RESOURCE BRIEF 1

# DENALI'S DISAPPEARING LAKES

## SHALLOW LAKE MONITORING IN THE CENTRAL ALASKA NETWORK: DENALI

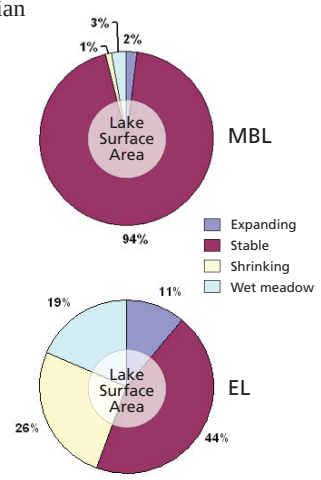
ARE SOME OF DENALI'S LAKES DISAPPEARING? AQUATIC ECOLOGIST, AMY LARSEN, EXPLORED THIS QUESTION FOR THE CENTRAL ALASKA NETWORK INVENTORY & MONITORING PROGRAM.

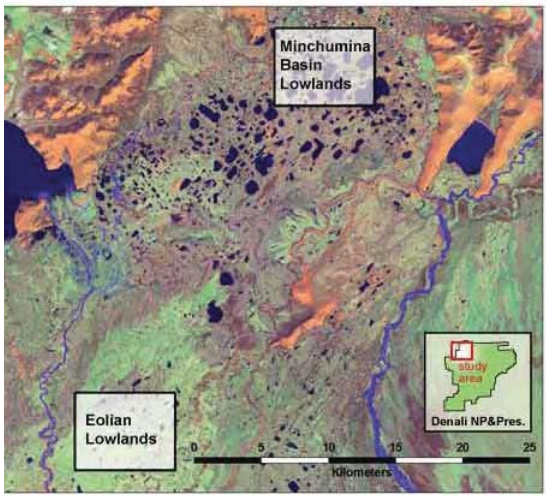
In a recent study, high altitude aerial photographs taken in 1980 were compared with landsat TM satellite images from 2007 for two index sites in the northwest corner of Denali National Park & Preserve. Lakes in the Minchumina basin lowlands (MBL) and the Eolian lowlands (EL) were analyzed to track changes in their size, abundance, and distribution. When the Minchumina basin lowland images from 1980 & 2007 were compared, there appeared to be little change. The story was quite different for the Eolian lowlands.

Change in the Eolian lowlands was dramatic. In 27 years, a full 26% of the lakes had shrunk markedly. Another 19% were no longer lakes, but had turned into wet meadows. What had happened?

Changes in lake surface area in Denali are likely influenced by climate, soil composition, and the depth and prevalence of permafrost. The soils underlying the lakes of the Minchumina basin lowlands are largely made up of a thick, spongy layer of peat (as deep as 22") underlain with frozen silt loam. The Eolian lowlands consist of a very different suite of soils, largely composed of sand with patchy areas of permafrost. This sandy ground is likely the key factor contributing to the rapid change witnessed in the Eolian lowlands.

Particles of silt have the capacity to hold water at fairly high levels. Since the Minchumina basin lowlands are entirely contained by soil underlain with dense, frozen silt, the lakes in this region have seen little change during the past two decades. Not so with the Eolian lowlands and the reason is sand. The sandy soil of the Eolian lowlands is very porous. Quite simply, many of the lakes in this area are leaky, losing their water to the ground below.




*Satellite overview of the study site (near left).*

*Graphs (far left) show the status of shallow lakes surveyed in two regions of Denali N.P. & Pres. High altitude aerial photographs taken in 1980 were compared with 2007 landsat TM images.*

*While very little change has occurred to the lakes in the Minchumina basin lowlands, lakes in the Eolian lowlands have experienced a 26% decline in surface area and 19% have transformed from lakes to wet meadows.*

### What do we want to understand about shallow lakes?

1. Decadal-scale trends in the size, distribution, and number of shallow lakes and ponds.
2. Decadal-scale trends in the water quality (chemistry) of shallow lakes and ponds.
3. Decadal-scale trends in the structure and composition of vegetation in shallow lake and pond margins.
4. Detect decadal-scale trends in species richness and abundance of macro-invertebrate taxa (insects) in shallow lake and pond ecosystems.

## Why Are Shallow Lake And Pond Ecosystems Important?

### They are cradles of biological diversity... upon which countless species depend for survival.

There are well over 25,000 shallow lakes and ponds distributed across the Central Alaska Network's landscape. Wetlands, of which shallow lakes are one type, are among the world's most productive environments and provide a wide variety of ecological benefits. They are cradles of biological diversity, providing the water and primary productivity upon which countless species of plants and animals depend for survival. Wetlands are the kidneys of the landscape: they store, release and purify water via retention of fluid, nutrients and other compounds. Because they are so productive and support diverse groups of plants and animals, shallow lakes are important to the people who hunt and trap within the boundaries of the parks. Empirical evidence collected over the past five years in Alaska, Russia and Canada indicates that lakes in interior Alaska and throughout the boreal forest are disappearing, likely due to global climate change. Research shows a 54% decline in the number of lakes in Wrangell-St. Elias National Park and Preserve and a 5% decline in Denali National Park and Preserve. Monitoring surface area of lakes and the water quality within is essential to understanding how to effectively manage the health of the parks.

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# How Are We Monitoring Shallow Lakes?


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**PARKS BEING MONITORED:**


DENA: Denali National Park & Preserve

WRST: Wrangell-St. Elias National Park & Preserve

YUCH: Yukon-Charley Rivers National Preserve

Our basic approach uses remote imagery to track the number, size, and distribution of shallow lakes and ponds on a landscape scale. In addition, we conduct on-the-ground field sampling at a subset of lakes to track water quality, macroinvertebrate, and plant communities. This network-wide sampling scheme will allow us detect the following:

1) Changes in the quantity of water by measuring size, number, and distribution.

2) Changes in the quality of water by measuring water chemistry and biotic indicators.

The ponds and lakes being studied were selected as an unequal probability sample based on distance from navigable water. The design was drawn in a way that assured that chosen sites were spread out across all navigable waters. Another words, site choices were kept relatively unbiased by using statistical analysis, while ensuring that scientists could reliably and affordably travel to these areas. Some "index" ponds and lakes will be sampled every summer, the rest will be on an 8 year rotation.

CENTRAL ALASKA NETWORK

# USING SCIENCE TO PROTECT OUR PARKS

**THE CENTRAL ALASKA NETWORK (CAKN) IS ONE OF 32 NATIONAL PARK SERVICE INVENTORY AND MONITORING NETWORKS. EACH NETWORK EXISTS AS PART OF A NATIONAL EFFORT TO BETTER UNDERSTAND AND MANAGE PARK LANDS USING SCIENCE-BASED INFORMATION.**

In order to focus this effort, 270 national park units with significant natural resources were grouped into 32 regional networks.

The Central Alaska Network is made up of 3 parks: Denali National Park and Preserve, Wrangell-St. Elias National Park and Preserve, and Yukon-Charley Rivers National Preserve. Together, these 3 parks contain over 21.7 million acres and makeup 25% of all the land in the National Park Service. They represent a great diversity of climate and landform, from temperate coastal rainforests to glaciated mountain ranges. What they share in common are their largely wild and unaltered landscapes.

In order to track the condition of our parks, Central Alaska Network scientists have chosen 37 key indicators, or "vital signs," to represent the overall health of the network. Each vital sign falls into one of 4 categories: animal life, physical environment, human use, or plant life. Underlying these 4 vital sign categories is a focus on habitat change.

**CAKN VITAL SIGNS:**

**Animals**

- Arctic Ground Squirrel
- Bald Eagles
- Brown Bears
- Caribou
- Freshwater Fish
- Golden Eagles
- Macroinvertebrates
- Moose
- Passerines
- Peregrine Falcon
- Ptarmigan
- Sheep
- Small Mammals
- Snowshoe Hare
- Wolves

**Environment**

- Air Quality
- Climate
- Fire
- Flooding
- Glaciers
- Land Cover
- Permafrost
- Rivers & Streams
- Shallow Lakes
- Snow Pack
- Soundscape
- Tectonics & Volcanoes

**Humans**

- Human Population
- Human Presence
- Natural Resource Consumption
- Trails

**Plants**

- Exotic Species
- Forage Quantity/Quality
- Insect Damage
- Plant Phenology
- Subarctic Steppe
- Vegetation Structure/Composition


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