

# Assessing Climate Change Impacts on Forested Ecosystems of Alaska

This assessment will provide an overview of current and future climate change impacts on all forested regions of Alaska. Specific objectives are to:

1. Review and synthesize existing knowledge.
2. Provide a baseline and scenarios of change.
3. Identify data gaps and uncertainties.

# Primary Report Sections

- A. Introduction to Climate Change
- B. History of Alaska's Forests
- C. Overview of Key Stakeholders
- D. Overview of Forested Ecosystems
- E. Ecosystems in Flux
- F. Impacts and Feedbacks within Human and Ecological Systems
- G. Input Data Sets for Construction of Future Scenarios
- H. Climate Projections and Assessment Tools

## **A. Introduction to Climate Change**

1. Overview of IPCC 4<sup>th</sup> Assessment
2. Summary of High latitude impacts
3. Social justice issues

## **B. History of Alaska's Forests**

1. Paleohistory
2. Native Alaskan populations and their land management activities
3. 20<sup>th</sup> century timber harvest
4. 21<sup>st</sup> century uses, management, and forest related industries

## **C. Overview of Key Stakeholders**

1. Landowners
2. Local populations
3. Tribal and local governments
4. Community and non-governmental groups
5. Forest products industry
6. Tourism industry
7. Commercial salmon fisheries industry
8. Research institutions

## D. Overview of Forested Ecosystems

### 1. Biophysical components

- a. key species (trees, understory, megafauna, avian, insects, microbial)
- b. geological substrate
- c. permafrost
- d. freshwater hydrology
- e. disturbance regimes (fires, insects and disease, floodplain dynamics)
- f. climate
- g. biogeochemistry
- h. carbon storage/ sequestration

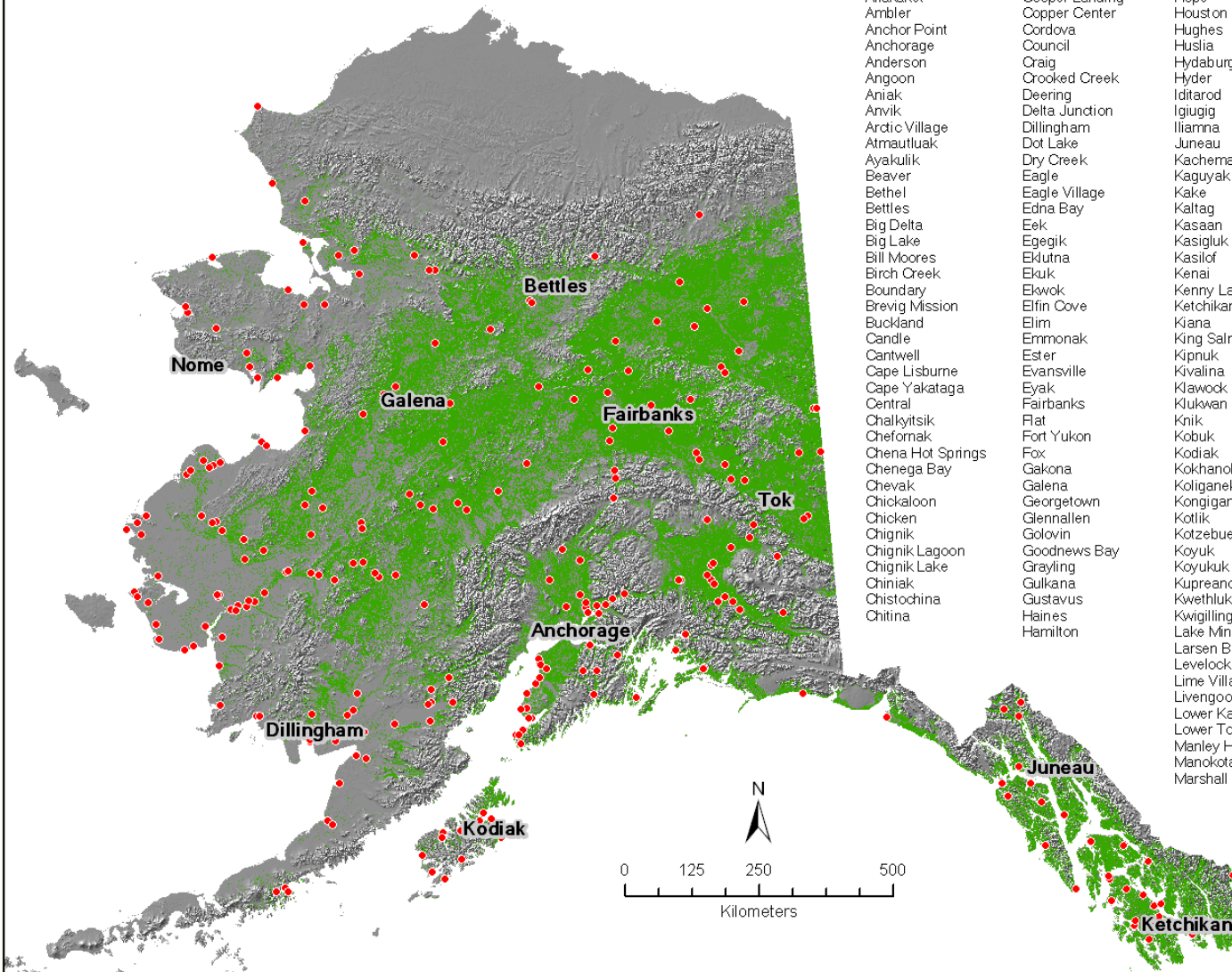
### 2. Ecosystem Services

- a. Provisioning
  - 1. Market
  - 2. Non market
  - 3. Valuation, incommensurability, and Trade-Offs
- b. Regulating (clean air, carbon sequestration, water filtration, climate regulation)
- c. Cultural
- d. Supporting (nutrient cycling, soil formation, primary production)

## **E. Ecosystems in Flux**

1. Thawing permafrost
2. Glacial thaw
3. Sea level changes
4. Changing hydrological cycles and water availability
5. Changes to the fire regime and post-fire succession
6. Carbon budgets
7. Forest insect outbreaks and forest fungal diseases
8. Energy budgets and climate system feedbacks
9. Changing phenology
10. Encroachment by non-native species
11. Biome shifts
12. Forest growth and yield
13. Terrestrial and aquatic wildlife

# Forested Communities of Alaska



- |                   |                    |                    |                   |                 |
|-------------------|--------------------|--------------------|-------------------|-----------------|
| Afognak           | Chuathbaluk        | Healy              | Marys Igloo       | Red Devil       |
| Akhiok            | Chuloonawick       | Healy Lake         | McCarthy          | Ruby            |
| Akiachak          | Circle             | Hollis             | McGrath           | Russian Mission |
| Akiak             | Circle Hot Springs | Holy Cross         | McKinley Park     | Saint Mary's    |
| Alakanuk          | Clam Gulch         | Homer              | Medfra            | Saint Michael   |
| Alatna            | Clark's Point      | Hoonah             | Mendeltna         | Salamatof       |
| Aleknagik         | Coffman Cove       | Hooper Bay         | Mentasta Lake     | Salcha          |
| Allakaket         | Cooper Landing     | Hope               | Mettlakatla       | Saxman          |
| Ambler            | Copper Center      | Houston            | Meyers Chuck      | Scammon Bay     |
| Anchor Point      | Cordova            | Hughes             | Minto             | Selawik         |
| Anchorage         | Council            | Huslia             | Moose Pass        | Seldovia        |
| Anderson          | Craig              | Hydaburg           | Mountain Village  | Seward          |
| Angoon            | Crooked Creek      | Hyder              | Nabesna           | Shageluk        |
| Aniak             | Deering            | Iditarod           | Naknek            | Shishmaref      |
| Anvik             | Delta Junction     | Igiugig            | Nanwalek          | Shungnak        |
| Arctic Village    | Dillingham         | Iliamna            | Napakiaik         | Sitka           |
| Atmautluak        | Dot Lake           | Juneau             | Napamiute         | Skagway         |
| Ayakulik          | Dry Creek          | Kachemak           | Napaskiak         | Skwentna        |
| Beaver            | Eagle              | Kaguyak            | Neichina          | Slana           |
| Bethel            | Eagle Village      | Kake               | Nenana            | Sleetmute       |
| Bettles           | Edna Bay           | Kaltag             | New Stuyahok      | Soldotna        |
| Big Delta         | Eek                | Kasaan             | Newhalen          | Solomon         |
| Big Lake          | Egegik             | Kasigluk           | Newtok            | South Naknek    |
| Bill Moores       | Eklutna            | Kasilof            | Nightmute         | Stebbins        |
| Birch Creek       | Eluk               | Kenai              | Nikiski           | Stevens Village |
| Boundary          | Elwok              | Kenny Lake         | Nikolaevsk        | Stony River     |
| Brevig Mission    | Elfin Cove         | Ketchikan          | Nikolai           | Susitna         |
| Buckland          | Elim               | Kiana              | Ninilchik         | Sutton          |
| Candle            | Emmonak            | King Salmon        | Noatak            | Takotna         |
| Cantwell          | Ester              | Kipnuk             | Nome              | Talkeetna       |
| Cape Lisburne     | Evansville         | Kivalina           | Nondalton         | Tanacross       |
| Cape Yakataga     | Eyak               | Klawock            | Noorvik           | Tanana          |
| Central           | Fairbanks          | Klukwan            | North Pole        | Tatitlek        |
| Chalkyitsik       | Flat               | Knik               | Northway          | Tazlina         |
| Chefornak         | Fort Yukon         | Kobuk              | Northway Junction | Telida          |
| Chena Hot Springs | Fox                | Kodiak             | Nulato            | Teller          |
| Chenega Bay       | Gakona             | Kokhanok           | Nunapitчук        | Tenakee Springs |
| Chevak            | Galena             | Koliganek          | Ohogamut          | Tetlin          |
| Chickaloon        | Georgetown         | Kongiganak         | Old Harbor        | Thome Bay       |
| Chicken           | Glennallen         | Kotlik             | Ophir             | Togiak          |
| Chignik           | Golovin            | Kotzebue           | Oscarville        | Tok             |
| Chignik Lagoon    | Goodnews Bay       | Koyuk              | Ouzinkie          | Toksook Bay     |
| Chignik Lake      | Grayling           | Koyukuk            | Paimiut           | Tonsina         |
| Chiniak           | Gulkana            | Kupreanof          | Palmer            | Tululsak        |
| Chistochina       | Gustavus           | Kwethluk           | Paxson            | Tuntutuliak     |
| Chitina           | Haines             | Kwigillingok       | Pedro Bay         | Tununak         |
|                   | Hamilton           | Lake Minchumina    | Pelican           | Twin Hills      |
|                   |                    | Larsen Bay         | Petersburg        | Tyonek          |
|                   |                    | Levelock           | Petersville       | Uganik          |
|                   |                    | Lime Village       | Pilot Point       | Ugashik         |
|                   |                    | Livengood          | Pilot Station     | Unalakleet      |
|                   |                    | Lower Kalskag      | Pitkas Point      | Upper Kalskag   |
|                   |                    | Lower Tonsina      | Point Baker       | Uyak            |
|                   |                    | Manley Hot Springs | Poorman           | Valdez          |
|                   |                    | Manokotak          | Port Alexander    | Venette         |
|                   |                    | Marshall           | Port Alsworth     | Vasilla         |
|                   |                    |                    | Port Graham       | Whale Pass      |
|                   |                    |                    | Port Lions        | White Mountain  |
|                   |                    |                    | Port Protection   | Whittier        |
|                   |                    |                    | Portage Creek     | Willow          |
|                   |                    |                    | Portlock          | Wiseman         |
|                   |                    |                    | Quinhagak         | Womens Bay      |
|                   |                    |                    | Rampart           | Woody Island    |
|                   |                    |                    |                   | Wrangell        |
|                   |                    |                    |                   | Yakutat         |

## **F. Impacts and feedbacks within human and ecological systems**

### **1. Climate change impacts on human systems**

- a. Timing of open hunting seasons with favorable hunting weather & conditions
- b. Impacts on subsistence & personal use salmon harvest in streams & rivers
- c. Human health conditions from forest disturbances
- d. Cultural loss for rural hunters and elders
- f. Food security
- e. Displacement of people and/or whole communities
- f. Infrastructure deterioration

### **2. Compounding human impacts on ecological systems**

- a. Land-use conversions
- b. Potential small and large scale hydro-electric projects
- c. Roads in previously unroaded areas
- d. Ecosystem – Human Feedbacks

### **3. Opportunities for Adaption and Mitigation**

- a. Management Options
- b. Forms of Change
- c. Emerging Opportunities/Challenges/Outcomes

## **G. Input data sets for construction of Future Scenarios**

1. Disturbance history
2. Vegetation change
3. Climate

## **H. Climate Projections and Assessment Tools**

1. Warming projections
2. Precipitation projections
3. Derived projections
  - a. lengthening growing season (decreasing frozen/snow pack season)
  - b. hotter growing season (growing degree days)
  - c. less extreme cold in winter (removing limits on species kept out by cold)
4. Multi-model projections (e.g. fire dynamics, permafrost change)
5. Assessment of impacts on communities and forest stakeholders
6. Assessment of new opportunities because of climate change