And in doing so, we are able to integrate the hard and the soft dimension of this infrastructure.

On its hard dimension, the infrastructure is composed by multiple Flags being organically distributed across the region, and a digital platform. Each Flag is composed by a set of sensors, a technical brain, a battery pack, and a shell. The digital platform is a virtual space where information about the environment and socio-ecological dynamics are accessible to different agents both in its raw format, as well as in dashboards.

In addition to technical information and providing a voice to the environment, the digital platform, yet to be refined, has the potential to shape a marketplace for ecological services in the Region. We created several mockups to represent how the interface could support different users. The screens are embedded in the scenarios presented on the following pages.

The market gap this platform fills can become an infrastructure for matchmaking between landowners, residents, and service providers. In order to better represent such potential, we created speculative dashboards to show how ways through which data could be integrated. These representations reflect the following goals: habitat restoration, building local ecological capacity, strengthening local economies. (Appendix C)

Hard Dimension: The Installation

The installation consists of two parts: the body and the brain. They both come inside a sleeve that can be used for other purposes.

The body* consists of three components:

Halo: the top frame has LED lights to communicate what information the brain is picking up from the environment through colors;

Flagpole: supports the installation, and is customizable;

Base: connects the flag to the ground.



The brain comes pre-assembled, and is placed in the center. It contains the follwing electronic components in a transparent casing:



Battery Pack Connects to the solar panel, and gives power to other parts of the brain.



Micro-controller A small computer that receives and communicate information.



GPS Sensor **Global Positioning** System tells users where the Flag is placed.



Environmental Sensor Brings of information about Atmospheric Pressure, Humidity, and Temperature.

*Although in our refined prototype all components were made of MDF sheets cut with laser machines, we believe that if this effort is to be scaled, the Flags must be made of recycled plastic of a local manufacture, and continue to be color-coded for ease of assembly.

On its soft dimension, the infrastructure a digital brain, building a sculpture, brings (1) a curriculum centered around visualizing data, etc.). the integration of art, science, and Yet, specific activities can be designed computer science, and (2) concept to integrate the learning from each one of a new marketplace and cultural of them, using the conditions of the practices that integrate environmental Calumet Region as the context for such concerns into the daily life of individuals application. At the end of the semester, and organizations, including providing students might come together to meaningful job opportunities. assemble Flags across the region, and Regarding the former, the curriculum learn how to apply their learnings in a was designed to provide guidance collective manner. for activities that increase awareness On the other hand, if used in a about how each one of the three **Corporate Social Responsibility** disciplines add value to solving (CSR) activity, the curriculum can be environmental challenges of the 21st leveraged to inform employees about century, and how they can be integrated the different contributions that each into a single intervention. discipline brings to the Flag Calumet The proposed curriculum can be used Kit, and how they shape the installation in various situations. from a two-hours participants will be assembling. assembling exercise, to a semester long On the following pages we provide educational course. It all depends on more details about the integrated the audience, and interest and focus curriculum, and a suggetion for a twoof the provider, and the flexibility and hours workshop for participants to build availability of participants. their own installations. For example, if used as a strategy Regarding the second part of the for a semester-long high school soft dimention (the concept of a new program, each discipline can rely on the marketplace and cultural practices), proposed material to develop its own we speculated how new interactions independent curriculum, and design could shape new realities through activities that build both intellectual and collectivelly built scenarios, mock ups, creative skills in each one of the steps in and dashboards.

alignment with the Flag (e.g. developing



Soft Dimension: Integrated Curriculum

Computer Science

Data & Sensors: introduce the contemporary application of sensor technology in both artificial and natural environments. Participants should understand the benefits and challenges of having access to data, including the discovery of seemingly unrelated patterns, and the dependency on data to take actions, respectively.

<u>Coding:</u> frame the activity of coding through the lenses of providing meaning to raw data, and making data more accessible. Instructors should render visible the bias that people might transfer to their codes, and create opportunities for participants to explore more inclusive coding practices by incorporating considerations of different users into their activities.

Data Visualization: present a portfolio of different types of data visualization, including interactive ones, and offer hands-on activities for participants to use different platforms to represent raw data to different audiences.

Science

<u>Ecosystem Composition:</u> introduce the variety of ecosystems present in the Calumet Region, and how they are interdependent.

Invasive Species: present real-world cases of invasive species in the Calumet region, including Phragmities, how they flourish, and why they are harmful to the functionality of the Region's ecosystems.

Habitat Restoration: present the different approaches for habitat restoration being undertaken in the Region. Fundamental technical and scientific aspects underlying these initiatives should be presented together with key barriers to promote the necessary change in people's behavior.

Soft Dimension: Assembling Workshop

Art

<u>History of Public Art:</u> introduce the historical and cultural value of different expressions of public art in the Region, including murals, sculptures, installations, landscape marks, etc., and their role in informing change in society.

Art & Social Responsibility: select specific cases in the Region that can serve as examples of the fundamental role that art can play in promoting social changes, and the collective responsibility in maintaining the public art piece.

<u>Sculptures:</u> develop hands-on activities for participants to use different materials and build their own sculptures. Individuals must understand the ecological foundations of the materials, and how they have different cultural meanings in people's daily lives based on their individual experiences with them. Below we suggest a way for leveraging the experience of assembling the Flag to increase awareness of participants about the habitat they live in. Since context and purpose of activities might vary according to the proponent's goal and the targeted audience, we encourage leaders of the activities to contextualize and customize the following information accordingly.

About the Experience

Individual Experiences: Instructors must focus on providing personalized support to each one of the participants as their experience will mirror their own values and beliefs.

<u>Group Experiences:</u> It is not

recommended to have more than three participants per group. Decisionmaking processes should be articulated out loud to one another. In doing so, the dynamic between participants become more tangible for instructors to intervene and provide the proper support. In doing so,

Considerations for the Instructors

Below we provide some questions we consider relevant for the instructors to reflect before organizing an activity:

Is the place where activities will happen representative of the audience? Why?

Is the activity culturally appropriate, including language barriers?

Is the time-frame proposed for the activity respecting participants' agenda?

How should participants be selected? Why?

Who will be involved? Why?



SETTING THE STAGE



Contextual Introduction

Instructors should start with a group introduction, followed by introducing the task at hand.

Depending on the situation, other relevant information related to previous efforts might also be shared at this moment. Then, participants should have an opportunity to share their relationship with the ecosystem they inhabit, including their perception of, experience with, and/or connection to unproductive properties or contaminated areas in the Calumet region.

A quick group conversation might be relevant around patterns of perceptions or experiences. If the installation is part of an existing educational program, then instructors should use this initial moment to present the rationale behind the proposed experience in relation to the overall goals of the program. For example, one might relate the issues of non-native Phragmites with those related to migratory birds.

10min

Activity Introduction

Once participants have learned from each other, and about the contextual background they are involved, instructors should present the Flag Calumet Kit and its overall objectives. At this moment, we recommend that instructors use the proposed curriculum that integrates computer science + science + art as a structure to describe the Kit, and the activities people will participate.

Starting with computer science, instructors should present the different parts of the brain, and how they work. Next comes science, when instructors describe the ecosystem participants are in, and how the technology can increase people's understanding about its condition because it can gather different types of data. Lastly, the art enable people to build and customize the Flag based on their own ideas given the Flag's modularity, presence of surfaces that afford coloring, and holes that afford installing extensions or using threads, among other aspects that are core to its concept.

Once the three parts are presented, instructors should situate the installation within the overall context of Calumet region, and explain how the task at hand might set the basis for new ecological services across the territory.

It is critical to leave room and time for questions and clarifications as information is being shared. When listening to the participants, instructors should keep track of each individual experience, and rely on this data to recall relevant points, and support participants in their own processes during assembling.

Before moving to the next step, instructors should provide a proper summary about what has been said among the participants, and structure the groups given the experiences in the audience. The more diverse are the groups, the higher the chances for peer-to-peer learning.

RUNNING THE EXPERIENCES



Prototyping

Depending on the number of participants, an instructor might have more than one group to facilitate. If that is the case, each group should receive a separate Kit.

We recommend that before assembling, participants conceptually plan, discuss, and sketch how they think the final version of the installation should look like. The activity of collectively envisioning something can anticipate conflicts before they even happen.

Alternatively to sketching is the use of Lego pieces for participants to discuss and represent their intention as a group. Instructors should make sure that all participants are involved in the making, and that voices are being equally heard and considered.

10min

Assembling

Once participants of the group agreed upon the form, they should rely on the model as a reference to assemble the core structure of the Flag, including the brain.

Because their conceptual representation will likely have different sizes, proportions and properties from the Flag Calumet installation, instructors should incentivize participants to adapt as necessary.

Lastly, instructors should support participants with connecting the brain with the body.



Customizing

With the core structure assembled, participants can start to project their own identity to the installation.

While some participants might be more proactive in using art materials and supplies to create a unique piece, others might need incentives. As such, instructors should pay attention to these dynamics and make sure that the installation represents all the participants from the group.

If teams face challenges in combining their individual ideas, then instructors might intervene to mediate conflicts, and suggest how can participants combine their efforts as a group.



Activating

Whenever participants complete their customization, instructors should invite them to activate their units.

Each group should select one member to activate the brain, and make sure that all sensors and lights are working properly.

The activation should happen one at a time until all parts of the installation are lighted up.

DEBRIEFING



Debriefing on the Experience

Once the installation is activated, instructors might ask participants to reflect on their own experience and share their perceptions.

Instructors might need to provide prompt questions based on the audience's interest or other contextual determinant to get the conversation going.

For example, participants might be asked about their decisionmaking process that led to the final composition, including:

Why they assembled the Flag in that particular way?

What message are they intending to convey in their installation? Why?

If there is more than one group, instructors should encourage the participants from non-presenting groups to huddle around the installation so they can learn about different perspectives and approaches towards the Flag.

The overall goal should be to encourage participants to reflect on their own experiences, while learning from others. Additional questions might be:

What were the main challenges in the overall experience? Why?

What were the major takeaways? Why?

What would they do to maintain their installation? Why?

As instructors perceive differences between groups, in depth questions about specific, relevant topics can be raised.

For example, those related to the integration of different ideas into one single installation as a collective representation of identity, and the association of the usage of the installation with their own daily lives.

10min

Reflecting on the Flag

Instructors should spark critical reflections on the different dimensions of the Flag, including the understanding of the relationship between the data being collected from the sensors and the colors being represented through the LED strips as a result of coding.

Similarly, participants should be able to correlate their customization with relevant principles of art, such as material and color composition.

Finally, users should reflect on the role of science in supporting healthier socioecological systems, and how might data being collected from the installation can be a source to better choicemaking processes of their own.

By doing so, participants are able to correlate the theoretical and conceptual background of the program with the intervention made, their own experiences, and potential future actions.

15min

Future Actions

Instructors must support participants in reflecting about how the Flag is a reflection of the diversity of those who assembled it, but also a means for new forms of interactions between them and the ecosystem they live in.

After assembling the Flag, instructors can provide questions based on the audience's interests and inputs gathered during the activities to speculate about the multiple actions that can take place once the new infrastructure is in place.

For example, instructors can ask:

What can participants do with the new information they have about the environment?

What actions could they take that are different from what they are doing now?

What additional resources might they need? Why?

SCALING UP IMPACT

Residents The platform The Flag is The Flag Data is sign up for a assembled, aggregated, informs users captures paid ecological installed and environmental based on their and new service job. customized. data. opportunities interests. are revealed.

> Degraded habitats are restored.

Local economy is revitalized The dynamics of scaling up the Flag Calumet Kit efforts relate to its potential for applying its enhanced technological ability to promote large scale transformation into postindustrial environments and resulting social dynamics.

A particular collective value the Kit creates is the gathering of environmental data at the local level, and setting the precondition for its public access, democratizing and increasing the ability of residents to use for their own interests, and distribute it accordingly. While the technology for such an impact has already been created and used in other contexts, the challenges underlying how people access, understand, interpret and use such apparatus and its data are critical points that needs greater attention.

Still, providing access to local data, pushing and pulling notifications from dispersed networks (e.g. residents, researchers, government agents, landowners, etc.), crowdsourcing both the assemblage and placement of the Flat and information to act upon habitat restoration efforts through services and management of the property, are all critical aspects that can be further explored. However, if successfully implemented, the Flag can enable new ecological services, relying on the engagement of diverse groups with emerging technologies, physical space (brownfields and immediate surroundings), and infrastructures for mediating activities of gathering, sense-making, and sharing of data. Combined, these features present a new approach to embed principles of sustainability and equity in the form of socio-ecological services.

Although the activities and advancements were not centered around policy change, we believe the Flag Calumet Kit can be well integrated with efforts made by the municipalities and government agencies across the Region. The platform has flexibility and potential to be fit to different organizational structures, goals, and scopes, including into existing policies providing benefits for habitat restoration and other efforts related to climate change and social justice initiatives.

It is important to recognize that other efforts have followed similar paths in the context of habitat restoration (e.g. I-Tree platform), but provide less contextual support and mechanisms



for strengthening social inclusion and involving local agents.

This research and the prototyping activities we ran brought about new perspectives concerning the need to facilitate creative interactions between dispersed networks working in the same places. New communication channels and critical mediation mechanisms are keen in determining the direction for post-industrial regional redevelopments.

While it is unknown the total impact the Flag Calumet Kit can create, we can anticipate that by making data about local environments available and accessible to diverse agents, the Flag Calumet Kit can support better collective diagnosis of the socioecological dynamics in the Calumet region, while also enabling different pathways for transforming collective imagination into yet to be created alternative business models, and civic entrepreneurial activities centered around new ecological services.

Rather than improving and reinforcing current approaches, it emphasizes the importance of a broader ecosystem of individuals and organizations participating and being impacted by brownfields redevelopment efforts. By considering a broader set of constituencies, the Flag Calumet Kit also expands its contributions for creating new synergies between dispersed groups, and network effects between them to support new innovation ecosystems to emerge, consequently increasing value through collaborative advantage.

In this research project, we worked at the intersection of art, science, and computer science to empower local individuals and organizations in the Calumet Region to develop and proof a resident-driven model for cooperatively building a new infrastructure that could:

reflect the resident's identity;

• increase the resident's capacity to claim ownership of their surrounding environment by accelerating its ecological regeneration;

• contribute to revitalize local economies.

The world needs an audacious approach to the design of new infrastructures that can enable more sustainable and equitable opportunities, processes, and outcomes than today.

The Flag Calumet Kit is a project that can lead the way.

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Interim report for G-1808-275561

FLAG CALUMET KIT

empowering residents to contribute to habitat restoration of the Calumet region

We thank all the participants that have been involved in this research project from the beggining until now. and for the Kresge Foundation to support our work. Their commitment and contributions were critical to the development of this report. We welcome feedback and suggestions that can contribute to move this initiative forward.

December 31, 2019

Co-created by: Dr. Andre Nogueira Dr. Carlos Teixeira

A partnership between:





Prototyping protocols

Preparing for your prototyping activities

About the project

Overall goal State the overall goal of the interventions and the desirable impacts to support transitions towards more sustainable systems.

Guiding questions State the questions that will guide decision-making during the project.

About the prototype

Describe the prototype considering its morphology, physiology, anatomy, and desirabale transformations. Utilizing previously develop representations of the anatomy of system, situate the prototype considering the opportunity spaces, and speculate about the new flows to be added in the system's representation.

What is your hypothesis?

What are your assumptions?

Propose an explanation about the opportunity for intervention in the context. Describe the necessary conditions for the hypothesis to be true.

What are your predictions?

Describe what would it happen if the hypothesis is correct.

About the engagement

What are your objectives?

State the purpose of this activity in relation to the project's agenda, and why.

What are the main questions?

Raise the specific questions you would like to answer through your engagements, and why.

How will you go about answering them?

Describe step by step of the activity propose in your prototyping experience, and why.

Who will be involved and who is your audience? State who will be involved in the activities, and who will the intervention impact, and why.

Where and when will the engagement happen? Describe the environment where activities will take place, and when and why will it happen, and why.

How will you learn in your activities?

Describe the how data will be gathered, and what will be your role in the activities planned, and why.

Ethnography of infrastructures

Stocks

The subjective resources units quantification a prer provisioning ES, but also to most other ES.

Morphology

The size, shape, volume, texture, materiality, arrange the infrastructures in the system.

Physiology

The function of the elements in the infrastructure, t performances.

Anatomy

The structure or parts that make up the infrastructuliving interactions, incluting biological components

Behavior

The dynamics of the interactions between agents re variant actions or reactions in response to a particular

Origin

The reason why infrastructures existis, and what go support.

Distribution

The physical and non-physical presence of the infraof agents in the system.

Affordances

The actionable properties that the infrastructures a processes that occurs in the systems because of the

| requisite to harvest a | What is the infrastructure made of and what resources it needs to funcion? |
|--|--|
| ements and composition of | What is the form and composition of the infrstructure? |
| heir roles, responsibility, and | What is the current function of the infrastructure? |
| ures in the systems and their s, products and services. | What are the different parts and how they are connected? |
| esulted from the aggregate of Ilar situation. | What are the bahaviors influenced by the performance of the infrastructure? |
| als their were intended to | Why was the infrastructure built? What was it buit for? |
| structures in the daily lifes | Where and what are the impacts of this infrastructures? |
| re unlocking, and the eir presences. | What does the use of this infrastructure enables? |

Prototyping protocols

Field notes during your prototyping activities

Initial impressions

State the your initial impressions of the context in which you are involved. This includes your feelings, as well as the descriptions of the elements influencing the experiences and the interactions of agents. You might account for your perception of demographics, compositions and variety of species, and movements. You might also consider sizes, spaces, noises, smells, quality of interactions, colors and equipaments in the built environment. Finally, you can state your perceptions of potential absences of components and interactions.

APPENDIX A

Page 03

Key events observations

State the your impressions considering the key events in the prototyping agenda. Key events should be considered those composed by core activities intentionally designed to provide you the desirable answers. In this part, you should also state suprises and conter expectations given the interactions happening with the prototypes, including the participants emotions, actions and reactions, and the outcomes of their interactions. It is important to register what was your involvement as a participant (if any), and the outcomes of your interactions.

Significant observations

State significant observations considering the relationships formed and the interactions that are happening. You should register when, where, why, and according to who those observations are to be consider significant. It is fundamental that you account for your role in the significant observations. Thus, consider registering in detail what were your interactions with the participants and the environment.



APPENDIX B Page 01

APPENDIX C Page 02



EQUITABLE REGIONAL DEVELOPMENT > HABITAT RESTORATION

OBJECTIVE HABITAT RESTORATION

APPENDIX C Page 01



94

APPENDIX C Page 03

