Green, Blue, and White Open Public Spaces in a Changing Arctic City: Learning from Fairbanks Residents and Indigenous Communities

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Dedication

To my family:

Jenya, parents and grandmother

Thank you for always seeing the best in me and for your endless support of my curiosity.

Acknowledgments

My Master's thesis represents the culmination of two transformative years of graduate studies at George Washington University (GWU). This journey has developed my ability to conduct both quantitative and qualitative research independently while also making significant contributions to a remarkable team, for which I am immensely grateful.

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In discussing Indigenous peoples in the Arctic, I must clarify that I am not an Arctic Indigenous person. I am a student living outside the Arctic and have traveled there for field trips. However, my background includes Tatar and Udmurt heritage – two ethnicities recognized as Indigenous peoples of Russia – alongside Russian and Ukrainian roots. Consequently, my insights and analyses may reflect the perspective of an outsider or visitor and might not fully align with those of Arctic Indigenous Peoples. This work primarily addresses the academic discourse surrounding the topic,

acknowledging that academic materials may not capture the entire spectrum of Arctic Indigenous Peoples' viewpoints.

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Abstract of Thesis

Green, Blue, and White Open Public Spaces in a Changing Arctic City: Learning from Fairbanks Residents and Indigenous Communities

The Arctic, often perceived as a sparsely populated region, is very urbanized, with nearly two-thirds of its population living in cities. This thesis examines the role of open public spaces (OPS) within Arctic urban settings, aligning with the Sustainable Development Goal № 11: to create Sustainable Cities and Communities. In Arctic cities, green and blue spaces (areas with vegetation and water) usually experience short periods of unfrozen water and green vegetation, as they are predominantly covered in ice and snow (white spaces) for most of the year. This research seeks to investigate the impact of climate change on the utilization of OPS by Arctic residents, including Indigenous communities. It investigates the impacts of climate change on space utilization and assesses in what ways perceptions of climate change influence urban development in the Arctic, particularly regarding the right to the cold city, sustainable development, resilience, and justice. The study focuses on the analysis of public spaces in Fairbanks, Alaska, USA. The findings show that the role and usage of OPS in Arctic conditions differ from regions in warmer climates and require different approaches for understanding their contribution to sustainability and resilience. Climate change influences the use of OPS in Fairbanks and highlights the need for equitable access and the inclusion of Indigenous perspectives in urban planning, underscoring the diverse impacts of climate change across communities. The findings contribute to the fields of urban sustainability, resilience, and justice, offering valuable insights for local and Indigenous communities striving for a just Arctic future.

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Chapter 1: Introduction

1.1. Introduction

Open public spaces (OPS) that are safe, inclusive, and accessible constitute a key objective of the United Nations Sustainable Development Goal №11: "Sustainable Cities and Communities" (United Nations Department for Economic and Social Affairs, 2023). The United Nations identifies three primary areas for the development of public spaces: ensuring accessibility for women, children, the elderly, and persons with disabilities; equitable distribution of public spaces within cities; and the role of these spaces in fostering urban resilience, particularly in response to climate change (The Sustainable Development Goals Report, 2022).

The Sustainable Development Goals Report (2022) highlights the significance of parks, boulevards, and playgrounds, not just for improving urban life quality, but also as crucial venues for social interaction and economic activity. These insights underline the intricate relationship between the urban environment, including OPS, and broader social issues.

Despite the extensive research on urban socio-environmental interactions in cities with tropical and temperate climates, as noted by Fedorov et al. (2021), there is a noticeable knowledge gap regarding Arctic cities. This research aims to bridge this gap by exploring the unique characteristics and usage of OPS in the Arctic context.

1.2. Relevance

As the Arctic undergoes rapid warming, Arctic residents are continuously adapting to these changing circumstances. This research focuses on the utilization of public spaces in Arctic cities, examined through the lenses of the right to the cold city, sustainable development, resilience, and justice. Its primary objective is to anticipate the impacts of

climate change on the usage of OPS, providing insights that could inform adaptation strategies in Fairbanks, other Arctic communities, and beyond.

A significant emphasis of this study is on enhancing the understanding of public infrastructure as a crucial component of the socio-environmental urban ecosystem in the context of climate change. This infrastructure can either support resilience or induce vulnerability among the residents. The distinctions are critical: green, blue, and white OPS demonstrate varying degrees of resiliency and vulnerability under the influence of climate change, and the experiences of different resident groups will vary. The most vulnerable among these groups—including Indigenous elders, women, youth, activists, queer individuals, and homeless people—may interact with OPS differently compared to the White majority, and hold distinct perspectives on the justice supported or neglected by public infrastructure.

Employing mixed-methods approaches, the research aims to provide a comprehensive analysis of the dynamics between OPS, climate change, and the broader community of Fairbanks residents, with a particular focus on Indigenous peoples. By offering nuanced insights into residents' experiences within OPS, this research addresses the challenges posed by the changing Arctic environment.

1.3. Literature Review

1.3.1. Public Spaces from an Urban Planning Perspective

Urban planning views public spaces, particularly parks, as vital elements in city landscapes. OPS are places, where "local and global, material and social, science and everyday life meet" (Blok et al., 2016, p. 18). The "grandmother" of urbanism, Jane Jacobs writes that "[parks] can be delightful features of city districts", they are also important spaces for public activities (Jacobs, 1961). Urban open spaces in a city are publicly accessible areas

designed for the spontaneous activities of residents and visitors (Jurkovič, 2014). Their key elements are green areas, covered with grass and planted with trees and flowers, and blue areas of water.

Green spaces have positive impacts on mental and physical health (Sugiyama et al., 2008; Coventry et al., 2019; Holy-Hasted & Burchell, 2022; Honey-Roses & Zapata, 2023), safety (Kondo et al., 2015), socialization cohesion (de Vries et al., 2013), vitality and livability (Zhou & Masud, 2012). They are vital for creating a healthy urban environment (Harvey, 2003) and fostering a better society (Young, 1995), particularly significant for residents grappling with urban lifestyle-related conditions like stress, anxiety, and depression (Andersson, 2021).

While the value of green spaces is well-established (Bolund & Hunhammar, 1999; Pincetl & Gearin, 2005), the importance of urban blue spaces has been acknowledged more recently (Steeneveld et al., 2014; Gunawardena et al., 2017). These areas are credited with enhancing air quality, temperature regulation, and overall quality of urban life (Fedorov et al., 2021). Also, blue spaces improve the vitality of the city: blue and green spaces provide a "flow of landscape and flow of natural elements through the major arteries and meeting places of the city" (Bašová et al., 2021, p. 233). Moreover, a combination of green and blue spaces results in a synergy of benefits to an ecosystem (Gunawardena et al., 2017; Fedorov et al., 2021).

Byrne and Wolch (2009) explore the evolution of the "park idea", revealing that parks have been shaped by social and historical factors. Originally private lands of the elite, these spaces transformed into public parks, initially in England. This shift was part of a broader movement that saw parks as solutions to public health issues and moral upliftment. Parks, by introducing light and air into dense urban areas and creating spaces between homes to curb disease spread, hold continued relevance in today's context, underscored by recent pandemic

experiences (Nilsson et al., 2021). The development of urban parks in the U.S., such as Golden Gate Park, reflects a progression from therapeutic to democratic concerns. However, these spaces were not always democratic, with issues of racial segregation and social control evident in their history (Byrne & Wolch, 2009).

Contemporary research indicates that park usage varies among different ethnic and racial groups. Byrne and Wolch (2009) propose four explanations for this: marginality, ethnicity, assimilation and acculturation, and discrimination. These theories, however, have limitations, often overlooking the ongoing role of racism and the spatial effects of systemic racism. Byrne and Wolch (2009) suggest a model that considers socio-demographic characteristics, political ecology, historical and cultural landscapes, and individual perceptions. It highlights the uneven development of park resources and access, particularly affecting communities of color and disadvantaged groups. Recent geographic research integrates perspectives from environmental justice, cultural landscape, and political ecology (Braun, 2005; Byrne & Wolch, 2009; Gandy, 2022). This approach expands the understanding of environmental injustice, focusing on unequal access to environmental benefits, and how parks contribute to broader environmental inequalities in urban settings.

1.3.2. Colonial Context of Arctic Urban Development

The Arctic, traditionally defined as the region north of the Arctic Circle, also includes areas inhabited by communities living an Arctic lifestyle, shaped by historical and contemporary factors (Grenoble, 2022). This expanded definition, used by the Arctic Human Development Report (AHDR), encompasses various territories including parts of Alaska, Canada, Greenland, and northern regions of Europe and Russia. Approximately 12.5% of the Arctic's four million inhabitants are Indigenous (Grenoble, 2022), a demographic that is defined variably by organizations like the United Nations (UN) and the International Labour Organization (ILO). These definitions highlight the ongoing and historical dynamics between

Indigenous peoples and settler-colonizer states, underlining critical aspects of justice claims (Przybylinski & Ohlsson, 2023).

The classification and recognition of Indigenous peoples vary across countries in the Arctic region, not only in terms of definitions but also in the terminology and criteria used. For instance, "Alaska Native" is the term predominantly used in Alaska, while Canada's Constitution refers to Indigenous populations as "aboriginal," with "First Nations" being another common term within Canada (Ferris, 2013). Going back to the Indigenous Arctic, the demographic composition varies across countries and even within regions of the same country. In the Arctic and sub-Arctic areas of Alaska, Athabaskan peoples make up about 2 percent of the total population, whereas in Canada's Northwest Territories and Yukon Territory, they represent around a third (Grenoble, 2022). The Arctic Athabaskan peoples hold significant political influence, evidenced by their representation in the Arctic Council's Permanent Participants through the Arctic Athabaskan and the Gwich'in (Grenoble, 2022).

Indigenous populations in the Arctic are distributed across international borders, with significant groups like the Inuit, Sámi, Athabaskans, Aleut, and Yupiit spanning across Alaska, Canada, Greenland, and parts of Europe and Russia (Grenoble, 2022). This distribution challenges the conventional understanding of political boundaries and provides a unique perspective on Indigenous knowledge systems.

Urban development in the Arctic has predominantly been driven by colonial motives, with towns and settlements established primarily for resource extraction (Laruelle, 2019; Dybbroe et al., 2010). European colonization brought not only territorial and resource control but also significant cultural and linguistic shifts. Policies promoting monolingualism and cultural assimilation were prevalent post-World War II, leading to language shift and cultural erosion among Indigenous communities (Grenoble, 2022). The establishment of residential

schools contributed to this cultural oppression, causing long-lasting psychological and social impacts.

For many Arctic Indigenous peoples, colonialism remains a current and tangible reality, deeply affecting their culture, language, identity, and well-being (Grenoble, 2022). The legacy of colonization, similar to other regions globally, has led to significant shifts in self-esteem and cultural identity among these communities.

Western concepts of land ownership, public recreation, and urban aesthetics have been imposed in the Arctic, transforming Indigenous ancestral lands. Urban design and public spaces in these regions often reflect the values and history of the colonizers, marginalizing Indigenous narratives. Public spaces and city development have embodied a legacy of discrimination and disenfranchisement, altering the Indigenous communities' relationship with their land and identity.

1.3.3. Indigenous perspectives

Indigenous perspectives, as outlined by Dennis Foley (2003), encompass three interconnected realms: the Physical World, the Human World, and the Sacred World. The Physical World, viewed as the mother, includes the land, sky, and all living organisms, providing food, culture, spirit, and identity. The Human World comprises knowledge, social norms, family, ceremonies, and the potential for change. The Sacred World, extending beyond a purely metaphysical interpretation, is foundational in healing (both spiritual and physical), lore (the retention and reinforcement of oral history), and the maintenance of laws and traditions.

Indigenous views significantly diverge from Western philosophies and justice theories, often centered around human interests. Indigenous views emphasize a deep and intrinsic connection with nature (Przybylinski & Ohlsson, 2023), contrasting with urban planners who often see parks as solutions to societal issues and as symbolic “lungs” and

“conscience” of cities. This Western approach only partially aligns with the Indigenous perspective, which involves a deeper relationship with the environment. For example, the Sámi language contains over 300 terms to describe snow and its conditions, illustrating the depth of Indigenous Knowledge about their environment (Arctic Indigenous Peoples, 2021). Similarly, Inuit languages offer detailed terms for describing beluga whales, reflecting a nuanced understanding based on gender, age, color, and other specific features (Arctic Indigenous Peoples, 2021). These linguistic examples highlight the close relationship between Arctic Indigenous Peoples and their environments, where activities such as herding, hunting, fishing, and gathering are fundamental to their cultural, social, and spiritual lives (Arctic Indigenous Peoples, 2021).

Urban settings typically reflect Western values and colonial histories, leading to the marginalization of Indigenous identities (Puketapu-Dentice et al., 2017). Racial biases and stereotypes challenge Indigenous peoples' efforts to create safe, suitable spaces for preserving their identities, communities, languages, and cultures, all deeply tied to their territories (Finegan, 2021). Despite about 78% of Indigenous peoples in the US living in urban areas, there remains a significant gap in recognizing Indigenous urban presence and, consequently, in research on Indigenous peoples’ interactions with urban public spaces (Finegan, 2021). Nevertheless, cities represent not just the essence of settler urbanism but also centers of Indigenous resilience and vibrancy, essential for negotiating Indigenous rights, presence, and self-determination. Some parks are starting to acknowledge urban Indigenous presence, focusing on reconnecting Indigenous people with the land and educating the public about Indigenous heritage as steps towards improving park-Indigenous relations (Finegan, 2021). Efforts by parks to host events, create spaces for private cultural activities, and increase Indigenous visibility in public areas are crucial for promoting spatial justice in urban settings (Finegan, 2021). There's an imperative need to rethink urban landscapes to prominently

incorporate Indigenous identity, values, and principles, drawing on their longstanding relationship with the land.

1.3.4. Climate Change Pressure on Arctic Urban Communities and OPS

Research on OPS and urban socio-environmental interactions, while extensive in tropical and temperate cities (Fedorov et al., 2021), reveals a significant gap for the Arctic, where two-thirds of the population resides in urban areas (Larsen & Fondahl, 2015). The urban landscape of the Arctic, characterized by a blend of built-up areas and natural spaces, is largely dominated by "white spaces" – areas covered with snow and/or ice for the majority of the year, except during summer, late spring, and early fall. Despite the well-documented benefits of green and blue public spaces, the research on white public spaces is limited. White spaces might be contradictory, as they can simultaneously heal and harm (Finlay, 2018). Snow, the essence of white OPS, plays a significant role culturally, and economically (Snyder & Stonehouse, 2007), and in the physical and mental well-being of the community (Callaghan et al., 2011).

In addition to the historical challenges of colonialism, Arctic Indigenous peoples and residents face various pressures, notably the significant impact of climate change on urbanization (Arctic Resilience Report, 2016; Gassiy, 2018). Polar amplification results in pronounced climatic and environmental changes, affecting the Arctic region’s urban infrastructure (Martello, 2008; Chapman et al., 2017) and leading to potential economic losses, deterioration of water quality, social unrest, forced migration, and a rise in both infectious and non-infectious diseases, including mental health issues and substance abuse (Gassiy, 2018). Indigenous communities are particularly vulnerable to these climate-induced challenges, facing risks to their health, safety, and survival of their cultures, identities, and traditions due to changes in hunting, herding, fishing, and gathering practices, as well as

compromised safety in navigation due to altering ice and weather conditions (Gassiy, 2018; Ford et al., 2019).

The warming of the Arctic adversely impacts its fragile ecosystems and, as a consequence, the ancestral lifestyles and knowledge of Indigenous peoples, which are strongly integrated with the Arctic landscape (Almonte, 2023). Climate and weather pattern changes affect Indigenous peoples' survival in the polar region (Ferris, 2013). The temperature increase, change in snow cover and vegetation, change in frequency of wildfires related to climate change, and anthropogenic stressors such as industrial development (Ford et al., 2021) pose challenges for Indigenous communities, who have a deep connection with snow and outdoor activities. The changing patterns of snow cover in the Arctic have profound implications for the climate and local populations (Callaghan et al., 2011), affecting the traditional land use practices (Landrum & Holland, 2020). The 2022 Arctic Report Card highlighted record levels of precipitation in Alaska and the changing onset of snow cover (Signs, 2022).

Warming temperatures and changing snow cover patterns are accelerating permafrost thaw, affecting infrastructure (Ford et al., 2021). Indigenous communities in the Alaskan Arctic face breaking infrastructure and destroyed public facilities (Ferris, 2013; Ford et al., 2021). OPS infrastructure like roads and trails which Indigenous residents use is also being affected. Arctic urban infrastructure gets vulnerable (Martello, 2008). The vulnerability of infrastructure is intensified by its aging condition, the challenges associated with its maintenance, the inefficacy or unsuitability of protective measures, obstacles posed by institutional frameworks, and the high operational costs in the Arctic environment (Ford et al., 2021). The impact of climate change on infrastructure poses challenges for communications and transportation, with reduced ice thickness making it difficult to cross

rivers and lakes and increasing risks for hunters and dogsledders due to thin ice (Ferris, 2013).

Contemporary urban planning employs spatial strategies to address climate change, drawing from the historical use of parks to resolve social challenges. Since the 19th century, urban parks have been key in addressing various urban problems, including cultural, political, and economic issues (Loughran, 2020). Today, open public areas, particularly green spaces, are increasingly recognized for their crucial role in addressing issues related to climate change, equality, and social justice (Nilsson et al., 2021).

Early research focused on leveraging science and technology to combat global changes, but more recent perspectives underscore the significance of leveraging historical insights, local wisdom, and cultural practices for a deeper understanding of climate change and the creation of effective strategies (Martello, 2008). Nevertheless, climate change is affecting the reliability of Indigenous communities' traditional knowledge, particularly in forecasting safe ice conditions, indicating a shift in the dependability of ancestral wisdom due to environmental transformations (Ferris, 2013).

1.3.5. Summary

As Aboriginal scholar Bronwyn Fredericks (2013, p. 2) articulates that “place and space can never be neutral… place and space can either marginalise and oppress urban Aboriginal and Torres Strait Islander people, or demonstrate that they are included and engaged”. The Arctic with its distinct colonial history and significant Indigenous population, presents a nuanced scenario. Although parks are not traditionally part of Indigenous culture, the profound connection with nature, the cultural and spiritual significance of the environment, and the established experience of living in urban settings make it crucial to understand the usage of OPS from an Indigenous perspective. Regardless of whether OPS are part of the Physical-Human-Sacred world systems, limited research emphasizes the

experiences of Indigenous peoples living in urban areas (Fredericks, 2013). Issues related to urban OPS as accessibility, justice, cultural representation, and community engagement form a part of Indigenous urban living. There is an urgent need to investigate these issues, especially in the context of climate change (Byrne & Wolch, 2009). Martello (2008) observes that research that utilizes Indigenous knowledge of climate change often skews towards male perspectives and relationships with the environment, largely because the activities most closely scrutinized by scientific inquiry – such as fishing, hunting, and herding – have traditionally been male-dominated roles. Additionally, Martello (2008) points out a significant gender imbalance in the visual representation within the Arctic Climate Impact Assessment (Hassol, 2004), where images of men predominate, and women are much less visible. This highlights the necessity of integrating perspectives that have historically been overlooked or invisible, ensuring a more inclusive understanding and representation in research.

1.4. Goals and Objectives

The primary goal of this research is to investigate the utilization of green, blue, and white OPS by residents of a subarctic city. This includes analyzing the evolution of these spaces over time, their accessibility to and usage by the local population. Furthermore, the study aims to assess the impact of climate change on the use of these public spaces, integrating perspectives related to the right to a cold city, sustainable development, resilience, and justice. Additionally, the research seeks to identify variations in the use and perception of climate change in OPS among all Fairbanks residents, with a special emphasis on Indigenous communities. The research deeper explores social differentiation in the role and usage of OPS by documenting the experiences of specific vulnerable Indigenous groups: the elderly, women, youth (including males, female activists, and queer individuals), and the homeless.

The objectives of this study are shaped by the following research questions, related to Fairbanks, Alaska:

1. To what extent are OPS accessible to the community, and is there a difference in accessibility between Indigenous and all Fairbanks' residents?
2. How are OPS used by all Fairbanks residents, and how does this differ from the perspectives of Indigenous respondents?
3. How do local communities perceive the impact of climate change on OPS and their use?
4. How does social differentiation, such as gender, age, and socio-political engagement, within the Indigenous community influence the usage of OPS and perception of climate change?
5. In what ways does evolving use patterns and the perception of climate change in OPS influence Arctic urban development, particularly concerning the right to the cold city, sustainable development, resilience, and justice?

1.5. Research Area

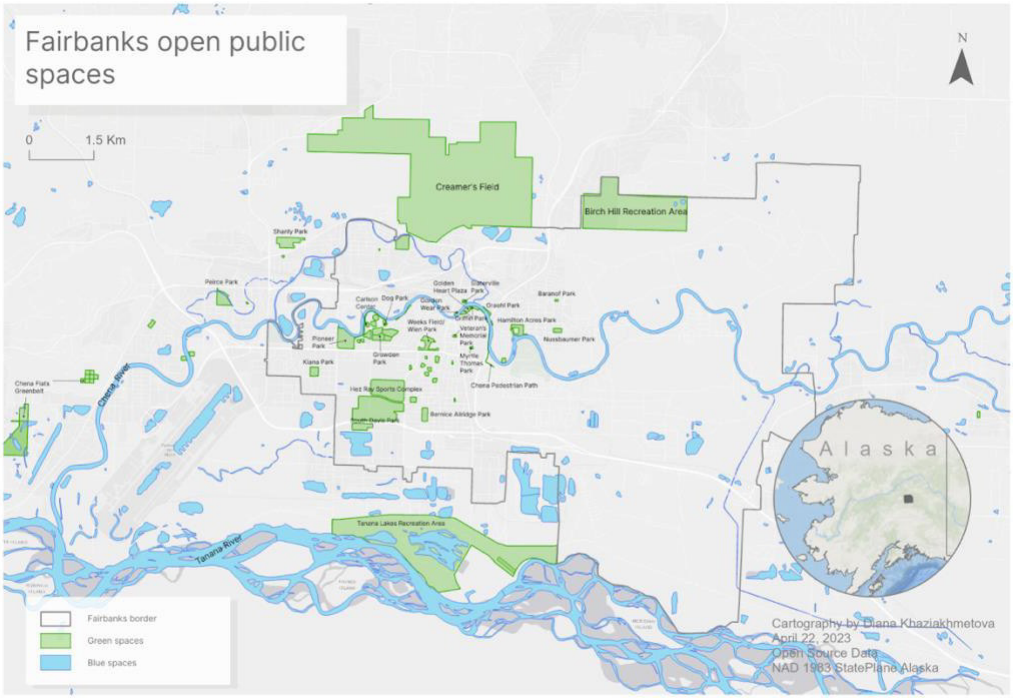


Figure 1. Research area.

1.5.1. History

This study focuses on Fairbanks, Alaska, USA (Figure 1). Fairbanks stands on the traditional lands of the Dene people. As written on the wall of the permanent exhibit at the Morris Thompson Cultural and Visitors Center, one of the main points of attraction for both locals and tourists in Fairbanks: “There is a place in Interior Alaska where two great rivers meet – the Yukon and the Tanana. The Alaska Natives have named the place Nuchalawoyya, meaning simply ‘where the two rivers meet.’” Fairbanks has a rich Indigenous history dating back to the Athabaskan (Dene) people (Holton, 2009). Traditionally a nomadic people, they visited Fairbanks’ territories to do the hunting, fishing, trapping, and berry gathering.

1.5.2. Geography, Economy, Climate

Fairbanks, the largest city in the Interior region of Alaska and second-largest in the state city, is located at 64°49’ N in a low-lying valley covering an area of 32.62 square miles

(84.5 square km) with a population of 32,107 as of 2022 (United States Census Bureau). The city of Fairbanks quickly evolved into a bustling community following a gold strike in the nearby hills (Movius, 2009; Schaffner, 2020). Such a beginning marked the city's trajectory towards becoming a vital hub for mining, lumbering, and later, as a strategic point in the construction of the Trans-Alaska Pipeline. In 1917 Alaska Agricultural College and School of Mines was established – the foundation for the University of Alaska, Fairbanks (UAF), which is now known worldwide for its Arctic research and Alaska Native studies. Fairbanks' economic landscape today is diversified, however holds significant contributions from the military presence due to the location nearby of Fort Wainwright and Eielson Air Force Base.

Fairbanks' climate is one of its most defining features. Classified as continental sub-Arctic, it experiences extreme temperature variations, with warm summers and very cold winters (Wendler & Shilski, 2009). As highlighted by Rick Thoman, a climate expert at the International Arctic Research Center at the University of Alaska, Fairbanks is the coldest among U.S. cities with a population of over 25,000 (AP News, 2023).

1.5.3. Climate Change

Fairbanks, similarly to other Arctic and subarctic climates, has experienced increased temperatures and changing climate in the past decades (Wendler & Shulski, 2009). This region is affected by polar amplification (Rantanen et al., 2022).

A century-long analysis from 1906 to 2006 reveals a consistent temperature rise across all seasons, with a significant 1.4°C annual increase from 1996 to 2006 – nearly double the global rate (Wendler & Shulski, 2009). Concurrently, the occurrence of extremely cold days, with temperatures below -40°F/C, has diminished from an average of 14 to 8 days per year (Wendler & Shulski, 2009). These conditions often lead to ice fog, which can severely reduce visibility and travel safety. The growing season has extended significantly, from 85 to 123 days, marking a 45% increase over the last century (Wendler & Shulski,

2009). Fairbanks has a low annual precipitation of only 280 mm (Wendler & Shilski, 2008). This, coupled with the 11% decrease in precipitation since 1916 and rising temperatures, heightens the risk of wildfires (Wendler & Shilski, 2008).

In 2004, Fairbanks experienced air quality levels surpassing the U.S. Environmental Protection Agency's most critical danger threshold of "hazardous" (above 250 micrograms per cubic meter over a 24-hour period) for a total of 15 days (Trainor et al., 2009). Incidents of severe weather have escalated and are projected to continue rising, alongside an increase in wildfires, with annual burn rates for boreal forests and taiga ranging from 0.5% to 1.5% (Laruelle et al., 2019). Projected climate changes suggest that the annual average area burned in Alaska will likely double by mid-century and could triple or even quadruple by the century's end, depending on moderate or high greenhouse gas emission scenarios respectively (Trainor et al., 2009). To mitigate urban fire risks in 2006 the Fairbanks North Star Borough created Community Wildfire Protection Plan (2006).

Moreover, with rising temperatures in northern latitudes, Fairbanks is likely to experience an increase in both the extent and frequency of ice hazards, such as Rain on Snow (ROS) events (Schwoerer et al., 2024).

1.5.4. Demographic Data

Fairbanks has a diverse demographic landscape, with the five largest ethnic groups being White (Non-Hispanic) at 62%, American Indian & Alaska Native (Non-Hispanic) at 9.3%, Black or African American (Non-Hispanic) at 7.7% (United States Census Bureau, 2022). The local economy supports around 12,000 workers, with the leading sectors being Health Care & Social Assistance, Retail Trade, and Public Administration (Data USA, 2021). Notably, the highest-paying industries are Mining, Quarrying, Oil and Gas Extraction, Agriculture, Forestry, Fishing and Hunting, and Construction (Data USA, 2021). Poverty affects 9.12% of the population, lower than the national average, with the largest affected

groups being Males and Females aged 25-34, and Females 6-11; White individuals followed by Native American and Black are the most common racial or ethnic groups living below the poverty line (Data USA, 2021).

1.5.5. Share of green space

The primary indicator for urban planning within the ISO 37120 Sustainable Cities and Communities standard is the share of green area per 100,000 population. To analyze the share of green spaces in Arctic cities, a dataset compiled by the PIRE project (Orttung et al., 2021), which is based on the ISO 37120 metrics, was utilized. Figure 2 illustrates the green area (in hectares) per 100,000 population across Arctic cities, differentiated by color coding for each country with blue representing the USA. This visualization, supported by the sources from Orttung et al., 2020, and Kuklina et al., 2021, provides a comparative perspective of green space distribution among Arctic cities. According to this data, the share of green area per 100,000 population for Fairbanks is 13,198.65 ha (Figure 2).

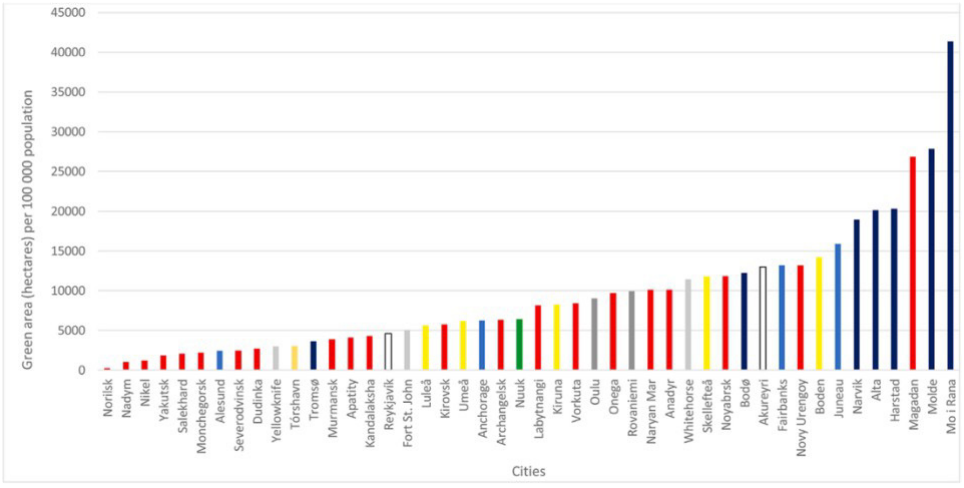


Figure 2. The share of green area (in hectares) per 100,000 population across Arctic cities. Sources: Orttung et al., 2020; Kuklina et al., 2021.

The ISO 37120 doesn't prescribe any specific "normal" values for the green area indicator; however, it provides a framework for cities to measure and compare their performance. According to this framework, Fairbanks has a high share of green area per 100,000 population.

Although the overall amount of space appears more than sufficient, the distribution, accessibility, safety, amenities, and quality of individual green spaces significantly impact benefits (Kuklina et al., 2021). Assessment beyond strict per capita measures is important to fully understand the value and impact of green spaces in urban environments.

1.5.6. OPS Management

In Fairbanks, part of the Fairbanks North Star Borough, the management of parks and recreational spaces is predominantly a collaborative effort involving the Fairbanks North Star Borough's (FNSB) Parks and Recreation Department and the Mayor's office (Table 1). An exception to this collaborative model is Creamer's Field Migratory Waterfowl Refuge, a 2,200-acre bird sanctuary, which is maintained by the Alaska Department of Fish and Game.

FNSB governance and oversight of OPS are carried out by the Parks and Recreation Commission. The Commission's duties include the review and assessment of current parks and recreation facilities, advising on both immediate and long-term needs to enhance these spaces for community benefit. A significant part of their role involves making recommendations to the Borough Mayor and the Parks and Recreation Director on matters such as the development and improvement of facilities, budget considerations for parks and recreation, and the naming and dedication of park areas and facilities through the evaluation of applications for memorials and plaques.

Open Public Space	**Type**	**Location (Fairbanks/outside of city limits)**	**Location**
Aurora Park	Green	Fairbanks	1706 Central Ave
Baranof Park	Green	Fairbanks	525 Baranof Avenue
Bernice Allridge Park	Green	Fairbanks	2550 Wilson Street
Big Dipper Ice Arena	White	Fairbanks	1920 Lathrop Street
Birch Hill Rec Area	Green	Fairbanks	101 Wilderness Drive
Bluebell Park	Green	Fairbanks	1555 Bluebell St
Bud Nelson Riverside	Green	Fairbanks	90 Slater Drive

Park			
Carlson Center: area around	Green	Fairbanks	2010 2nd Avenue
Chena Kiwanis Park	Green, with a view on blue (Chena River)	Fairbanks	4525 Chena Small Tracts Road
Chena Lake Recreation Area	Blue	Outside of Fairbanks	3780 Laurance Rd North Pole, AK 99705
Dan Ramras Community Tennis Courts	Green	Fairbanks	803 14th Avenue
Fahrenkamp Park	Green	Fairbanks	4004 Fahrenkamp Ave
Fairbanks Lions Recreation Area	Green	Fairbanks	1486 Hampstead Ave
Fun Time Park	Green	Fairbanks	3440 Shanly Ave
Gillam Multi-use Field	Green	Fairbanks	1194 19th Ave
Gordon Wear Park	Green	Fairbanks	Cushman Street/Chena River
Graehl Park	Green, with a view on blue (Chena River)	Fairbanks	301 Front Street
Griffin Park	Green, with a view on blue (Chena River)	Fairbanks	360 Wendell Ave
Growden Park	Green	Fairbanks	207 Wilbur St, Fairbanks, AK 99701
Hamilton Acres Park	Green, with a view on blue (Chena River)	Fairbanks	101 Hamilton Avenue
Janel Thompson Park	Green, with a view on blue (Chena River)	Fairbanks	1701 2nd Avenue
Kiana Park	Green	Fairbanks	1802 Kiana Street
Kiwanis Football Field	Green	Fairbanks	1920 Lathrop Street
Mercier Park	Green	Fairbanks	823 22nd Avenue
Midnight Sun Lions Park	Green	Fairbanks	770 15th Avenue
Myrtle Thomas Park	Green	Fairbanks	323 12th Avenue
Pioneer Park	Green	Fairbanks	2300 Airport Way
Slaterville Park	Green	Fairbanks	341 Slater Street
Shoreway Park	Green	Fairbanks	Cushman Street and Chena River
South Davis Park – Dog	Green	Fairbanks	1915 25th Avenue

Park			
Tanana Lakes Recreation Area	Blue	Fairbanks	4400 S Cushman St Ext
Trails	Green	Fairbanks	Multiple locations
Turf Complex	Green	Fairbanks	1966 Davis Road
Weeks Field/Wien Park	Green	Fairbanks	805 Smythe Street

Table 1. OPS facilities maintained by FNSB.

The maintenance of many OPS within FNSB follows a similar tradition: land generously donated by individuals or groups is developed into parks, which are then maintained by the FNSB. However, there are exceptions, such as the Golden Heart Plaza in downtown Fairbanks, which are kept up by community organizations (Fairbanks Daily News Miner, 2013), highlighting the diversity in park maintenance approaches across the area.

The trails of Fairbanks benefit from a collaborative maintenance effort involving the FNSB and numerous local volunteer groups. The FNSB Comprehensive Recreational Trails Plan (Trails Plan) serves as the guiding document for the allocation of resources for the upkeep of local trails. The 2023 version of the Trails Plan outlines an expansive network of over 1,000 miles, encompassing 118 trails, demonstrating the Borough's commitment to the development of outdoor recreational infrastructure (The Comprehensive Recreational Trails Plan, 2023).

Fairbanks' diverse OPS are designed to accommodate a broad spectrum of the community, including families with children, senior citizens, and individuals with disabilities or special needs. The FNSB's parks, trails, and natural areas, such as the Chena River, and Tanana Lakes Recreation Area, offer a rich variety of recreational opportunities.

1.6. Methods and Data

This research adopts a mixed-methods approach, recognized for its ability to provide comprehensive insights, especially in interdisciplinary studies (Cheung et al., 2022). To

effectively address the research questions, the study utilizes a combination of methods as follows:

1.6.1. Land Cover Change Detection Analysis

The rapid pace and significant magnitude of human-induced changes to the Earth's land surface are profound. These alterations, which include changes in land cover (the physical attributes of the Earth's surface) and land use (how these attributes are utilized by humans) significantly affect Earth's system functions. They influence global biodiversity, climate patterns, soil health, and the provision of ecosystem services that are crucial for human well-being.

For this analysis, Landsat 5 and Landsat 8 images, accessed through Google Earth Engine, were processed using ERDAS Imagine. The methodology involves several steps:

1. Obtaining Images for Analysis Utilizing the Google Earth Engine:
    1. Satellite Imageries Utilized for Analysis: Landsat 5 (July 6, 1986); Landsat 8 (July 6, 2022).
    2. Satellite Imageries Utilized for Accuracy Assessment: Landsat 5 (July 6, 1987); Landsat 8 (July 19, 2021).
2. Conducting Unsupervised Classification:

This technique is employed when the specifics of objects within an image are not well-defined. It involves the algorithm grouping pixels with similar characteristics into clusters according to statistical rules. These clusters are subsequently labeled with descriptive terms and sorted into classes such as impervious surfaces, vegetation, water, and soil.

3. Performing Accuracy Assessment:

Following the classification, conducting an accuracy assessment is crucial to determine the reliability of the categorization.

4. Engaging in Change Detection:

The final phase involves identifying transitions between classes over time, which provides insights into how land cover has evolved.

1.6.2. NDVI Analysis

The Normalized Difference Vegetation Index (NDVI) is the most widely used vegetation index that provides insights for spatial assessment of vegetation using satellite images (Engstrom et al., 2019; Huang et al., 2021). It is highly valuable for a broad spectrum of environmental and climate change research (Liu et al., 2023). In this study, NDVI is employed to analyze vegetative changes in Fairbanks, Alaska. Utilizing the Google Earth Engine, NDVI indices for Fairbanks were calculated for each year using Landsat 5 and Landsat 8 imagery. The selection of these specific satellite datasets and the Google Earth Engine platform was based on their extensive historical archives and advanced analytical capabilities, respectively.

When assessing vegetation conditions over time through NDVI image comparison, the timing of observations is critical for accurate and meaningful analysis (International Production Assessment Division, 2024). Although comparing images from the same day is ideal, this study could only perform comparisons within the same week. Comparing images taken during the same week of different years offers a compromise between minimizing differences in phenological stages and managing data availability challenges, such as cloud cover. For Fairbanks, the analyzed week was the 27th week of the year (around July 4–10).

1.6.3. Geospatial Analysis in Python

The analysis of park accessibility was conducted using racial demographic data from municipal and national databases, complemented by buffer analysis. Although Larsen and Gilliland (2008) acknowledge the limitations of the circular buffer, it is still the prevalent method for assessing accessibility in GIS applications. While there is no universal standard for the distance to a park, with recommendations varying, we adopted the approach suggested

by the European Regional Office of the World Health Organization (2016), which advocates for a 5-minute walk to a park, approximately 300 (Annerstedt Van Den Bosch et al., 2016) to 400 meters (UN-Habitat, 2018; Kuklina et al., 2021). The methodology involved the following steps:

1. Calculate the total area of each census block using the "Calculate Geometry" function on TIGER shapefiles.

2. Join Census Data on residents with TIGER shapefiles using the "Spatial Join" or "Intersect" function to create a Census Block Map for residents.

3. Employ the "Clip" function with parks and downtown area shapefiles as inputs to produce shapefiles of parks in the downtown area.

4. Generate buffers around parks using the "Buffer" function, setting parks in the downtown area as the input, 400 meters as the distance, and producing shapefiles of buffers around these parks as the output.

5. Overlay park buffers with the Census and TIGER file using the "Intersect" function.

6. Determine the area of each intersected feature with the "Calculate Geometry" function.

7. Calculate the proportion of each census block covered by the park buffer zone using the "Field Calculator," which involves dividing the area of the intersection by the total area of the census block.

8. Add a new field to the intersected layer for recording the proportion of each block covered by a park buffer, expressed in percentages, using the "Add Field" function.

9. Introduce another field with categories of accessibility based on percentage proportions from the previous step, creating "High," "Medium," and "Low" accessibility

categories. Blocks with over 50% coverage are classified as "High," between 20% and 50% as "Medium," and below 20% as "Low," using the "Add Field" function.

10. Repeat all steps for a second set of census data.

This detailed methodology facilitates the comprehension of the spatial distribution and accessibility of downtown OPS in Fairbanks.

1.6.4. Qualitative Analysis

A diverse set of qualitative methods was employed.

1. Interviews were conducted during two field trips in 2023 – one in March, when Fairbanks was covered in snow, and another in July. A total of 32 interviews were conducted, encompassing residents, stakeholders, local authorities, members of Indigenous communities, and Indigenous allies. Of these, 11 interviews involved Indigenous participants, with 7 conducted with Indigenous residents and 4 with allies associated with Indigenous organizations. Indigenous respondents identified themselves as Tanana Athabaskan (Dene), Denaakk'e (or Koyukon) Athabascan, Inupiaq, Sámi, Sukteeneidí, and Tlingit. The remaining 21 interviews involved non-Indigenous individuals, with 3 of these interviews involving 5 people employed by the Fairbanks North Star Borough, among them the mayor and staff from the Parks and Recreation Department. The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board (or Ethics Committee) of the George Washington University (IRB number: NCR202872, 1 June 2021) for studies involving human subjects. Before each interview, participants were presented with the Informed Consent for Participation in a Research Study document, which detailed the project's scope, the research institutions, contact information for the

researchers, the rights of the respondents, and the questions that would be asked. A semi-structured interview guide (Table 2) was prepared, facilitating open-ended and adaptable conversations that varied in depth and sequence, influenced by the dynamics of participant interaction (Perry et al., 2021). Each discussion was unique, leading to diverse insights, including the significance of the concept of justice for Indigenous communities. The interviews were transcribed using Sonix, an audio and video transcription tool, and were manually verified for accuracy. The most of interview analysis was performed using Atlas.ti, a qualitative data analysis software. This program was instrumental in coding all interviews, categorizing respondents and their experiences, and analyzing perceptions of public space (using the Concept Analysis tool) and activities (using the Word Frequencies Analysis tool).

2. Mental Mapping: This method involves inviting community members to participate in mapping exercises to uncover their interactions with public spaces. Known also as sketch maps, these are typically created by hand on paper (Brennan-Horley, 2010). Due to the challenges participants faced when starting with a blank sheet, tourist maps were utilized as foundational maps, featuring landmarks and road networks (Brennan-Horley, 2010). Participants then charted their regular paths and pinpointed the public spaces they visited, leading to discussions about their reasons for visiting these places and their related experiences (Cheung et al., 2022).
3. Observations: The research employed a participatory observation approach, emphasizing engagement to challenge traditional research dynamics and power relations. This method seeks to achieve "knowledge for action" by fostering partnerships between researchers and community members,

promoting a relevant, morally conscious, and non-hierarchical methodology that may lead to emancipation and the discovery of alternative insights into complex situations (Clark et al., 2009). Moreover, this approach is close to Indigenous methodologies, highlighting learning by watching and doing (Wilson, 2008). Observations were made during March and July 2023 at various parks and events within them, catering to the broader community (such as music events in the garden at UAF or the Golden Days Parade) as well as specifically to Indigenous residents (like a three-day powwow).

Section 1: Introduction and Consent
1. Greetings and introduction. 2. Presentation and discussion of the "Informed Consent for Participation in a Research Study" document. 3. Request for consent. Proceed to Section 2 upon consent.
Section 2: Interview Questions
General Questions: • How long have you been living in this city? • What is your place of birth, and where did you move from? • What do you do for a living? Green Spaces: • What types of green spaces are you aware of in your city? • How frequently do you use them, and for what purposes? • Which green spaces are your favorites, and why? • Are there any green spaces you avoid, and if so, why? • How would you evaluate the quality of these green spaces and their infrastructure? • Are there needs for more or specific types of green spaces? • What infrastructural improvements are required? • Based on your experience, who primarily uses certain green spaces? • Have you encountered any accessibility issues? • Have you noticed any changes in the local flora and fauna around the city? (Possibly due to climate change?) Blue Spaces: • Which water bodies within the city limits do you find most significant? • What are the primary functions of these water bodies for you and other residents in summer? In winter? • How do you utilize the city's water bodies (for drinking, swimming, boating, fishing, winter sports, etc.)? • How would you rate the quality of urban water bodies and their infrastructure? • What improvements are necessary? • Based on your observations, who are the main users of specific water bodies?

White Spaces:

- How important do you consider snow in the city?
- What problems and benefits do snow-covered spaces (white spaces) present for you and other city residents?
- Have you observed any changes in snow quantity or the snow season over recent decades?
- How do changes in white spaces impact local mobility, recreational activities, and daily life?

Local and Indigenous Knowledge (for Indigenous respondents):

- What can be inferred about natural phenomena from the state of snow and ice cover?
- What changes in climate have you observed in recent years?
- Is Indigenous knowledge represented in the city?

Additional Urban Planning Questions:

- What practical issues does the local community face?
- Who are the key contributors to the city's functioning?
- How would you narrate the city's story? Is it one of success?
- Is the downtown area active? What kinds of activities occur there, and do people participate?
- Would you describe the city as open and welcoming?
- What does the future hold for Fairbanks?

Table 2. A semi-structured interview guide.

1.7. Theoretical Framework

1.7.1. Right to the Cold City

This research aligns with the concept of the right to the city, as posited by Lefebvre (1991) and expanded by David Harvey (2008). It emphasizes that citizens should have the right to occupy and utilize urban spaces, shaping them to meet their needs. This principle suggests that urban environments should be participatory in their creation and evolution, inclusive of all residents (Cardullo & Kitchin, 2019), including Indigenous peoples. Puketapu-Dentice et al. (2017, p. 11) further emphasize the importance of integrating Indigenous cultural values in urban environments: “Integrating Indigenous cultural values within the built environment can provide a vehicle for advancing Indigenous aspirations for spatial justice by creating a sense of identity through direct association to a place that is often dominated by Western design and planning practices”.

Building upon the idea of urban rights, the "right to the cold city" concept is inspired by Sheila Watt-Cloutier's "The Right to be Cold" (2018). It addresses the environmental and

cultural challenges Indigenous peoples face in Arctic regions, emphasizing the intrinsic connection between the Inuit way of life and the cold environment. The concept encapsulates the collective right of Arctic Indigenous communities to maintain their environment and cultural and physical survival. Watt-Cloutier's assertion that "ice is life" for Inuit communities illustrates the profound dependence on a frozen landscape. This concept may seem foreign to representatives from warmer climates but is crucial in understanding the rights of Arctic peoples (Watt-Cloutier, 2018).

In contextualizing the "right to the cold city," it is important to consider the broader implications of environmental changes in cold urban environments. This includes exploring how urban planning and design in Arctic cities can be adapted to both mitigate the impacts of climate change and preserve the cultural and environmental conditions essential for the survival and prosperity of Indigenous communities. The concept challenges traditional urban design perspectives and calls for reimagining urban spaces that are sensitive to the unique environmental and cultural needs of urban Arctic populations.

1.7.2. Sustainable Development

OPS are places, where “local and global, material and social, science and everyday life meet” (Blok et al., 2016, p. 18). Safe, inclusive, and accessible OPS are one of the main targets of United Nations Sustainable Development Goal №11 “Sustainable Cities and Communities” (United Nations Department for Economic and Social Affairs, 2023). The Sustainable Development Goals Report (2022, p. 49) states that urban features such as parks, boulevards, and playgrounds not only improve the quality of life in cities but also serve as important venues for social and economic interactions. An understanding of OPS reveals connections between urban environments, including OPS, and social issues.

As defined in the United Nations’ “Our Common Future” report (Brundtland, 1987, p. 16) sustainable development is focused on “the needs of the present without compromising

the ability of future generations to meet their own needs". However, measuring sustainable development specifically for Arctic cities poses a challenge, as existing Arctic indicators do not concentrate on this domain. While these indicators highlight economic, social, and environmental challenges, they lack comprehensive development (Orttung, 2020). An alternative approach to measuring sustainable development is through the application of the ISO 37120 urban sustainability indicators. Although not specifically designed for Arctic cities, these indicators are considered universal in scope. The availability of such indicators allows to compare cities with each other and provide an understanding of urban dynamics. One of the core urban sustainability indicators in the ISO 37120 standard is the amount of green space. Green spaces offer numerous benefits, including improved air quality, efficient stormwater management, and providing recreational opportunities for residents. The Arctic urban landscape, characterized by a unique blend of built and natural environments, faces distinctive challenges, including climatic extremes and the urban heat island effect in densely built areas (Laruelle et al., 2019). Consequently, examining the interplay between built and natural spaces in Arctic cities is vital. This research segment focuses on documenting the historical and current states of vegetated and impervious surfaces in these settings, offering a comparative analysis over the past century.

The discourse surrounding public spaces frequently emphasizes accessibility and the methods by which it is measured (Wolch et al., 2014). As outlined earlier, accessible green spaces are one of the objectives of the Sustainable Development Goals. However, green open spaces are often not as "open" as they should be, excluding low and middle-income citizens (Haase et al., 2017), as well as various ethnic and religious groups (Comber et al., 2008; Nesbitt et al., 2019). As the World Health Organization notes, girls, women, the elderly, individuals with low socioeconomic status, those with special needs and chronic illnesses, marginalized groups, Indigenous populations, and residents of rural areas frequently

encounter barriers to accessing safe, affordable, and suitable public spaces for physical activity.

A research gap exists concerning the accessibility of OPS in Arctic cities. Historically, most American cities have evolved in a manner that offers the greatest park access to the wealthiest and often whitest neighborhoods (Rigolon & Németh, 2021). Applying these indicators, we keep in mind their shortcomings. As Nadezhda Zamyatina, Luis Suter, Dmitry Streletskiy, and Nikolay Shiklomanov point out: “Unfortunately, such statistical measures cannot fully describe how these conditions developed. For such an analysis, the context of historical and ongoing processes—economic, social, and political— is necessary. Such context is best provided by communications with local peoples, historians, and policymakers, and stresses the importance of fieldwork and experiential research in these unique locations” (Orttung, 2020, p. 69). Moreover, ISO 37120 lacks a comprehensive approach to dynamically addressing climate change, missing indicators for evaluating a city's impact by and response to climate change, as well as preparedness for related hazards like permafrost thawing and wildfires (Berman & Orttung, 2020). It also overlooks crucial aspects such as relationships with local Indigenous populations and the impact of shifting geopolitical interests on Arctic city production (Berman & Orttung, 2020).

The applicability of sustainable development as a research framework within the Arctic context has been subject to scholarly debate. Pilyasov and Molodtsova (2022, p.123) challenge the relevance of the traditional notion of sustainable development: “We should stress that the concept of resilience is focused on analyzing the reaction of urban systems to crisis, extreme conditions. On the other hand, the concept of sustainability is mainly focused on the analysis of cities' stable development.” This perspective shifts the focus towards resilience, deemed more suitable for addressing the Arctic's distinct environmental and climatic challenges. This reframing underscores the need for a resilience-oriented approach in

Arctic urban planning and development, acknowledging the unique environmental and climatic challenges faced by Arctic cities.

1.7.3. Resilience

In recent discourse, the concept of resilience has been increasingly integrated into the broader narrative of sustainable development. As Brown points out, resilience is "a new wave of thinking around sustainability in an age of economic and political instability" (Brown, 2014, p. 107). The concept of resilience, initially emerging from ecological studies, has been well-articulated by Holling (1973). He defines it as a system's capacity to absorb changes and persist, distinguishing it from stability, which is concerned with a system's ability to return to equilibrium post-disturbance. Holling's extensive research on forest insects in Canada illustrates that in areas with extreme climatic conditions, systems may exhibit high resilience despite low stability, characterized by wide population fluctuations yet a robust capacity to withstand environmental extremes. This distinction is crucial for Arctic cities, where the phenomenon of Arctic amplification demands a resilient approach to urban planning and development.

This study adopts a two-fold resilience approach. First, it adopts a sociological perspective on resilience, focusing on Arctic communities' capability to adapt and thrive amidst social, political, and environmental changes and challenges (Adger, 2000, p. 347). Indigenous peoples are known for thousands of years of adaptability to changing environments. As Ford et al. (2020, p. 539) note, "There are numerous examples of resilience evidence that Indigenous peoples are coping and adapting to rapid change".

It also applies a resilience framework to analyze the OPS infrastructure, aligning with the US National Academy of Sciences' definition of resilience as the capacity for preparation, absorption, recovery, and adaptation to adverse events (Committee on Increasing National Resilience to Hazards and Disasters et al., 2012). Specifically, this study examines such kind

of “frozen infrastructure” (Kuklina et al., 2023), highlighting the critical need for research due to their susceptibility to climate change impacts. Recent findings indicate that a substantial portion of infrastructure in permafrost regions faces the threat of damage or loss due to thaw subsidence, with significant impacts anticipated in Alaska (Streletskiy et al., 2023). The rapid environmental transformations in the Arctic necessitate a resilience-based approach to secure the adaptability and long-term viability of these urban settings.

Resilience is closely linked with the concept of vulnerability, which aims to identify factors leading to susceptibility to harm (Ford et al., 2020). Vulnerability and resilience can coexist within a community, varying across different social groups, over time, and depending on the stressor. Thus, what enhances resilience for some may increase vulnerability for others (Ford et al., 2020), highlighting the complexity of addressing these challenges in the Arctic context.

1.7.4. Justice

A critical shortcoming in resilience theory and practice is that they fail to address equity and justice topics (Fitzgibbons & Mitchell, 2019), particularly in relation to climate change (Adger, 2006). Climate change exacerbates vulnerabilities and amplifies existing injustices (Adger et al., 2014). The complexity of justice, encapsulated in David Harvey's reflective query, "Which is the most just theory of justice of all?" (Harvey, 2003, p. 940), remains a crucial challenge.

Multidimensional perspectives of justice include:

1. Global and Arctic Justice Contexts: Wood-Donnelly (2023) stresses the importance of addressing justice in the Arctic, a region at the intersection of various global concerns like climate change, pollution, and geopolitics. This context frames the current injustices arising from historical exploitation and marginalization. The Arctic exemplifies the need for a

comprehensive understanding of justice that encompasses environmental, social, and cultural dimensions.

2. Spatial Justice: As emphasized by Przybylinski and Ohlsson (2023), spatial justice highlights how the production of space can perpetuate social relations of domination and oppression.

3. Indigenous Perspectives on Justice: Central to Indigenous conceptions of justice is the process of healing, both within communities and in response to the traumas of colonialism (Przybylinski & Ohlsson, 2023). This perspective underscores the importance of acknowledging and addressing historical oppressions and the role of land in Indigenous ontologies and epistemologies.

The challenge lies in integrating these diverse perspectives of justice into urban planning and climate resilience strategies. Uban justice should be reconceptualized to include:

1. Recognition of Diverse Perspectives: Acknowledging the various dimensions of justice, from spatial to Indigenous viewpoints, is essential. This involves understanding the unique vulnerabilities and needs of different communities, especially those in fragile environments like the Arctic (Watt-Cloutier, 2018).

2. Equitable Resource Distribution and Access: Addressing the allocation of resources and opportunities for participation and representation in urban development is crucial. This includes ensuring equitable access to housing, employment, and public spaces, as pointed out by Fainstein (2010).

3. Addressing Historical and Ongoing Injustices: Recognizing and rectifying historical injustices, especially those faced by Indigenous communities, is a fundamental aspect of achieving a just city. This involves not only reparative actions but also a

transformative approach to urban governance and planning, that respects and integrates Indigenous knowledge and practices (Wood-Donnelly, 2023)

4. Collaborative and Inclusive Decision-making: Creating a just city requires participatory and representative decision-making processes that genuinely consider the voices of all stakeholders, particularly marginalized communities (Mels, 2023; Wood-Donnelly & Ohlsson, 2023)

1.7.5. Summary

All in all, this comprehensive framework merges the concepts of the right to the cold city, sustainable development, resilience, and justice, providing a detailed perspective for analyzing Arctic urban planning of OPS and socio-environmental challenges. The right to the cold city underlines the significance of participatory and socially and culturally inclusive approaches in the creation and maintenance of OPS as well as a particular focus on frozen landscape and its impact by climate change. The lens of sustainable development directs research towards achieving the United Nations Sustainable Development Goals of safe, inclusive, and accessible OPS, and examines the interplay between OPS and social issues within cities. The application of the resilience concept seems essential in the Arctic, considering both the millennia of resilient experiences of local Indigenous communities and the (in)adaptability of urban public infrastructure to climate change. The justice perspective, though sometimes absent in the concepts mentioned above, becomes essential as climate change intensifies existing injustices. Despite the debatable nature of the justice concept within both the Arctic and urban planning contexts, it stands as the foundation for our research, particularly since a focus on it was requested during formal and informal discussions conducted on the field trip to Fairbanks for this work.

Chapter 2: Perspectives from Fairbanks' Residents, Indigenous communities, and Municipality

In the following chapter, the perspectives of Fairbanks' residents and Indigenous communities on OPS will be presented and compared. This will include discussions on accessibility, usage, the impact of climate change on usage, and the local understanding of justice and resilience.

2.1. Accessibility

is a crucial issue for OPS and is an important part of discussions. However, notions of accessibility differ in discussions with diverse residents from what have been usually utilized in planning and decision making as accessibility indicators, especially in the Arctic context, where access to these spaces varies depending on the season. Residents appreciate the year-round accessibility of places such as Pioneer Park and trails, mentioning fat biking as a method to improve access to OPS in Fairbanks: "Bikes have become really popular in Fairbanks, especially these bicycles with wider tires – the fat bikes, which are really popular. There are really good trails throughout the town, mostly a bit on the outskirts. But there are really great trails, and UAF has some really good ones around. So, the university has done a really good job of providing bike trails. And the cool thing, along with the city as well, is that along the major roads, there are specific paths for bicyclists. Not only in summer but also in winter" (male, 25). However, it is not a universal solution for everyone: "Biking is big in this community, but there isn't a lot of access between the spaces" (male, 25).

Another issue related to accessibility in Fairbanks is its sprawl, necessitating a focus not on walking but on driving for access. The Fairbanks North Star Borough Parks and Recreation Department commented on this, suggesting an increase in parking lots as a solution: "There are also some standards in the Parks and Recreation field about the number of parks and playgrounds per mile. Here, we don't meet that because we are so spread out. We've managed pretty well in our urban core areas, where we can have a park about every

five miles, but that still creates a spread-out feeling. So, we have to have these parking lots for people to transport themselves to the playground because not all of these playgrounds are within walking distance, which would be ideal – to have a park or playground or green space within walking distance of a large population center. So, that's something we look at in our Master planning, but we absolutely need to have good-sized parking lots for our trailheads and parks because the only way for a lot of folks to get there is by car" (male, 40).

Some Indigenous residents agree with the Parks and Recreation Department on the need to increase parking, especially downtown. However, others emphasize the importance of walkability and the existing challenges in accessing different urban areas easily and quickly: “Fairbanks [is] really sprawled out city… Nothing is good for walking” (female, 25). Additionally, from the Indigenous perspective, an interesting view emerged in an interview with a politically active local NGO focused on the accessibility and visibility of rallies for racial justice: “We think about what is most accessible to people and also what will help us get the message out to as many people as possible. For a rally for racial justice, we used the Veterans Memorial Park and then we marched to the Golden Plaza downtown” (male, 25).

2.1.1. Green OPS

Opinions about the accessibility of green spaces in Fairbanks vary from “it is really accessible here in Fairbanks” (male, 25) to “not built for walking” (female, 25). Often, green spaces outside of Fairbanks are perceived as more accessible than those in town and downtown:

- "You can be in town, but almost everyone was going outside of town for their green spaces" (male, 25);
- "That's one of the neat things about Fairbanks: there are so many different outdoor options right next to town. And town is so small that you're out of town in no time. In Anchorage, you've got to drive a way, but in Fairbanks... 5–10 minutes and you can

be somewhere outdoors. And there are not many places you can live like that" (male, 50).

Fairbanks' urban morphology is characterized as scattered (Jull, 2016). Because of contradictory opinions about downtown OPS accessibility, geospatial analysis with Python was conducted using racial demographic data to compare the accessibility to White and Indigenous citizens in Fairbanks. To address this specificity, the analysis concentrates on the downtown area where eight parks are located: Chena Pedestrian Path, Gordon Wear Park, Graehl Park, Griffin Park, Myrtle Thomas Park, Slatterville Park, Veteran's Memorial Park, and Weeks Field/Wien Park (Figure 3).

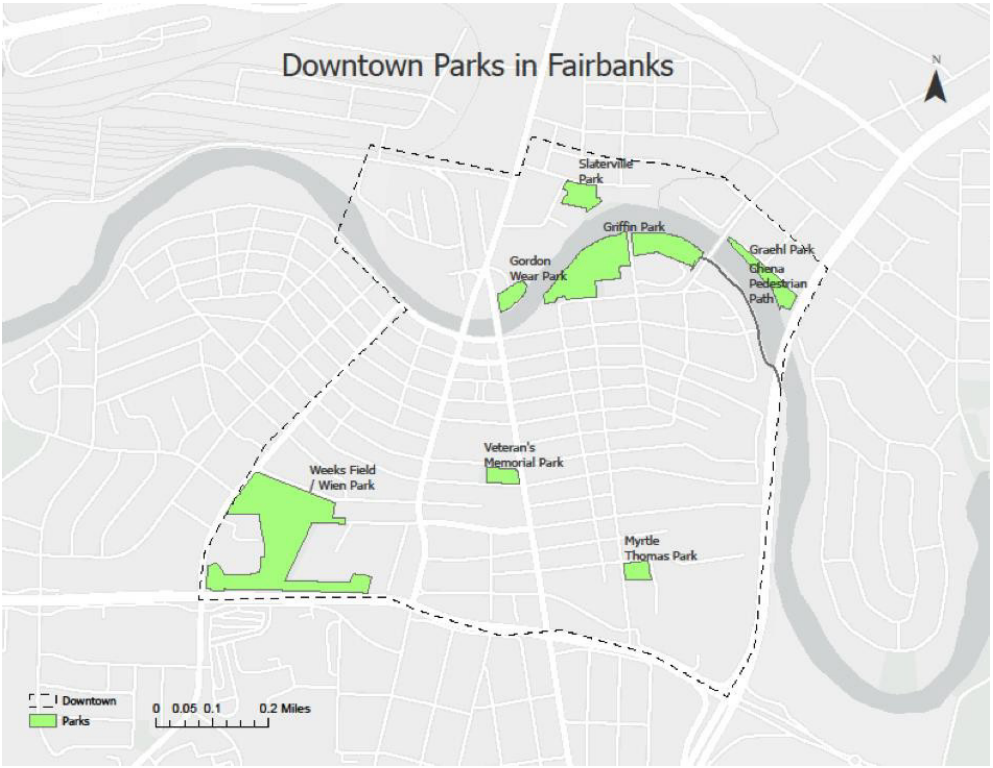


Figure 3. Downtown green OPS in Fairbanks.

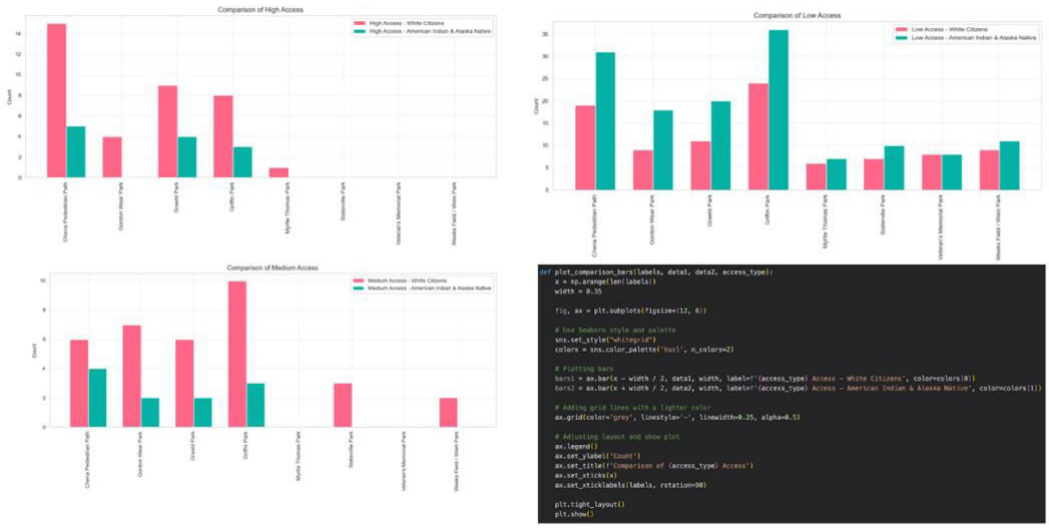
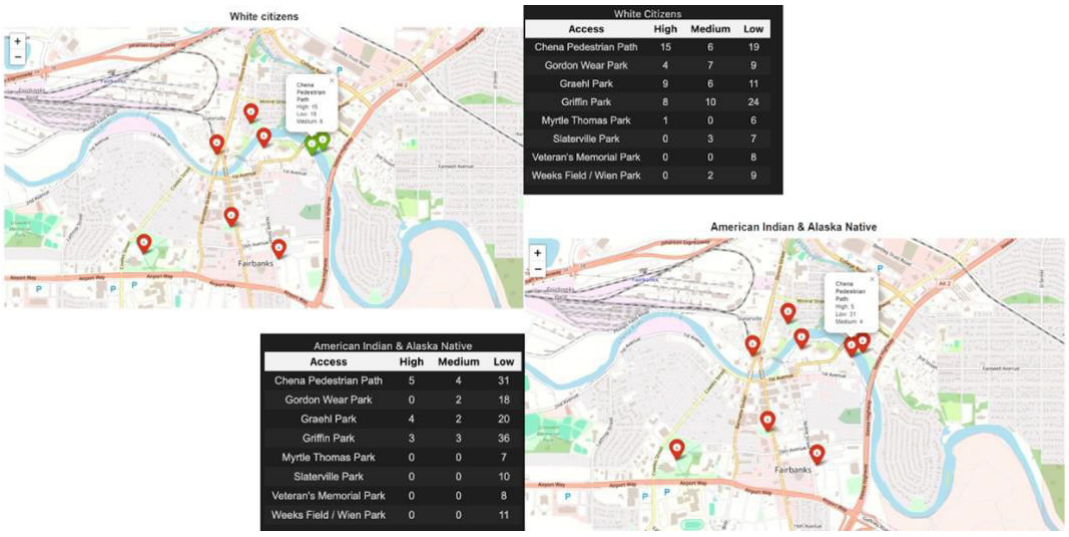


Figure 4. Accessibility difference results.

All accessibility results were categorized into three groups: high access, medium access, and low access (Figure 4). According to the findings, White citizens experience the highest high access, the highest medium access, and the lowest low access. Conversely, Indigenous citizens have the lowest rate of access to downtown parks – Figure 5.



White Citizens

Access	High	Medium	Low
Chena Pedestrian Path	15	6	19
Gordon Wear Park	4	7	9
Graehl Park	9	6	11
Griffin Park	8	10	24
Myrtle Thomas Park	1	0	6
Slaterville Park	0	3	7
Veteran's Memorial Park	0	0	8
Weeks Field / Wien Park	0	2	9

American Indian & Alaska Native

Access	High	Medium	Low
Chena Pedestrian Path	5	4	31
Gordon Wear Park	0	2	18
Graehl Park	4	2	20
Griffin Park	3	3	36
Myrtle Thomas Park	0	0	7
Slaterville Park	0	0	10
Veteran's Memorial Park	0	0	8
Weeks Field / Wien Park	0	0	11

Figure 5. Visualization of downtown OPS accessibility comparison.

In summary, the map-based results indicate that all parks exhibit low accessibility for Indigenous citizens. This disparity highlights significant issues of equity and inclusion within urban planning and underscores the necessity of developing more inclusive strategies for green space accessibility in Fairbanks. Indigenous allies emphasized the importance of

equitable access to green urban spaces, especially for marginalized communities. "Urban areas need accessible green spaces, particularly for underrepresented and marginalized communities," (male, 25). The Stone Soup Community Garden created by Bread Line, a charity dedicated to combating hunger in the Fairbanks community since 1984, serves as an unfenced green space open to everyone. "We refuse to fence off our garden because involvement, whether for better or worse, is healthy, healing, and brings joy..." (female, 30), ensuring that marginalized and/or homeless Indigenous individuals can use it without barriers.

However, six out of the eight parks also have low accessibility for White citizens, illustrating that accessibility is a concern for all residents. The analysis points toward a broader challenge within urban development: ensuring that green spaces are accessible for all groups of the population. Given the unique geographic and socio-economic context of Arctic cities, these findings emphasize the importance of tailoring accessibility initiatives to meet the needs of these diverse communities.

Future research should consider more granular analyses, including the quality of green spaces, the variety of amenities offered, and the specific barriers to access faced by different community groups. Additionally, engaging with community members and stakeholders in the planning process can help identify priorities for improving accessibility and ensure that green space development aligns with the needs and desires of all city residents (Vargas-Hernández et al., 2023; Vidal et al., 2020). Moreover, for a city covered in snow for half the year, the direct distance to green spaces becomes less significant than the availability of pathways that are either cleared of snow or specially prepared for winter conditions (Kuklina et al., 2021). For research on the public spaces of Arctic urban environments, the examination of green spaces must acknowledge the dual seasonal usage—addressing not only the green months but also the long winter period when OPS are covered with snow (Kuklina et al., 2021).

2.1.2. Blue OPS

Blue spaces are generally seen as accessible, with nearby rivers and lakes, though this is mostly from a car-dependent viewpoint: "Of course, we still struggle with accessibility to these more remote parts, mostly because they're not within the public transport system. So, it's very dependent on having your own mode of transportation" (male, 25).

Tanana Lakes Recreational Area and boat launches are mostly described as accessible: "Even right here in the summertime, this boat launch area. People will launch their boats or canoes, and they'll go up and down the river. It's definitely easy to access" (male, 25). However, Tanana Lakes Recreational Area has not been designed for a large number of visitors: "It certainly couldn't handle a large function. You couldn't have an Independence Day festival at that location. It's just far too small" (male, 30).

The issue of crowding, affecting accessibility, is also highlighted by an Indigenous ally: "Those [blue open public] places tend to get pretty crowded sometimes, especially in the summertime: when it's nice out everybody wants to be out on the lake" (female, 30). Additionally, an Indigenous kayaker mentioned that the Chena River's accessibility is sometimes compromised by risks: "I like to go kayaking. Sometimes the river is higher than in other years, more so because of the melting of the snow up, and it creates a kind of danger – very high – which other people who weren't used to the river would not go on to the river. Or there are times when I'm kayaking and I go underneath the bridge I have to duck when I'm going over there" (male, 50).

For both Indigenous and non-Indigenous residents, accessibility concerns regarding blue spaces are notably less pronounced.

2.1.3. White OPS

The accessibility of white OPS can be defined by several parameters:

- Incorporation into the larger trail system: "When I go cross-country skiing, there's a really great blue space called Smith Lake, which is incorporated into the trail system. It's a big wide-open area and it's really beautiful" (male, 25);
- Lighting conditions: "A lot of the trails are lighted in the winter. Not in the morning, but in the evening. The lights are on from dark until 9 or 10 pm. I think there are about 14 km of lighted trails, and that might be an underestimate because it has increased over the years" (male, 40);
- Grooming of the trail: "Some of those trails, they actually have a snow machine that pulls a device that kind of fluffs the snow up and then sets tracks for cross-country skis. It's probably about four to five feet wide. You'll see some trails that are groomed, which means they are groomed periodically after a snowfall. The person will go out and groom the trails. The University of Alaska Fairbanks has a series of trails that get groomed. So, there are people out there skiing every day of the week, some students, maybe professors go before or after class" (male, 50);
- Quality of sidewalks: "There's a large population of fat bikers because, over the snow and the ice, people use fat bikes. The sidewalks, however, are not... I don't even want to say groomed because it's really hard to groom ice and stuff. But they're not wide enough for two individuals on fat bikes to pass each other in opposite directions. So, there's a lack when I think about the infrastructure providing proper foot and bike traffic to individuals, especially because, in the darkest and coldest of hours, there's an increase in snowmobile traffic" (male, 30);
- Seasonal accessibility changes: "We have wetlands, a lot of wetland areas, they would be considered bogs, and there's permafrost. And they're wet in the

summertime. In the wintertime, those areas become accessible, and there are trails, winter trails, that go all over the interior of Alaska. What in the summertime is boggy and wet, in the wintertime becomes easily traversed with a snow machine or sled dog team" (male, 50).

However, winter brings increased challenges in accessibility, mentioned by Indigenous residents:

- Snow removal: “A lot of times snow removal is nonexistent in the winter time, especially for sidewalks and stuff around here – you can't really walk anywhere, because you're going to end up walking in the road and it's icy. And then sidewalks are like two or three feet of snow. And it might be hard-packed in some areas but then you're going to fall through and it's not fun. It's not very walking-friendly at all here” (female, 30).
- Public transportation: “You have to drive everywhere. Yeah, there's a bus system, but it's not really the most ideal and comfortable option, especially in the winter” (female, 25);
- Snow impact on wildlife and humans: “I would say for the past 10 years we've had too much snow. Too much snow is hard for the animals to get around. The bigger animals when it's hard for them to get around. It is easier for other animals to kill them. And it's harder for us to move around in more snow too. Makes everyone's life a little bit more difficult” (male, 25).

Despite these challenges, cars and snowmobiles remain vital for winter mobility from an Indigenous perspective: "A lot of people utilize the river and the trails for snow machines" (male, 50). The Chena River used to freeze fully, allowing for activities such as snow machining: "We used to be able to run around on snow machines" (male, 25). Yet, there's an opinion among Indigenous residents too on prioritizing vehicular access over walkability: "9

months out of the year we're not kind of walking around – make the sidewalk smaller so we can get some more cars there" (male, 25).

Overall, winter accessibility remains a significant concern for all Fairbanks residents, including Indigenous communities, affecting their engagement with outdoor activities and transportation. Indigenous residents, in particular, have shown a keen focus on accessibility issues, with some extending their considerations to include the impact on animals, highlighting a holistic view of accessibility and its effects on the broader ecosystem.

All in all, our analysis indicates that Fairbanks does not fulfill the United Nations Sustainable Development Goal №11's criteria for safe, inclusive, and accessible OPS. Respondents reported a lack of safety (particularly during dark times), accessibility (especially for Indigenous communities), and inclusivity (with OPS primarily serving the general Fairbanks community and tourists, neglecting Indigenous communities and cultures).

2.2. Usage of OPS

While the residents often discuss usage of OPS in the same terms as elsewhere, there was a specificity related to seasonality, some environmental and cultural traditions.

2.2.1. Green, Blue, and White OPS: Any Season

The analysis of activities undertaken by residents of Fairbanks revealed expected trends such as hiking and walking (Figure 6). Biking emerged as a year-round activity across both green and white spaces. The term "marching" was frequently mentioned, underscoring the political role of OPS. The words "supporting" and "empowering" were significant, linked to community engagement and the reinforcing role of OPS. Positive sentiments were expressed through terms like "love" and "enjoy," reflecting the enjoyable interactions with these spaces. "Mushing" was also highlighted, illustrating the unique Arctic context of activities in Fairbanks.

In addition to the activities mentioned above, Indigenous respondents specifically highlighted dancing: "It's really nice seeing all these Native people in their regalia, dancing really hard" (male, 20). Learning was another aspect brought up by Indigenous residents, pointing to the potential of OPS as venues for "learning traditional activities" (female, 60).

However, some members of the Indigenous community highlight a disconnection between OPS and Indigenous culture and values: “We're not going to do a potlatch in a public place. We usually have community halls in the villages and each village, they utilize that for, for potlatches. Our traditional activities don't really take place in public settings… I think that goes back to maybe culture to feel like maybe it's a little odd to think about it that way from like a native perspective because. At least from what I've heard, you know, the land, the land is everywhere. And you can really connect everywhere you are. And then to go a step further than that, it would be, you know, hunting or berry picking or something like you're getting out on the land to get native food, right? And it would be kind of I think maybe it's a cultural thing where it would be kind of odd. Why would we gather outside? To do what? You know, whenever the traditional activity you're going outside to do is gathering and hunting. And you can't do that in parks” (female, 60).

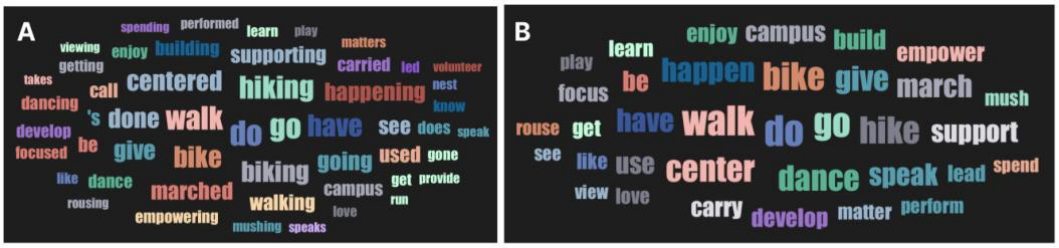


Figure 6. Word Frequencies Analysis in Atlas.ti for activities during all seasons: (A) all residents; (B) Indigenous residents.

2.2.2. Green and Blue OPS: Summer

During the summer (Figure 7) the interplay between green and blue spaces becomes particularly vibrant, offering a wide variety of outdoor experiences. This period sees heightened engagement with nature, from hiking and picnicking in green areas to water-based

activities like swimming and boating in blue spaces. It is interesting to note that one of the most frequently mentioned verbs is "floating," especially in the context of floating down the Chena River, highlighting the central role of this blue space in residents' lives. Another popular term is "play," showcasing the entertaining function of green and blue spaces for residents. Walking and running were also popular activities in green spaces during the warm months. Swimming emerged as a favored activity, mentioned in the context of the Chena River, Tanana Lakes Recreational Area, and Chena Lake. The word "enjoy" frequently appeared, clearly reflecting the mood of people using green and blue OPS in the summertime.

Indigenous residents share these activities, adding foraging, skateboarding, celebrating, picnicking, and gathering as part of their summer experiences in green and blue spaces showing a connection with land: “I could still go subsistence foraging and find berries and herbs or anything that I need” (non-binary person, 25).

Fishing is big too as well as overall connection with water: “Part of our being is being able to have fish camps and go fishing every summer and provide for the family” (female, 60). The Chena River holds significant nature resources and has been playing an important role for Indigenous communities and the Dena people: “The word ‘cheno’ which is the actual name of the river from the Lower Tanana River… It originally means that this river was a good place to get game, basically big animals” (male, 50).

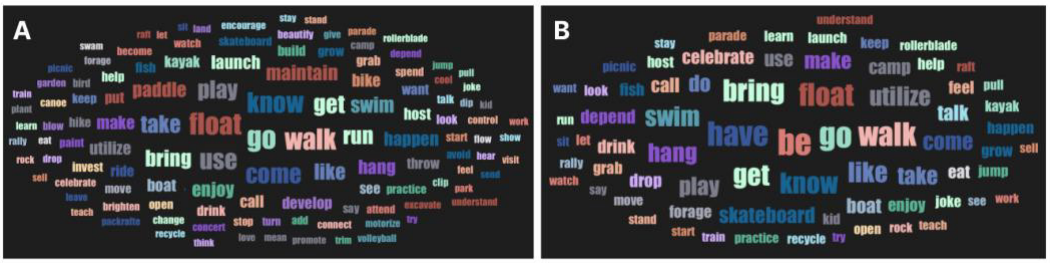


Figure 7. Word Frequencies Analysis in Atlas.ti for activities during summer: (A) all residents; (B) Indigenous residents.

2.2.3. Green and Blue OPS: Fall

In the fall (Figure 8), while green and blue spaces persist, people maintain their engagement with these areas, walking on trails and alongside water bodies. During this season, the activities of Indigenous residents distinguish themselves from those of non-Indigenous residents. In addition to traditional walking, Indigenous residents often engage in berry picking, hunting, and communal gatherings. Activities such as foraging and hunting, which may not typically be associated with conventional parks, are predominantly carried out in areas beyond the city limits, highlighting a seasonal shift in how residents interact with OPS. Furthermore, Indigenous residents observe events in honor of Missing and Murdered Indigenous Women, held in urban settings.

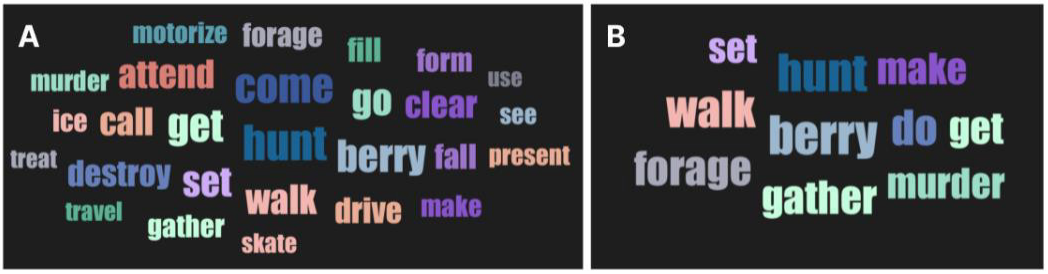


Figure 8. Word Frequencies Analysis in Atlas.ti for activities during fall: (A) all residents; (B) Indigenous residents.

2.2.4. Green and Blue OPS: Spring

When green and blue OPS emerge from beneath the snow, the verb "watching" becomes most prevalent as shown in Figure 9. People engage in watching birds migrate through the town at Creamer's Field, officially known as "Creamer's Field Migratory Waterfowl Refuge": "You can see a few cars up there, but usually in April and May, it's full of cars on both sides. The side in the front, watching the geese and the swans and the cranes" (female, 60).

Observing wildlife and the ice breaking on the river are also popular activities. This season is marked by a serene observation of nature's thawing and renewal processes, engaged

in both from a stationary position and while walking, making it a common activity among all residents, including Indigenous communities.

Spring is also a time for collecting trash and tidying up: “I still have a little bit of snow in my backyard, but during the melt, it's when a lot of garbage, either on roadsides or along different trail systems, pops up because they'd been covered in snow and there's a community-wide effort to pick up and collect that garbage. So right now, if you were to come to Fairbanks, you would drive on any of our roads and see piles of yellow garbage bags on the side of the street from people who've picked up trash, um, and I've done it on my neighborhood road. People do it all over” (female, 30).

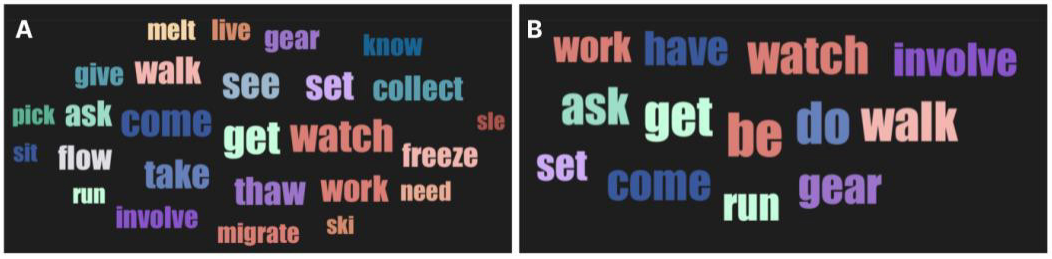


Figure 9. Word Frequencies Analysis in Atlas.ti for activities during spring: (A) all residents; (B) Indigenous residents.

2.2.5. White OPS: Fall, Winter, Spring

Covered in snow from October to April, white spaces dominate the fall, winter, and spring months, shaping residents' activities around snow and ice. Despite the harsh, cold, and dark winters, residents maintain an active lifestyle focused on outdoor enjoyment and nature, such as cross-country skiing, walking, and sledding, as shown in Figure 10. All Fairbanks residents engage in activities like biking, trail maintenance, snowshoeing, and dog mushing, also highlighted in Figure 10.

Indigenous residents particularly engage in cross-country skiing, snowboarding, riding snow machines, ice fishing, and ice skating, with all their cultural events closely tied to the snow. An Indigenous resident highlighted the importance of snow for traditional activities, noting, “A lot of [dog mushing] races that happened start off on the river that's why it's so important to have snow” (male, 50). Winter activities for Indigenous peoples

demonstrate a deep connection with nature and animals: “Looking at the animals, watching the animals. When we do get a lot of snow like last year the moose, they take the path which is much easier for them to go through. We have to be really careful and make sure, when we're driving that we don't need to hit a moose. Last year there were many moose that were on campus. One moose was over at one of the parking lots and they are just resting because they're hungry, they're starving – all the food that they can eat is underneath the snow. Looking at animals' behaviors helps us predict the snow, predict the weather as well” (male, 50).

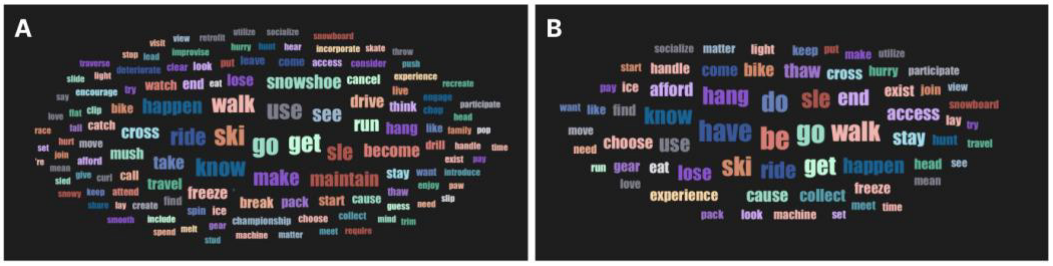


Figure 10. Word Frequencies Analysis in Atlas.ti for activities during winter: (A) all residents; (B) Indigenous residents.

2.3. Changes in Usage of OPS

Respondents universally recognize climate change as a reality affecting their daily lives in Fairbanks, primarily by creating unsafe conditions that discourage outdoor activities and encourage staying indoors, with expected increases in impact over time.

The paradox of relying on the fossil fuel industry for economic stability while facing its long-term detrimental effects creates significant cognitive dissonance within the community: “In Fairbank's for the past 50 years, a central component of the economy was the fossil fuel industry and it was cheap fuel, and it created a number of jobs. For Fairbanks, climate change has certainly presented this huge cognitive dissonance where you rely upon something to put food on the table and to heat your home. But it's also destroying your home, but not necessarily like today, but maybe 50 years or a hundred years from now, like down some far-off distant threat, it's not an urgent crisis. And it's the state of Alaska and the

Fairbanks Borough's reliance upon fossil fuels is creating all kinds of social tension. We're seeing that some of our fellow citizens are losing their homes to eroding coastlines. And we see the banks, global banks are not supporting oil development north. And it's an interesting time to be a resident of this Borough and of this state to know that we're spending 300 to close to a billion dollars a year on damage from climate change to our roads and bridges, buildings to see our neighbors, homes burned in a wildfire, that is triggered by a warming environment, warming climate, to see our salmon runs destroyed because of excessive temperatures in the river. And yet we have these jobs and we have this permanent fund dividend check that we get from oil originally from oil income and revenue. And it's an interesting situation that we find ourselves in" (male, 50).

2.3.1. Green OPS

Climate change visibly affects green OPS, particularly trails, which are cherished by the Fairbanks community. The degradation of these trails due to environmental changes, such as the persistent wet conditions transforming vibrant birch forests into closed for safety reasons trails at Creamer's Field (Figure 11), exemplifies the direct impact of climate change on local ecosystems and recreational infrastructure: "This is a trail that I really love, but it's closed right now due to global warming. The trail is in terrible shape past this place. It used to be able to walk on it. See all of these birch trees? When I first came here, they were all alive. There's a wet area through here. It's called Seasonal Pond. It used to be that the seasonal pond dried out in the summertime. It no longer dries out. The water just stays and it's killed all the trees around here. The boardwalks through that area have turned into twisty, unsafe places… The trail has been redone about three times since I lived here in 1996. So, it had happened. But it's worse now" (female, 60).

Figure 11. Notification about the closed trail and the trail itself at Creamer's Field. June, 2023. Photo made by Diana Khaziakhmetova.

The Fairbanks North Star Borough Parks and Recreation Department observes permafrost thaw causing sinkholes and trail infrastructure damage, a testament to the changing landscape and the challenges in maintaining these green spaces: "We do see a lot of our trails are impacted by permafrost thaw all over Fairbanks. They're getting sinkholes. Basically, the ice is melting and then the water is running into those spots. A very interesting thing that I learned again from my old boss is that most of our parks in Fairbanks are on the worst land. That's why they hadn't been developed. That's why there are no houses there. So now it looks like a nice grassy park, but it was a swamp before they filled it. And there's all these ice lenses under there or just not great soils. We've got some parks where the pavement buckles in the winter because there's so much moisture under there, the ground swells. We just resurfaced an ice rink out here and they had to stop taking care of the ice in the winter because it buckled. The asphalt raised up so much that it started breaking the ice and sticking through. And then we couldn't use our Zamboni because you're going to hit asphalt with this really fancy blade. So, we had to close it all together. But that's almost the opposite, right? Like, that's the effect of permafrost, not the effect of not having permafrost" (male, 40).

The increasing occurrences of wildfires and the resultant decline in air quality have led to the cancellation of outdoor programs, underscoring the broader implications of climate

change on community health and recreational activities: “The impact of that [climate change] is more, more fires. More smoke means we [the Department of Parks and Recreation] are canceling outdoor programs because of air quality. We had to do that a lot last summer [2022]. We had these Park Play Days and if the air was above whatever it was, 20 parts per million or 200 parts per million, what EPA says is unhealthy, we just canceled things and so we canceled a lot. But on the flip side, because we have these nice few indoor facilities, people were coming here, you know, so it was increasing use of our inside facilities but decreasing our ability to do outside programs. If there were more fires, more smoke, then there would be less soccer and less football and less baseball and less people wanting to get out and hike in general” (male, 40).

Indigenous allies, deeply concerned about the increase in wildfires and the decline in air quality, face significant uncertainty regarding their future: “I feel a great degree of uncertainty of will the degree of wildfires just make it impossible to live here? Or is it the case that things will be hard here?” (male, 25). However, some residents note positive aspects of climate change, such as extended growing seasons and reduced insect nuisance, reflecting a nuanced perspective on its impacts. Yet, there's an overarching concern about the long-term viability of Fairbanks in the face of these environmental changes, with speculation about its potential role for climate refugees: “Maybe it's actually going to be more hospitable here than in other places. And maybe the Arctic is actually going to be a place that accepts quite a lot of climate refugees” (male, 25).

Some residents do not perceive the effects of climate change in urban OPS, attributing this to human intervention: “A park is so influenced by humans anyways it's hard to notice any change to the park itself. It's planted, manicured grass and there's lots of manipulation to all the wild stuff around. If there are birch trees – they're heavily pruned and trimmed. I think it's hard to notice something like climate change in a park” (male, 40).

However, changes are occurring, regardless of their connection to climate change. Firstly, this is evident from the results of the NDVI analysis. The dataset for Fairbanks, structured by years and corresponding NDVI values (Table 3), is comprehensive but not exhaustive due to missing years and varied image acquisition dates within a week's range. Despite these limitations, it supports a meaningful analysis of NDVI trends from -1 to +1, where values closer to +1 signify denser vegetation and those near -1 indicate water, ice, or snow presence, offering insights into temporal changes in green space (Liu et al., 2023).

Year	1986	1987	1994	2009	2011	2015	2017	2020	2021
NDVI index	0.34	0.34	0.3	0.32	0.33	0.24	0.27	0.24	0.25

Table 3. NDVI indices for Fairbanks (1986 – 2021) within week 27.

In Fairbanks, there is a clear and significant trend of decreasing NDVI, which might indicate a loss of vegetation or decreasing its health over the years (Table 4).

Parameters	**Mean NDVI**	**Trend Slope**	**P-Value**
Fairbanks	0.29	-0.0065	0.0048 (statistically significant)

Table 4. Trend analysis of NDVI values from 1986 to 2021 in Fairbanks.

Secondly, change is observable through Land Cover Change Detection analysis. Unsupervised classification revealed significant changes over 36 years from 1986 to 2022 in Fairbanks, demonstrating the transition from vegetation cover to built-up areas. This analysis showed a decrease in vegetation (34.5 km) and an increase in built-up environments within the city (Figure 12; Table 5), indicating substantial urbanization.

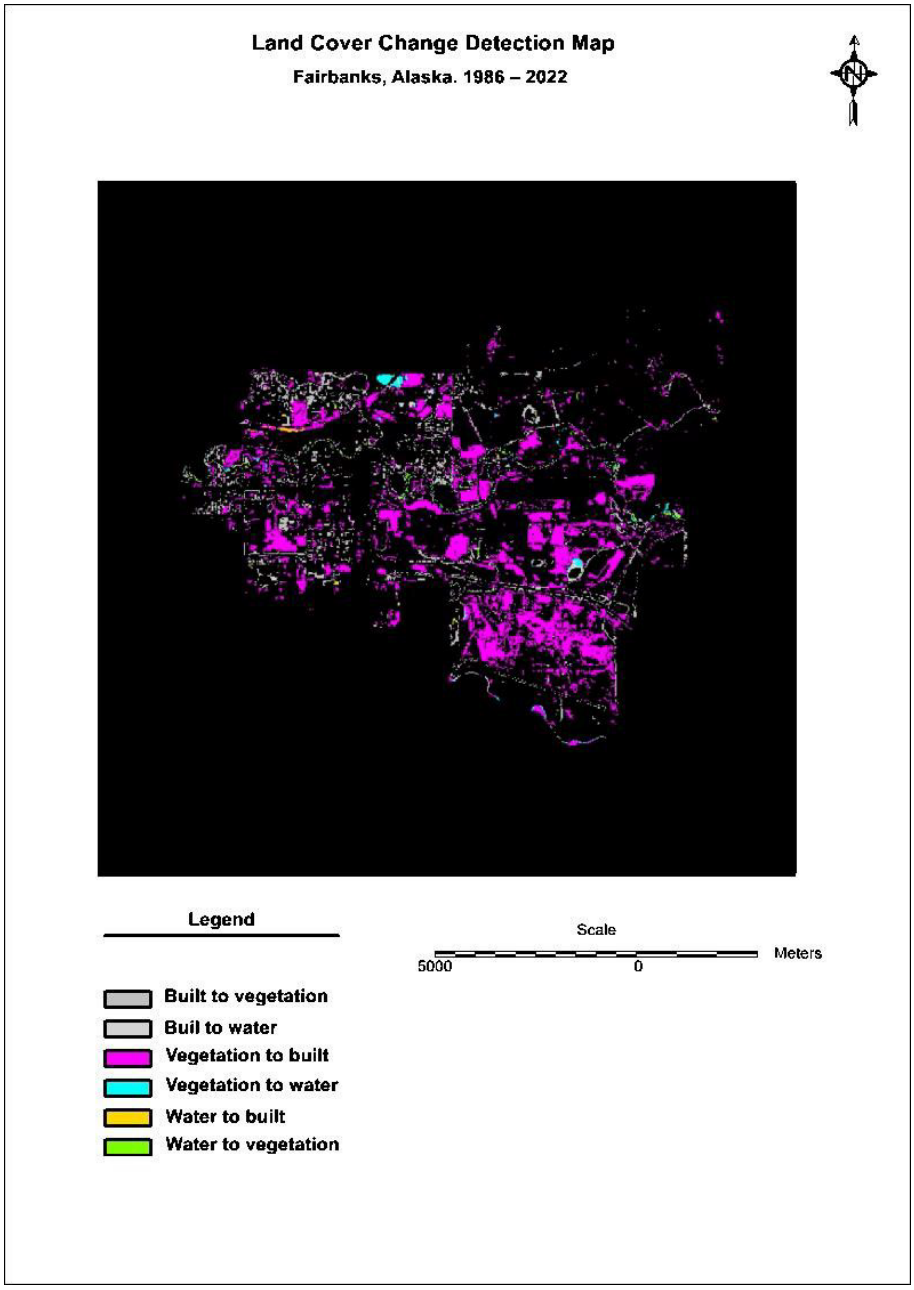


Figure 12. Land Cover Change Detection map from 1986 to 2022. By Diana Khaziakhmetova.

Color	Name	Area in km
	Vegetation to Impervious	34.5
	Impervious to Vegetation/Water	12.6
	Vegetation to Water	1
	Water to Impervious	0.4
	Water to Vegetation	0.6

Table 5. Land Cover Change Detection from 1986 to 2022.

Our quantitative analysis, including NDVI and land cover change detection, revealed a steady decrease in green areas. This reduction in green spaces, alongside the growth of built-up areas, suggests unsustainable development of the city.

2.3.2. Blue OPS

While the impact of climate change on blue spaces may not receive as much attention in public discourse as green spaces do, it is nevertheless observed, especially by Indigenous residents. This observation underscores the significance of blue spaces for their communities.

Climate change impacts the usage of blue OPS in multiple ways. One concern is when the Chena River levels are higher than usual, which restricts activities such as kayaking. This concern has historical roots. The Tanana River flows to the south of the city, while its tributary, the Chena River, runs through the center of Fairbanks. Recurrent flooding has posed a significant challenge, with the Chena River's overflow causing substantial damage in the years 1905, 1911, 1930, and 1967 (Pearson & Smith, 1975). The flood events in Fairbanks, notably the devastating flood of August 1967 that submerged approximately 95% of the city and caused over $170 million in damage, and a subsequent flood in 2008 with damages estimated at $10 million, highlight the city's vulnerability to flooding. Over time, urban planning globally has evolved to integrate blue and green infrastructure (BGI) for effective flood management. Analysis of flood risk areas, termed "Blue Spots" indicated that BGI distribution is not disproportionate to pluvial flood risk and is equitably present, providing adequate protection even in socially vulnerable neighborhoods (Ajidabe et al., 2021).

According to the “Risk Factor,” Fairbanks faces a severe flood risk, posing a significant threat to social facilities. The FNSB Multi-Jurisdictional Hazard Mitigation Plan (Hazard Mitigation Plan, 2021) addresses the issue of flooding, outlining potential impacts

and the likelihood of future events (sections 7.3–7.4). It highlights that the University of Alaska Fairbanks (UAF) anticipates an increase in rainfall, which could significantly affect Fairbanks.

The Hazard Mitigation Plan also details Long-term Mitigation Projects, emphasizing the Chena River Lakes Flood Control Project. This project, authorized by Congress in the Flood Control Act of August 13, 1968, safeguards the cities of Fairbanks and North Pole, Fort Wainwright Army Base, and the Fairbanks International Airport. It features the Moose Creek dam and floodway, completed in 1979 to provide 100-year flood protection by diverting excessive Chena River flood flows into the Tanana River and capping flows at Fairbanks. The plan includes public outreach efforts focused on promoting flood hazard awareness.

In addition to flooding, another commonly perceived impact of climate change on the usage of blue spaces is its influence on Indigenous traditional lifestyles: “People fished here thousands of years ago… these people are still here. You know, we're still here, and we still fish this way. But now we're kicked off and we're siloed to this part of the land and our fish aren't coming. So, we can't fish because of climate change and mass capitalism and people in different countries want our fish. It justifies capitalism and profit in the salmon industry over people who've been doing this for thousands of years” (female, 25).

Moreover, erosion is also perceived as related to climate change: “There is some erosion in some of the areas. If you ever get a chance to come here during the summer time, you'll see how people put tires and things like that to help prevent erosion. I've had to see people's yards, the river going into people's yards more and more. There's a tourist company called the Riverboat Discovery. They used to go on the Chena River and then they go into Tanana River, they go fishing will, back then, and then they turn around and then they go to meet an old village, basically a replica of an old village, it's all Alaska Native tour guides that

described various things. With the amount of silt coming from the glaciers, they're no longer able to go on to Tanana River because it's so low they can't go on there anymore. And that village site has moved because of erosion more inward. So that affects. That's just one example of how the erosion is affecting some areas as well" (male, 50).

Another issue related to blue OPS, yet not mentioned by residents, involves perfluorinated compounds (PFCs), chemicals found in firefighting foams that have been manufactured since the mid-1980s. In June 2022, the EPA updated its health advisories for PFAS chemicals, impacting Fairbanks, Alaska, where PFAS contamination, notably PFOA and PFOS, was first discovered in 2015 at the Regional Fire Training Center. Despite remediation efforts, including soil and contaminated water removal and providing affected residents with municipal water connections, challenges persist. Fairbanks has engaged in addressing these issues, including expanding well testing and connecting properties to clean water sources. The EPA's advisory and subsequent local actions underscore the seriousness of PFCs' environmental and health risks, highlighting ongoing efforts to mitigate contamination and ensure safe drinking water.

2.3.3. White OPS

The discourse on climate change's impact is particularly resonant when it comes to white OPS in Fairbanks. Here, the transformation brought about by climate change is not just a matter of observation but of profound change in lifestyle and community activities. "We lose our winter because of climate change," one respondent (male, 50) noted, encapsulating a widespread concern among the community that the very essence of their winter activities is under threat. In 2020, The Front Bottoms, a band from New Jersey touring through Fairbanks, released a song about the city, in which they sing about traditional to citizens crossing of Chena River by car during winter, which is impossible now because the river doesn't freeze completely anymore: "When the river freezes over, I will drive across… But

now it’s never cold enough so I’m forever lost”. Fairbanks has experienced an annual temperature increase of 2.1° over the past 67 years (Wendler et al., 2017). This is a significant departure from the rate of present average global warming of ~1.2 °C (Lenton et al., 2023), and is consistent with warming patterns across the Arctic (Serreze & Barry, 2011; Cohen et al., 2020; Landrum & Holland, 2020).

Over the entire state, precipitation has increased by 17% over the past 67 years, as warmer air can hold more water vapor (Wendler et al., 2017). An increase in precipitation does not necessarily lead to more snow cover but can result in changes to snow patterns.

The significance of snow to Fairbanks' winter cultural programming is paramount, and its absence or inconsistency poses a direct challenge to the cultural life of the community. Events traditionally celebrated, such as dog mushing and ski events, have faced cancellations due to changes in the snow cover: “They would have races on the river, dog races. Iron Dog long snow machine race in the world would end up down here on the river – can't do that anymore because the [Chena] River is open all the time down here. I don't know where they have them come in at [now] because usually, the finish line is here in Fairbanks, I think they might have gone out the North Pole” (male, 25).

The community has adapted by introducing fat bikes for changing snow conditions. However, even these adaptations face limits: “White space is in jeopardy in Fairbanks. We’re seeing it. We’ve had outdoor events canceled because of lack of snow cover: dog mushing events, and ski events. Have you heard of fat bikes? It’s a mountain bike that has been retrofitted with large tires, big tires, so you can go over snow. If the snow is packed you can ride your bike, on the snow. And we have people that are, myself included, out riding on bikes in the wintertime. We’ve had… they're called fat bikes, the fat tires [races]... We’ve had those events canceled in the past in late March and April because of lack of snow, or

conditions that are deteriorating, ice conditions, the rivers are getting mushy, there's water on top of the ice... So, the white spaces… If you look at a time graph, we may not be losing our winters, but the quality of the outdoor activity is in jeopardy because of inadequate snow conditions for getting out and recreating" (male, 50).

"Rain on snow" (ROS) events further exacerbate these challenges: "Short-term observations like we have more rain events in the winter than we used to have. So last year we had like an inch of rain in December and it created this nasty crust in the snow. And in Fairbanks, the snow doesn't melt in the winter, right?" (male, 40). ROS events are projected to increase in frequency across most areas of Alaska (Bieniek et al., 2018). ROS creates hazardous conditions that impact both human and wildlife populations. These events lead to avoidance of outdoor activities and concerns over safety.

To summarize, we can distinguish the following forms of vulnerability resulting from changes in white spaces:

- Vulnerability for humans:
    - "I think we had a couple days when it was so bad, nobody really could go anywhere. There was just too much snow and ice" (male, 40);
    - "There are other times that due to climate change, we'd get rain and then it would freeze up and then all the roads are like an ice rink. And it's unsafe to drive. And schools get closed because it's too warm. Not because of the snow, it's because it's too warm, too dangerous… I wouldn't want to drive. There have been times when during that time I would put on my snow boots and cleats take my sleds and walk to the store to go grocery shopping because it was so unsafe to drive" (male, 50).

- Vulnerability for animals:
    - “We can have snow and then we get rain shower and then the rain freezes, and that creates a crest on the snow and then animals have a hard time pawing through the snow to get to food” (male, 50);
    - “So that was like a hard impact on the wildlife. And then also on the trails until we got more snow to cover that ice up, but for like the wildlife. It impacted like the creatures that go underneath the snow couldn't get out” (male, 40);
- Vulnerability for physical infrastructure:
    - “Plus, the roads. When it rains like that that's the worst because then it'll get cold again and then you have that much ice on the road until it thaws. And they had to scrape off all the roads and it was just a mess. They did their best but the roads were in terrible shape last winter from that big rain” (male, 50);
    - “People were working from home but during that storm, there's also a lot of huge power outages so it really slowed things down. Because when it rains in winter, the trees will get heavy and their branches will bend down and go on the power lines. We had tons of power outages last year from the storm” (male, 40);
    - “Sometimes we have a lot of power outages from heavy snow because trees are falling on the power lines that, again, especially when we get rain and it basically grabs onto the trees and then the snow builds up and we have a lot of power outages and then that affects our facilities. We almost lost our ice rink because this building was without power for a couple of days and it doesn't have a backup generator” (male, 40).

The changing conditions of the Chena River illustrate the safety risks associated with thinner ice, leading to significant risks to life, which were especially often mentioned by Indigenous residents:

- “There are a lot of people that ski on the river, but … When I went up skiing on Sunday, I noticed that there's open water on the river which is not normal this time of year [March]. It's too early. Some people use the river as a shortcut between Chena Small Tracts Rd... right here you can drive right across the river, but many times, almost every year… they stop doing it once there's a vehicle that goes right through the ice” (male, 50);
- “Just spaces that are on the river if you look out… It used to freeze up. And you used to be able to run around on a snow machine. You could not pay me to do that now. It stays thawed out pretty good all winter. I mean there's a few trails here and there were people made trails that cross [it], but the majority of that river is thawed out and it stays pretty open. And I wouldn't… If I was going to ride on it, I would hurry, I have to be pretty geared up and going pretty fast” (male, 25);
- “There's a trail along the river, but it's not really safe because the river hasn't been freezing up. It's not too safe for the dogs if they want to go run on the river, you know. My dog is young. I keep her back in the woods so I can monitor her and, you know, she doesn't fall through the ice. I haven't been walking on the ice” (female, 25).

Despite these challenges, some non-Indigenous community members highlight the milder winters as a positive development, enjoying the shorter and less harsh cold seasons: “I think most people here are happy about winters getting shorter and not as cold. Definitely,

people think back at it and like "Oh well, it's not as brutal of a place"" (male, 25). This perspective reveals a complex relationship with climate change, where the immediate benefits of warmer weather contrast with the long-term disruptions to traditional ways of life and the natural environment. In sum, the impact of climate change on white OPS in Fairbanks is multifaceted, touching upon environmental, recreational, and infrastructural aspects of community life.

Literature on the future of Fairbanks precipitation generally agrees that the area is headed towards a shorter winter and snow season, and may even experience a significant decline of snow cover in the winter months. One approximation of season change in interior Alaska is the timing of the first and last rain days after and before winter respectively (Landrum & Holland, 2020). Landrum and Holland (2020) project that the timing of first and last rain events corresponds with warming seasonal temperatures; they found an increase in season length of about 20-60 days by the mid-twenty-first century, and an increase of 60–90+ days by the end of the century in interior Alaska (Landrum & Holland, 2020). This prediction of seasonal change is corroborated by other models. Lader et al. (2020) model first snow melt events in their prediction of seasonal changes in Alaska. Each cold season in Alaska historically has a period with continuous snow cover, and interior areas on average lose this snowpack during late April or early May (Lader et al., 2020).

Currently, the most significant changes in snow cover in Fairbanks is a shorter snow season. And though some residents, especially those who moved to Fairbanks, highlight the milder winters as a positive development, enjoying the shorter and less harsh cold seasons, the Indigenous communities are worried about the negative consequences of warming, already influencing their safety and security.

Various risks, such as environmental damage, and social and cultural conflicts, are only part of the story. What if Fairbanks is a place to accept climate refugees? What if the green transition leads to a decrease in extractive industries? No matter what happens, Indigenous communities will be the ones to stay and continue care for the land, so they should be the focus of all short and long-term decision-making processes.

Indigenous communities create grassroots organizations, organize protests, make public art, dance in powwows, and care for the future of Fairbanks. They advocate for cultural recognition and Indigenous acknowledgment being visible in OPS, more focus on vulnerable groups of the population, and less focus on unstable and unsustainable tourist flow. These are their way to exercise the right to the cold city, but it is still limited by lower access to public spaces in general as well as with a lack of or limited legal possibility to shape spaces and policies. And while the FNSB Climate Action and Adaptation Plan, defeated on June 2023, “encourages Indigenous partnerships to facilitate the incorporation of this knowledge, which can support healthy ecosystems and a resilient community, into FNSB actions” (p. 7), it doesn’t guarantee them.

2.3.4. Usage of OPS and resilience concept in the context of climate change

The concept of resilience, particularly in the context of green, blue, and white OPS, emerges sparingly within the collected materials for all residents and can be illustrated through its creative adaptation to the subarctic environment: “I think that's the neat thing about Fairbanks is that it is cold and dark and snowy and icy and you have to get out. I think that it leads to creative things especially at the community level, but also in different social groups. You see different people engaging. You have to be creative to make fun new exciting things. There's like the Ice Park. And winter-themed events are always fun because it really is making do with what you have. We used to do this like progressive ski dinner parties. We'd have friends in an area. And you'd ski from house to house and in each house, you'd have a

different part of the meal and then you'd end with dessert at somebody else's house. And you're just popping around and you just ski from house to house and go in and have something else and then gone again. Just things like that make Fairbanks a community and probably a tighter community because of sharing those unique social aspects. Because you're making do with what you have" (male, 40). Such activities highlight the capacity of Fairbanks' residents to transform the challenges posed by the cold, dark, snowy, and icy conditions into opportunities for enhancing social bonds and community cohesion.

Within the collected materials, Indigenous perspectives compared to all residents' perspectives are richer in terms of resilience. Some respondents note that climate change affect Indigenous knowledge and its ability to predict changes: "And in ancestral times we've always relied on, we – meaning most Alaskan cultures, not all of them, relied on a person who could predict the weather, that was trained to predict the weather ever since childhood. Nowadays in different areas in Alaska the way that they were trained it's much harder to predict the weather because of climate change" (male, 50). Nevertheless, Indigenous knowledge remains a reliable source: "From the Indigenous perspective, we are adaptable… The way that we adapt to climate change we can rely on the ancestors, Indigenous knowledge systems: when it's safe to go out ice fishing, when it's going to get really cold, we rely on the Indigenous knowledge systems for that. When we see a sun dog – the rainbow around the sun – during the wintertime we know that it's going to get cold. So, we prepare ourselves for that. We plug in our car to make sure that our engines won't freeze or batteries don't die out and their oil doesn't freeze up" (male, 50).

Adaptability, along with embracing the harsh environment, forms the backbone of resilience: "When you live in a subarctic community, like during the wintertime, it can be really intense when it's super dark. I personally love the darkness" (non-binary person, 25).

Resilience also stems from ancestral storytelling, community trust, and a connection with nature: "There is this story that actually comes out of Southeast Alaska, but I think about it all the time. There is this young girl just beginning menstruating. It was at the time when you had to go over to the corner and be over there in the corner for a little while. And she got so mad, she didn't want to be in the corner. And she called down to the glacier and was like: 'If no one will hang out with me, can you come hang out with me?' And the glacier came down. And the glacier began to crush the village. And the whole village had to flee. In the story, the young woman's grandmother comes up and puts her on a boat also and says: 'You got to run. I'll stay and I'll stop the glacier.' I'm like crying and talking about this. The grandmother stood there and took the force of that to protect everyone else. And I feel like: that's a value in Alaska amongst Indigenous cultures specifically to protect the next generation down. And some folks haven't had that capacity. And trauma cycles trauma unless we can stop it. So, we have a higher incidence of Indigenous folks using our services because Indigenous folks are culturally abused in Alaska, live in poverty, and have been really harmed. I'm glad to see the undoing of it. I'm glad to see the standing in front of the glacier. But man, no more glaciers, huh. That's such harm, such harm has happened here. And our state refuses to address it, our local government refuses to address it. So, it just kind of like... gross, and we're not fixing it as fast as we could. But a lot of people are doing a lot of work to help" (female, 30).

This narrative captures the essence of resilience within Indigenous communities – adapting to and withstanding environmental changes through the strength of ancestral wisdom, community solidarity, and an intrinsic bond with the natural world.

2.3.5. Usage of OPS and justice concept in the context of climate change

Justice: Municipal Perspective

This section explores the concept of justice as perceived by officials in Fairbanks, with a focus on the municipal perspective. The analysis draws on interviews with the Fairbanks North Star Borough Mayor, workers from the Fairbanks North Star Borough Parks & Recreation Department, and representatives from Fairbanks Area Surface Transportation (FAST) Planning, the Metropolitan Planning Organization (MPO). Instead of distinguishing the concept of justice among green, blue, and white public spaces, the discussion centers on the overarching official stance on justice within the realm of public spaces.

Municipal Perspective on Indigenous Justice

Officials view justice primarily as an acknowledgment and recognition of Indigenous communities "those members of the community who were first here" (male, 40). This acknowledgment is manifested through partnerships with Native organizations to incorporate cultural elements into public spaces, such as the integration of Native design work into park beautification projects and the establishment of land acknowledgments in parks: "So we also partnered with some of our Native organizations to put some beautification in this park as well. You see this beautiful design work which is going to be turned into a mosaic that will be done by tile actually in the ground and lay there, kind of like a recognition of our Native culture that is here in the Fairbanks area. Over at the Morris Thompson Center they also have these kind of around our building, so it helps to tie the two organizations together. And then we also worked with Denakkanaaga which is kind of one of the leadership groups here to create a land acknowledgement that will also be a part of this park and all of our parks in the area moving forward as well. And it's a good opportunity for us to be able to recognize the work that they've done and the lands that that's we are able to enjoy and spend time in. So, this is just another one of those things that we're working on to try to provide that area with a

nice clean welcoming feel" (male, 40). These initiatives are seen as opportunities to honor the Native culture and history of the Fairbanks area.

Collaboration with Indigenous organizations extends to cultural programming, especially aimed at engaging the elderly in the community and creating space for Native organizations to facilitate the community engagement process themselves: "They call it the Alaska Native Cultural Coalition of the Interior – so they have Representatives at the table from all three: from Denakkanaaga, Tanana Chiefs Conference and Doyon – all three of the table and they make quarterly… They took the initiative to do the call for bead work to the 42 different villages in which they serve. And then allow their elders to vote and select the art work. They facilitated that whole process to get us the piece of bead work that was selected. But, again, you have all three organizations at the table so that's how we have everybody in the room on the cultural side to engage them in conversation" (male, 45).

However, officials acknowledge challenges in executing such collaborative projects, primarily due to limited resources. The desire to incorporate Native art and public input into park projects often confronts financial constraints, making it difficult to achieve the desired level of community involvement and beautification: "We put in an extra amount of money to basically do an inlaid Native art tile into the concrete. But we do struggle a little bit with even anybody, not even just Alaska Natives, but incorporating the public input into our projects either because of timeline or because of resources. Like we have just enough money to replace the playground and it takes another $50,000 to make it that much nicer and then another $50,000 to do public meetings and include everyone. And if you if you had $500,000 and you do those two things, then all of a sudden, you're not doing as nice of a park project" (male, 40).

Providing space for Native events is another aspect of justice, with Parks and Recreation partnering with organizations to host cultural events, thereby supporting the

visibility and celebration of Indigenous culture: “We as Parks and Recreation we partner with you know those organizations in lots of different ways: the World Eskimo Indian games or WEIG holds their games at our facilities every single year. Providing space for them to do these cultural events is another way that we partner with them” (male, 40).

Despite these efforts, some officials perceive a gap in reaching out to Native communities effectively, suggesting that more needs to be done to include these groups in Parks and Recreation activities: “From the Parks and Rec perspective. I feel like we're not reaching what you would, I guess, call minority communities very well. And not just Alaska Native, but like other cultures as well or other low-income levels, like because they don't necessarily have time to be on Facebook or they're not reading the newspaper. And I'm struggling with like how to reach these folks and include them… Alaska has some very strong and wealthy Native corporations that do quite a bit of activities more focused kind of around their Indigenous interests. So, they've got a nice [Chief David Salmon] Tribal Hall down on the river, they've got a [Chena] Bingo hall down there, they do a fiddle festival. And you've been to Morris Thompson [Cultural and Visitors Center]. That's kind of got a strong Indigenous focus there, I think. Yeah. You went to the powwow by the Carlson Centre, so there are quite a few things that they put on. But from a Parks and Rec perspective, we don't do anything specific for the Indigenous cultures. We have started… trying to recognize that these were their lands first, right? So, on some of our park signs, we're putting Alaska Native names or Alaska Native themes are on there. We have a park we just renovated just a block away here. And one of the Native corporations, Andrew Isaac Medical Center gave us some money to put in” (male, 40).

Municipal Perspective on Transportation Justice

Justice also pertains to making roads more accessible to non-vehicle users, exemplified by projects aimed at repurposing roadways to accommodate pedestrians, cyclists,

and green spaces: “And the asphalt we did was primarily to show the community potentially repurposing some of these roadway’s basis for other users than just vehicles. On 5th Avenue, we painted the sidewalks in 20 ft showing that well this coming summer it'll be under construction but showing that this road be narrowed down to one lane traffic and the rest of the space will be devoted to green infrastructure, trees, benches, and really wide sidewalks but they'll also maintain on-street parking out there, so it's taking space away from vehicles in providing it to other users but also adding green space to that roadway. The murals didn't necessarily portray what the roads would look like – they were very artistic but it showed the space be rededicated to other users than vehicles, so blocked off that space and it was interesting to watch cars navigate through there. Because they don't want to park on the artwork, they don't want to drive over it – they really wanted to keep it clean, so they were using the street the way it will be used after construction this coming summer. It was a really interesting project…” (male, 45). These efforts reflect a shift towards reducing vehicle dominance in urban spaces and enhancing the livability and sustainability of the community.

Municipal Perspective on Cultural Programming Justice

Justice initiatives extend to cultural programming and accessibility for vulnerable populations, including:

- People with special needs: “Well, this is a hard community to live in, right? It's hard to get around in the winter. There's a lot of isolation because people can't get out or things aren't accessible. Everything. A lot of our parks were built before the Americans with Disabilities Act, the ADA. And they're not accessible. And at one point in time, folks recognized that you know, a lot of these special needs folks weren't having access to parks or exercise or just getting out. Parks and Recreation started their adaptive program, we call it. And anybody can enter anybody with special needs can enter it. It's geared towards adults. But we do let older teens in and

they do actually… They didn't use to do that, but they go bowling on Mondays, every Monday. And that's our most probably our most popular program. But we do outdoor games a few days a week. They come here to the Big Dipper, there's a walking track and this walking track is open all year except for this month when the ice is out. It's super popular, but it's a place for people to that there isn't anything like it in Fairbanks. There's like nowhere to go to just kind of walk or run in the winter. There are no facilities like that. I guess the university has one, but it costs a lot. Ours is free here… We probably have maybe 30 or 40 participants, but at a time we probably have 10 to 20 that come" (male, 40).

- Senior citizens: "And what's interesting in our community right now? The senior population is growing like crazy. They're calling it the Silver Tsunami. So right now, we have 18,000 seniors in Fairbanks out of 100,000 people. Right. And it's going to be up to 25,000 by, I don't know, 20, 27 or something like that. And almost 5000 of those are going to be 80 plus. So. There's a lot of things. Those folks struggle with it, right? There's housing, there's food, there's being active. We play the active part. An interesting thing with both the adaptive and senior programs is the borough has a kind of small bus called Van Tran that will provide rides to folks who don't have their own vehicles. If you want to participate in one of our programs, there are a lot of caveats here, but you can get free Van Tran rides. The big limitation is Van Tran will only serve within a half mile of an existing bus route. Our bus routes are somewhat limited. Our Van Tran, who can participate in Van Tran is somewhat limited. But a lot of folks do use Van Tran to come to our facilities. We've been trying to grow some other kind of. Fun programs. So, we're doing this grandparents-grandkids crafts once a month. You bring a little kid with you and you can do all sorts of crafts. We've been trying to

start up some potlucks where everybody brings some food. Those have been pretty popular" (male, 40).

However, climate change increases vulnerability for all, disrupting cultural events through heightened wildfire risks and poor air quality, necessitating cancellations or indoor relocation for health and safety.

Art and Culture in Justice Work

Art and culture emerge as vital tools in justice work, facilitating community engagement and messaging. For example, environmental justice is addressed through initiatives like the Storm Drain Art project (Figure 13), aimed at raising public awareness about the impact of street runoff on rivers, emphasizing the connection between urban infrastructure and environmental health: "For that public infrastructure every year we do the new Storm Drain Art to bring the public's awareness that anything they go down the drains in the street ends up in the river. It is part of environmental messaging" (male, 45).

Figure 13. Storm Drain Art Project. June, 2023. Photo made by Diana Khaziakhmetova.

However, local authorities do not associate justice explicitly with Indigenous place-naming, particularly in the context of the Pioneer Park/Alaskaland naming conflict. However, a shift in perspective is emerging: “Everybody in Fairbanks wants to call it Alaskaland. Well, I grew up with it as Alaskaland, but I also defend the name Pioneer Park because if you do your research, it was Pioneer Park before it was Alaskaland. Yeah, because it was created by the Pioneers as part of this World Expo in 1964. The pioneers of Alaska created it and called it Pioneer Park and then it somehow got changed to Alaskaland. And one of the reasons they changed it is because people thought it was going to be like rides like Disneyland. This isn't Disneyland. This is much different than Disneyland. Let's change it back to Pioneer Park. But I think the idea is that when we get to recreate this playground that we call the playground Alaskaland, and so we can still get it all back to Alaskaland. I just had my 30th high school

reunion. And, you know, everybody now knows I'm working in Parks and Rec, and I almost called it Pioneer Park. And I was like, ooh, you're supposed to call it Alaskaland" (male, 40).

Justice: Indigenous perspective

This section delves into how Indigenous communities perceive justice in the context of OPS and explores the implementation of this vision through actions by various stakeholders, including government authorities and park departments. The emphasis is on what Indigenous communities expect from these institutions. Some broader justice suggestions include making spaces safe, accessible for all, aligned with sustainability, and supportive of cultural preservation: "Alaska Native people have seen lower 48 Native people and how they've struggled with the loss of culture, because there's all these breaks in the line of transmission. And just the Westernization. I would say it's more just to make sure that the culture stays alive" (female, 25).

Indigenous residents have highlighted collaborative projects that integrate Indigenous culture into public spaces as exemplars of justice in action. One celebrated achievement is the partnership with local authorities to install mosaics outside the Morris Thompson Cultural Center, inspired by Indigenous beadwork, a project that symbolizes the inclusion of Indigenous art and sensibilities in public spaces (Figure 14). Such initiatives not only celebrate Indigenous culture but also advocate for further engagement with Indigenous communities in urban planning and public space enhancement.

Figure 14. Indigenous beadwork project near Morris Thompson Cultural Center. Photo made in July, 2023 by Diana Khaziakhmetova.

The calls for renaming public spaces, particularly advocating for the return of the name Alaskaland over Pioneer Park, underscore a broader desire for the decolonization of public spaces and the recognition of Indigenous histories and languages within urban environments. This desire extends to incorporating Indigenous languages in street signage as a means of fostering community pride and increasing awareness among both locals and tourists.

There is a pressing need for public spaces that not only acknowledge traditional land uses and respect for the land but also serve as educational platforms about Indigenous cultures, values, and histories. Such spaces should ideally break away from narratives dominated by colonial or conservationist perspectives, offering instead places that are truly representative of and catered to Indigenous communities:

- “I know that there are public parks and all, but it would be nice to have places that were a little bit more within mind of recognizing what the land was used for traditionally. And then also how to respect the land” (female, 25);
- “A lot of stuff that's like wordplay. It's just it's a simple history overview. It's not about the colonization of Alaska natives. I don't think it's really with the mind to have people have a deep cultural experience or anything like that. It's just ironic that really the only places that are historical places, they always have to be wrapped up with mining or conservation. There's no Black, Indigenous or Brown people's cultural spaces just owned by us. For us. It's always with the white or settler. It doesn't even have to be white. It could be a person of native background or descent, but with a very like settler colonial mindset or undertone, which is like keep the history clean” (female, 25);
- “There could be more elements of representation of each individual tribe” (non-binary person, 25).

Suggestions also point towards creating spaces dedicated to traditional Indigenous activities, such as gathering wild plants and berries, as a means of reconnecting with cultural practices: “A park specifically dedicated to gathering wild plants and berries and stuff. That's what you're supposed to do in that park. It's for you to gather plants” (female, 25). Moreover, reducing barriers to park use and focusing on aspects of healing within these spaces are seen as crucial steps towards fostering community well-being and re-engaging with traditional activities.

Justice: comparison between municipal and Indigenous perspectives

Both perspectives recognize the importance of incorporating Indigenous culture into public spaces; however, their approaches and underlying motivations differ significantly. The municipal approach focuses on partnership and acknowledgment within the framework of

existing urban planning processes, often constrained by resources and broader community outreach challenges. In contrast, the Indigenous perspective seeks a more profound transformation of public spaces to reflect Indigenous identities, histories, and values directly, advocating for spaces that are not only inclusive but also serve as platforms for education, cultural preservation, and healing.

Bridging these perspectives requires a mutual understanding of justice that encompasses acknowledgment, respect, and the active incorporation of Indigenous voices in shaping public spaces.

2.3.6. Usage of OPS by Vulnerable Groups among Indigenous Residents

This section provides a detailed analysis of Indigenous peoples' perspectives on the usage of OPS and the impact of climate change on them. It specifically focuses on vulnerable groups within the Indigenous population, based on an in-depth analysis based of one to two interviews available for each group.

2.3.6.1. Indigenous Elderly (female, 60)

Sharon McConnell, the executive director of Denakkanaaga, an organization advocating for Native elders, sheds light on the Indigenous elderly people’s position. She emphasizes the mission of preserving traditional Native culture, notably through cultural camps and activities (the latest cultural camp was organized in 2023 at Griffin Park): "One of our main missions here at the organization is to truly carry on our traditional way of life as Native people. As part of this, we engage in various cultural activities. One such activity is a cultural camp, named Elders Mentoring Elders. This initiative arises from our understanding of the past and the history of our Native people. Some of our current elders were deprived of learning traditional activities due to historical circumstances. Hence, for the second year running, this camp has been organized where knowledgeable elders impart skills to those who missed learning activities such as fishnet making, steam bending with caribou fur, artwork,

beadwork, moosehide crafting, canning, storytelling, and discussions on our values as Native people. The objective is for the knowledgeable elders to pass on their wisdom to other elders, who can then disseminate what they've learned within their communities, thereby ensuring the continuity of these traditions."

The conversation also highlighted the significance of integrating Indigenous place names and languages into public spaces, like parks (for example, renaming Pioneer Park back to Alaskaland), as a method to foster awareness and pride in Native culture: “There's always a joke about Alaskaland. We call it Alaskaland, and nobody in the Native community likes it being called Pioneer Park. Just because it always brings back that historical component about who was here first. And it wasn't the pioneers. They may have settled here, but the Native people were here for long before that. So, people like me, always refer to our Alaskaland”. While acknowledging the progress made, Sharon notes, “It is slowly taking place about Indigenous names around our town, but we still have a long way to go”. She also touched upon the Indigenous relationship with land, stating, “Our land is very sacred. It gives us nourishment, shelter, medicine, everything. So, we respect that and those kinds of activities that go along with that”.

Additionally, Sharon addressed the consequences of climate change on traditional activities, such as fishing, stating, "Fishing has become virtually non-existent; the king salmon are no longer coming as they used to. Fishing, integral to our being and enabling fish camps and summertime fishing to provide for families, has been severely impacted due to the absence of fish."

2.3.6.2. Indigenous Women (female, 30; female, 30)

mentioned public spaces where they prefer to spend time, such as Riverwalk, Slaterville Park, and Birch Hill. They also use Pioneer Park and call it Alaskalanad: “Pioneer Park used to be called Alaskaland and we still call it that” (Figure 15).

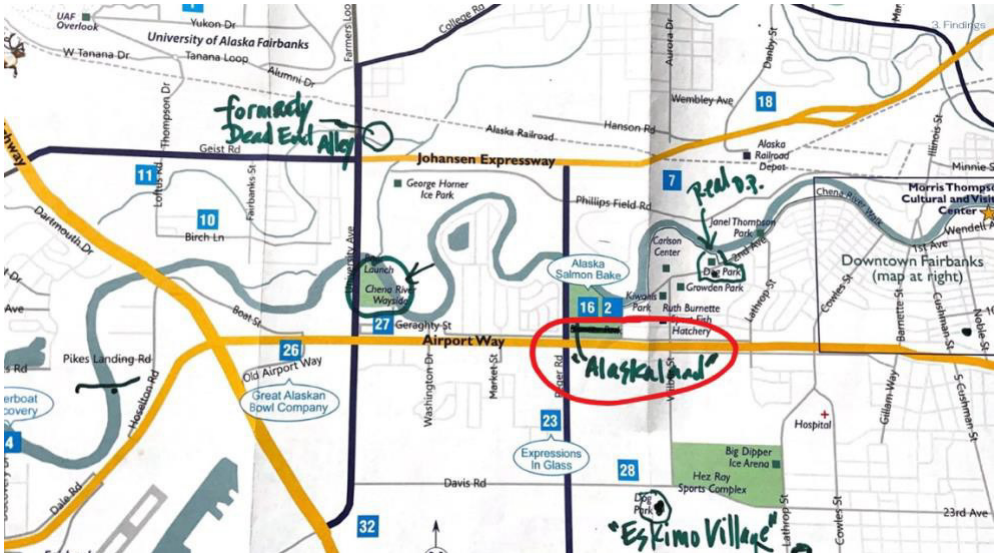


Figure 15. An example of a mental mapping exercise, where a resident has crossed out the name "Pioneer Park" and replaced it with "Alaskaland."

The preference for a particular space was closely linked to feelings of safety. Safety in public spaces varies, with judgment and racism still present: “We do have a lot of people who do stop to help if you break down on the side of the road and there are a lot of safe people who will help but it also depends on the people, where you're at and who you are, whether they stopped or not. Cause not always people will stop if it's maybe a Native person. It is just unfortunately people have a lot of judgment, and racism, it happens a lot”.

Indigenous women are very conscious of using specific spaces at particular times, prefer to be in company, and avoid unpopular or poorly lit spaces. They also tend to not use spaces during the evening hours, even in summer when evenings are light: “You wouldn't want to be walking around downtown at night. I mean, sometimes in the summer it's a little better because it's 24 hours sunlight, but you probably still wouldn't want to go by yourself”.

Besides safety, housing, mental health, and addiction treatment issues were major topics of discussion: “It has a lot to do with not having coping mechanisms. There's generational trauma and it just keeps getting passed down because the parents didn't know how to cope, and they raise their child. Even though their child doesn't experience that

trauma, they experience a different type of trauma associated with their parents' trauma. So, it just keeps getting past down, past down, past down until somebody breaks the cycle".

Discussions covered homeless encampments and the high rates of alcoholism and trauma in the Native population, highlighting the need for services and support: "We have a lot of missing Indigenous people here. We have seven people that they're actively looking for they haven't found within the last few years. And many times, it's those who are in vulnerable places: who are using different coping, they're trying to get by on, without housing, maybe not familiar with Fairbanks".

The interviewees highlighted the importance of healing and traditional activities, along with community events such as powwow celebrations and farmers' markets. They expressed hopes for a safer and more inclusive city. In terms of climate change, they mention that increased wildfires and decreased air quality negatively influence their ability to spend time outside.

2.3.6.3. Indigenous Female Activist (female, 25)

The Indigenous female activist highlighted a need for safe OPS that are accessible and welcoming to Indigenous communities, emphasizing the pervasive issues of discrimination and classism that make some places feel unwelcoming: "Even though there's some places that are everywhere supposedly public, you know, for the most part, there's still really like crude acts of discrimination and like people who will you could just see by their customers, like the majority are white people who are served, you know, And it's not that like there's no it's not like anyone's saying no, people can come here, but it's just like you don't really want to go there. And it's like classes too, you know, There's a lot of classism here. And I honestly joke to a lot of people that the only real community place in Alaska that's like even playing ground, everyone goes is Fred Meyers and Safeway".

The activist expressed a desire for public spaces that more accurately reflect and celebrate Indigenous culture and history, advocating for more signage acknowledging traditional uses of the land and respect for it: “One of the biggest and simplest things I think we can do smallest with the big impact is that we have really a lot of spaces that were traditional gathering places or traditional fishing locations or traditional travel routes and stuff like that. And just very easily there could be more signage even… It would be nice to have places that were a little bit more like within mind of recognizing what the land was used for traditionally. And then also how to respect the land”; “The Arctic idea of downtown is just so silly. What is this, a little New York? No, we're Native land, we're Arctic Indigenous land. Why don't we have more public spaces that reflect the way our people gathered for a trade versus Fifth Avenue or the Prospectors or Big Ray's? Why don't we have anything like that?”

The activist criticized the commercialization and tourist orientation of certain areas like Pioneer Park (calling it Alaskaland) and Morris Thompson Cultural Centers, which they feel do not serve the local Indigenous community adequately: “It's a simple history overview [there]. It's not about the colonization of Alaska Natives. I don't think it's really with the mind to have people have a deep cultural experience or anything like that. It's just ironic that really the only places that are historical places, always have to be wrapped up with mining or conservation. There are no Black, Indigenous or Brown people's cultural spaces just owned by us. For us. It's always with the white or settler. I don't even it doesn't even have to be white. It could be a person of Native background or descent but with a very like settler colonial mindset or undertone, which is like keep the history clean.”

The activist also stresses the significance of incorporating sustainable and environmentally friendly designs in public spaces, reflecting on the rapid changes in the Arctic climate affecting local wildlife and the environment. They advocate for climate

education that incorporates Indigenous knowledge, underscoring the visible effects of climate change in Fairbanks and the importance of public awareness and engagement.

Their activism is driven by a commitment to racial justice and equality, motivated by the disparities they have observed from a young age: “My organizing and activism came from a racial justice lens. Why are people who are different colors being treated this way and being treated like criminals for just living? That's how my journey into activism came I've just seen inequality since I was a kid from men and women, Natives and whites’ different abuses”.

3.3.6.4. Indigenous Male Youth (male, 20; male, 25)

Indigenous young males in Fairbanks, Alaska, share a perspective on their city's OPS, informed by their heritage and modern urban experiences. The first respondent, an enthusiast of both basketball and traditional native activities, highlights the significance of recreational areas and community events, such as sledding hills, basketball courts, and lake swimming. These activities reflect a youthful culture that prioritizes physical activity and community engagement. Concurrently, they address broader societal concerns, including homelessness and the necessity for enhanced homeless support services, as well as environmental conservation efforts, focused on local wildlife: “There's still like animal and fish population. And that's like something that we really need to work on, take care of, and keep an eye on”. This individual expresses a desire for the city to maintain its community-oriented character while also improving modern amenities like internet access and recreational facilities.

The second respondent offers a critical opinion of the environmental and social challenges affecting public spaces in Fairbanks, particularly highlighting issues of littering in downtown areas and the visibility of marginalized communities, including the homeless. They reflect on the historical dominance of bars and liquor stores in the city and their contribution to the homelessness crisis.

Despite these challenges, the second respondent appreciates the inclusion of Indigenous culture in the urban landscape through murals, statues, and cultural representation at the Morris Thompson Center: “They have murals. All kinds of Alaska Native-themed murals around the city and pictures. There's a picture of some Elder holding a fish with some kids… And at this park here, they got a statue of some Native guy and his family here and they got their sled dogs which is really cool. And then the Morris Thompson Center of course because it's all pretty much our cultural stuff” (Figure 16).

Figure 16. Community mural in downtown Fairbanks, created in collaboration between Native Movement, Fairbanks Climate Action Coalition, and NDN Collective in 2022. Photo made by Diana Khaziakhmetova in July, 2023.

Both individuals note the impacts of climate change on local environments, particularly the Chena River not fully freezing during winter, affecting traditional activities like snow machining. Both youths articulate a vision for Fairbanks that includes healthy, safe, and clean public spaces.

2.3.6.5. Indigenous Queer & Non-Binary Youth (non-binary person, 25)

Their artistry, deeply influenced by their cultural background and personal identity, serves as a medium for expressing the complexities of belonging to marginalized

communities: “That's just a part of being seen as visibly queer: I think this guy was taking pictures of me on the bus earlier today, which was pretty uncomfortable. I had my mask on, though. But things like that happen. That's why I created this work, this body of work because it's therapeutic. It helps you process those emotions or that uneasiness, not feeling completely safe. You know, it really helps me kind of transmute it into something productive and, you know, make a statement on what it means to be seen as visibly queer publicly here in Fairbanks. And this happens everywhere… And I'm sure it's probably happened to you pretty often where you've been like talked down to or you're treated like you weren't as capable you are. And that happens quite often here… I have to be stronger and show them that they have no power over me. It's hard being seen as visibly queer. You have to have a level of resilience. You have to be resilient. You have to be strong”. They speak to the dual reality of Fairbanks' environment: on one hand, there exists a supportive community that embraces diversity and inclusivity; on the other hand, they encounter individuals and attitudes that are less accepting, threatening his sense of safety while using OPS.

They emphasize a deep connection with the land: "I could still go subsistence foraging and find berries and herbs or anything that I need", highlighting the importance of environmental stewardship shared by the Fairbanks community and asserting, "I personally believe, the land really shouldn't be under any ownership. I feel the right way is to repatriate the land back to the Indigenous peoples who know how to take care of it and preserve it for future generations."

The need for more representation of Indigenous culture in public spaces and leadership in inclusivity efforts is clear: "There could be more elements of representation of each individual tribe. There are individual tribes, but they could at least do something for the general groupings of people, like Inupiaq and Aleut… Renovations would be nice, maybe

repaint and have an actual Indigenous artist create a different form of design that would fit for that."

They underscore the significance of creating safe and inclusive spaces that welcome all identities, advocating for the proactive engagement of marginalized communities to foster change. The challenges of discrimination, particularly towards queer individuals, and the gaps in sexual and health education in Alaska, underscore the broader systemic issues that require attention beyond park improvements: “The city council voted to extend housing and legal rights for housing and job security to queer individuals. An employer or a landlord cannot evict them on the grounds of being queer or an employer cannot evict or fire them on the grounds of being queer. The city council passed it and the mayor vetoed it. So technically there are no protections for our queer community here in regards to job security or housing. So technically, based on their own identity, they could lose their job or lose their housing. We have the community that would fight for those rights and values. However, there are many of those that are here that are still stifling or prohibiting that from happening”.

The respondent hopes for the development of a more inclusive and culturally rich public sphere, where diversity is not just acknowledged but celebrated. In terms of climate change, they acknowledge the importance of local Indigenous climate activist movements and grassroots organizations.

2.3.6.6. Indigenous Experiencing Homelessness (female, 30)

The COVID-19 pandemic has notably exacerbated the demand for services combating hunger and supporting those experiencing homelessness. There significant portion of those being served are Alaska Native, reflecting the high poverty, incarceration, and trauma rates within the Alaska Native population: “We had this demographic built out at some point. It is like a 25 to 55-year-old Alaska Native male. That is the vast majority of the

people that we serve. And that's reflected in poverty incarceration and trauma rates in Alaska broadly".

The legacy of colonization, coupled with the introduction of drugs and alcohol, has been identified as a contributing factor to the disproportionate number of Indigenous peoples facing homelessness: "We had territory before that sure but it has been an extractive colony since the beginning. And required to do that with the destruction of culture here. So, babies were stolen out of houses, and sent to boarding schools. People were not allowed to use their language or have their religion, their dances, or their cultures. It was all stripped away immediately. At the same time introduction of drugs and alcohol into a system. And so now we have a huge amount of trauma and then you also have a culture like the Western culture is real drink heavy. Like Alaska has an alcohol problem and I mean that like across all races and ethnicities. We have more suicides that are related directly to alcohol. We have more DUIs [Driving under the influence]. We have all of the stuff. We drink too much. This is a hard place to live. And when we remove the cultural safeguards from what makes this place much more healthy, we're left with people that have intense ongoing generational trauma, and racism that just ain't got to quit anytime soon around that. But, also, so many things. It's a colonization and white supremacy in my personal opinion".

Homeless individuals often find themselves at various locations throughout Fairbanks, the main being Golden Heart Plaza and Veteran's Memorial Park. There is a growing awareness and concern for the homelessness crisis among Fairbanks residents, however not much done: "It's a big problem and there are no plans to do anything. Fairbanks doesn't even have day shelters. We don't have warming centers. We don't have anything. There is one high barrier shelter and that is it. Neither a city nor a Borough chooses to participate with homeless services in that way". However, the change is possible: "Because I get frustrated with the Golden Heart Plaza. That is a public space where people go. And, yes, people are

often intoxicated. And, yes, sometimes there are fights. People are going to graffiti something. Because they are hurt and traumatized and experiencing generational trauma just unabated at all in our community. And the city's response was to hire police officers to do 24-hour surveillance on the property there. To put in a camera with whatever thing. First of all, we've barely... We don't have enough cops quote-unquote as it stands. They're constantly trying to hire new police because there is not enough quote on quote. I don't agree with that. But I did the math on what it would cost to give somebody permanent supportive housing and with the amount that they are proposing, actively proposing to put into this security system for the Golden Heart Plaza. They could permanently house 19 people. Fairbanks has on the high-end 70 people who are unsheltered, high needs, high vulnerability. 19 people is a solid, nearly a third of that. So, again, I ask this question on a regular basis. If we are not being financially responsible and we are not being concerned with human life, and dignity what are we prioritizing here?"

There is a request for creating an emergency cold weather plan, which is absent now. Moreover, there is a belief in the potential of OPS to foster healing and community-building: "We push people to the periphery. Here physically and literally we are pushing people out of the city limits but we also push them out of the cultural context of being in a community with each other. These are all human beings with experiences and knowledge".

Events that bring the community together, along with initiatives like community gardens, are seen as opportunities for positive engagement and support for those most vulnerable, suggesting a pathway towards using public spaces as grounds for societal healing and inclusivity.

Chapter 3: Discussion

3.1. Accessibility

Access to OPS in the Arctic cities is significantly affected by their climate, which is a "major enabler and barrier to public space usage" (Arctic Yearbook 2023 Special Issue: Arctic Pandemics). For many decades the car and the easy movements it facilitates also promoted dispersed activities, such as peripheral residential areas and shopping (Arctic Yearbook 2023 Special Issue: Arctic Pandemics), as well as the overall sprawled nature of cities, Fairbanks being an example of that. The problem of sprawled nature could be compensated with a developed bus system; however, the Fairbanks North Star Borough Parks and Recreation Department focuses on developing "good size parking lots" for people getting to public spaces by car. It is especially relevant for blue OPS, access to which is available only by car, Chena River being the only exception flowing through the center of the city. Once people get to blue OPS, everything else tends to be described as accessible including all infrastructure like boat launches, benches, tables, etc. Just like M. Tennberg (2023) describes Rovaniemi, a Finnish city with a subarctic climate: "A popular assumption in Rovaniemi, a Finnish city with 60,000 inhabitants located near the Arctic Circle, is that a car is a necessity to be able to live and work in the city. Yet people walk and cycle in the city in all seasons, despite the harsh Arctic weather conditions, cold temperatures, snow blizzards, and icy streets", the same description can belong to Fairbanks. Biking has become a more and more popular mode of transportation in Fairbanks, especially fat biking makes this activity possible throughout the year. Biking, although it has its own limitations, increases mobility and accessibility, which can be called "bikeability" and is defined as "a comfortable and safe bicycle infrastructure for access to required destinations" (Turunen, 2023). As M. Turunen points out: "While winter cycling will in future be facilitated by longer snowless periods and shorter frost periods, increasingly variable weather will continue to challenge the

maintenance of bicycle infrastructure and the safety of cyclists (Turunen, 2023). According to residents' opinion, there is a lack of developed infrastructure for biking in city limits.

Discussions about OPS accessibility with residents tended to drift beyond city limits. OPS located outside of town are perceived to be more accessible than urban places, lacking sidewalks, safety, and overall attractiveness to residents. This can be explained by the overall value of access to nature and the outdoors (Hemmersam, 2023) shared by most of Fairbanks' residents. Furthermore, this indicates that traditional metrics of downtown accessibility, typically suited to European urban settings, might not be directly applicable to U.S. Arctic cities like Fairbanks (Brueckner et al., 1999). Here, the majority of residents reside in or near suburbs, and the concept of OPS, along with their accessibility, is largely tied to the vast natural areas encircling the city.

However, the downtown area is not equally inaccessible for all Fairbanks residents. According to our analysis, downtown OPS accessibility varies depending on race: all downtown OPS exhibit low accessibility for Indigenous citizens. It proves the idea that Indigenous people experience discrimination more often than other groups in urban environments (Walker et al., 2017). Due to cultural, social, political, and economic factors, certain groups may face limitations or exclusions from public spaces, even if the latter are officially open to all. While theorists advocate for universally accessible spaces that foster democratic engagement (Costamagna et al., 2019), it is not present in Fairbanks.

Trails tend to be most used, developed, and cherished by local community types of public infrastructure with their year-round accessibility, closeness to nature, and variety of activities to perform. Parameters affecting the accessibility of green and white OPS the most often are incorporation into the bigger trail system, lighting conditions, and overall quality of infrastructure including trails, sidewalks, etc. Sometimes white OPS increases accessibility, "providing new opportunities, such as shortcuts through the frozen bodies of water"

(Oikarinen, 2020), which is the case for Fairbanks' wetlands and Chena River. However, a lot of times the opposite happens and white OPS are less accessible and walkable, due to the lack of snow removal.

3.2. Usage by Residents

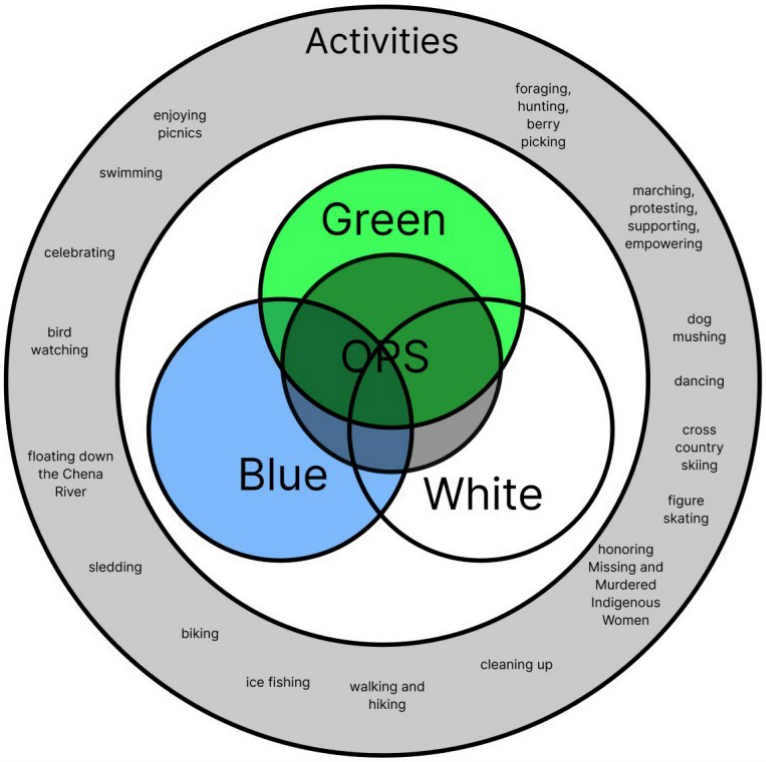


Figure 17. Usage of OPS.

In Fairbanks the community's engagement with and mention of OPS distinctly mirrors the region's diverse natural landscape, categorized into green, blue, and white spaces (Figure 17). Green spaces, with Pioneer Park— referred to as Alaskaland by most Indigenous residents and some non-Indigenous —leading the mentions, highlight the local's cherished outdoor areas for leisure. The Morris Thompson Cultural Center and Golden Heart Plaza also receive significant attention both from Indigenous and non-Indigenous residents. The Carson Center, Birch Hill Recreation area, and community gardens are more mentioned by all residents, while Creamer's Field is more mentioned by Indigenous residents.

Blue spaces, prominently featuring the Tanana Lakes Recreation Area (as most mentioned among all Fairbanks population) and the Chena River (as most mentioned among

the Indigenous population), are vital to Fairbanks' natural allure, facilitating a connection with water-based environments. Lastly, white spaces, primarily the Birch Hill Recreation Area, and various trails are crucial during the snow-covered months for all residents. These mentions reflect a community deeply intertwined with its environmental context, valuing and utilizing the open spaces that define their urban and natural landscapes throughout the year.

OPS, formatting socio-cultural and identity values of residents (Perovic & Folic, 2012), mentioned and perceived in the interview, underscore the value of these OPS as places for recreational enjoyment, cultural celebration, and respect for the natural environment. Such analysis is important for understanding the urban environment not as a disturbance of nature but as an urban biome with its unique set of socio-environmental interactions belonging to each particular place and city (Fedorov et al., 2021).

The exploration of activities in Fairbanks' OPS across different seasons reveals a rich engagement that reflects both the unique Arctic environment and the community's adaptability. Throughout the year, hiking, walking, and biking persist, showcasing the residents' enduring connection with their natural surroundings, which follows the main principles of “winter city”: “contact with nature and year-round usability” (Pressman, 1996).

The political and community-strengthening roles of public spaces are highlighted through activities like marching, protesting, supporting, and empowering. Public spaces are indeed arenas for civic engagement and expression of individual rights, given their acknowledged role as platforms for political activism, linking the quality of public spaces to the quality of democracy (Costamagna et al., 2019). Unique to the Arctic context, activities like dog mushing and Indigenous dancing also play a significant role in the community's recreational life.

All in all, activities shift a lot throughout the year. Summer months activate usage of green and blue spaces with a variety of water-based and outdoor activities, where floating

down the Chena River and enjoying picnics become popular. Indigenous residents also mention this time as the time to celebrate and forage. Fall transitions into a period of hunting, berry picking, and foraging, moving beyond traditional parks usage into the broader natural landscape. Such activities prove the value of accessing nature and passion for outdoor activities (Hemmersam, 2023). Indigenous residents also mention such activities as gathering together as a community and participating in events honoring Missing and Murdered Indigenous Women, acknowledging more gathering together as a community and focusing on community-centered activities. Spring reawakens public spaces with residents engaging in bird watching, walking, and rejuvenating their environment through clean-up efforts.

According to the Winter Cities movement, winter and overall time when the ground is covered with snow, despite the challenges of low temperatures, limited daylight, snow, and precipitation, significantly impacts social activity and the use of outdoor public spaces in cities (Stout et al., 2018). For instance, in Fairbanks winter does not deter outdoor activities; instead, it reshapes them, with Fairbanks residents embracing the snow through cross-country skiing, sledding, dog mushing, and biking. Fairbanks residents also often mention such activities as riding snow machines and snowshoeing, Indigenous residents particularly – sled racing, ice fishing, and ice skating.

Sometimes it seems problematic to distinguish activities related to the seasonal differentiation of winter, spring, summer, and fall, because winter activities start with snow, which usually comes and stays in Fairbanks from October (which is supposed to be still the fall season) and disappears fully in May (which is supposed to be already the end of spring). It is especially evident with fall and spring when we see in word clouds traditionally more "winter" activities and associations like skiing, figure skating, ice, and winter gear. Activities in the Arctic, especially traditional Indigenous ones, are less connected with the calendar, but

more with natural events, phenomena, and states like the presence or absence of snow or sun, temperature, etc.

The quality of public space, including its architecture, equipment, and design, has been shown to directly influence the amount of physical activity among citizens, either enhancing or diminishing residents' levels of outdoor activity (Paukaeva et al., 2021). For Fairbanks residents, the high quality of the trail system creates space for outdoor recreation during the cold time of the year.

Urban design and research have aimed to make winter public spaces more comfortable by optimizing wind flows, minimizing precipitation, and maximizing sunlight access, with some strategies also incorporating heated and enclosed pedestrian areas; however, these approaches often overlook the potential to foster positive perceptions of winter outdoor activities (Stout et al., 2018). To increase activity levels and outdoor leisure time during winter, a new design strategy that celebrates the season through festivals and events, highlighting winter's beauty and encouraging social inclusion and enjoyment of snow, is necessary (Paukaeva et al., 2021). As noted by residents, including those from Indigenous communities, there is a perception that cultural programming in Fairbanks becomes less active during the winter season, highlighting a potential area for improvement.

The interesting point here is that green, blue, and white OPS are characterized as popular and sometimes too crowded, which leads to avoidance of such areas, while such characteristics represent the vitality of these spaces. By vital public spaces, we mean urban areas that support human functions, biological needs, and capabilities, emphasizing the social success of a space (Costamagna et al., 2019). However, for Fairbanks residents, excessively high vitality of a place leads to avoidance.

3.3. Usage Impacted by Climate and Urban Change

The quantitative part of the analysis was mostly devoted to understanding how green OPS change over time. Vegetation is an important parameter, influencing mental and physical health, social cohesion, and urban vitality. Moreover, the amount of vegetation is one of the most important factors of urban planning according to the ISO 37120 Sustainable Cities and Communities standard. It was found that Fairbanks experienced a decrease in vegetation for 35 years from 1986 to 2021, which was proved by conducting NDVI analysis and land cover change detection. NDVI analysis has shown a significant decrease, while land cover change showed that most green areas were turned into built-up areas, representing growing urbanization. Thus, choosing between two parallel phenomena happening such as Arctic 'greening' and Arctic 'browning', Fairbanks experiences browning or "also known as 'green desertification'... the product of the artificial disturbances created by urbanization" (Laruelle et al., 2019). Despite such a decrease in vegetation, comparing Fairbanks to other Arctic cities based on the previous Arctic studies (Orttung et al., 2021), revealed that Fairbanks still has a decent amount of greenery, and Arctic cities in other places, especially Russia, experience much more dramatic lack of vegetation. Interestingly, increasing urbanization may address Fairbanks's major challenge of urban sprawl by improving accessibility. This observation suggests that the global urban planning emphasis on green space might be less applicable to Fairbanks's Arctic context, where extensive green areas exist beyond the city limits.

Moving from green spaces to blue spaces, land cover change detection analysis didn't show a significant loss of water in the city, however, the presence of water creates some level of danger due to flooding events of the past and possible future, as the UAF predicts an increase in rainfall in the future and continuing risk of flood for the city.

Since climate significantly shapes urban life and spatial forms and should be integrated into the evaluation of traditional economic, political, and administrative aspects of urban planning, especially in the frame of securing a sustainable future in the realm of climate change (Stout et al., 2018). A large portion of Arctic cities mirror the design of southern cities, with urban layouts primed for warmer seasons, despite their contrasting colder environments. As climate change challenges the predictability of weather patterns, these cities face heightened vulnerability to more frequent and severe weather disturbances. According to some scholars, climate change in the Arctic necessitates urban planning shifts towards reducing car dependency and increasing sustainable transportation (Larsson & Chapman, 2020; Sinclair, 2019), climate change creates challenges to walkability of OPS. The damage to the infrastructure is evident, like the birch forests and trails at Creamer's Field, which have become unsafe due to climate-induced conditions.

Climate change and human activities are destabilizing permafrost, the critical underpinning of Arctic infrastructure, leading to a compromised ground-bearing capacity and exacerbating frost heave and thaw subsidence, which in turn can cause building deformities and collapses that disrupt the socio-economic stability of Arctic communities (Shiklomanov & Streletskiy, 2015). Permafrost thaw is leading to sinkholes and damage to trails and park facilities. Efforts to adapt, such as redesigning trails to combat erosion, are underway, but the struggle to maintain the recreational and ecological integrity of these spaces continues.

As mentioned by all Fairbanks residents including Indigenous peoples, increased wildfires have introduced another layer of concerns, which impacts air quality and forces the cancellation of outdoor activities, thereby affecting community health and lifestyle. The Community Wildfire Protection Plan showcases a partnership between the State of Alaska, Division of Forestry, Fairbanks Area, Fairbanks North Star Borough, and various local, state, and federal agencies, working together to develop strategies, share resources, and unify

wildfire mitigation planning efforts for the safety of Fairbanks North Star Borough residents. Indigenous residents express uncertainty about the sustainability of living in Fairbanks under these changing conditions, highlighting a specific concern for the community's ability to maintain traditional lifestyles and cultural practices in the face of escalating environmental threats.

For the general Fairbanks community, the effects of climate change on blue spaces are acknowledged but less emphasized in public discussions compared to green spaces. The concerns that are mentioned relate to river conditions that affect traditional activities like fishing, indicating an awareness of ecological shifts but perhaps not as central to their daily experiences or cultural practices. Indigenous residents, however, articulate a more direct and profound impact of climate change on blue spaces, highlighting increased risks, erosion, changing water levels, and the implications for traditional lifestyles and subsistence practices. The increased river danger due to higher water levels from snowmelt presents a safety risk for activities like kayaking, directly impacting Indigenous peoples' ability to engage with these spaces safely. Furthermore, the disruption to traditional fishing practices, exacerbated by climate change and commercial interests, represents a significant loss of cultural and subsistence activities that have been maintained for thousands of years.

White spaces in Fairbanks are perhaps the most strikingly affected by climate change. The anticipated shortening of winters, coupled with a significant decline in snow cover, directly challenges the fabric of community life that revolves around winter activities. The Chena River, a central blue space in the summer and white space in the winter has exhibited thinner ice, posing safety risks and altering the patterns of winter recreation, such as skiing and fat biking. As Laruelle et al. (2019) note: “In a context of a positive feedback loop of climate change, these processes are becoming irreversible, creating a new ‘blue’ (partly ice-free) Arctic”. Snow- and ice-dependent events like dog mushing and ski races have faced

cancellations. These transformations in white spaces are compounded by the thawing of permafrost, leading to infrastructure damage such as buckling pavement and unusable ice rinks. ROS events further exacerbate these issues, creating hazardous conditions and contributing to roof collapses and power outages.

The research by Landrum & Holland (2020) and Lader et al. (2020) supports the local observations, projecting a dramatic shift in the timing of snowmelt and a decrease in snowpack, which could lead to a nearly complete loss in southern Alaska by the latter half of the century. The climate change effects on white spaces underscore a broader disruption to Fairbanks' traditional lifestyle and raise concerns about the long-term viability of its winter culture and activities. The projection of fewer snow days and a warmer climate poses serious questions about the sustainability of winter sports and activities, ultimately challenging the cultural identity of Fairbanks as a winter wonderland.

Both general and Indigenous perspectives reveal a deep concern over the loss of traditional winter activities and the broader implications for community identity and cultural practices. While general public focus on the impact on recreational events and infrastructure, Indigenous voices highlight the implications for cultural continuity and safety in engaging with traditionally significant spaces. This comparison underscores the multifaceted nature of climate change's impact on white spaces in Fairbanks, pointing to the need for adaptive strategies that address both the physical changes to the landscape and the cultural and community aspects intertwined with these spaces.

The rise in extreme events, made more apparent by climate change, prompted the development of the 2021 Multi-Jurisdictional Multi-Hazard Mitigation Plan. The plan identifies floods/erosion, wildfires, severe weather, seismic events, cryosphere changes, and ground failure as relevant hazards for Fairbanks. Community engagement in the plan involved input from local fire departments, utilities, resource management agencies, social

service providers, and the public, alongside several outreach events, a survey, and a 30-day review and comment period on the draft plan. The plan outlines key mitigation activities including outreach and education to increase hazard awareness, integrating mitigation goals across community planning efforts, and non-structural mitigation activities like promoting safer building practices and flood risk reduction measures. The plan also emphasizes identifying funding for hazard mitigation projects, documenting high-risk areas for natural hazards, and encouraging construction activities that minimize hazard impacts. These strategies aim to enhance community resilience against natural disasters through education, policy integration, and proactive risk management.

The Fairbanks North Star Borough's Climate Action & Adaptation Plan (CAAP), launched in 2007, represents another strategic approach to addressing climate change. Despite obstacles such as its partial approval in 2023 and critique over its modifications, the CAAP outlines a comprehensive strategy for climate resilience, advocating for community-wide involvement in adaptation and mitigation initiatives. It leverages a grassroots model of public engagement, providing diverse opportunities for participation and prioritizing the well-being of FNSB residents. The plan further commits to equitable practices by recognizing the particular challenges faced by vulnerable groups and valuing partnerships with Indigenous communities. Nonetheless, the future execution of the CAAP remains to be closely observed, requiring ongoing assessment of related actions and community responses.

3.4. Indigenous Experiences: Generational, Gender, and Socio-Political Influences on the Use of OPS and Climate Change Perspectives

There is consensus on the impact of climate change on Indigenous communities in the North, presenting significant future challenges, yet the specific risks remain unclear. The experiences and responses to climate change are shaped by various social, cultural, economic, and political factors, with a noted lack of studies focusing on community perspectives

regarding its human implications (Ford et al., 2006). While climate change remains a critical area for research and resolution, it is essential to contextualize and broaden our perspective to ensure a comprehensive approach towards studies involving Arctic Indigenous communities and others globally. The research community possesses both a significant opportunity and a moral obligation to adopt Indigenous viewpoints, evaluate how knowledge benefits Arctic populations, and adjust our strategies and policies to support these communities effectively (Huntington et al., 2019). Few studies specifically targeted distinct groups such as youth, Elders, and women, underscoring the critical need for future research on the impacts of climate change on youth, whose well-being and identities are deeply tied to land-based skills and livelihoods, essential for cultural continuity (Lebel et al., 2022). Research exploring the intersection of climate change with factors such as Indigeneity, gender, sexuality, age, race, class, caste, socio-economic status, ability, and other aspects of identity is still nascent, yet it offers a promising direction for more detailed analysis of Indigenous communities and climate change impacts (Johnson et al., 2022).

3.4.1. Generational Insights: Elderly versus Youth

The elderly prioritizes cultural preservation and the transmission of traditional knowledge to ensure cultural continuity, viewing land and traditional practices as sacred. The transmission of traditional knowledge is a challenge for all Indigenous Arctic communities. Ford et al. (2006) describe the experience of the Inuit in Arctic Bay, Canada, where the traditional methods of knowledge transfer for hunting and other traditional activities are no longer as effective, leading to a decline in the hunting skills and knowledge among younger Inuit generations, posing increased risks and reducing their adaptive capacity for safe and successful harvesting. Same as for the Inuit community in Arctic Bay, Fairbanks elderly's concerns about climate change are directly tied to its impact on Indigenous traditions, especially harvesting fish (Ford et al., 2006).

In contrast, Indigenous youth blend traditional values and culture (subsistence activities (hunting, fishing, foraging), and culturally valued practices (speaking the native language, beadwork)) with modern concerns, focusing on inclusivity, environmental sustainability, and integrating Indigenous culture into urban life (Ulturgasheva et al., 2014). They actively seek to address discrimination and promote a more equitable society, using art and activism as tools for change. Youth perspectives also reflect a nuanced understanding of climate change, advocating for adaptation strategies that include Indigenous knowledge and prioritizing community well-being (Petrasek MacDonald et al., 2013).

This generational comparison reveals the deep respect for tradition among the elderly intersecting with the youth's drive for social and environmental justice. Both groups, though focusing on different priorities, underscore the importance of respecting the land, serving as a bridge to their ancestors and nature, fostering spiritual growth, perpetuation of traditions, and the preservation of historical memory (Lebel et al., 2022). For both young and older generations, the impacts of climate change are visible and affect their daily lives. Climate change is affecting physical access to the land across the Circumpolar North and including Fairbanks, jeopardizing individuals' bonds with the land and affecting various factors contributing to their mental health and resilience (Lebel et al., 2022). Climate change can induce ecological grief through the erosion of environmental knowledge and identity among those with intimate connections to nature (Cunsolo & Ellis, 2018). Moreover, emerging with climate change obstacles to accessing traditional foods like salmon exacerbate the already critical issue of food insecurity in the North, potentially leading community members to increased reliance on store-bought, less nutritious options, alongside growing anxiety, concerns for the future, and a sense of detachment from their Native identities, food preferences, and practices (Lebel et al., 2022).

Integrating voices from different generations enriches the understanding of climate change's effects and its influence on daily practices. These findings highlight the importance of including perspectives from all societal generations in the formulation of credible and relevant future climate policies (Dankel et al., 2020).

3.4.2. Gender Differentiation: Female, Male, and Non-Binary Perspectives

Within the Indigenous community on the use of OPS and perceptions of climate change in Fairbanks, Alaska, there are differences in perspectives and concerns among Indigenous women, men, and non-binary individuals.

Indigenous women prioritize safety in public spaces, expressing concerns about racism and judgment that may deter their use of certain areas. They emphasize the importance of being in company and avoiding poorly lit or unpopular spaces, especially during evening hours. Indigenous women also highlight the need for healing and traditional activities, pointing out issues related to housing, mental health, and addiction within their community. Discussions about homeless encampments, high rates of alcoholism, and trauma underline the necessity for targeted services and support. Women advocate for more inclusive and safer cities, expressing a desire for public spaces that foster community events and celebrate Indigenous culture. In terms of climate change, they mention that increased wildfires and decreased air quality negatively influence their ability to spend time outside, potentially leading to more stress in their families as a consequence of longer time spent in confined spaces (Lebel et al., 2022).

Indigenous men focus on recreational areas and community events that encourage physical activity and engagement, such as basketball courts and sledding hills. They also address broader societal issues like homelessness and environmental conservation. Men emphasize the inclusion of Indigenous culture in the urban landscape, through murals and cultural representations. Their vision for Fairbanks includes accessible, healthy, and clean

public spaces that maintain the city's community-oriented character while embracing modern amenities. They express concerns about the impacts of climate change on traditional activities due to the Chena River not freezing as it used to. Research suggests that ecological grief can arise from slow, ongoing ecological alterations like long-term changes in weather, landscapes, or ecosystems, often overlooked or unseen due to their gradual nature and absence of immediate indicators of crisis (Cunsolo & Ellis, 2018). This concept aligns with the idea of 'solastalgia,' defined as feeling homesick while still at home, and also as mourning the loss of a healthy environment and vibrant ecosystem (Cunsolo & Ellis, 2018).

Research on climate change has primarily focused on Indigenous men and women, leaving a significant void in understanding its effects on Indigenous LGBTQ+ groups, such as lesbian, gay, bisexual, transgender, queer, pansexual, asexual, intersex, non-binary, gender-fluid, and two-spirit people (Johnson et al., 2022). Indigenous transgender, gender-diverse, two-spirit, lesbian, and bisexual women and girls in Canada face higher levels of racial and sexually motivated stigmatization, violence, and murder compared to their heterosexual or cisgender Indigenous and non-Indigenous peers, with additional barriers in accessing healthcare and support highlighted by various scholars (Johnson et al., 2022). The non-binary respondent discusses the challenges of being visibly queer in public spaces, emphasizing the need for resilience and the therapeutic role of art in navigating these experiences. They highlight a deep connection with the land and advocate for its repatriation to Indigenous peoples who can preserve it for future generations. This individual calls for more representation of Indigenous culture and inclusivity in public spaces, addressing systemic issues like discrimination and the lack of legal protections for the queer community. They envision a more inclusive and culturally rich public sphere that celebrates diversity. In terms of climate change, they acknowledge the importance of local Indigenous climate activist movements and grassroots organizations, which have emerged as forefront advocates

in the social and environmental justice arenas, especially concerning climate justice and fishing rights (Norman, 2017).

In summary, gender within the Indigenous community significantly influences how OPS are used and perceived, particularly concerning safety, cultural representation, and the impacts of climate change. Women's narratives focus on safety and community healing and less time outside due to climate change consequences, men's perspectives highlight recreational use and cultural pride and the negative influence of climate change on water bodies and cultural activities, and the non-binary viewpoint underscores the importance of inclusivity and environmental stewardship, as well as Indigenous collaboration in forms of grassroots organizations, focused on climate change issues.

3.4.3. Socio-Political Engagement: Politically Active versus Homeless Experiences

The influence of socio-political engagement within the Indigenous community on the use of OPS and perceptions of climate change in these areas is distinctly manifested through the perspectives of a political activist compared to those experiencing homelessness.

The Indigenous activist emphasizes the need for public spaces to be safe, accessible, and welcoming to Indigenous communities, highlighting the issues of discrimination and classism. Their advocacy for spaces that reflect and celebrate Indigenous culture and history, including the call for more signage and less commercialization and touristification of spaces like Pioneer Park (Alaskaland), underlines a desire for public recognition and respect for Indigenous heritage. They view public spaces as potential venues for community healing and cultural expression, stressing the importance of inclusivity and the promotion of Indigenous history and values. Furthermore, their activism, rooted in a commitment to racial and climate justice and equality, drives a vision for public spaces that are planned and utilized in a way that honors Indigenous cultures while addressing broader issues of discrimination, accessibility, and environmental sustainability. Addressing climate change effectively

requires acknowledging the intertwined relationships among climate change, human-induced environmental degradation, and racial, social, economic, and environmental injustices (Gilliam et al., 2023).

Conversely, the experiences of homeless Indigenous individuals, as reflected in the services combating hunger and homelessness, highlight the severe impacts of colonization, coupled with the introduction of drugs and alcohol, contributing to the disproportionate number of Indigenous peoples facing homelessness. The main locations where homeless individuals gather, like Golden Heart Plaza and Veteran's Memorial Park, become focal points for discussions on the homelessness crisis. Urban planning predominantly aims to mitigate winter's effects for a generalized urban dweller (healthy, strong, with free time and income), focusing on enhancing outdoor leisure and consumption opportunities (Stout et al., 2018). This approach fails to acknowledge that, for some groups, winter represents a critical survival challenge, not merely a period devoid of appealing activities. The narrative around homelessness reveals a critical look at the lack of shelters and warming centers, pointing out the city's shortcomings in addressing the needs of its most vulnerable populations. Yet, there's a belief in the potential of public spaces to foster healing and community-building, with community and medicine gardens and events seen as opportunities for positive engagement and support. Indeed, such understanding and value of OPS can be seen through Environmental Repossession lenses, according to which Indigenous peoples are actively working to 'repossess' or reestablish connections with their environments and affirm their rights to enhance community health and wellness, based on fostering social relationships between Indigenous Knowledge (IK) and the land (Ambtman-Smith & Richmond, 2020). A medicine garden is exactly a space based on Environmental Repossession, where the Indigenous community can engage in, share, and enhance their Indigenous Knowledges, serving as a venue for cultural practices, IK validation, and fostering social connections that

promote health by reinforcing Indigenous identity and a sense of belonging (Ambtman-Smith & Richmond, 2020).

Comparing these perspectives, it's evident that socio-political engagement plays a significant role in shaping the use of OPS and perceptions of climate change among the Indigenous community in Fairbanks. While political activists focus on advocating for changes that would make these spaces more inclusive and reflective of Indigenous cultures, those experiencing homelessness highlight the immediate need for shelter, safety, and support within the same environments. Both viewpoints underscore the importance of recognizing and integrating Indigenous voices and experiences in the planning and management of public spaces, albeit from different angles of socio-political engagement. The activist perspective is geared towards systemic change and cultural preservation, whereas the perspective from those experiencing homelessness calls for urgent action to address basic human needs and rights.

And while political activists openly talk about climate change, it’s not mentioned as an issue from a homelessness perspective. While climate change frequently intensifies existing issues, an exclusive emphasis on it, as seen in much of the current environmental discourse on the Arctic and beyond, can divert attention from immediate measures that could enhance the lives of Arctic communities (Huntington et al., 2019) which we can see on the example of homeless residents of Fairbanks.

3.5. Right to the Cold City

From the Indigenous perspective, the right to the cold city is a radical concept. This is underscored by the 2018 petition filed by the Inuit Circumpolar Council, led by Sheila Watt-Cloutier, author of "The Right to be Cold" (2015), which holds the United States accountable for its significant contributions to global warming and its impact on Arctic Indigenous communities. Moreover, the right to the city is conceptualized as a "radical-cooperative"

notion (Althorpe & Horak, 2023), promoting the formation and growth of Indigenous grassroots organizations as avenues to exercise the right to the cold city. Examples of this in action include local grassroots organizations in Fairbanks, such as the Native Movement and Fireweed Collective, which demonstrate the practical application of this right through organizing marches, protests, and community-centered events focused on healing, reciprocity, respect, and justice.

The place-based right to the cold city challenges the colonial underpinnings of urban planning (Oh, 2023) and champions rights crucial for local communities. These include the increasing awareness of general public about importance of winter and snow, active involvement in local governance on issues of social, environmental, and political significance, and the elevation of local culture within urban environments. Despite these aspirations, Indigenous communities face significant barriers, demonstrated by their underrepresentation in the Climate Action and Adaptation Plan (CAAP) finalization process, limited political influence at the city and Fairbanks North Star Borough levels, and the FNSB Department of Parks and Recreation's insufficient attention to Indigenous concerns. These political constraints hinder Indigenous residents' ability to advocate effectively for their rights and interests, exacerbating issues such as vulnerability to climate change, challenges in preserving traditional winter activities, deterioration of public infrastructure, cancellations of public events, salmon scarcity, and inadequate Indigenous involvement in climate change response efforts.

Social rights are under protected, with Indigenous residents experiencing issues with accessibility, safety, and respect in public spaces. Cultural rights are also lacking, with insufficient representation of Indigenous languages and cultures, and an ongoing struggle over the renaming of Pioneer Park to Alaskaland. Nonetheless, among Indigenous residents there is quiet support for the Land Back movement's call for the restitution of lands and

waters, advocating for a shift towards Indigenous legal, governance, and caregiving frameworks, thereby challenging traditional settler-colonial urban models (Tomiak, 2023).

3.6. Sustainable Development

In the Arctic, sustainable development initiatives should aim to improve the health, well-being, and safety of communities and individuals, while also preserving ecosystem integrity, functionality, and resources (Graybill & Petrov, 2021). However, these initiatives lack efficiency in Fairbanks from economic, social, and environmental perspectives. From an Indigenous perspective, people's subsistence practices (though limited in the city) are impacted (Orttung et al., 2019).

Moreover, local residents observe an imbalance in allocating resources toward attracting tourists rather than caring for the well-being of local communities. The influx of tourists could potentially intensify the physical and ecological disruptions in the Arctic (Palma et al., 2019).

Based on interviews, the discomfort of using OPS is visible, especially among Indigenous communities. The flaws in the construction and maintenance of OPS can be attributed to the harsh climate, unpredictable changes, isolation, complex logistics, high construction costs, and colonial legacy (Cho & Jull, 2023; Cooke & Marsik, 2023). This situation has resulted in a trend of reactive development, where solutions from outside (predominantly southern regions) are adapted for economic reasons, emphasizing engineered efficiency and stability over designs that meet the specific environmental, socio-ecological, and cultural needs of Arctic communities (Cho & Jull, 2023).

The sustainable development framework, both from the United Nations Sustainable Development Goals and ISO 37120, overlooks Indigenous perspectives on sustainability. A redefined interaction between Indigenous communities and global measurement systems is essential for achieving global sustainability goals (Waldmüller et al., 2022). To incorporate

decolonial thought into sustainable development, T. Degai and A. Petrov (2021) suggest revising the current 17 goals to include five new ones that reflect Indigenous knowledge and sustainability aspirations: Sustainable Governance and Indigenous Rights, Resilient Indigenous Societies, Livelihoods and Knowledge Systems, Life on Ice and Permafrost, and Equity in Access to Resources and Investment in Youth. All of these five new goals are, to some extent, related to the utilization of OPS, underscoring their significance in aligning both traditional and Indigenized versions of the United Nations Sustainable Development Goals with the lived realities and aspirations of Arctic communities.

3.7. Resilience

From an infrastructure resilience perspective OPS of Fairbanks are vulnerable to multiple factors. Green OPS suffer from uncareful usage of four-wheeled vehicles leading to erosion of trails, mining activities limiting usage of trails, urbanization eliminating trails. Blue OPS suffer from invasive species and toxic chemicals. White OPS or “frozen infrastructure” make climate change vulnerability especially obvious with "we lose our winter because of climate change" quotes from residents. Inadequate snow and ice cover, permafrost thawing, ROS events, road damage, power outages are some of the consequences of climate change already visible during winter time. Permafrost thaw damaging trails, the increasing occurrences of wildfires and the resultant decline in air quality are some of the climate change vulnerabilities faces using green and blue OPS.

From sociological perspective on resilience, tightly connected with vulnerability, people express concerns about safety and security. Unpredictable and troubling weather patterns and lack of snow and ice lead to avoiding leaving homes and consequently using OPS for connection with nature, socialization and time with family and friends and engaging in traditional winter activities. Social resilience to climate change is expressed through creative practices for Fairbanks community in general and through adapting to and

withstanding environmental changes through the strength of ancestral wisdom, community solidarity, and an intrinsic bond with the natural world for Indigenous communities.

Though studies indicate that Arctic Indigenous communities have historically exhibited flexibility and endurance in response to evolving environments, however, both oral traditions and scholarly research have highlighted the boundaries of these communities' abilities to manage the impacts of climate change, including fluctuations and severe conditions (Ford et al., 2006). The sociological perspective on resilience more and more often discussed to be problematic: “Stop calling me resilient. I’m not resilient. Because every time you say, “Oh, they’re resilient”, you can do something else to me. I am not resilient” – these are words of women being called resilient after Hurricane Katrina struck New Orleans in 2005 (Ranganathan & Bratman, 2021, p. 117). As Ranganathan and Bratman (2021) note, the language of resilience has become normalized in the context of external climate and economic challenges, suggesting an unlimited ability of impacted communities to merely withstand these pressures. Kaika (2017) critiques the resilience narrative for overlooking the root causes necessitating resilience, questioning for whom and against what resilience is aimed. This discourse, focused on "climate proofing" rather than addressing historical and ongoing injustices, perpetuates the status quo with minimal change, benefiting mainly private entities profiting from resilience projects at the expense of affected communities coerced into entrepreneurial roles for aid, under the guise of participation in neoliberal, market-driven planning and architectural practices (Ranganathan & Bratman, 2021).

3.8. Justice

As it was stated in the beginning, climate change amplifies existing injustices (Adger et al., 2014). The concept of Arctic Justice (Wood-Donnelly, 2023) is relevant to Fairbanks and its Indigenous communities, calling for a shift from urban narratives controlled by colonial or conservationist views to actively involving Indigenous communities and their

knowledge in urban planning processes (Mels, 2023; Wood-Donnelly & Ohlsson, 2023). Spatial justice (Przybylinski and Ohlsson, 2023) directs attention to the accessibility of OPS and homelessness within them, illustrating how reduced access for Indigenous communities exemplifies ongoing historical exploitation and marginalization. The lack of equitable access to public spaces, along with disparities in housing and employment, significantly affects Indigenous communities' chances for meaningful participation and representation in urban planning and development (Fainstein, 2010).

Our research points to the necessity of challenging Western normative conceptions of justice, which, if left unexamined, risk perpetuating the conditions leading to the dispossession and disempowerment of Indigenous and other marginalized peoples (Elliott 2016; Rosol and Blue, 2022). These conceptions, deeply rooted in Western histories of political thought, may inadvertently reproduce inequalities, underscoring the need for a more inclusive approach to justice that recognizes the diverse histories and struggles of Indigenous populations. In order to reconceptualize justice in a new way, we need to recognize diverse perspectives on justice, including Indigenous ones.

In our analysis we collected and compared municipal and Indigenous perspectives on justice and the research results showed the difference in its understandings. It was possible to distinguish several justice topics addressed by municipality: transportation justice with a focus on walkability and accessibility of public spaces, cultural programming justice with a focus on people with special needs and senior citizens, role of art in addressing and developing justice project, as well as Indigenous justice, which is viewed as acknowledgment and recognition of Indigenous communities through partnerships with Native organizations, land acknowledgements in public spaces, but as it was highlighted earlier they share that "from a Parks and Rec perspective, we don't do anything specific for the Indigenous cultures" (male, 40). As Walker et al. (2017) note for the Canadian aspect, the popularity of public art

and monuments celebrating Indigenous cultures and histories aligns with state's tendency to embrace the most favorable aspects of Indigenous culture, yet the enthusiasm for incorporating Indigenous names and elements into public spaces, architecture, and design are not as popular despite being a key area for forward-thinking civic leadership.

From the Indigenous residents' perspective there is a lack of municipal leadership towards healing and building relations with Indigenous communities. However, they especially highlight collaborative projects that integrate Indigenous culture into public spaces as examples of justice in action. Nevertheless, Indigenous respondent note that land acknowledgements are not enough and there should be created educational platforms for Indigenous cultures, values, and histories, and OPS can potentially serve as this platform. Moreover, Indigenous respondents suggest creating spaces which break away from narratives dominated by colonial perspectives such as renaming of Alaskaland to Pioneer Park (most respondents express protest and call it Alaskaland), name streets in Indigenous languages and celebrate Indigenous culture.

Sultana (2022) emphasizes that a critical climate justice perspective explores the varied impacts of climate change on different groups, blending academic theories (like feminist, anti-racist, and decolonial frameworks) and insights from climate justice activism to encourage united action. In our work, we analyzed multiple dimensions of public space usage and climate change concerns, as well as communicated and participated with local activist grassroots organizations such as Native Movement, Fairbanks Climate Action Coalition, and Fireweed Collective. Our observations and interactions with these organizations reveal a strong and steady emphasis on environmental justice principles, centering on local effects and experiences, unequal vulnerabilities, the significance of community input, and calls for community sovereignty and efficacy (Schlosberg & Collins, 2014). In terms of the concept of

justice, the impact of climate change on the usage of OPS has become evident through issues such as the disruption of cultural events, activities, and stable ecosystems.

Overall, our analysis and framework lead us to an understanding of the activities occurring in Fairbanks' OPS, as well as how key concepts such as the right to a cold city, sustainable development, resilience, and justice are impacted by climate change.

Chapter 4: Conclusion

Studies of OPS in Fairbanks allowed us to identify specific characteristics that distinguish Arctic cities in questions of sustainability, right to the (cold) city, resilience, and justice. In particular, there are distinct perceptions of accessibility and variety of activities taking place in OPS that have to be taken into account.

The accessibility of green, blue, and white spaces in Arctic cities like Fairbanks is significantly influenced by climate, with factors such as car dependency, underdeveloped public transit, and the challenging weather conditions shaping their usage and access. Moreover, access to OPS outside city limits is more valued than access to downtown and central OPS. Disparities in accessibility exist, particularly for Indigenous citizens and in downtown, underscoring issues of discrimination and the need for more inclusive urban planning. Trails and natural areas outside urban limits provide valued access to nature, highlighting the community's preference for spaces that offer safety, connectivity, and engagement with the environment, despite the barriers presented by harsh weather and insufficient infrastructure for non-vehicular access.

In Fairbanks, local residents deeply value and actively utilize OPS. These spaces are perceived as essential for recreational, cultural, and social activities, with green spaces like Pioneer Park (Alaskaland) and Birch Hill Recreation Area being particularly cherished for leisure. Blue spaces, such as the Tanana Lakes and the Chena River, facilitate connections with water-based environments, while white spaces, especially trails, are crucial for winter sports and activities. Activities traditional to cities include skiing and sledding in winter, bird watching in spring, and hiking and swimming in summer and fall. Other activities, characteristic of subarctic cities with a significant Indigenous population, include dog mushing in winter, hunting and berry picking in fall, organizing protests and powwows throughout the year, and dancing and honoring Missing and Murdered Indigenous Women.

Overall, these areas are integral to the community's quality of life, providing venues for physical activity, relaxation, cultural expression, healing and fostering a strong connection with nature and community well-being.

Over the past 35 years, Fairbanks has experienced a significant reduction in vegetation due to urbanization, marking a shift towards 'green desertification,' despite still maintaining more greenery compared to other Arctic regions which face even more dramatic vegetation losses. In the case of Fairbanks, this process is not entirely negative, as the primary challenge residents encounter is urban sprawl, which necessitates a denser built environment within the city.

Concurrently, while blue spaces have not significantly diminished, the risk of flooding has increased with predicted higher rainfall. White spaces are witnessing a notable shortening of the snow season and a reduction in winter snowpack, exacerbated by more frequent rain-on-snow events, signaling a profound impact of climate change on the character and accessibility of Fairbanks' OPS.

Local communities in Fairbanks perceive the impact of climate change on OPS as a significant modifier of urban life and spatial forms, necessitating a reevaluation of urban design and policy. Climate change challenges the predictability of weather patterns, leading to damage to infrastructure, alterations in traditional activities, and heightened vulnerability to weather disturbances. This has resulted in a direct and profound impact on green, blue, and white spaces, affecting their usability and the community's ability to engage in traditional lifestyles and cultural practices, with a particularly strong concern over the loss of traditional winter activities.

Social differentiation within the Indigenous community, such as gender, age, and socio-political engagement, affects the usage of OPS and perceptions of climate change by highlighting different priorities and concerns across these groups. Elders focus on cultural

preservation and the transmission of traditional knowledge, youth integrate traditional values with concerns for inclusivity and environmental sustainability, and gender perspectives reveal distinct priorities and experiences relating to safety, recreational activities, and the impacts of climate change on traditional practices and community well-being.

The concept of a place-based right to the cold city not only highlights the colonial roots of traditional urban planning but also highlights the imperative for Arctic cities to ensure the existence of winter landscapes, critical for the cultural and environmental sustainability of Indigenous communities. It underscores the importance of Indigenous peoples' active participation in shaping policies and urban designs that reflect their deep-rooted connections to the land, emphasizing the need for urban environments to adapt to the realities of climate change in ways that preserve the unique characteristics of the Arctic. Moreover, by aligning with movements like Land Back, it seeks not just to adjust urban planning practices but to fundamentally transform them. This transformation involves shifting power dynamics, prioritizing Indigenous leadership in environmental stewardship, and reimagining urban spaces in ways that honor Indigenous sovereignties. It suggests a radical departure from conventional approaches to urban development, advocating for a future where cities are designed with the wisdom of Indigenous governance models that have long fostered harmonious relationships with the natural world, thus offering a path towards truly sustainable and inclusive urban spaces that respect both the planet and its original stewards.

The perception of climate change in OPS influences Arctic urban development in terms of sustainable development by highlighting the need for urban environments that address economic, social, and environmental vulnerabilities. This includes the necessity for maintenance and resilience enhancement in OPS against climate effects, addressing the underrepresentation of Indigenous communities, and tackling the infrastructural challenges

posed by climate change to ensure the fulfillment of United Nations Sustainable Development Goals, particularly Goal №11, for safe, inclusive, and accessible spaces.

The overlook by both the United Nations Sustainable Development Goals and ISO 37120 of Indigenous perspectives on sustainability necessitates a transformative approach to global sustainability frameworks. Integrating decolonial thought, as suggested by T. Degai and A. Petrov (2021), involves revising existing sustainability goals to include Indigenous knowledge and aspirations. Through such integration, sustainability goals can be reoriented to better reflect and serve the unique environmental, cultural, and societal contexts of Arctic Indigenous peoples, thereby enhancing the relevance and impact of global sustainability efforts.

The perception of climate change in OPS influences Arctic urban development in terms of resilience by highlighting vulnerabilities in infrastructure and the sociocultural fabric of communities. The need for adapting urban planning to address climate-induced challenges like erosion, permafrost thaw, and increased wildfires demonstrates a pressing requirement for resilient infrastructure. Additionally, the sociological impact of climate change on community practices and the safety concerns it raises necessitate a broader, more inclusive approach to resilience, moving beyond mere endurance to addressing the root causes of vulnerability and fostering a holistic, community-centered resilience that includes the preservation of cultural practices and environmental integrity.

The perception of climate change in OPS influences Arctic urban development in terms of justice by highlighting the need for equitable access, recognition, and inclusion of Indigenous communities in urban planning. The impact of climate change on the usage of OPS has become evident through issues such as the disruption of cultural events, activities, and stable ecosystems. However, both the concept of justice and the impact of climate change on Fairbanks reveal multiple perspectives, differing between municipal representatives and

Indigenous residents, as well as within Indigenous communities from the viewpoint of various vulnerable groups. This highlights the necessity of employing a multidimensional approach to understand the diverse insecurities climate change introduces and the injustices it creates for different marginalized social groups.

In terms of the future steps, we advocate for further research that genuinely engages Arctic Indigenous communities, amplifying their voices, and supports their initiatives creating meaningful community engagement. We have tried to contribute to this effort by participating in the creation of a grant application for the NSF in collaboration with Indigenous organizations in Fairbanks, and by showcasing the voices of Indigenous communities at the NNA Annual Community Meeting exhibition "Arctic StoryWords: Weaving Different Ways of Knowing through Arts, Science, Local and Indigenous Knowledge," featuring work on Alaskaland (Figure 18).

Figure 18. Alaskaland Zine by Diana Khaziakhmetova and Olga Lo. 2024.

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