

6. HUMAN LAND USE AND MANAGEMENT

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6.1 Introduction

Human land uses in Alaska change ecosystems which are currently or soon could be affected by climate change. At the same time human uses of the land are affected by climate variation. In Alaska, humans use land at all scales and levels of intensity. Alaska is one of the world's notable tourist destinations; tourism is the 3rd largest sector in generating economic activity in Alaska according to some measures. The subsistence way of life, as it is practiced in some parts of Alaska, is rare in the world. Certain elements of subsistence are legal rights. The practice of subsistence is important to the world's heritage of native cultures. Alaska forest products are locally economically important and fill certain unique world needs. Forest management in its broad sense intimately affects other resources, such as fish and wildlife, through activities such as fire management, access roads, timber cutting, and other activities. Alaska supports a slowly expanding agriculture, including some unique subarctic products, and Alaska is one of the few places in the world where agricultural potential would increase under global warming.

Agricultural resources and practices:

About 30,000 acres of land in Alaska are currently in agricultural production, excluding grazing lands. Of that, 10% is located on the Kenai Peninsula, 35% in the Matanuska Valley, and 55% in the Tanana Valley. Principal crops in descending order of acres planted are: grass hay, barley, oats, potatoes, lettuce, carrots, cabbage, and other vegetables. All of these crops are grown in the Matanuska and Tanana Valleys, but grass hay and potatoes are the only commercial crops grown on the Kenai Peninsula. Yields of the main crops are: grass hay = 1.2 tons per acre, barley = 50 bu. per acre, oats = 54 bu. per acre, and potatoes = 21.5 tons per acre.

In addition to farmed land there are about 185,000 acres of pasture for cattle and horses. Reindeer grazing uses over 12,000,000 acres of land for 30,000 reindeer. Most of the herds are located on the Seward Peninsula with some located on Nunivik Island and the Aleutian Islands. There are a total of 10,500 head of cattle in the state, of which 700 are dairy cows and the rest beef animals. There are 1200 sheep, 2000 hogs, and about 4000 chickens. The

numbers of beef and hogs have tended to increase over the last few years while dairy cattle and sheep numbers have decreased. Reindeer numbers have increased in the last few years, but are far below the maximum numbers of the past.

The amount of land under cultivation in Alaska has increased steadily the over the last three decades with the exception of the early 1980's. During the early 1980's the state government encouraged clearing and planting of new lands in the Tanana and Matanuska valleys. This resulted in a short boom period for agriculture followed by a sharp decline. Aside from the short boom and bust period of the early 80's, there has been a steady increase in agricultural production, but at a slower pace compared to the increase in population.

The Kenai Peninsula and the Matanuska Valley are located south of the Alaska Range mountains. In that area the climate is tempered by the proximity to the ocean. As a result, summers are cool and winters are not as cold as in interior Alaska. The Tanana Valley is located in the interior of the state and has a continental climate, with warm summers and very cold winters. Growing seasons are shorter in Interior Alaska, but a greater number of heat units are experienced than in the coastal regions. Table 6.1 shows some of these different climatic characteristics of the different agricultural regions of Alaska.

Table 6.1. Climatological data for principal agricultural locations in Alaska (20 year averages).

| Location | Precipitation in | | Growing Degree Days (40°F) | Frost free days |
|-------------------------|------------------|--------|----------------------------|-----------------|
| | Total | Summer | | |
| Tanana Valley | | | | |
| Fairbanks | 12.22 | 7.59 | 2138 | 95 |
| Big Delta | 12.18 | 9.58 | 2001 | 101 |
| Clearwater | 15.98 | 10.20 | 1708 | 55 |
| Matanuska Valley | | | | |
| Palmer | 15.60 | 9.49 | 1938 | 124 |
| Kenai Peninsula | | | | |
| Kenai | 18.63 | 10.12 | 1520 | 122 |

Recreation and tourism:

Recreation and tourism may be affected both positively and negatively by anticipated climate change scenarios in Alaska. Recreation and tourism are important to the Alaska/Bering Sea Region because they are an important sector of the economy. Tourism and recreation rank fourth in overall importance to Alaska's economy behind oil and gas production, government services, and commercial fishing (Neil Fried, personal communication.) Scenic resources and abundant fish and wildlife attract visitors to Alaska from around the world, particularly from the rest of the United States. Alaska contains numerous spectacular mountains including the highest mountain in North America, over half the land area in the U.S. National Park System, over 90% of the land area designated as National Wildlife Refuges, 25 designated Wild and

Scenic rivers, most of the nation's mountain and tidewater glaciers, over half the nation's coastline, and an abundance of marine and terrestrial wildlife. We hypothesize that climate warming and changes in precipitation patterns would generally result in increased recreation and tourism, particularly if infrastructures are built and maintained. Some localized and periodic reductions to recreation and tourism could result from catastrophic events such as floods, earthquakes, or other major events.

In many ways potential climate change impacts to recreation and tourism are a social/cultural consideration that may cross over into several other assessment headings. Changes in recreation and tourism also relate closely to climate effects to infrastructure and the coastal zone. Transportation systems, such as highways, trails, railways, bridges, airports, ships, and ports, and buildings, such as hotels, lodges, and visitor centers, must be constructed and maintained for tourism and recreational activities to flourish. Coastal zones are very important because the majority of recreational and leisure activities occur in these areas. Increases in tourism and recreation are also largely a result of marketing regional opportunities and settings.

6.2 Past effects of climate change

The decades of the 1980's and 1990's have been the warmest on record worldwide (Jones and Briffa 1992). The major agricultural areas of Alaska are generally located in the same regions that have experienced the long-term warming trend described in Chapter 3 of this report. Despite some cool summers, cumulative growing degree days in both the Matanuska and Tanana Valleys have increased noticeably. A regression of growing degree days against years shows an average increase of 24 and 40 growing degree days per year, in the two regions respectively. The number of frost-free days (days above 0°C [32°F]) have increased at all locations except Big Delta. Total annual precipitation has also increased, although primarily during the winter. Some stations have experienced slight increases in summer precipitation, while others have had slight to moderate decreases.

A comparison of grain yields from variety trials conducted by Dr. F. Wooding (1978) at Fairbanks and near Delta Junction found that, in years of adequate moisture, maximum yields were obtained when more than 1,750 growing degree days accumulated. Below that, yields dropped substantially. Variations in number of frost-free days and summer precipitation did not coincide with variations in yields. However, Sharratt (1992) calculated that more moisture was transpired from crops and evaporated from soil than normally fell as precipitation in the summer at the same interior Alaska locations. He found that grain crops largely made up the summer moisture deficit by using stored soil water, and barley yields increased in response to supplemental irrigation.

The more recent findings indicate that summer rainfall in much of Interior Alaska is currently marginal at best, and additional heat units may cause water stress on barley and other small grains. Potato yields were reduced at Delta Junction in years with high heat units, even when summer rainfall was normal. Comparison of potato yields with and without irrigation at Palmer shows that potatoes at that location need irrigation to reach maximum yields. Water is evidently currently marginal or deficient during the summer at most agricultural sites in Alaska, and unless increased summer temperatures are accompanied by additional precipitation, yields of non-irrigated potatoes and small grains will decline.

The Alaska Division of Tourism in the Alaska Department of Commerce and Economic Development supports the Alaska Visitor Statistics Program (AVSP). The Alaska Visitor Arrivals reports contracted to the McDowell Group show marked increases in visitation to Alaska between 1987 and 1995. The total number of people arriving in Alaska by aircraft, vessel, or vehicle during the summer of 1987 (June through September) was 705,886; the total in the summer of 1995 (May through September) was 1,357,894, almost double in less than 10 years. About 70% of all arrivals each summer are non-residents. In recent years the greatest increases in visitation have occurred in May, June and September. Visitor arrivals have dropped during fall and winter, particularly fall. (See AVSP tables and reports.)

Within the last decade increases have occurred in all three major modes of arrival to Alaska, domestic aircraft, cruise ship, and highway vehicle. Arrivals by domestic aircraft increased 90% from 402,075 in 1987 to 763,554 in 1995. Arrivals by cruise ship increased 74% from 163,469 in 1987 to 285,093 in 1995. Arrivals by highway increased 148% from 73,451 in 1987 to 182,212 in 1995. Though the greatest percentage change was by vehicle over the Alaska Highway, the greatest increase in numbers was by aircraft (AVSP reports). Over 300 cruise ships dock in Juneau now, and over 100 cruise ships dock in Seward.

The most popular recreational activity in Alaska is sport fishing. Recently the number of non-resident fishing licenses surpassed the number of resident fishing licenses.

Visitation to Alaska is limited somewhat because of the state's remote location. Families generally cannot afford to visit Alaska except during the summer season when school is out. Many groups save for several years before making the expensive trip to Alaska. As national demographics change with an increasing percentage of retirees, visitation to Alaska during the "shoulder months" could increase because of the sheer pressures to access the region. Some service sectors are marketing Elderhostel programs in the "shoulder season". Numerous tour companies are opening for business earlier in the visitor season or remaining available all year. For example, tour boat companies out of Seward are staying available year round, and they are actively marketing the gray whale migration in March and April. Some cruise ship companies are sailing to Southeast Alaska as early as April and as late as October 1.

6.3 Future Changes

Agriculture

An extension of the regression line out to project growing degree days for the next decade illustrates what would happen if the current trend continues. By the year 2000 the average growing degree days for a year could exceed 2600 in Alaska's interior, and reach 2300 in the Matanuska Valley. An increase of heat units of this magnitude would certainly allow a greater window in time for planting and harvesting crops which are currently grown in these areas and would make it possible to raise crops which are now marginal because they normally fail to fully mature. However, supplemental irrigation would probably be required in most areas.

Recreation and tourism

Given the climate change scenarios described by Weller et al. (Chapter 2) and by John Walsh (personal communication), the existing trends over the last decade (showing an increase in visitation to Alaska during the summer "shoulder months") are likely to continue at an

accelerated rate. A longer snow free season and the expected warmer and drier spring seasons are likely to lead to increased tourism and recreational activities in the spring “shoulder season”, particularly in May. The increase in precipitation as rain and the potential for increased extreme weather events in fall are likely to retard increases in tourism and recreational activities in late September, October, and November. Some “shoulder season” increase in visitation during September may continue as observed in recent years. Increases in precipitation as snow at higher elevations may attract more early season winter enthusiasts such as skiers and snowmachiners, but long dark and cold days during the heart of winter will probably deter large increases in visitation to Alaska. Changes in summer tourism and recreational patterns are likely to be affected more by marketing and changes to infrastructure than to actual or perceived changes in climate. Some visitors may be attracted to cool, coastal Alaska as a respite from increasing hotter conditions outside of the region. Also, as the public learns that Alaska is warming faster than temperate and equatorial zones, the general perception of Alaska as an icebox may melt away.

The demand for more services during shoulder seasons will likely increase. Existing services will have to extend seasons or new businesses will need to develop to serve tourists during this time. The tourism industry will push for earlier openings of visitor centers and other destinations. Accommodating such requests and pressures during a period of declining operating budgets will strain public agencies. In some cases the expansion of the visitor season is limited by management decisions. In other words the climate and conditions may be conducive to visitation, but area land managers limit shoulder season activity because of fish and wildlife sensitivity or limited budgets.

Much of the tourism and recreational activities in south coastal Alaska are marine oriented. Rising oceans could result in completely new shorelines. Places that are currently dry uplands could become submerged or seasonally and diurnally affected by tides. With limited shallow-angle shores in south coastal Alaska, users may be forced to concentrate land-based activities on less suitable areas. Increases in precipitation and violent weather events, coupled with increased use levels may result in increased search and rescue responsibility for state and federal agencies. Floods such as recent 100-year events sustained in southcentral Alaska, could interrupt or prevent recreational activities and tourism until facilities are reconstructed. As an example, numerous roads, campgrounds, bridges, and trails were damaged or washed out by the September 1995 flood in southcentral Alaska.

Although glaciers are retreating in general, they will remain a major attraction in the foreseeable future. The current retreat of some of the most popular glaciers like Portage and Mendenhall Glaciers, however, may alter visitor travel patterns. Agencies and tourism businesses will need to respond to these changes and restructure their services or infrastructure. For example, Chugach National Forest now provides a concession-operated tour boat on Portage Lake to enable visitors to see Portage Glacier as it retreats out of view from the visitor center.

Another major attraction for visitors is wildlife. Although not fully understood, global change affects fish and wildlife populations. Warming of the oceans and ocean current shifts could affect fish and marine wildlife distributions and abundance. Similarly, substantial warming and impacts to upland vegetation patterns could alter terrestrial wildlife habitat. Replacement of open tundra and alpine vegetation with shrub or forest cover could reduce viewing opportunities of wildlife. These changes could affect visitor destinations

As a winter destination, Alaska will become more attractive with increased snowfall and warmer temperatures. Tourism providers will seek to market and develop more winter recreational opportunities such as skiing, snowmachining, dog mushing, guided backcountry skiing, and helicopter-skiing, especially during early and late winter. Increased conflicts between different user groups and between residents and visitors will likely occur.

Summary of Expected Changes

Agricultural sector: Longer, warmer growing season improves agriculture potential; irrigation may be required to obtain the potential benefit to crops of warmer conditions

Tourism sector:

- ◆ A longer summer tourist season, generating more revenue and activity but greater impacts to resources, would occur in Alaska.
- ◆ Local disruption to visitors would occur due to changing features (glacial retreat, large-scale forest death) and weather extremes (storms, smoke from forest fires, etc.).
- ◆ Milder winters and decreased options elsewhere in the world will have a positive effect on winter sports in Alaska.

6.4 Uncertainties

At this juncture we are uncertain how great the effect of climate change would be on recreation and tourism in the Alaska Region beyond the direct human effects from improved access, an enlarged and diversified service infrastructure, and marketing. If climate change proceeds as expected, the changes are likely to be positive in general to tourism and recreation. The climate changes are likely to support the expansion of the visitor “shoulder season” rather than drive it. We suspect that negative impacts to recreation and tourism would be short-term and localized. We do not know how climate change will affect infrastructure like roads, railways, ports, and structures upon which tourism and recreation depend.

6.5 Additional research and monitoring needed

- ◆ Develop an information database on new agricultural pest species (including control measures) that would likely thrive in a warmer Alaska climate.
- ◆ Identify new crops that would be suitable for production in a warmer Alaskan climate. Identify any special measures needed to adapt them to high latitude production or cultivation in Alaska conditions.
- ◆ Identify new visitor pattern and markets that would be possible as the result of warmer climates both in Alaska and at points of tourist origin.
- ◆ Develop reliable statistics on tourists, including points of origin, visitor interests, knowledge of Alaska attractions, visitor plans, repeat visit potential, modes of travel, and economic impact.

The Alaska Division of Tourism has recently experienced significant budget reductions. As a result, the Alaska Visitor Statistics Program has been all but eliminated in recent years. These surveys should not only be continued to monitor trends in tourism and recreation, but additional research questions need to be included that ascertain whether existing climatic conditions and expected changes in climate affect people's decisions to visit Alaska.

It would be useful also for the state of Alaska to determine how well prospective visitors understand Alaska's general weather patterns and the effects of climate change on Alaska's environment. In other words, a social research tool could also be used as a public education tool.

Additional climate stations should and could be established around the state where people tend to visit. Also, ecosystems in key locations should be monitored for vegetative and habitat changes. A cross-section of ecosystems in the state from Southeast Alaska to Northwest Alaska should be monitored. Representative locations would include the southern part of the Alaska Panhandle, the northern part of the panhandle such as the Glacier Bay Ecosystem Initiative area, the Prince William Sound-Copper River Ecosystem Initiative area, Denali National Park, the Fairbanks/Poker Flats Research Area, and Noatak National Preserve in northwest Alaska. Most of these locations have ongoing or historic ecosystem monitoring programs.

6.6 Mitigation and Adaptation Measures

- ◆ Develop irrigation facilities in Alaska agricultural regions. Anticipate and resolve issues in water resource law
- ◆ Form partnerships with agricultural producers, marketers, and customers who currently produce and consume crops that could be produced in a warmer Alaskan climate. Develop and share expertise to handle these crops.

The primary means to mitigate potential adverse affects of climate change to the tourism and recreation industry in Alaska is through public education and proper design and location of transportation and visitor accommodations. The visiting public needs to become aware of the potential changes in Alaska's environment as a result of expected climate change. Roads and structures used by visitors should be located off sites with discontinuous permafrost and away from flood plains and wetlands. Infrastructure that is adversely affected by climate change factors should be rapidly repaired or replaced, or Alaska will acquire a reputation as a poorly maintained state with deteriorating, unsafe facilities.

6.7 Bibliography

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