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Natural Climate Solutions in Alaska

Harnessing Natural Resources for Climate and Economic Leadership

PREPARED FOR

The Nature Conservancy 

PREPARED BY



McKINLEY RESEARCH
GROUP, LLC

Formerly McDowell Group

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Context and Opportunity

Climate change is happening, and Alaska is on the front lines:

- Alaska has warmed more than twice as rapidly as the rest of the U.S. Average winter temperatures have risen 5.5°F since the 1950s.
- Warming waters and ocean acidification are putting fisheries and fisheries-dependent communities at risk.
- At least 31 villages are in “imminent” danger from coastal erosion and flooding, according to the U.S. Army Corps of Engineers.
- We are seeing an increase in intensity and frequency of events such as forest fires, landslides, and flooding.

While the threats are sobering, Alaska also has unique assets and opportunities in the fight against global climate change. As the world mobilizes to address the climate challenge, **Alaska is well positioned for opportunity.** For example:

- Alaska has abundant renewable energy resources that will become increasingly economically and technically feasible to develop.
- Low-carbon transportation, construction, industrial processes, and materials development can create new jobs and industries.
- Alaska’s vast carbon stores and intact natural systems are increasingly recognized for their value in climate stabilization and mitigation.

This third opportunity is the focus of this report.

Nature plays an essential role in stabilizing the world’s climate. Alaska has vast natural resources that already act as greenhouse gas “sinks,” or storage mechanisms. Proactive management can drive additional climate value from these natural systems. These include Alaska’s boreal forests, rainforests, marine expanses, and undeveloped lands.

Through the use of its resources as *natural climate solutions*, Alaska can make important contributions to greenhouse gas management, realize economic and employment benefits, and bolster community resilience.

Natural Climate Solutions are...

...conservation, restoration and improved marine or land management approaches that increase carbon storage or avoid greenhouse gas emissions. Natural climate solutions can also harness traditional knowledge, and foster community resilience in the face of change.

What Are Natural Climate Solutions?

Natural climate solutions, or NCS, are approaches to conserving, restoring, or managing natural ecosystems to increase their capacity to absorb carbon dioxide. These approaches hold potential to provide one-third of the net-emissions reductions (7 Gt CO₂ per year by 2030) required to limit temperature increase to 1.5° or 2°C, as described by the Intergovernmental Panel on Climate Change. Examples of natural climate solutions include avoided deforestation and avoided peatland impact, peatland restoration, reforestation, and projects that make use of marine and tidal systems (known as “blue carbon”).

Alaska’s land and marine resources are well suited to support natural climate solutions. For example, Alaska has vast carbon and greenhouse gas stores in its forests and in boreal peatlands. Kelp holds potential as a marine carbon sink. Understanding and nurturing opportunities to implement natural climate solutions in Alaska will have broad benefits. These opportunities exist in three broad categories:

- **Management of current greenhouse gas stores** including forests and peatlands. This can include conservation of carbon-storing natural systems, and avoiding loss through fire management.
- **Blue carbon**, or the development of seaweed and kelp mariculture projects that can capture and store carbon.
- **Infrastructure projects** that improve or restore natural systems and provide greenhouse gas and air quality benefits.

Natural climate solutions offer opportunities for creative thinking around the value of Alaska’s lands and waters - economically, socially, and as global resources. While some of this thinking is new, much of it calls on time-honored traditions and values. Alaska’s indigenous people have been practicing natural climate solutions for thousands of years. Harnessing traditional knowledge and local scientific observations can strengthen Alaska’s climate response and foster community resilience in the face of change.

“Native people have learned to live in harmony with the earth for millennia by developing a complex integration of cultural values, traditions, spirituality, and economic base tied to the land. ... Nature is dynamic, and concomitantly, people and cultures must be also.”

-Angayuqaq Oscar Kawagley (1934-2011), Yup’ik scholar

Economic and Community Benefits

The benefits of any NCS project depend on the type of project, its goals, and its implementation. The following examples illustrate how multiple benefits can flow through Alaska's economy and communities.

- ✓ Wildland fire management in Alaska's boreal zone **generates economic activity through regional fire prevention and fire response activities**. Local residents may be employed, and contracts may flow to local firms. Already, **seasonal wildland firefighters from rural communities play a critical role in fighting fires**, protecting towns and infrastructure. The federal Bureau of Land Management (BLM) Alaska Fire Service has six active contracts with crews throughout rural Alaska to provide rapid response in remote regions; additional crews across rural Alaska are hired as needed. These highly trained, federally funded crews may be deployed to other states as needed. In addition, wildfire suppression can **prevent fire-related economic losses**. And as the Tok School case shows (see next page), fire risk mitigation can generate other community benefits.
- ✓ In the case of carbon credit projects developed by an Alaska Native Corporation, the sale of carbon credits generates revenue to the corporation. **These revenues may be reinvested, distributed to shareholders, or used to support cultural and education investments**. In addition, development of the necessary climate intelligence (including

Multiple Benefits: Tok Case Study

An example from the Tok area illustrates how nature-based approaches to climate change can have broad benefits. To reduce wildland fire risk in the region, the state in 2019 approved a five-year timber sale along previously constructed fuel breaks north of Tok. Some of the wood was purchased by the Tok School, which installed a wood-chip-fired boiler in 2010. The biofuel system, which provides both heat and electricity to the school, displaces about 59,000 gallons of diesel fuel annually, generating significant cost savings and a cascade of community benefits.

"Between heat and power, we're probably saving \$400,000 to \$500,000 a year," said Alaska Gateway School District Superintendent Scott MacManus. "That money goes toward better education, counselors, arts programs and science, technology, engineering and mathematics programs; those are the things that keep kids in school."

The school's biofuel system also heats an on-campus greenhouse that produces 20,000 pounds of fresh vegetables each year for the school and local markets. The project helps reduce fire risk, reduces Tok School's carbon emissions, saves money, supports local food production, and expands learning opportunities.

initial quantification and ongoing monitoring of the carbon credit project) requires field work and scientific analysis, creating opportunities for employment and skills growth. In addition, lands designated for carbon management will remain undisturbed. Conservation of habitat **supports forest and stream health, strengthening community wellbeing through subsistence and other traditional uses of the land.**

Tribes, municipalities, and the State of Alaska are similarly positioned to benefit from carbon credit projects.

- ✓ Over longer timeframes, Alaska can benefit from **development of in-state expertise in carbon quantification, carbon project management, and other specialty services** related to climate mitigation. The expansion of expertise of Alaska's existing professional firms and **the growth of a new class of experts** will provide **diversified employment opportunities** and **position Alaska to capture more benefit** from the evolving global market for climate solutions.

Mitigation or Adaptation?

While natural climate solutions are valuable for their ability to mitigate climate change, they can have additional benefits for *climate adaptation*. These benefits include conservation and habitat protection and improvement.

- The establishment of trees and vegetation along stream and riverbanks can provide temperature relief for salmon and other freshwater organisms as average temperatures increase.
- Seaweed and kelp may buffer ocean acidification by absorbing carbon from the marine environment to the benefit of shellfish populations.
- Beach grasses, trees and other vegetation planted along vulnerable coastlines and riverbanks can have a secondary benefit of carbon uptake.

NCS Potential in Alaska

Alaska in Context

To understand the role Alaska can play in global climate stabilization, it is important to understand the size and scale of Alaska itself. Larger than Texas, California, and Montana combined, Alaska's landmass is one-fifth that of the contiguous U.S. Alaska spans the distance from Georgia to California, and from Texas to North Dakota.



Source: Alaska.org

Ownership and management of Alaska's lands is largely shared among three groups:

- federal government (57%)
- state government (29%)
- Alaska Native Corporations (ANCs, more than 10%).¹

Less than 1% of lands are in private ownership (excluding ANCs).

Alaska's natural ecosystems hold significant greenhouse gas stores. Though much of Alaska's land base faces no imminent risk of human-caused degradation (beyond that posed by climate change itself), other areas are subject to development activities – for mineral extraction, road

Alaska: Outsize Resources, Outsize Opportunities

While Alaska is known for economically valuable resources like oil and gas, it also holds a disproportionate share of resources the world is just beginning to properly value, including:

- More than 40% of the nation's surface water
- Over 46,000 miles of coastline, more than the rest of the states combined
- 90% of the nation's tidal energy resource
- North America's largest intact temperate rainforest
- 36% of the nation's federal lands
- 35,000 square miles of glaciers, 97% of the nation's total

¹ Resource Development Council for Alaska, Inc., 2009. "[Who Owns Alaska?](#)"

construction, timber harvest, or other purposes. Even greater portions are susceptible to wildfire, with increased risk expected as temperatures rise.

Below we describe the three broad NCS opportunities in Alaska:

- **Management of current greenhouse gas stores** in forests and peatlands
- **Blue carbon**, or aquatic and mariculture opportunities to stabilize climate
- **Infrastructure projects** that improve or restore natural systems and their climate benefits

Forests and Peatlands: The Foundation of Alaska's Carbon

Forests will play a significant role in the suite of natural climate solution opportunities in Alaska. Globally, temperate and boreal forest biomes hold more than a third of the world's carbon.



These biomes account for the majority of Alaska's landmass. Policies and economic tools that support active greenhouse gas management in Alaska's forested regions can form the foundation for significant impact in the state, and drive economic benefit to landowners.

In forestry, opportunities for natural climate solutions are in two buckets:

- **improved forest management** - avoiding loss or degradation of intact forest lands
- **reforestation** - reestablishing forests on deforested lands

When considering carbon resources in Alaska, the temperate rainforests of Southeast and eastern Southcentral Alaska are most present in the popular imagination. These forests are **significant storehouses for carbon**, with towering trees and other forest growth that act as carbon sinks. Most of Alaska's existing carbon projects rely on this resource.

But there are untapped opportunities beyond the temperate zone. **Alaska's boreal forests and peatlands are also dense carbon sinks**. Globally, boreal regions represent about one-fifth of existing carbon storage, exceeding that of temperate forests. **Boreal peatlands are particularly carbon rich**, making up about 25% to 30% of the globe's boreal forest biomes, and storing nearly two-thirds of the carbon in boreal regions. Carbon credit projects have already been established in the boreal region of Alaska.

KEY OPPORTUNITIES AND NECESSARY SUPPORTS

Alaska is rich in opportunities to leverage forest and peatland resources to benefit the climate and Alaska's economies. Policy leadership can accelerate the opportunities for landowners and climate entrepreneurs.

- ✓ The **continued development of carbon credit projects** by private landowners, particularly Alaska Native Corporations, can provide multi-faceted benefits. These projects allow traditional land uses by Indigenous people and other users; secure long-term climate benefits; and provide beneficial economic impacts to ANCs, shareholders, and associated businesses. Though the percentage of Alaska land in private ownership is very small, the scale of Alaska’s landscapes mean this is still a significant area of land.

Alaska Native Corporations: Carbon Credit Leaders

Alaska Native Corporations have been among those pioneering carbon credit projects in Alaska. Sealaska (the regional Alaska Native Corporation for Southeast Alaska), Huna Totem Corporation (the village corporation for Hoonah), Chugach Alaska Corporation (the regional corporation for Prince William Sound and the eastern Kenai Peninsula), and others have designated portions of their lands for long-term protection.

These corporations are able to sell carbon credits on the largest carbon market in the US, the California Cap-and-Trade Program, generating revenues and ensuring long-term protection of their lands.

- ✓ **Wildfire suppression in Alaska’s boreal environments** may have **the potential for carbon and greenhouse gas benefits** at a relatively low cost per ton of avoided carbon: less than \$12 per ton of CO₂, versus \$250 to \$600/ton for direct air capture² or afforestation and reforestation at \$15-\$50/ton.³ Management of boreal lands to control wildfire may be a tool for storing carbon that would otherwise be lost to fire, while also safeguarding communities and providing regional economic and employment benefits.
 - ✓ Alaska has previous examples of fire breaks that have been successfully implemented near populated areas, where they can **slow or limit the spread of fire and allow for improved firefighter access** during fire response.
 - ✓ Wildfire interventions can capitalize on natural fire breaks such as large lakes and cliffs, as well as deciduous forests. **Creating fire break linkages** between these kind of natural features, and between can limit the spread of fire across the carbon-dense boreal zone.
 - ✓ The scale and remoteness of much of Alaska’s landscape limits the practical application of fire suppression across much of the state. However, **increased**

² World Resources Institute, 2021. [Direct Air Capture: Resource Considerations and Costs for Carbon Removal](#).

³ National Academies of Sciences, Engineering, and Medicine 2019. [Negative Emissions Technologies and Reliable Sequestration: A Research Agenda](#). Washington, DC: The National Academies Press.

financial support for firefighting around populated areas, with a focus on areas with concentrated carbon resources, merits additional consideration.

- ✓ **Silviculture** is defined as the “art and science of controlling the establishment, growth, composition, health and quality of forests and woodlands” on a sustainable basis.⁴ Opportunities **to boost carbon and greenhouse gas storage potential exist** in Alaska, primarily in temperate rainforest regions that have been previously logged.
- ✓ It will be critical to develop pathways that allow for the **management of carbon and greenhouse gas resources on public lands**. In Alaska, where more than 9 out of 10 acres are publicly held, policies for public lands will be essential for maximizing the carbon benefits of our lands.
 - ✓ The State of Alaska is evaluating the potential to **generate carbon credit revenues from some state-owned lands**. Interest is driven in part by the state’s need for new revenues. This development would make **all Alaskans beneficiaries of a new type of “resource development”** in Alaska.
 - ✓ Federal lands in Alaska store significant carbon and greenhouse gas. **Management and policy choices that safeguard or revitalize intact ecosystems on these lands offer multiple benefits**. For example, intact ecosystems support healthy fish habitat, subsistence traditions, and recreation and tourism opportunities. Conservation of public lands and their stored carbon is a simple yet powerful national climate solution.

Food for Thought: Irrecoverable Carbon

The carbon and other greenhouse gases already sequestered through natural cycles in Alaska’s forests, peatlands, and oceans are part of the background functioning of the world’s natural climate cycles. Global efforts to control global temperature rely on the continued functioning of these natural systems. Between now and 2050, existing ocean and terrestrial sinks are anticipated to draw down 50% of annual emissions globally.

Carbon and greenhouse gas lost through the degradation of slow-developing natural systems – such as Alaska’s old-growth forests or boreal peatlands – is understood to be “irrecoverable” on the timescales needed to prevent catastrophic temperature increases. The continued functioning of natural systems is a critical ingredient in the effort to limit the severity of climate change over time.

⁴ [U.S. Forest Service](#). Retrieved October 15, 2021.

Blue Carbon: Stabilizing Climate with Seaweed

Efforts are underway globally to understand the potential **role of kelp and seaweed to mitigate climate change**. Potential uses include replacement of carbon-intensive terrestrial food products with seaweed and kelp, inclusion of seaweed in cattle diets to reduce methane production, and use of seaweed for biofuels and bioplastics. Researchers and commercial interests are also investigating the **potential of seaweed and kelp to capture and store carbon in the marine environment**.



Alaska has more than 46,000 miles of tidal shoreline, nearly half that of the entire US. The state is also home to thousands of commercial seafood harvesters, maritime tradespeople, and shoreside seafood processing infrastructure. **Efforts to investigate and quantify the seaweed carbon potential in Alaska are already beginning** in the state, but much more work is needed.

KEY OPPORTUNITIES AND NECESSARY SUPPORTS

- ✓ Alaska may see **significant future potential in climate responses built on the backbone of seaweed mariculture**. These may include carbon credits or other important uses (such as bioplastics to offset the use of petroleum-based products). If Alaska can establish leadership in climate-responsive mariculture at this critical stage of development, it could anchor investment activity in the state for years to come.
- ✓ Efforts to quantify the carbon sequestration potential of seaweed are in process in locations around the world. To be part of future programs that incorporate seaweed as a blue carbon tool, **Alaska needs baseline research establishing the carbon potential of seaweed** grown or naturally occurring in coastal Alaska. The establishment of baseline data by the University of Alaska or other research bodies could lay the foundation for future programs, regionally or across the state. Absent this baseline assessment, these opportunities cannot move forward.
- ✓ Blue carbon opportunities can be distributed around Alaska's coastline, providing local **employment and economic drivers for rural and Indigenous communities**, as well as Alaska's larger population hubs. Investment by tribes, Alaska Native Corporations, the State of Alaska, and regional non-governmental organizations, as well as private industry, can drive benefit across the coastal regions of Alaska.

Nature-Based Infrastructure Solutions

As the United States prioritizes infrastructure investments, it is important to identify opportunities to integrate natural systems into high-functioning infrastructure. Projects in the built environment can provide multiple benefits, yielding results for climate mitigation and adaptation in addition to primary project objectives.

- ✓ Improvements to aging infrastructure can include climate considerations and benefits. Examples of approaches that been implemented in Alaska follow:
 - Some recent development projects in Anchorage have “daylighted” creeks that were forced into underground culvert systems decades ago. These projects also **reestablished trees and other urban vegetation**. In addition to carbon benefits, these projects can improve fish passage, provide cooler temperatures and advantageous habitat for spawning and juvenile salmon, improve absorption of stormwater runoff, improve air quality, and make a more livable city for people.
 - In areas of Alaska where use of all-terrain vehicles has degraded wetlands, the construction of hardened trail surfaces has been shown to support the **return of wetland vegetation and characteristics**, while also providing benefits for salmon and other aquatic creatures.
- ✓ Infrastructure projects can be **championed and owned by a broad range of actors** in Alaska, including tribes, municipalities, state and federal agencies, and private business.

In addition to direct funding, financing for this type of infrastructure is increasingly available. Globally, green bond issuance surpassed USD\$1 trillion in 2020. Issuance of green bonds in 2021 alone was expected to approach USD\$500 billion. “Environmental impact bonds” (EIBs) are also gaining traction as a new tool for nature-supported infrastructure investments.

Fossil Fuels: Another Piece of the Puzzle

While natural climate solutions are a powerful tool for combatting climate change, scientists agree it will be difficult to achieve global climate goals without shifting away from fossil fuels. As an oil-producing state, this shift will not be painless for Alaska. Natural climate solutions hold potential to provide jobs and economic stability as oil’s role declines in the state.

Identification of Resources

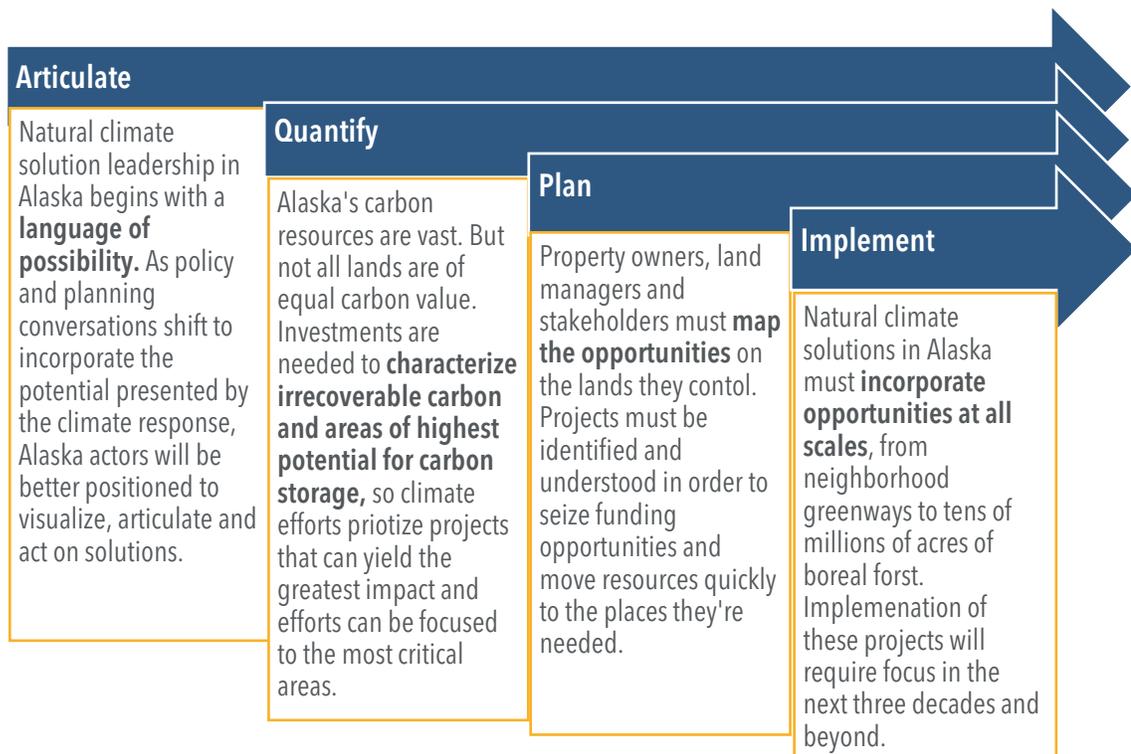
To realize Alaska's rich nature-based climate opportunities, we need to know what exists, and where.

- ✓ **Inventory carbon resources across Alaska's diverse landscapes**, to identify high-value carbon and greenhouse gas resources. This critical step helps prioritize land uses and accelerates private and public sector investments in climate mitigation.

Natural Climate Solutions in Alaska: A Pathway

Policy Leadership and Investment for the Future

There are several important next steps that will help Alaska harness the benefits of natural climate solutions. These include a shift in perception as we reorient and **articulate** our understanding of climate change to include not only threats but opportunities; action to **quantify** Alaska’s carbon resources; identification of opportunities at various scales (private, municipal, and beyond) and **planning** so that projects stand ready for funding opportunities; and **implementation** of projects across the state.



Alaska stands on fertile ground for implementation of natural climate solutions. Sophisticated actors in the state - including Alaska Native corporations, major corporate entities, entrepreneurs, and non-governmental organizations - are already identifying pathways for their own investments and interests. A new policy framework is emerging in proposed and recently passed federal legislation. While details remain unclear, the imperative for action is present, and

the tools to accelerate implementation of natural climate solutions are being created. Alaska landowners and stakeholders will capture the most benefit from these future investments if they are prepared to act. Nature-based solutions have potential to be win-win for Alaska, providing economic benefits while strengthening Alaska's ecosystems and boosting community resilience.

Further Reading

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