

Refuge Notebook

Volume 5 • 2003

This volume was compiled in 2016 by Jennifer Peura from the Kenai National Wildlife Refuge's archive of *Refuge Notebook* articles. Formatting has been improved, some hyperlinks (URI's) have been updated, and minor edits were made, but the articles have mostly been unchanged.

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Refuge System centennial a chance to celebrate wildlife conservation in America

by Doug Newbould

This year marks the 100th birthday of the first national wildlife refuge. On March 14, 1903, President Theodore Roosevelt established Pelican Island, a three-acre island off the Atlantic coast of Florida, as a Federal Bird Reservation to protect pelicans and their habitat.

In 1942, Congress redesignated Pelican Island and other federal wildlife reservations as national wildlife refuges. From such humble beginnings, the U.S. Fish and Wildlife Service now manages a system of public lands consisting of 540 National Wildlife Refuges on 94 million acres. This system of strategically located habitats is represented in all 50 States and U.S. territories.

Alaska's 16 refuges encompass about 77 million acres, or 82% of all the lands in the National Wildlife Refuge System. About 23% of Alaska's refuge lands, or 18 million acres, are designated wilderness. Most Alaskans and perhaps most Americans are aware of refuges such as Pelican Island, Arctic and maybe even the Kenai national wildlife refuges. But how many have heard of refuges like Innoko and Tetlin in Alaska, Bosque del Apache and Sevilleta in New Mexico, or Cape May and Forsythe refuges in New Jersey?

Don't feel bad if you haven't heard of these places. Up until a couple of months ago, I was not aware of many of these special places either. Perhaps this lack of awareness is why some have referred to the National Wildlife Refuge System as "America's best kept secret."

But perhaps this year, the national celebration of the National Wildlife Refuge System centennial will help America discover one of its most important natural treasures.

My personal awareness and understanding of the U.S. Fish and Wildlife Service and the National Wildlife Refuge System expanded greatly last October, when I attended the National Wildlife Refuge Management Academy in Shepherdstown, W.V. I was one of four Alaskans and one of 28 Americans to spend three weeks in the "Mountain State" of West Virginia. I didn't have the heart to tell the locals we have glacial moraines bigger than some of their mountains.

Of course, that part of the country has its own beauty, and I was fortunate to be back there during the peak of autumn colors.

The first week, we attended lectures and participated in group exercises designed to expand our knowledge of the refuge system, its history, its mission and purposes, its incredible diversity and, most important to me, its wonderful workforce. I learned that the first year I came to work for the Fish and Wildlife Service and the Kenai Refuge was the year the National Wildlife Refuge System Improvement Act passed into law, 1997. The Refuge System now had its own "organic legislation," a set of marching orders, if you will.

Refuges now have a mission statement: "The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people."

Refuges offer outstanding wildlife-dependent recreational opportunities, including "the big six"—fishing, hunting, wildlife observation and photography, environmental education and interpretation. If refuges are America's best-kept secret, then more than 35 million visitors each year are keeping their mouths shut.

At the end of the first week, each of us was asked to make a 10-minute presentation about our home units. It was a phenomenal day for me as I witnessed 27 peers share their passion for conservation—each telling a story about the special place they work. I learned about the little refuge on the coast of Maine, named for Rachel Carson, the woman who wrote "Silent Spring." I learned about the Lower Rio Grande Valley NWR, where several neighboring communities compete with each other to capture some of the several hundred thousand birders that "flock" to the area every year. I learned about a refuge in Minnesota, named for the wild rice that grows there: Rice Lake NWR, a place where wolves still run free. And I learned about the Yukon Delta NWR, over 19 million acres of western Alaska wild lands that still fit the definition of "untrammelled."

During our second week at the academy, we traveled to four very special “urban refuges,” and it was quite an experience for a country boy like me. First we crossed the Delaware River on a ferry to visit the Cape May NWR at the southern tip of New Jersey. There we saw some of the remnants of the millions of horseshoe crabs that beach themselves there each year.

From Cape May we traveled to the Edwin B. Forsythe Refuge at Brigantine, where you can look across the tidal marsh to the high-rise casinos of Atlantic City. I was surprised to see so many snow geese there, feeding on the marsh grasses.

Next, we continued north to Philadelphia to visit another unique refuge, the John Heinz NWR at Tinicum. This is truly an urban refuge that hosts tens of thousands of inner-city school children annually, teaching them about conservation and wildlife.

The last refuge on our trip was the Patuxent Research NWR near Laurel, Md. This special refuge is where the whooping crane restoration project began and continues today.

Our last week was back at the training center in Shepherdstown, and I think it was my favorite week of

all. We continued to learn about refuge programs, issues, challenges and opportunities that week, and our final exercise was a team presentation before a panel of refuge managers.

Each team of six service employees was given a set of refuge management scenarios/ problems to “solve.” These scenarios were really difficult situations designed to test our mettle. It was akin to the “Kobiashi-maru.” (For you non-trekkers, that was the test without a solution, for which Captain Kirk found a “creative” solution—he cheated.)

The really special thing about that week was the lasting friendships we formed. It was so hard to say good-bye to my new friends. But I know I will see them all again, as I travel this great land of ours visiting some of our national treasures—our National Wildlife Refuges.

Doug Newbould is the Fire Management Officer at the Kenai National Wildlife Refuge. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

New Kenai National Wildlife Refuge ecologist comes full circle

by Mark Laker

Looking at my calendar, it's hard to believe only two months have passed since I started my new job as an ecologist for the Kenai National Wildlife Refuge. It's been a year of major changes, peaking with my wedding this past June. Though it was hard to leave Juneau and Southeast Alaska, my home for 12 years, the rumor was it rains less on the Kenai Peninsula. After being delayed in Tok by an earthquake, we arrived in Kenai just in time for the rain and floods. Thankfully, the natural disasters have become less routine and my schedule more so. I'm also thankful for the great group of people I work with at the refuge.

It feels good to be back on the Kenai. I first came to the peninsula 20 years ago while helping an aunt, uncle and three cousins move to Homer. I arrived, more or less, fresh off the farm from Minnesota, the typical wide-eyed young boy with an intense curiosity of the natural world. After spending several months exploring Kachemak Bay, I decided it was time to sample the rest of the state. My study design was simple, systematic and cheap—hitchhike down any road I came across and sleep in a tent. Ever the keen observer, after a few months I noticed Alaska was very large. I would have to explore alternative sampling methods to tackle this problem.

Along with my new goal of exploring Alaska, my interests included furthering my education in science and biology and finding the finances to pay for it all. I pursued a Bachelor of Science degree in marine biology from the Florida Institute of Technology. I have to admit those Jacques Cousteau films of scuba diving in warm, clear water around coral reefs left strong impressions on my childhood mind during those long Minnesota winters. To finance my education and continue to explore Alaska, I fished commercially out of Dutch Harbor in the Aleutian Islands during the summer months between school semesters.

After finishing school and the fishing season, I decided to investigate that other part of Alaska—Southeast. You know, where the capital is. My plan was to spend the summer in Southeast then head back up to Alaska—I mean the “Interior.” To make a long

story short, I was pleasantly surprised with Southeast Alaska and stayed (12 years). I started working for the Forest Service at Admiralty Island National Monument as a fisheries technician. I enjoyed the work so much I went back to school for my master's degree in fisheries from the University of Alaska. I studied populations of cutthroat trout in Southeast Alaska lakes. We found populations varied a great deal from lake to lake and cutthroat trout are easy to catch. On some lakes with public recreational cabins, people were able to catch half the population of adult fish over one summer.

Counting fish is only one part of the equation in fisheries management. Habitat management is equally important, especially if you work for a federal land management agency and that's what it is paying you to do. Being the only fish biologist on a one million acre island, I had a lot of ground to cover. Again, with my keen observation skills, after a few summers tromping through the woods, walking up salmon streams and meeting bears, I realized not all fish habitat is equal, and I couldn't survey it all. It was the same dilemma as when I arrived in Alaska, too much to see and not enough time. Again I needed alternative sampling methods. Several years ago I read what I consider a good definition of science: the search for patterns in nature. Why are some lakes and streams more productive than others? Is there a pattern, could I find it, or better yet, had someone else?

The majority of fisheries research regarding habitat has been cause and effect. Studies such as the effect on salmon habitat of removing all the trees along a stream were common. I was looking for the bigger picture. Why did one region of the island have abundant fish populations and another lousy? What caused two similar lakes to have dramatic differences in fish populations? Why were some populations more sensitive to disturbances? It was more in the discipline of ecology than fisheries that I started finding answers.

Ecology is the study of the relations and interactions of animals and their environment. In the field of ecology, things were really happening. With computers becoming faster and more powerful, revolutionary

software tools were being developed and made available. Based on this technology, geographic information systems (GIS) were developed for land management agencies. These systems were built to display and produce digital maps of any surveyed resource. Common resources that were mapped included vegetation (forest, brush or alpine), water (lakes, streams or ice) and geology (volcanic, metamorphic, sedimentary, etc.). It was now possible to efficiently describe resources over a large land mass. In the search for patterns in nature this was the dream tool. Better yet, there was a lot of work already done and available. A good example is Robert Bailey's Ecoregions of the United States (http://www.fs.fed.us/land/ecosysmgmt/ecoreg1_home.html). Bailey used climate and geology to explain patterns in vegetation and animals across the United States.

At this point I knew I was close to taking that next big step to better understanding the fisheries resources on Admiralty Island. There was one minor problem, I was missing information about all the non-fish resources. I became a real information hound—addict may be a better description. I found several good sources to keep me supplied for a few years. A great public resource is the Alaska Geospatial Data Clearing House (<http://agdc.usgs.gov>). Here you can download stuff like topographic maps.

Things were finally starting to come together; patterns were emerging from the piles of data I had accumulated. I found several interesting relationships between the geology and fish productivity. When I tossed in vegetation, things really got exciting. I get chills just thinking about it. Looking at a handful of maps, I could do a pretty good job of predicting the fish resources. Now I was able to visualize and de-

scribe, in a general way, large regions of land I could never physically get around to seeing. As a manager, this allows me to better focus limited resources within a very large chunk of public land and stretch those taxpayer dollars as far as possible.

Eventually, I changed occupations and began working as an ecologist. This better reflected my evolving interest in natural resource management and the work I was doing. Life after fish included bears, newts, goshawks, water quality and all kinds of vegetation. In addition to analyzing the information being collected in the field, there was the responsibility of proper study design and data storage. In the last few years, I've worked on national protocols for collecting and storing physical and biological data. I've also had the pleasure of participating in more esoteric endeavors such as measuring wilderness character. The quality of a study, or map, is only as good as the information collected. Additionally, ensuring collected information is made available to other researchers is plain good science. Though not as exciting as radio-collaring bears, I find this latter work rewarding, which is fortunate because it will be a large part of my job here on the Kenai National Wildlife Refuge.

Being here on the Kenai Peninsula, I feel I have come full circle from that day 20 years ago when I set out from Homer to see the natural wonders of Alaska. With piles of data around me, I'm starting to feel those chills again.

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Aurora borealis—Alaska’s best light show

by Candace Ward

I have always been fascinated by northern lights. However, it wasn’t until my college years while on field study at Lake Clark National Park in Alaska that I actually first saw them. Late one August night I observed tremendous yellow green curtains undulating across the night sky. Since then I have been hooked on watching for auroras.

Working at the Kenai National Wildlife Refuge Visitor Center I receive many questions about northern lights. People are most interested in how they can be sure to see auroras.

Experts at the Northern Geophysical Institute, University of Alaska, offer these tips. The best time of year to check out the night sky is August 15 to April 15 when there is sufficient darkness. The best hours for aurora viewing are generally 11:00 p.m.-1:00 a.m. However, if you see bright active auroras as soon as it gets dark in the evening, it’s a good bet that the auroral display will be active all night. Getting away from human created light sources and the “glow” of town will give better viewing. Checking out the night sky on clear nights optimizes viewing potential.

Interestingly, Alaska and eastern Siberia have northern lights that are typically 20-30% brighter than other displays throughout the world. Ft. Yukon, Alaska, may be the best location in the Northern Hemisphere for seeing auroras. The northern hemisphere’s auroral oval, a donut shaped area centered around the geomagnetic North Pole, favors this location.

While being outdoors offers the most invigorating viewing, don’t forget to look for auroral displays on night flights to and from Alaska. Carla Helfferich from the Geophysical Institute offers this advice. Try for a window seat so you can see east to northeast (the right side heading north and the left side going south). Use a blanket or jacket to block out light reflections when looking out your cabin window. Thanks to the curvature of the earth you can see auroras over 1000 miles away when you are flying at 30,000 ft. The air clarity at these high elevations will give brighter auroral viewing than on the ground. According to Neil Davis, author of *The Aurora’s Watcher’s Handbook*, at times of good visibility and auroral activity, it’s possible to

see almost 25% of all aurora occurring in the Northern Hemisphere on a flight between Alaska and Seattle.

Once people start watching northern lights, they become curious about what causes them. Understanding how the aurora “works” is difficult because many of the factors creating them are things we can’t see.

The aurora is constantly occurring at both poles. However, it is obscured by daylight so we can only see it at night. Huge flows of electrically charged particles flow from the sun entering the earth’s upper atmosphere. These flows known as magnetic storms usually focus at the poles and are pulled in by the earth’s magnetic field. Occasionally these storms are larger and more intense spreading beyond the poles to lower latitudes. When this happens auroras may be seen over 60% of the earth’s surface to latitudes of 30° in both hemispheres.

Mish Denlinger, who composed the website “Auroras: Paintings in the Sky,” gives one of the best short explanations of how auroras happen. “Energetic electrically charged particles (mostly electrons) accelerate along the magnetic field lines of the earth into the upper atmosphere, where they collide with gas atoms, causing the atoms to give off light.” The variation in colors seen in the northern lights depends upon the elevation in the atmosphere where incoming charged particles collide with particular gas molecules.

Auroras occur between 40 and 200 miles above our heads. At 180 miles above the earth, oxygen is the most common gas atom and collisions there create a rare red aurora. The strong yellow to green light that is most commonly seen in auroral displays is produced by collisions with oxygen atoms at 160 miles above the earth. Below 160 miles above the earth, nitrogen molecules bombarded by electrically charged particles emit a red light seen at the lower fringes of auroral curtain displays.

If our earth’s gas composition at upper elevations were different, we would see other colors predominating in auroral displays. If our upper atmosphere contained large amounts of neon, we would see bright orange. If it contained high amounts of sodium gas, we would see a dark yellow light.

Our atmosphere does contain lighter gases like hy-

drogen and helium, but our eyes cannot always see them in the night sky. Our eyes see better in the green-yellow-orange part of the spectrum. So often good photographic film can capture magenta and purple colors in the aurora better than our eyes.

Where do these energetic electrically charged particles that create the aurora come from? Our sun produces bursts of these particles (ions) in solar flares. They travel to earth by the solar wind. The solar wind is created in the top most layers of the sun's corona and the ions it carries are pulled into the earth's magnetic field becoming magnetic storms. The solar wind also travels beyond earth to other parts of the solar system. Did you know that Jupiter and Saturn also have auroras?

Planets that have magnetic fields like Earth, Jupiter, and Saturn pull in these ions from the solar wind which collide with upper atmospheric gas molecules. These "excited" molecules emit colored light creating beautiful auroral displays.

Auroras recorded by Voyager and the Hubble Space telescope on Jupiter and Saturn are bright pink from hydrogen gas in their atmospheres. You will never see a green aurora on Jupiter or Saturn. Can you guess why? These planets have no oxygen in their

atmospheres like our earth does. As we continue to study the solar system evidence of green auroras on other planets may be an indication of an oxygen atmosphere and life.

Auroras have fascinated humans on Earth for millennia. With all of the varied forms of human sky events from fireworks to space shuttle launches, it's amazing that the best light show on earth is still the aurora borealis.

To learn more about auroras, check out the following resources: *An Aurora Watcher's Handbook* by Neil Davis and the following web sites—Auroras: Paintings in the Sky at www.exploratorium.edu; Geophysical Institute, University of Alaska, site at <http://www.gi.alaska.edu>; and the NASA and NOAA space weather site at <http://www.spaceweather.com>.

Candace Ward works at Kenai National Wildlife Refuge as a park ranger specializing in visitor service and education. She enjoys observing northern lights with her husband Walter and chocolate lab, Tiaga. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Dinosaurs and modern mammals developed comparable traits

by Ted Bailey

Although the dinosaurs and today's mammals are separated by more than 65 million years—an immense gap of time too great for our minds to comprehend—many of the dinosaurs developed traits comparable to those of today's modern mammals. These similarities became evident to me during the past several months while I was teaching a class entitled “The Dinosaur Renaissance” at the Kenai Peninsula College. Although some may still believe dinosaurs were obsolete, dumb, giant “lizards” that were driven to extinction by the efforts of “advanced” mammals, this is untrue. Most scientists now believe the demise of the dinosaurs was caused by a catastrophic event, probably an asteroid impacting the earth with devastating worldwide environmental destruction, rather than by any lack of adaptability on the part of the dinosaurs. An assessment of the various adaptations of dinosaurs reveals that many dinosaurs were superbly adapted to their environment, not unlike today's mammals.

Unlike many people who became fascinated with dinosaurs as a child, I became interested in them in middle age, specifically in 1975, the year my family and I returned to the United States after living for two years in Africa. That was the same year that a maverick paleontologist named Bob Bakker published an article entitled “The Dinosaur Renaissance” in the magazine *Scientific American*. In that article he proposed that unlike previous views of dinosaurs as lethargic cold-blood reptiles, new evidence suggested that dinosaurs were warm-blooded animals—like mammals and birds—and that some were very active, agile and intelligent. That article and later his book *Dinosaur Heresies* initiated a revolution in the study of dinosaurs that continues unabated today. And since then, I have attempted to keep informed of the latest findings.

Here are a few examples of dinosaur adaptations compared to mammal adaptations with which we are familiar, including mammal adaptations on the Kenai Peninsula. The earlier, more primitive and familiar plant-eating dinosaurs—the giant sauropods like *Brontosaurus* and *Brachiosaurus*—swallowed stones (gastroliths) to help grind up the plants they ate be-

cause they lacked plant-grinding teeth, just as modern spruce grouse pick up gravel for grinding food in their gizzards.

The next generation of plant-eating dinosaurs gave up the rock-and-gizzard approach, and developed complex plant snippers and plant-grinding teeth. Fast-forward roughly 70 million years to the present day and we see similar mechanisms for plant snipping and plant grinding in today's moose, caribou and many other hoofed mammals. These mammals snip off plant parts in the front of an elongated mouth with special teeth or bones, and then pass snipped-off parts through a toothless gap in the jaw to the back of the mouth where highly specialized teeth are used to grind up the plant tissue into small pieces for efficient nutrient extraction. Thus, many of today's “advanced” mammalian herbivores are using some of the same basic feeding mechanisms that the dinosaurs developed millions of years ago.

One of the most agile and intelligent predatory dinosaurs was a species paleontologists have named *Troodon*. It had one of the largest brains relative to its body size of any dinosaur. Its method of locomotion was bipedal, similar to the method used by today's famous bird of the southwest—the roadrunner. *Troodon*'s rear leg bones and other features indicate it was also swift running; its large eyes set partially forward in its head indicated it probably had binocular vision for depth perception. Its arsenal also included flexible, grasping front hands with sharp recurved claws. It may have been a stalker or a fast pursuer or perhaps both but regardless, it was an efficient two-legged predator well adapted to capturing elusive prey.

A close relative of *Troodon* was *Velociraptor*. It had the same features but was smaller and weighed only about 33 pounds. I find several similarities between *Velociraptor* and the modern lynx. The lynx, like many wild cats, has a relatively large brain; it is intelligent and has large forward-looking eyes with binocular vision for depth perception. A lynx can either secretively stalk or swiftly pursue its prey, usually a snow-

shoe hare, then grasp it in its claws while delivering a lethal bite. By the way, *Velociraptor* was the intelligent and cunning dinosaur portrayed stalking humans in the movie *Jurassic Park*. Those swift, agile, intelligent and misnamed “Jurassic” Park dinosaurs were actually modeled on yet another larger but related predatory dinosaur *Deinonychus*, a species that also had many of the same features as *Velociraptor* and *Troodon*, including a large sharp claw on each hind foot. *Deinonychus* are thought to have hunted in packs—like wolves—to bring down prey much larger than themselves.

I find these similarities between dinosaurs and today’s mammals fascinating. And I get great satisfaction watching the living descendents of the dinosaurs in my backyard and on winter walks. Yes, most biologists and paleontologists believe that today’s birds—our familiar black-capped and boreal chickadees, red-

breasted nuthatches and others—are actually nothing less than small, feathered dinosaurs whose ancestors somehow survived the great extinction event 65 million years ago. I find it even more remarkable that some of these flying “dinosaurs” have adapted so well to exceptionally harsh environments including our cold, dark and snowy Alaskan winters.

Ted Bailey is a retired refuge wildlife biologist who has worked on the Kenai Peninsula for over 25 years. He is an adjunct instructor at the Kenai Peninsula College and maintains a keen interest in the Kenai Peninsula’s wildlife and natural history—and in dinosaurs. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Mountain hemlocks—ghosts of the past or harbingers of the future?

by Ed Berg

Mountain hemlock is normally a dweller of the high mountain slopes, perched up above the highest white spruce. As you drive through the mountains to Anchorage, you can see the dark green hemlock band at the top of forested slopes, and at Turnagain Pass you come right up into this zone. The hemlock trees, often bent and gnarly at treeline, have deeply grooved bark that is quite distinctive, once you have an eye for it, even at 65 mph.

Mountain hemlocks are the oldest dateable trees (with countable rings) on the Kenai Peninsula. We have cored live hemlocks that were born in the 1500s at treeline above Upper Fuller Lake, for example. There are cottonwoods on the Kenai that are probably older, but the old ones are always rotten inside and you can't count the rings. George Pollard showed me a grove of giant cottonwoods on the northeast corner of Tustumena Lake; the largest one was six feet in diameter, but it was hollow and I crawled inside and could stand up. Hemlocks however are tough, and the bark beetles don't touch them. Mountain hemlock wood is strong, and its close relative western hemlock is an important lumber and pulp tree in the Pacific Northwest.

Here is the puzzle about mountain hemlock. Although mountain hemlock has evolved to live in one of the most extreme habitats on the Peninsula (alpine treeline), it also grows quite well out on the western Kenai lowland, along with white/Lutz spruce, birch, aspen, and cottonwood. We find thriving patches of mountain hemlock scattered around the western Peninsula in well-drained sites, a long way from the mountains. For example, on the north side of the Swanson River oilfield there is a nice stand of hemlock, with trees dating to the 1600s. (I'm told that the geologists who drilled the Discovery Well at this site in 1957 punched into an oil-producing conglomerate at 10,000 feet, which they named the Hemlock Conglomerate in recognition of the unusual forest around the well.)

There are several more stands of hemlock north of the oilfield, around Scaup Lake, with trees dating to the 1500s. These stands are fairly visible from the air

and on aerial photos as continuous dark green patches. Ted Bailey recently told me about a nice patch of hemlocks a mile down the Funny River Horse Trail, and there are some hemlocks along Echo Lake Road.

Given that mountain hemlocks can grow well on the western Kenai, far from their alpine treeline home, we can ask why aren't there more of them out on the lowland? Indeed, if hemlocks are the oldest conifers and they have not been thinned like spruce by the repeated bark beetle attacks, why isn't mountain hemlock the dominant forest type, at least on well-drained sites? Two possible hypotheses come to mind in such situations. The first hypothesis is that our present hemlocks are "ghosts of hemlocks past," i.e., relict survivors of once widespread forests during the cooler times of the Little Ice Age (1300s-1850s). In this case we would say that the hemlocks are slowly being out-competed by white/Lutz spruce which are better suited to warmer sites (and a warmer climate).

The second hypothesis is that the scattered hemlock "islands" on the western Kenai are simply products of random long-distance dispersal of seeds, probably by some of the strong northeast winds blowing down out of the mountains in the fall when the cones open up and release the seeds. Once a hemlock seed germinates and establishes, it can grow up and begin producing seeds in about 20 years. On this hypothesis, the trees in a particular patch should be closely related, being all descendents of the original wind-blown "colonist." The stand should show a high degree of inbreeding, similar to the inbred descendents of shipwreck survivors on a desert island.

The first hypothesis—hemlocks as relict survivors of a once-widespread forest—has different genetic implications. In all conifers the male contribution to mating—the pollen—is wind-borne; the pollen parent (i.e., the father) of a given seed may be located hundreds of yards or even miles from the cone-bearing parent (the mother). This means that there is little inbreeding in any particular group of trees. Even if the forest has been reduced to isolated patches, say by logging or climate change, the genetic composition of the

surviving trees doesn't change with aging, anymore than it does in humans.

It is not difficult in principle to assay the genetic composition of trees; this is done routinely in genetics labs, using either proteins (allozymes) or DNA. I did a study like this on scrub oak trees in South Carolina for my PhD thesis, and there are now some high school biology labs in Alaska that could carry out the basics of such a study.

On the Kenai Refuge we have tried a more direct approach to testing these two hypotheses, looking at pollen in lake sediment cores. In 1997 we assisted Scott Anderson from Northern Arizona University in pulling a 9 meter (30 foot) core of sediments from a lake we call Paradox Lake between Camp Island Lake and the Swanson River Road. Scott has analyzed the pollen (and charcoal, for fire history) in this core and has a detailed record of the revegetation of the Kenai lowland following the retreat of the last glaciation (13,100 years ago, at this location). In this core Scott found that alder arrived 11,000 years ago, and that both black and white spruce arrived 8400 years ago. The key point, however, is that he never saw any hemlock pollen at all in the core. We would have felt better about this study if he had picked up at least a few hemlock pollen grains in the core, just to show that the pollen preserved well and could be distinguished from the many other species of pollen in the sediment.

Last summer we took another shot at this question. Scott Anderson returned with colleagues Darrell Kaufman, Al Werner and their students to take cores in several lakes to look at climate change effects recorded in the sediments since deglaciation. Cores were taken in Tustumena Lake, as well as in a small pond in the Swanson River oilfield that is surrounded by hemlocks. They called this pond "Discovery Pond," because it is near the 1957 Discovery Well and because it offers promise of more discoveries. The living hemlocks in this area are well in excess of 400 years old, by tree-ring count, so hemlock pollen should be abundant in at least the upper 400 years of sediment. A radiocarbon date on the lowest hemlock pollen in the core should tell us when hemlock arrived at this site.

We know from pollen studies by Tom Ager of the

US Geological Survey that mountain hemlock arrived on the Kenai at the Tern Lake junction at least 2500 years ago, and in Girdwood by 3000 years ago. In a core from Hidden Lake, Tom observed traces of hemlock pollen appearing 6000 years ago, but he suspects that this pollen was blown in from Prince William Sound, and that hemlock forest didn't arrive until much later. Tom did not find any hemlock pollen in peat and lake sediment cores at K-Beach Road, Clam Gulch, and Homer. He did find traces of mountain hemlock pollen at the head of Kachemak Bay at Circle Lake (mile 18, East End Road), which began appearing about 1000 years ago. Today there are a few western hemlocks in the China Poot-Peterson Bay areas of Kachemak Bay, and occasional mountain hemlocks at higher elevations in the mountains.

All of these pollen observations (or lack thereof) considered together are shifting the weight of evidence toward the second hypothesis—that the scattered hemlock patches on the western Kenai are simply products of random chance events of long-distance seed dispersal. When the wind gods roll the dice up in the mountains, who knows where the dice will fall? As to why mountain hemlocks are not the dominant forest type on the western Kenai, my best guess is that the trees simply haven't gotten here yet; they are still in the process of dispersing.

In a future column I will explore the possibility of planting mountain hemlock on the western Kenai as an alternative to planting bug-prone species like white spruce, lodgepole pine, and Siberian larch. Mountain hemlock has a proven hardiness and versatility that we should not ignore. Perhaps we should speed up the rolling of the dice.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. Further information on mountain hemlock (and most other tree species) can be found on the Fire Effects Information System <http://www.fs.fed.us/database/feis/>, sponsored by the US Forest Service. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

A love for the outdoors should be shared

by Doug Newbould

One week from today some of us will recognize our relationships with loved ones in a special way. And if you are one of those who are prone to forget dates like Valentine's Day or Mother's Day, this can serve as a reminder. You can thank me later. I know that some of you might chafe at such sentimental holidays, or like me—at the commercialism that overwhelms us every year on these days. But Valentine's Day is well placed on the calendar, late in the winter when we might suffer from cabin fever or some other form of depression.

Valentine's Day is special to me because it carries the promise of spring, of longer days and warm sunshine, of new life and nature's beauty. And that brings me to the subject of my article this week. I believe that a love of the outdoors, of time spent outside in the wildlands or in a park, a garden or even your backyard—a love for all things natural, is so much more meaningful if it can be shared with someone else.

When I think about the most romantic times in my life, it seems to me that all of them occurred outdoors. I remember a beautiful spring day in Giant City State Park in southern Illinois. I think I was eleven or twelve. The air was fresh and fragrant with new buds and blossoms, a soft breeze brought gentle motion to the leaves on the bushes and trees. The songbirds traded phrases in a lighthearted game of one-ups-manship. I was standing in the valley between the ivy-covered limestone walls that gave the park its name, when I saw a vision from heaven. It was a girl, whom I had shyly met once before at some grade school function. I don't remember her name. But I remember she was dressed in a loose white outfit that fluttered softly as she floated across my view. Her long golden brown hair reflected the light of the sun. She was so graceful and beautiful to me that my mouth fell open. I called out her name, but she didn't hear me. I started after her, but then I lost my courage. How could some gangly, dorky kid like me hope to fit into that vision of beauty?

It was in another grand outdoor theater that I met my future wife. As natural resource majors at Colorado State University, we were both required to at-

tend forestry summer camp at Pingree Park, high in the Rocky Mountains. If you have not been there, Pingree Park is a spectacular place. The campus sits in a broad glacier-carved valley, just north of Rocky Mountain National Park. Large old ponderosa pines watch over the grassland meadows in the bottom of the valley. Higher on the slopes, the pines give way to Engelmann spruce and subalpine fir. The snow-capped summits of the Mummy Range and the Never Summer Mountains encompass the park, creating a large natural amphitheater.

It was in that idyllic setting I met my soul mate. As I recall that summer, there were about sixty students and the male-female ratio was almost 50-50. We spent six weeks together studying forest ecology and natural resources measurements. I don't know if the gender make-up of the Pingree Park class of 1978 was by design or mere coincidence, but in such a beautiful place, romance seemed inevitable.

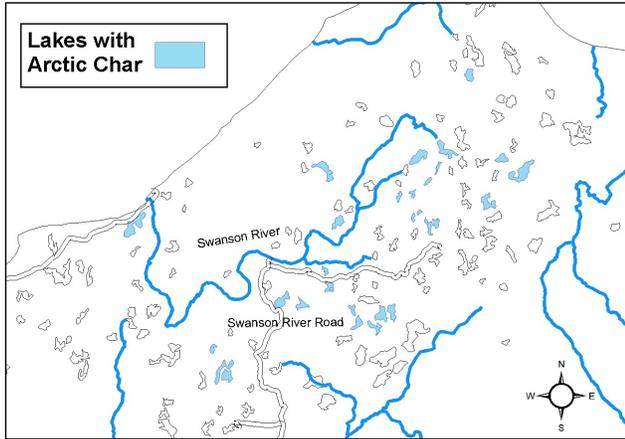
I didn't go to Pingree looking for love or anything like that. I was still kind of shy, gangly and dorky, so it took me several weeks to get up the nerve to approach her. I remember admiring Denise from afar. She was really cute—vivacious and fun loving. She always seemed to be smiling or laughing at something. I found myself wanting to share her joy. And to my good fortune, I am still sharing the joys of life and love with her today.

Our common love for the outdoors and for nature provided a foundation on which we built our friendship. Our friendship and the many outdoor adventures we have shared over the past twenty-five years have helped sustain and nurture our love for each other. What does all this have to do with the Kenai National Wildlife Refuge? Nothing really...I've just got spring on my mind!

Doug Newbould is the Fire Management Officer at the Kenai National Wildlife Refuge. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Arctic char on the Kenai Peninsula

by Jack Dean



Arctic char distribution in approximately 50 lakes in the Swanson River watershed.

The lakes along the Swanson River drainage have some special fish. Let's say that you've just caught a fish in one of these lakes. Your fish does not have the typical black spots found on a rainbow trout. Instead it has light pink or red spots, and white-edged ventral fins. If you look closely, a few spots are larger than the pupil of the eye. You might be inclined to call this fish a Dolly Varden, even though few Dollies have ever been found in these lakes. Most likely, your fish is an Arctic char. This fish is a little known and often confused sister species of Dolly Varden. Arctic char has a unique distribution on the Kenai, being restricted to some 50 lakes in the Swanson River drainage and to Cooper Lake in the Kenai River drainage (see map). Worldwide, Arctic char occurs further north than any other freshwater fish and is most abundant in the Arctic and sub-Arctic areas of North America, Asia and Europe.

Arctic char and Dolly Varden are closely related species that some authorities believe separated from a common ancestor over a million years ago. Not only are they closely related, they are also look-a-like species. On the Kenai Peninsula these look-a-like chars seldom occur together. If you catch a char in Cooper Lake or in a Swanson River lake, chances are at least 50 to one that you've just caught an Arctic char, not a Dolly.

In 1964 state fishery biologist Larry Engle was the

first person to discover Arctic char on the Kenai Peninsula. He identified them in East Finger Lake and had his conclusion verified by biologists at the University of British Columbia. A couple of years later he conducted a study to determine why these char were a common catch in the fall, winter and spring sport fisheries but were seldom seen in the summer. In East Finger Lake 89% of his char catches in vertical gill nets were taken in water 55° or colder. During the summer, Arctic char frequent the deeper waters where there is adequate oxygen and cold water. This requirement explains why Arctic char contribute little to the summer sport fishery. They are catchable during the summer, however, if anglers are willing to fish deeper than 25 feet, with salmon eggs or shiny spoons.

Here's what we know about our local Arctic char. They are fall-spawners that utilize gravels in lakes for this purpose. Most spawning occurs during October although populations in Cooper Lake also spawn into late November. Adult Arctic char feed on aquatic insects, snails, sticklebacks and sculpins. They feed much more heavily on sticklebacks than do Dolly Varden. As a result Arctic char, especially the older larger fish, are heavily parasitized. Most of the parasites are attached to the abdominal organs that are removed during cleaning. We don't know if these parasites can infect people, and we recommend that Arctic char be thoroughly cooked. Our Arctic char do not reach large size. The largest one taken in a gill net on the Kenai Peninsula weighed only 4.55 pounds. Most of the char taken by anglers weigh less than a pound. I consider a two-pounder a large one and a three-pounder trophy-sized.

The known distribution of Arctic char on the Kenai Peninsula includes only two areas: fifty lakes in the Swanson River watershed and Cooper Lake in the Kenai River watershed. This limited distribution is hard to explain. Our present populations can be described as lake residents, but this species is often anadromous (like salmon) in colder climates and it may have been anadromous here in the past. One theory suggests that anadromous Arctic char populated the Swanson River lakes after the glaciers melted from the Kenai lowlands about 13,000 years ago. If this the-

ory is correct, there should also be Arctic char in suitable deep lakes in adjacent watersheds such as those of the Moose River, Bishop Creek and the Chickaloon River, which became ice-free about the same time. Opposing this theory is the fact that Arctic char have never been reported in these watersheds. Another theory suggests that Arctic char may have been present on the Kenai Peninsula before the last glacial period and they survived in ice-dammed lakes somewhere in the Swanson River watershed.

The presence of Arctic char in Cooper Lake is even harder to explain. At first glance, you might think that some fisherman pilot simply decided to do his own stocking by bringing some char over from the Swanson River drainage. In this case I doubt that we can pin this phenomenon on the “human factor,” because there are actually three forms of char in Cooper Lake: two color variants (orange and gray) and a dwarf variant. To have introduced Arctic char into Cooper Lake, a person would presumably have had to collect both color variants from Swanson River lakes, as well as to make a trip to the Lake Clark area, across Cook Inlet, which is the nearest source for dwarf char. Generally humans aren’t this energetic.

The Arctic char in Cooper Lake could not have come up from the Kenai River (prior to construction of the dam) because there are several impassable falls below the dam. We have angler reports of “Dolly Varden” in Cooper Lake from the 1950s, but I have never found any Dollies in Cooper Lake, and I am inclined to view the 1950s reports as mis-identified Arctic char. In any case I think that Arctic char have been in Cooper Lake for many years. My best guess is that toward the end of the last glacial period, anadromous Arctic char climbed the Resurrection River from the Seward side, crossed a shallow pass, and entered the Cooper Lake drainage from the pass. When the valleys were choked with glacial ice and ice-dammed lakes, there were probably water routes open for fish migration that are dry land today.

Little government agency effort has been directed towards Arctic char on the Kenai Peninsula since the 1960s. Most of the recent work has been done by volunteers like myself. My efforts have included fishing one third of the Swanson River char lakes, assisting with gill netting sampling, reviewing state and federal lake survey reports and gathering appropriate technical reports. Other work was done by Dr. Nels Anderson’s Soldotna Boy Scout Troop 151 who fished

for char in several Kenai mountain lakes for a genetic study. The Alaska Department of Fish and Game, U.S. Fish and Wildlife Service and U.S. Forest Service also provided local char for this genetic study. Analysis of some of these samples by the Canadian laboratories has found genetic differences between Dolly Varden and Arctic char, and has shown that Arctic char in the Swanson River lakes and Cooper Lake have the same genetic fingerprint.

Recently Chugach Electric Association hired an Anchorage consultant to study Arctic char in Cooper Lake. This will be the first focused Arctic char study carried out on the Kenai Peninsula in nearly 35 years. Cooper Lake is populated with both dwarf and normal sized Arctic char. The dwarf char appears to be unique in south-central Alaska. The consultant has already located two char spawning areas on silt free-cobble bottoms at depths of 25-35 feet. Hopefully this study will greatly expand our knowledge of both forms of Arctic char in this deep mountain lake on the Chugach National Forest.

Among freshwater fish I consider Arctic char to be the “canary in the coal mine.” They are susceptible to a variety of ills, including introduced non-native fish and also to climate change. For example, northern pike are now present in Stormy Lake near the mouth of the Swanson River. If pike become established in the Swanson River they will have access to most of the Arctic char lakes, where the presence of pike could be detrimental, to put it mildly. There are two land-locked char populations that could be impacted by hazardous material spills from the Wolf Lake natural gas field. Global warming could affect local populations by reducing the amount of suitable cold-water habitat in lowland lakes during the summer. Given these potential threats, this interesting and hard-fighting native species may require our continued attention to remain a part of our fishery heritage on the Kenai Peninsula.

Jack Dean describes himself as a “semi-retired” fishery biologist, having formally retired after 31 years with the U.S. Fish and Wildlife Service. He lives with his wife Betty in Sterling, and is currently studying arctic char and long-nosed suckers in the lakes of the Kenai Peninsula. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Trapping on the Kenai National Wildlife Refuge

by Chris Johnson

For those looking for an excuse to get out this winter and explore the Refuge and its wildlife, trapping season started November 10th for many of the Peninsula's furbearers, and it runs through the end of March for several species. To trap on the Kenai National Wildlife Refuge you must first attend a trapper orientation class. This orientation class need be taken only once in a lifetime, and it covers State and Refuge regulations, principles of furbearer management, trapping tips, and trapping ethics. Each trapper over the age of 16 must have a valid State of Alaska trapping license and must secure a trapping permit from the Refuge each year.

The Refuge has some special requirements for trapping. These requirements are primarily aimed at maintaining healthy furbearer populations and habitat on the Refuge. They are also designed to promote selective trapping to reduce harvest of non-target species, such as birds of prey, and to promote humane trapping methods. The requirements also seek to minimize conflicts between trappers and other winter outdoor users on the Refuge

I will go over the Refuge special trapping requirements and explain some of the reasons for those requirements. Of course all trapping must be done in compliance with State of Alaska game laws and regulations. On the Refuge all traps and snares must be identified by a registered mark or tag. The State of Alaska does not require trappers to tag their traps, although most states do require trappers to mark or tag their traps. Marking and tagging is not done so the trappers can be harassed, but to encourage trappers to take responsibility for the hardware they are putting out in the field. It also helps in the recovery of lost traps.

All leghold traps must be checked at least every four days in Game Management Unit 15A and 15B-West, and once at least every seven days throughout the rest of the Refuge. 15B-West is that portion of 15B, west of the mouth of Shantatalik Creek on Tustumena Lake northward to the west fork of the Funny River to the Kenai National Wildlife Refuge boundary. Conibear and drowning sets must be checked at least once every seven days throughout the Refuge.

The trap check requirement is directed at promoting humane trapping and the timely release of non-target animals. Checking traps regularly also increases the efficiency of the trapline.

Traps and snares are prohibited within thirty feet of sight-exposed baits. The term "sight-exposed" means any visible part of the bait or imitation thereof (excluding dry skeletal items from which the skin, hair, feathers, and flesh have been removed) that is used to visually attract an animal to a trap. This requirement is aimed at reducing the take of non-target animals, especially birds of prey, which hunt by sight. This is also a good trapping technique: you won't catch birds, and any furbearer that you catch won't be so near bait that it frightens off other furbearers.

We ask trappers to report all tags and radio collars taken from furbearers within three days, so that the biologists studying these animals do not waste your tax money trying to locate an animal that is in your garage or shed.

Trapping is prohibited within one mile of public roads, campgrounds and road-accessible trailheads, and within the Skilak Wildlife Recreation Area. Trapping for mink and muskrat using leghold traps size 1 ½ or smaller and 110 or 120 Conibears are allowed in all areas except Skilak Recreation area and the Headquarters Lake area. This requirement is designed to reduce user conflicts and provide opportunities for viewing wildlife near roads and campgrounds, especially for sedentary species such as beaver.

Steel leghold traps having teeth, spiked, or serrated jaws are prohibited. This requirement promotes humane trapping and reduces the likelihood of injury to a non-target animal that is going to be released.

Cubby and flag sets are not allowed when the lynx season is closed, as it is this year. A cubby set is a structure, natural or man-made, that will guide the animal into an area where bait is placed and a flag or wing is used to attract the lynx into the trap. Lynx are very curious and this type of set, especially used with a castor-type lure, can be very effective for them.

The Refuge also has special requirements for trapping beaver: only one set per lodge is authorized in the Game Management 15A portion of the Refuge. A

set is defined as one leghold or Conibear trap or a pole with a configuration of snares. Each lodge that is being trapped during the current season must be visually marked with a pole vertically set in the ice, so that another trapper will not trap the lodge. These requirements are designed to reduce the potential for completely trapping out an entire lodge, either by multiple traps from one trapper or by multiple trappers.

Trappers must submit an accurately completed furbearer harvest report after the trapping season is finished. This information is very valuable to the wildlife managers. Determining population levels of most furbearer species is extremely difficult, so harvest records, which provide a measure of annual trapping effort, provide a useful index of the status of furbearer populations and trends over time in these populations. This is one way that trappers can actively participate in management of the furbearers.

The Refuge will purchase the skinned carcasses of wolverines and wolves during this trapping season.

We will only buy intact carcasses. The biologists use the intact carcasses to study the overall health of the populations. They can also see if the animals are reproducing by looking at the uterus. The carcasses have to come from the Refuge, and they are paying \$50.00 for wolves and female wolverines.

I would remind snowmobilers that the Kenai Refuge is still closed to snowmobile use, due to lack of snow cover to protect the underlying vegetation. If we get a significant snowfall to cover the vegetation, the Refuge Manager may open up the Refuge to snowmobile use.

Chris Johnson has been a law enforcement officer on the Kenai National Wildlife Refuge since 1989. He and his wife Pam live in Sterling with their three children. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Radiocarbon dates dispel old myths about peninsula forest burns

by Ed Berg

Old myths die hard. One of my favorite hard-dying myths is that Captain Cook saw very little forest on the Kenai Peninsula when he sailed up the Inlet in 1778. Every time there is a public meeting on forest issues on the Kenai, someone trots out this story, and it has become part of our oral tradition.

With the assistance of Alan Boraas at the Kenai Peninsula College, I read through the accounts of Cook and his officers describing their 12-day exploration of Cook Inlet. Cook himself said very little about the vegetation, being mostly concerned about the strong tides and finding water deep enough to avoid being grounded.

He certainly said nothing about the Kenai being barren of forest. Cook's assistant surgeon William Ellis, however, wrote in his journal that, "The low land on the eastern side had a fertile appearance, and was well covered with trees," as viewed from his ship anchored for the night of May 29, north of Ninilchik at 60°8' North Latitude.

How the myth of the treeless Kenai got started I haven't a clue, but it can't be blamed on Captain Cook or his crew.

Another myth that I hear at these same public meetings is that a big forest fire once burned over the entire peninsula. This myth possibly started with forester William Langille's 1904 report on the forests of the Kenai Peninsula, prepared for Teddy Roosevelt's head forester Gifford Pinchot. Langille was not at all impressed with the "impoverished state" forests on the western side of the Kenai. He reported many recently burned areas and saw "old logs and decayed stumps of a large size", and speculated that there had once been "a prehistoric forest of greater proportions" that had been destroyed by fire prior to the Russian occupancy.

I don't question Langille's assessment that the Kenai forests were "impoverished" in 1904, but I think that their degraded condition had nothing to do with fire. Rather, Langille arrived on the Kenai some 25-30 years after an extensive spruce bark beetle outbreak on the central and southern Peninsula in the 1870-80s. He described the standing dead forests between Homer

and Anchor point, which had a thriving live understory of limby, short-bodied trees with a rapid taper.

This is exactly what you would expect to see 25-30 years after a bark beetle outbreak, where the surviving pole-sized trees had "released" and grown rapidly under the opened up canopy. The hole-ridden bark had probably fallen off the old beetle-killed trees by the time Langille arrived, and it would have not been obvious that the trees had been killed by beetles, unless a person knew what to look for, such as scars of beetle egg galleries.

We now have more direct evidence to bear on the proposition that the Kenai once had a big fire. In the Refuge Notebook of October 25, 2002 I described our recent study of charcoal fragments collected from soil under blown-over trees (throw mounds). We have obtained radiocarbon (C-14) dates on 63 charcoal samples, distributed over the logged areas from Clam Gulch (Falls Creek Road) to Happy Valley (Cottonfield Road). The median time-since-fire on these stands was about 600 years; the most recent fire was more than 300 years ago.

Furthermore, the median time between fires was also about 600 years. The oldest charcoal sample was about 3,600 years old. It thus appears that the 1.5 to 2 feet of soil that is typically turned up in a throw mound represents about 3,000 years. Much of this soil is volcanic ash, probably from Redoubt and Augustine. Soil scientists working on the Kenai typically dig a 3-foot hole in soil surveys, and they on occasion find deeper (and older) charcoal which we would have missed using throw mounds.

We know from the pollen record that spruce came into the central Kenai about 8,000 years ago, so there could be a lot of charcoal older than 3,000 years that we missed.

A skeptic could ask if whether we might have also missed a lot of younger charcoal. This is unlikely. To collect our samples we drove along the main logging roads and stopped every half-mile to examine all throw mounds within a few hundred yards of the truck. Sometimes there would be only a few, or oc-

asionally none, but sometimes there would be 40-50 mounds.

Usually we found charcoal in at least one mound and sometimes in many mounds. There was, however, a stretch of 7 miles along Cottonfield Road where we didn't find any charcoal at all, even though we checked a number of mounds. We collected charcoal fragments as small as a quarter of an inch. Young charcoal would probably be in larger pieces and should be easier to spot than old charcoal, so chances of missing young charcoal are not great.

A word needs to be said about the shortcomings of radiocarbon dating, especially of charcoal derived from burned trees. Trees take up carbon from carbon dioxide in the air. Most of this atmospheric carbon dioxide has stable Carbon-12, but a small fraction has radioactive Carbon-14. The Carbon-14 steadily decays to Nitrogen-14, with a half-life of 5,730 years, meaning that every 5,730 years half of the remaining C-14 disappears. A sample that has a full proportion of C-14 might be a few hundred years old, but a sample that has only a tiny amount of C-14 might be 30,000 years old.

After about 40,000 years virtually all of the C-14 is gone, and samples older than 40,000 years simply can't be dated with C-14. On the Kenai when we find such "dead" carbon, it is from the Tertiary coal beds that are dated to 5-20 million years, using radioactive Potassium-40 that decays to Argon-40 with a half-life of 1.3 billion years.

There can be quite a bit of laboratory error in measuring the amount of C-14 in a sample; a given date can be off by several hundred years. The height of the bars on the graph shows the measurement error of two "standard deviations" above and below the measured date. That is, the bars show that if you repeated the measurement of a sample many times, you would expect 95% of those measurements to fall within the bar.

As you can see, some of the bars cover more than 400 years. That is a lot of slop in the estimated age of a single sample, and that is why it is nice to have many samples.

There is a second source of error that can be even worse than the measurement error. Let's say that you burn a 300-year old tree; there is a 300-year difference in the age of the wood at the center and at outside of the tree. Thus, charcoal from the center should date 300 years older than charcoal formed on the outside of the tree, where the wood was laid down a year or two before the date of burning.

This time-of-growth error is called the "inbuilt age" of the sample, and it systematically biases fire dates based on radiocarbon-dated charcoal to be too old.

The problem is extreme when dead wood is burned: let's say that our 300-year old tree had been dead for 100 years before it burned. The carbon at the center of that tree would date 400 years older than the actual date of the fire.

Fortunately, on the Kenai we have some factors that should reduce the magnitude of the inbuilt age error. First, many fires move quickly through the forest and just burn the outside of the trees and the branches, so that most of the charcoal should be formed from young tissue.

Second, because of periodic bark beetle attacks, spruce trees on the Kenai generally don't live more than 300 years, if that.

Third, the fact that dead wood rots rapidly in our damp climate means that there isn't a lot of old wood available to contribute old charcoal.

I would thus expect that on the Kenai a radiocarbon date could erroneously date a fire as 200-300 years too old, but probably not a lot more than that. This contrasts strongly with a recent study on Vancouver Island in a coastal rainforest where western red cedar can live to 1,000 years or more, and there are large rotting trunks on the ground that don't burn readily.

Dan Gavin compared radiocarbon dates with fire dates determined from tree-rings and found inbuilt age errors as much as 670 years.

In the graph, the black triangles represent my best guess as to the dates of fires. When samples grouped within a few hundred years, I picked the youngest date for the fire, reasoning that the older dates represented older wood from inside the trees or dead wood. This could lead to underestimating the intervals between fires.

For example, on Falls Creek Road at Mile 1 we picked up two charcoal samples that dated to 1220 and 1410. With radiocarbon dating there is no way to tell if this was two burns separated by 190 years, or one burn where some of the wood was 190 years older than the younger wood, or simply measurement error in the C-14 dating process.

Looking at the graph, some basic patterns are apparent. First, as I noted, none of the six areas appears to have burned since the late 1600s, and there are intervals of many centuries between the burns.

Second, there is no single “big burn” that hit all of the sites simultaneously, contrary to popular mythology.

Third, these burns were fairly small, probably on the order of a few square miles. Each of the six roads shows a different pattern of burn dates, and the roads are separated by at least several miles.

Our samples were taken along logging roads that generally stick to the upland areas, but occasional they cross wet drainages like Clam Creek (on East Road) that probably served as natural firebreaks. Deep Creek is the largest drainage, which lies between the Caribou Hills Road on the north, and East Road and Cottonfield Road on the south.

Many areas of the Kenai have burned much more recently than the area of this study. For example, we have preliminary evidence of an early 1900s burn in the Clam Gulch area, two 1926 burns in the Kasilof area, and of course the 310,000-acre 1947 burn in the Sterling area and the 79,000-acre 1969 Swanson River burn, and numerous smaller 19th and 20th century burns north of the Kenai River.

Most of these were human-caused burns, and one can legitimately ask if some of the old burns documented in this study could have been caused by the Native inhabitants. This is not an area rich in archeological sites, like the Kenai or Kasilof Rivers, or Kachemak Bay.

The Dena’ina Athabaskan Indians arrived on the peninsula at least 1,000 years ago, but they are not known to have used fire as landscape management tool. They could have, of course, had their escaped campfires, but they didn’t burn forest for “mosquito control” like some of the early European settlers of the peninsula.

In short, I would expect that the great majority of the old burns were generated by lightning and not by escaped campfires.

Funding for this study was provided by the Pacific Southwest Research Station of the U.S. Forest Service and the U.S. Fish and Wildlife Service. The results will be used as part of nationwide program to model the development of forest fuels over long periods of time. Permission to use the logging roads and to take charcoal samples was provided by the Ninilchik Native Association and Cook Inlet Region Incorporated.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. He will be giving a seminar for the University of Alaska Anchorage Biology Department on “Fire History Studies on Kenai Peninsula” March 7 at 3:30 p.m. in Room 110 of the Engineering Building on the UAA campus in Anchorage. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Kenai National Wildlife Refuge ecologist defends mountain hemlock

by Ed Berg

My recent column on mountain hemlock has generated some lively debate among the readers.

In that column, which ran January 31, I described mountain hemlock as a long-lived tree species that we find in isolated clumps on the western lowlands of the Kenai Peninsula. It appears to be growing well and reproducing, even though its real home is high in the mountains above spruce treeline, such as at Turnagain Pass.

I suggested that we should consider planting mountain hemlock in areas where beetle-killed spruce forest has been logged off, because of hemlock's great longevity and its resistance to bark beetles.

This suggestion did not sit well with the foresters. Mountain hemlock has a poor track record on the Kenai as a commercial tree species. Al Peterson from the state Forestry Division commented that he had a terrible time finding buyers for mountain hemlock in state timber sales in Cooper Landing. The trees were bowed and had a considerable amount of defect (rot) in the middle of the trunks.

U.S. Forest Service plant pathologist Lori Trummer pointed out that older hemlock typically has two different kinds of stem rot: red ring rot (*Phellinus pini*) and the indian paint fungus (*Echinodontium tinctorium*). She noted that the 1987 Kenai forest inventory indicated that the net annual growth of mountain hemlock sawtimber on the Kenai was actually negative, because of loss due to rot.

These comments make me wonder if I am barking up the wrong tree!

What can be said in defense of mountain hemlock? I will concede up front that mountain hemlock does not have immediate potential as a commercial tree species, but trees have other value besides monetary value, such as aesthetic and wildlife habitat value. Does mountain hemlock have such values, if not cash crop value?

Since my January writing I have taken the occasion to visit two lowland mountain hemlocks stands. The Discovery Well stand on the north side of the Swanson River oilfield is a fine old-growth stand with

trees dating at least to the 1600s, from our previous tree corings. The understory is open, with only an occasional rusty menziesia shrub and a carpet of *Hylacomium* feathermoss.

It is pleasant to walk through this park-like stand and the term "elfin forest" comes to mind. The trees were all alive and green—a condition that I rarely meet in white/Lutz spruce forests of the Kenai Peninsula today after the extensive beetle kill of the 1990s.

The trunks of many of the larger trees had a banana-like bow that would drive a sawyer nuts in short order, because such trunks are impossible to mount on a sawmill for cutting full-length boards. I saw some grapefruit-sized conks (shelf or bracket fungi) on some of the larger trees, indicating heartrot. I cored a large 26 inch diameter tree with conks, and found that only the outer five inches of wood were solid.

A tree of this diameter should be about 450 years old. It was alive and had good foliage, and it may well have been rotten inside for several hundred years.

It is worth recalling that most of the wood in a tree is dead tissue. The inner wood is called the heartwood, and its primary function is support.

When the heartwood is quite rotten, the tree structurally becomes a big tube and can still be quite strong. That is why it is usually easier to bend a solid metal bar than a metal tube.

Hemlock wood appears to grow faster than its heartrot, so the heartrot really isn't a problem for the longevity of the tree.

The second mountain hemlock stand that I visited is about a mile down the Funny River Horse Trail. You see hemlock trees mixed with white spruce and birch along the trail as you come up over the first steep hill on the trail. The pure hemlock stand lies about 50 yards to the west of the trail.

This is a smaller and younger stand than the oilfield stand. The largest trees are 23 inches in diameter and would be about 400 years old.

I didn't core any trees, but I didn't see any conks growing on the trees, so I would expect that most

trunks are solid in the middle. The large trees again had that banana-like bow. The younger trees were nice and straight, so I am wondering at what age and under what conditions the bowing sets in.

The Funny River trail stand was also open and park-like, with a moss carpet and scattered rusty menziesia bushes. It appears that only certain plants can tolerate living under a closed hemlock canopy, and grass isn't one of them.

This ability to suppress competing vegetation is called "allelopathy." Walnuts trees are an extreme example: there are very few plants that can grow under a black walnut tree. The tree secretes a toxin called "juglone" which inhibits respiration in most plants, including black walnut seedlings.

I did an Internet search on "mountain hemlock allelopathy" and turned up a student thesis project on precisely this topic at Reed College, but no results are available yet. The student, Amanda Hemmerich, plans to make chemical extracts of hemlock bark, foliage, and soils, and to test the effect of these extracts on various plants and soil microorganisms in greenhouse experiments.

I would expect that most of her plants will turn up their toes with a good dose of mountain hemlock extract.

I observed good seedling reproduction extending out from both of the hemlock stands, especially in disturbed soil. There was an old cat trench off the Discovery Well pad, probably dating to the 1957 construction, and it had saplings 8 feet tall. There was abundant cone production, especially at the Discovery Well site, and I saw squirrels at work in both sites.

As I noted in my earlier article, I am puzzled about why these hemlock stands are not larger. What is limiting their rate of spreading? The presence of seedlings and saplings away from the center of the stands shows that the stands are spreading but apparently at a slow rate.

The oldest hemlocks in these stands probably predate the oldest neighboring spruce by 200-300 years, so they haven't been lacking in time for seed dispersal. I doubt that soil conditions are a factor, because there is no obvious variation in soil conditions or vegetation around these sites.

It is well known that most seeds of conifers such as hemlock, spruce and pine, fall within one or two tree-lengths of the seed parent. If the Kenai lowland hemlocks have only been in the forest for a few generations, as a product of infrequent long-distance seed

dispersal events, these trees may simply not have had enough time to spread out across the landscape. The pollen record in lake sediments says that white spruce has been on the peninsula for at least 8,000 years, so white spruce has had much more time to establish continuous forest cover over large areas.

Let me return to the question of the value of hemlock in our forests, and ask if it is worth artificially planting hemlock on the peninsula. I think that the chief value of mountain hemlock on the Kenai is as old-growth wildlife habitat. We have very little old-growth forest habitat on the Kenai, outside of the mountainous areas. Even though the lowland white/Lutz spruce typically doesn't burn for hundreds of years (as discussed in last week's Refuge Notebook), the trees are thinned by the beetles at least every 100 years or so.

Basically, our spruce trees don't live long enough to create classic old-growth forests, with huge standing trees and a lot of coarse woody debris on the ground in various stages of rotting. We see this kind of old-growth forest on the south side of Kachemak Bay and in the Girdwood area, for example, although beetles are taking out much of the Sitka spruce component of these old-growth forests.

Marten are creatures that prefer mature and old-growth forest. Most of the marten trapped on the Kenai come from the mountains on the Seward side, and only rarely are they seen on the western lowlands. Marten like old-growth forest because of hollow logs and stumps for nest sites, and the runways under snow-covered fallen trees. The closed canopy of older forest also provides good thermal cover for a variety of prey species.

Refuge biotech Stephanie Rickabaugh is planning to do a study this summer looking for marten with DNA hair traps. These traps are baited with scents and contain a strand of barbwire and some sticky material that captures a few hairs as the animal passes through the trap.

The DNA in the hair is analyzed to produce a "DNA fingerprint" for each individual marten. Stephanie's study will focus on the old growth hemlock and surrounding mature spruce-birch forest from the Discovery Well north of the oil field to the Bufflehead Lake area.

In Southeast Alaska and Vancouver Island, old-growth mountain hemlock provides important thermal cover for deer. In these forests one also finds Townsend's warbler, a mature forest specialist that is

probably a victim of habitat loss in the beetle-killed forests on the Kenai.

The largest mountain hemlock stand on the Kenai lowlands is the stand north of Scaup Lake. This stand, measuring about 1,100-by-450 meters, is a highly visible landmark for helicopter pilots flying to offshore oil platforms in the Inlet.

We have cored trees in this stand dating to the 1500s. Refuge Biologist Liz Jozwiak spent a week doing bird surveys in 2001 along the southern border of this stand. She camped under the tall hemlock trees and recalls it as some of the most aesthetically pleasing forest that she has experienced on the Kenai. The wood frogs were singing in full voice, and she frequently heard northern boreal owls calling during the night.

This old-growth habitat thus appears to have some special qualities for both humans and wildlife, and we need to think more about how to preserve this habitat.

With warmer summers expected from global warming, we can expect higher chronic levels of spruce bark beetle infestation on the Kenai. Our white/Lutz/Sitka spruce forests will cycle faster, with trees typically dying in mid-life 125 years or less, rather than 200-250 years. If this is the case, mountain hemlock is probably the only native species that will have the longevity to produce old-growth forest habitat in the future on the western Kenai.

If we want to have any old-growth forest in future, we need to protect the existing mountain hemlock stands from wildfires and logging. We also need to consider well-designed plantings of hemlock in areas that are not slated for any future development. Mountain hemlock is shade tolerant, so it could be planted in beetle-killed spruce forests, at least where the grass was not too thick.

In logged areas, mountain hemlock could be planted side-by-side with lodgepole pine, with the expectation that it would naturally succeed the pine after a couple hundred years or after the pine was cut.

On the Kenai National Wildlife Refuge the national policy of the U.S. Fish and Wildlife Service prohibits planting exotic species, such as lodgepole pine or Siberian larch, but we could consider planting a native species like mountain hemlock.

There is also the possibility of genetically improving mountain hemlock. Our existing lowland hemlock trees have already proven their hardiness on the Kenai with more than four hundred years of survival. Forest geneticist John Alden at the University of Alaska Fairbanks has suggested that trial plantings are needed to develop stock with suitable characteristics for commercial planting.

At best, mountain hemlock—at least with its present genetics—would be a niche market, for landowners and public land managers interested in promoting native forest diversity and old-growth wildlife habitat on the Kenai, with a long eye on the future.

If selective breeding and good silvicultural practice could straighten out the trunks and speed up the growth rate, early harvest (say at 100 years) could preclude the old-age heartrot problem and produce a hardy bug-resistant tree. Such an improved mountain hemlock variety might compete quite favorably as a commercial lumber or pulp tree, on par with some of the presently popular but bug-prone species like white spruce, lodgepole pine, and Siberian larch.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Happy 100th birthday to America's best kept secret

by Bill Kent

Today is the 100th birthday of the National Wildlife Refuge System. When President Theodore Roosevelt made Florida's tiny Pelican Island a refuge for birds on this date in 1903, he wrote the first chapter of a great American conservation success story.

It all began with one man and one boat, protecting pelicans on a five-acre island in Florida.

From that humble beginning arose the world's largest and most diverse network of lands dedicated to the protection and management of a vast array of wildlife.

The National Wildlife Refuge System is a network of habitats that benefits wildlife, provides unparalleled outdoor experiences for all Americans, and protects a healthy environment.

In its first hundred years, the Refuge System helped save our national symbol—the American bald eagle—from extinction and has protected hundreds of other wild species including fish, migratory birds, and many other plants and animals, as well as the habitats that support them.

Entering its second century, the National Wildlife Refuge System covers 95 million acres in more than 535 refuges and thousands of small prairie wetlands that serve as waterfowl breeding and nesting areas. There are wildlife refuges in every state, and at least one within an hour's drive of every major American city, providing much-needed refuge for people as well as wildlife.

Although there are many refuges, and millions of acres, this system is one of America's best kept secrets. This is unfortunate, because every American has reason to say, "Look what we have done in this country to protect our wildlife resources."

I have had the privilege of working in seven states on some of the most interesting of those 535 refuges, including a few where spectacular wildlife concentrations occurred with regularity.

I want to take you on a quick tour of those refuges, and hopefully, you will understand why I think every American should take pride in the National Wildlife Refuge System, especially during this Centennial year.

After graduating from the University of Georgia, I began my career on Merritt Island Refuge, which sur-

rounds the Kennedy Space Center in Florida.

Pelican Island Refuge was a satellite of Merritt Island, and I was fortunate to visit that tiny island a few times; once, to band young pelicans.

Merritt Island's semi-tropical woodlands, marshes and nearby brackish water rivers are home to diamond-back rattlesnakes, manatees, sea turtles, roseate spoonbills, bald eagles, osprey, and large concentrations of waterfowl during fall migrations. (Another Merritt Island satellite refuge, St. John's, was where the last Dusky Seaside Sparrow was seen in the wild. We spent long hours trying to reestablish its preferred habitat, but those efforts were too late.)

The hunting and fishing, wildlife photography and rocket launches at the Kennedy Space Center were all outstanding. However, my best memory is of working with nesting sea turtles, where we collected the eggs to protect them from raccoon predation, then released the newly hatched turtles.

Okefenokee Refuge in southeast Georgia is an entirely different habitat: a 400,000 acre freshwater swamp with upland islands containing oak and other hardwoods, bald cypress. "The land of the trembling earth" (one of the translations of the Native American "Okefenokee") is surrounded by tens of thousands of acres of pine forests.

Thousands of alligators, flocks of white ibis, spectacular wildflower displays in spring, osprey, black bears, bobcats, rattlers and other reptiles, wild turkeys, and sandhill cranes are all regular sights at Okefenokee Swamp.

My wife and I were fortunate to live in a small cabin on the refuge. When I think back to those years, I have memories of black bears grazing like cattle on an abundant acorn crop next to our cabin, long nights counting alligators from an airboat, and the great enjoyment of watching school kids learning about that magical and mysterious place from the refuge staff.

My family and I next made a big move to Massachusetts, to Parker River Refuge. This Refuge covers only 4,500 acres, of which 3,000 acres is salt marsh; the remainder is a large portion of the last barrier island on the northeast coast.

When I was there, we also managed six other

refuges in Maine and Massachusetts, including Rachel Carson Refuge, on the southern Maine coast. Once again, there were large flocks of waterfowl during fall migrations.

The truly spectacular wildlife events, however, occurred in spring and fall when, within a matter of hours, thousands of warblers of many species would move through the refuge on their way north or south.

At times, it seemed the most abundant species on the Parker River Refuge was *Homo sapiens*—that’s right, human beings. The refuge was only 30 minutes north of Boston and at that time no fee was charged to enter the refuge.

There are about seven miles of undeveloped beach, and many days it seemed as if half the population of eastern Massachusetts wanted to get their own piece of sand in the sun. There were only 350 parking spaces, and it was common on summer days that we closed the entrance gate at 8 a.m. because all the spaces were taken.

We reopened at 4 p.m., and it was quite easy to refill those spaces within 30 minutes.

Our next stop was the Klamath Basin Refuges: nearly 200,000 acres of wetlands, forests, sagebrush and farmlands spread between six refuges straddling the Oregon-California border on the east side of the Cascade Mountains.

This was our introduction to the importance of water to wildlife and humans; east of the Mississippi River, folks usually have no concerns about the availability of water, but here it was different.

Historically, there were over 500,000 acres of wetlands in the basin, but reclamation efforts for farming have reduced that area to less than 150,000 acres, the majority contained within the refuges. During the height of the fall migration, our surveys frequently totaled one million ducks and geese.

Watching those birds flying in and out of feeding areas was truly a spectacular, yet humbling sight. Needless to say, the hunting was excellent—even I managed to bring home a few birds.

Klamath Basin wintered as many as 1,000 bald eagles, as well as thousands of other raptors such as rough-legged hawks, harriers, and the occasional peregrine or gyrfalcon. One of the refuges in the basin

was established to protect a major night roost used by the eagles.

Standing at the entrance of that refuge early in the morning or just before sunset, when hundreds of eagles fly in and out of the roost, is a wildlife spectacle which draws observers from all across the U.S. and numerous foreign countries.

In 1991 we moved to the Kenai National Wildlife Refuge, fulfilling a desire my wife and I shared since we first married. You know, perhaps better than I, why the Kenai refuge is one of those “special places.”

Astonishing runs of salmon, thousands of moose, elusive brown bears and soaring bald eagles, are all reasons why more than 500,000 visitors come here every year.

The visitors also come to simply view the expansiveness of Alaska. Even though the Kenai Peninsula represents a small part of the state, the Kenai refuge is often referred to as “Alaska in miniature” because so many of Alaska habitats are found here, ranging from beach to forest to alpine tundra.

I hope this quick tour has provided you a small glimpse of the world’s finest system of wildlife habitats. I urge you, with deep sincerity, to visit this refuge and others in Alaska and the other 49 states during this Centennial year.

When you do, please take a moment to reflect on what no other country but this one has accomplished in providing every citizen with a continuing legacy of exceptional wildlife resources and the habitats to support them.

I am sure you will be as proud of the National Wildlife Refuge System as I am.

A final note: this August, the Kenai Refuge will co-host a Centennial Celebration with Alaska Maritime Refuge at the Ninilchik Fairgrounds.

Current plans call for live music, food, displays, and more. Watch for more information about the Celebration as the summer progresses!

Bill Kent has worked on National Wildlife Refuges for 27 years and is the Supervisory Park Ranger at the Kenai National Wildlife Refuge. He and his family live in Sterling. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Mental rewards of walking in nature surpass benefits of mere physical exercise

by Ted Bailey

I consider myself fortunate and am extremely grateful that I have the chance to walk daily amongst natural settings during the winter months.

And I am fully aware that most people do not have this winter opportunity. I did not have such an opportunity myself for many winters but yearned for it frequently while I spent seemingly increasing proportions of each winter indoors in an office setting. I viewed, sometimes with envy, those few privileged people that I would sometimes encounter beginning or returning from a midday winter walk on the Keen Eye Trail around the refuge office.

So after all those winters of confined days in the office, the time I now get to spend walking outdoors each winter day is especially rewarding.

Although I also walk daily for physical exercise, I consider the mental benefits of walking and experiencing nature to far exceed the physical benefits. And I am fortunate by circumstances to be able to enjoy wild nature close to home.

My hope at the beginning of a walk is to become so immersed in my immediate surroundings—the sights and sounds of nature—that all my previously acquired images of a distant war with the loss of lives, of disease, hunger, accidents and other misfortunes of people throughout the world, so prevalent in each day's news, will somehow magically vanish for a brief period and I will reside only and fully in my immediate and natural surroundings.

I vary my route from day to day but still, because of limitations of local geography, find myself repeating the same route every few days. But this does not deter me from each walk, for even if in the same physical space, each walk brings new and unexpected experiences.

I am satisfied if I only see a familiar bird. Over the winter, I have become acquainted with the wide-ranging haunts of a family of four Canada jays. I now know the local flight paths of ravens and the favorite perching trees of bald eagles. There are the anticipated pairs of boreal and black-capped chickadees foraging high in certain trees overhead. Periodically, I am

treated to a pair of northern three-toed woodpeckers feeding on the larvae of bark beetles in several dying but once majestic white spruce trees.

More recently, they have begun to establish their territories by loudly and repeatedly pecking on the most resonating trees. I pass by decayed, standing snags of trees with cavities that I make a mental note to check again in the spring for evidence of nesting birds.

Although uncommon this winter, flocks of redpolls sometimes appear, and I watch them busily extract tiny birch seeds high in the trees above my head. Also high overhead, white-winged crossbills deftly pry open cones and extract seeds of white spruce.

On three days I was rewarded by seeing brown creepers, an elusive species, feeding on the trunks of birch trees, carefully exploring each tiny nook and crevice in the loose folds of bark for hidden spiders and insects. Watching brown creepers is a rare pleasure because they are seen so infrequently.

Although the sky, clouds, trees and birds sufficiently provide temporary relief from the gloomy current events during such walks, I am always on the alert for the more rare signs of a furry wild mammal.

Usually their passing leaves only traces in the snow, and there were few traces during this atypical winter. Earlier, when we had a few periods of new snowfall, I was reminded of the reasons why living in Alaska is unique: one night a brown bear had walked in my tracks made the previous day.

Another time a coyote crossed my tracks twice in a single night; a mink and an ermine crossed my tracks numerous times in their perpetual quest for small mammals under the snow.

The previous year, a lynx passed through the area—but only once during the entire winter.

Although it is sometimes difficult each day for us to put aside the mental images accumulated from watching or imagined while listening to news reports or reading newspapers, those precious moments when all such thoughts have temporarily vanished and our thoughts are concentrated only on the present and nat-

ural surroundings often help us confirm an appreciation of the unique value of our lives, of all life, including those of other creatures.

For those who are unable to experience nature by walking from your own backdoor, consider walking the Keen Eye Trail at refuge headquarters at the top of Ski Hill Road or elsewhere on the refuge.

Having the opportunity to freely walk anywhere you please is one of the many benefits of having a wildlife refuge next door. For those like myself, who may prefer walking without the benefits of trails, the refuge is only minutes away and you can spend minutes or hours walking dependent only on your own

need for solitude and reflection and your personal quest to contemplate on the significance of life that can often be found in nature around us.

Ted Bailey is a retired Kenai National Wildlife Refuge wildlife biologist who has worked on the Kenai Peninsula for over 25 years. He is an adjunct instructor at the Kenai Peninsula College and maintains a keen interest in the Kenai Peninsula's wildlife and natural history. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Refuge mapmaker aids columbia shuttle recovery effort

by Mark Laker

Soon after the Columbia space shuttle disaster in February, I received an email at work requesting people with computer GIS (Geographic Information System) experience to assist in the shuttle debris recovery effort. The message was brief, requesting interested persons to state in a few sentences their experience and availability.

Space exploration has always inspired me and captured the best of my imagination. I'm proud of NASA's remarkable accomplishments, and I couldn't ignore this call for assistance in such a tragic situation. I sent off my papers and expected a quick reply. After a week passed with no response, I started packing to travel to Minnesota to pick up the new family hunting dog "Buster" from my uncle's farm. I was almost out the door when a fax came with orders to leave immediately for Houston, Texas; end of instructions. I repacked my bags, grabbed a laptop computer, and jumped on a plane to Houston.

From Houston I was to proceed to the Interagency Coordination Center in Lufkin, 100 miles northeast of Houston. On the trip to Lufkin were two wildland firefighters with the U.S. Forest Service from Colorado and Oregon. Contrary to my traveling companions, this road trip represented the most I would see of the Texas countryside during my stay. I could have used the exercise, but I would be searching the countryside and helping the recovery effort with my laptop computer, not with my hiking boots.

Although the Federal Emergency Management Agency (FEMA) is directing the recovery, most of personnel came from various state and federal agencies across the country. The search crews are primarily wildland firefighters from the Forest Service, National Park Service, Bureau of Land Management, Bureau of Indian Affairs, U.S. Fish and Wildlife Service, as well as state forestry agencies. Although trained for firefighting, these crews are sometimes mobilized for disasters and have responded well to the demands of the shuttle recovery effort. In addition to being physically fit and comfortable in the woods, these firefighters come complete with tents, showers, toilets, and an organized command structure.

The Coordination Center is located at the Bank of

America building, a large three story building which was mostly empty prior to the disaster. After making it through security and getting all the necessary security passes, I was off to the "GIS" shop. "The what?" asked the security guard. "The GIS shop," I said again. "Do they make maps?" the officer asked. "Bingo, that's the place."

Though maps are easily the most identifiable product of a GIS shop, its capabilities far exceed simple computerized mapmaking. The word "Geographic" is the key in a Geographic Information System. This means that the GIS data are physically associated with points on the ground, by means of spatial coordinates such as longitude and latitude.

For example, I could take my notebook with locations of fishing spots for halibut and trout I have collected with my handheld GPS unit, and make a trout map or a halibut map. I could label the locations with little halibut or trout icons, and when I click on a particular icon, a menu pops up giving water depth, previous catch information, and anything else that I care to have associated with that particular point on the map.

When I walked into "The Map Room" at the Coordination Center, my jaw must have dropped. I was looking at probably the largest GIS operation in the country. The historic scale of this recovery was starting to sink in. There were about 30 people arranged around several folding tables running the length of the room. I lost count of laptops and desktop computers packed on the tables.

Bundles of yellow network cables dropped down through ceiling openings, tying all of the electronic brains together. All along one wall were printers and plotters. A plotter is basically a huge printer, which is fed paper from a three- to five-foot wide role. We had 10 plotters! And of course the walls were covered with maps. After locating an empty three-foot desk space, I set up shop next to a couple other new guys, Kevin and Jacob, two consummate practical jokers who also happened to work for the U.S. Fish and Wildlife Service.

All set up and ready to flex my GIS muscles, I was anxious to start some productive work, as well as find out what other folks were doing. The highest prior-

ity for the GIS shop was to assist the ground search crews. It was obvious in the early days of the search that a search grid was needed to efficiently manage the recovery effort. In any large-scale search, you have to keep track of where you've been and where you need to go. To capture the primary search area, we created a GIS grid 130 miles wide and 280 miles long, stretching across half of Texas and Louisiana. On an average day we produced approximately 1,000 maps using this grid. During peak hours, printer and plotter time was coveted and coordinated by frequent announcements throughout the room.

Currently, there are 141 twenty-person search crews on the ground. Several maps are prepared daily for each search crew. Each map includes a color-infrared aerial photograph as a background. Structures (building, roads), forests, and general terrain are some of the easily recognizable features or landmarks visible on the background. Several additional "layers" of information are added to complete the map, including the search grid, labeled roads, lakes, streams, latitude and longitude marks, and dots representing previously found debris.

By studying the maps, the crews can plan how many people will be needed to search an area and what hazards exist. For example, a thick, brushy forest covers a large portion of the search area. If that's not trouble enough, a good number of the plant species offer nice big sharp thorns. Picture devil's club with 3-inch thorns! Finding pieces of the shuttle in such terrain is literally like looking for a needle in a "needle-stack."

With a search area potentially 280 miles long, any method that allows you to narrow your search is pure

gold. The original search area was based on the shuttle's predicted flight path. As more shuttle pieces were found, GIS analysts were able to determine that the actual debris path was different than predicted. With this information, we altered the search area to increase the likelihood of finding more debris. Using radar data and ballistic coefficient models, our analysts created maps predicting where the larger pieces might have fallen.

To date more than 10,000 people from across the nation have participated in the recovery effort, over two hundred being from Alaska. Over 1.7 million acres have been searched and approximately 42,000 confirmed shuttle items have been recovered and their locations recorded in the GIS. These fragments represent about 26% of the shuttle's landing weight. I also think it's important to not lose sight of the human tragedy of this disaster. Respect and sensitivity for the lost crewmembers, and their loved ones, has been evident throughout the recovery effort. I listened to several stories about kindhearted locals who offered support to the effort, sometimes at significant personal expense. I consider it an honor to have participated in the shuttle recovery, and hope that my small piece of the endeavor will contribute to safer space exploration in the future.

Mark Laker is an ecologist, data manager and GIS specialist at the Kenai National Wildlife Refuge. He recently joined the Refuge staff, after moving from the US Forest Service in Juneau. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Kenai Refuge sounds provide “ear opening” experiences

by Dave Kenagy

It's been a quiet winter here on the Kenai, but things are about to change. Migratory birds will soon be winging their way north to visit us, bringing their songs with them. In another month or so the local birds, mammals, frogs, and all the rest of our wild neighbors will become more vocal with their songs, barks, grunts, croaks, and hums.

Before we know it, the aspen leaves will again be fluttering in the wind, sounding like small waves sizzling on a beach. Adventuresome folks will hear chunks of glacial ice kersplashing into lakes, or squeaking and rumbling their way down the mountainsides. The rivers will start to roar again as water levels rise, and the landscape won't sound like quiet winter anymore.

OK, maybe I'm tottering dangerously on the edge of transcendentalist romanticism here, but if you're like me, the sounds of nature are a pure delight. Unfortunately, the sounds of nature are getting harder and harder to hear. We humans make a lot of noise, and much of our noise drowns out the sounds of nature.

I take heart, though, that there are still plenty of places where you and I can hear the sounds of wild Alaska. One of the best places is the Kenai National Wildlife Refuge. It's a big refuge, and just about anywhere on it you can hear the sounds of undisturbed nature. But, where are some hotspots, and how about a few listening tips, too?

I'll start with the tips. First, be quiet so you can hear as many animals as possible, especially those with small voices. Second, be sure to keep a reasonable distance from wildlife, especially sensitive species like trumpeter swans. Third, go out to listen when wildlife is most vocal. For songbirds, this is usually early, early in the morning. Just ask one of our biologists! Fourth, be sure to listen to all other sounds of nature. Don't just focus on the birds. And, last of all, relax and enjoy!

All right, where to go? One of my favorite listening places is the Dave Spencer Unit of the Kenai Wilderness—what most people call the “Canoe System.” It's a great place to hear common loons, pacific loons, redneck grebes, trumpeter swans, arctic terns, great horned owls, bald eagles, songbirds, and a variety others. You can also hear, if you're lucky,

beavers slapping their tails on the water, wolves howling, or a big bull moose splashing through the shallows. I've had some incredible listening experiences on Loon Lake, Swan Lake, and Jean Lake, but you'll hear a wide variety of wildlife and natural sounds on any canoe trip you take.

How about a quiet place? Can you keep this a secret? Try the Skilak Wildlife Recreation Area, in early May. The road will not yet be busy with traffic, and the area is amazingly quiet. You can hear the breeze snaking through the tree branches, the gray jays meowing in the spruce trees, and maybe even some wood frogs croaking in chorus. You can do this as a short day trip. And, just think, you don't have to go on a long wilderness trip to enjoy the quiet. Park your car at one of the turnouts or trailheads, and take a walk while enjoying the sounds of spring.

How about a more adventuresome listening trip? All right, let's go listen to a glacier. This requires a trip into the Andrew Simons Unit of the Kenai Wilderness, to visit either Skilak or Tustumena Glaciers. Both glaciers have lakes at their bases, and icebergs calve into these lakes with a loud splash. If you get close to the edge and listen carefully you can hear a very low creaking, groaning sound, and water dripping and flowing every which way. These are not trips for the faint of heart, but I've done them and I'm sure most of you could, too. Ah, wilderness!

Well, those are just a few of the many places you could go. The best thing to do is get out a map, pick a likely listening spot, load up the canoe or the knapsack, and head out on the Refuge for your own listening adventure.

But, what if you'd like to do more than just listen? Well, there are plenty of people who do just that—they record what they hear. Some even record what they can't hear. Can't hear? One nature recordist has recorded the popping sound made by sap rising in a tree. As the water moved up the tree trunk, it changed the osmotic pressure in the wood cells. As the cells expanded, they made a popping sound.

As you can imagine, recording nature sounds can require specialized equipment, especially microphones. There are close-up microphones that can lis-

ten to the sounds of ants snapping their jaws, or sap rising in the trunk of a tree. Shotgun and parabolic microphones can pick up sounds at a distance, for subjects that are either difficult or dangerous to approach. Hydrophones receive underwater sounds made by animals such as whales or shrimp. There are several different types of stereo microphone set-ups that make “landscape” sounds seem three-dimensional. There are even microphone systems that can bring the ultrasonic echo-location sounds of bats within the range of human hearing.

To find out more about the art and science of nature sound recording, just do an internet search and you’ll find plenty of information. Try searching with keywords such as “nature recording,” “bird song recording,” or “parabolic mic.”

If you’re interesting in what organizations are doing, be sure to check out the Nature Sounds Society, which exists “to encourage the preservation, appreciation, and creative use of natural sounds.” Visit their web-site at: www.naturesounds.org. Be sure to take a

look at the links they provide. And, by the way, the Society isn’t just for recordists; it’s for anyone with an interest in the sounds of nature.

Another interesting website is the “Nature Recordists” e-mail group at Yahoo. Here you will find discussions on a wide variety of nature recording topics by some of the top nature recordists in the world. Go to: <http://groups.yahoo.com/group/naturerecordists/>.

If you have questions about where to hear a particular sound on the Refuge, call (262-7021) or stop by Headquarters, on Ski Hill Road. We’ll do our best to point you in the right direction, and might even provide you with a map.

Dave Kenagy is the volunteer coordinator and image specialist at the Kenai National Wildlife Refuge, who still wonders what an iceworm sounds like. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Wildland fuels are the one component of the fire environment we can change

by Doug Newbould

Well, here we go again. Another wildfire season is fast upon us—a bit earlier than normal this year, it would seem. It's not like it (the fire season) snuck up on us...we were all aware of the lack of snow this winter. In my case, I kept hoping we would get three or four feet of wet snow in March and April. When that didn't happen, the fire danger went from Low to High in a matter of a few days.

Several wind events in the last six weeks have elevated the fire danger here on the Kenai into the High or Extreme category. High winds and low relative humidities can produce explosive fire conditions, as we experienced in mid-March (100-acre wildfire near Anchor Point). Typically, when we see those strong, north (gradient) winds, as we experienced that week, we can expect very dry air over Cook Inlet and the western Peninsula. In fact, some of our local weather stations recorded humidities under 20% during that wind event. And that is unusually dry air for a maritime climate.

As a fire management officer, I have an inordinate (some have suggested—obsessive) fascination with the weather. In fact, I'm one of those geeks who actually enjoy watching the Weather Channel! The Alaska Weather show on PBS is another of my favorites. And I don't just watch local weather reports. I watch world weather—especially when there are “big” weather events. I was vacationing in Mexico when the north wind hit south-central Alaska in March. When I returned and found out I had missed it—I was bummed out!

But for all the attention I give to the weather, I have learned one important fact: I can't change it. Of course, I will continue to be a weather geek, because weather has a profound influence upon fire behavior, and I am a student of fire behavior. I also study the land (topography) and the vegetation (fuels), and how those elements of the fire environment contribute to—and affect fire behavior. Another thing I've learned I can't change, at least on a landscape level, is the topography. Ah, but there is one element of the so-called “fire environment” that I as a homeowner or as a land

manager can change or manipulate...the fuels.

Since many of us live outside the urban environment, in locations where our homes, our out-buildings and our toys are either surrounded by—or are in close proximity to—forest vegetation (fuels), where the threat of a wildland fire is very real, I thought it would be good to share some ideas about managing fuels and the associated risks in the “wildland-urban interface”.

Before we hop on the bulldozer or crank up the chainsaw, let's stop and take a look around the property. We need to do a fuels hazard analysis or risk assessment. Essentially, we need to identify any vegetation or other organic materials (dead grasses, woody shrubs, evergreen trees, stumps, duff or forest litter) that could provide a pathway between an approaching fire and the house, the garage, the propane tank, the boat, etcetera. And while we're looking, we might as well identify the other flammable materials in close proximity. Are there woodpiles within 30 feet of any improvement? Is there a wood fence attached to the house? Are there fuel tanks or any other combustibles nearby?

The goal of this process is to create defensible space around those “values” we want to protect from an approaching wildfire. But before you or I design a “Firewise landscape” for our properties, we should also look at the bigger picture and consider the larger fire environment. What is the general topography of the area and does the position of my home on the larger landscape increase or decrease the risks from fire? What are the prevailing winds and seasonal weather patterns? Is there a history of wildfire in the area? Which forest fuels are more hazardous, more likely to carry a wildfire? If a wildfire occurs in the area, what is its likely direction of spread? From what direction would an approaching fire become a real threat to my family and property?

You may want to consult with one or more local wildland fire experts to get answers to some of these questions. The local fire chiefs and wildland fire professionals in the area can help you with the big picture. They can help you with the information resources and

the tools you need to conduct a risk assessment and design a firewise landscape. They can also give you some ideas about the most cost-effective methods to implement your plan.

Some of the basic rules of thumb for creating a defensible space are:

- Remove all flammable vegetation within 30 feet of all structures.
- On steep slopes, remove flammable vegetation out to 100 feet or more.
- Grow only fire-resistant vegetation within the defensible space zone.
- Maintain all plants by regularly removing dead branches, leaves and needles.
- Locate woodpiles at least 30 feet from structures and clear 10 feet around woodpiles.
- Locate LPG tanks at least 30 feet from structures and provide 10 feet of clearance.

Beyond the 30-foot defensible space zone, out to 100 feet or more depending upon the slope, you will

need to reduce the number of trees in heavily wooded areas and remove concentrations of dead woody materials on the ground. Space native trees and shrubs at least 10 feet apart. For trees taller than 18 feet, prune the lower branches within six feet of the ground. Maintain your defensible space and firewise landscape by watering during dry periods and keeping your lawn mowed.

Fuels management and defensible space are just part of the Firewise program. If you would like more information about Firewise, visit the national website: www.firewise.org. Or contact your local fire department, the Kenai Peninsula Borough's Office of Emergency Management or the Spruce Bark Beetle Office, the Alaska Division of Forestry, the Chugach National Forest or the Kenai National Wildlife Refuge. I would enjoy talking with you about the fire environment and how you and I can manage it.

Doug Newbould is the Fire Management Officer at the Kenai National Wildlife Refuge. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

National Wildlife Refuge System started on tiny Florida island 100 years ago

by *Stephanie Rickabaugh and Kelly Modla*

This year marks the 100th birthday of the National Wildlife Refuge System, which includes the two million acres of the Kenai National Wildlife Refuge with headquarters in Soldotna. Last month two of us from the Kenai refuge journeyed to Florida for the kick-off national centennial celebration, held at the very first refuge, called Pelican Island, established by Teddy Roosevelt in 1903.

Here is a bit of the story about how the tiny Pelican Island wildlife refuge got started, and inspired today's national refuge system that protects over 100 million acres in 540 refuges around the country.

Ten thousand years ago, the Indian River formed a lagoon along the east central coast of Florida, supporting the fish-based economy of the native Ais Indians. American settlers arriving in the mid-1800s soon discovered the thriving bird rookeries around the Indian River lagoon. Nineteenth-century fashions favored fancy plumes of bird feathers, and created an aggressive market for plume hunters and a mindless slaughter of colorful waterfowl such as herons, egrets, spoonbills and pelicans. In 1858, for example, witnesses reported seeing upwards of sixty spoonbills being shot each day.

In 1881 a naturalist named Paul Kroegel homesteaded an area overlooking the Indian River lagoon. Kroegel was visited by many influential naturalists during the 1880s to the 1900s, who took an active interest in protecting the local birds. One of the visiting naturalists was Frank Chapman, a well-known ornithologist and curator at the American Museum of Natural History in New York. Chapman discovered that Pelican Island was the last rookery for brown pelicans on the east coast of Florida, and he decided that government action was necessary to protect the birds.

Congress had some conservation-minded leaders during this period, and in 1900 it passed the Lacey Act to protect game birds and other wildlife from illegal interstate commerce. In Florida the state legislature passed laws protecting non-game birds. Paul Kroegel and Frank Chapman lobbied President Theodore Roosevelt to protect Pelican Island. On March 14, 1903

President Theodore Roosevelt signed the papers to set aside Pelican Island as the first National Wildlife Refuge.

The forward thinking of a few concerned citizens, backed by a conservationist President, have subsequently convinced most Americans that it is important to set aside wild lands to protect fish and wildlife for the benefit of future generations. We owe these pioneers a great vote of thanks.

Similar stories of concerned citizenry lie behind the establishment of many if not most of the nation's wildlife refuges. On the Kenai Peninsula hunters and conservationists lobbied Congress for years to protect the Giant Kenai Moose, which was thought to be a genetically distinct variety of moose. On December 16, 1941, the day after we entered World War II, another President Roosevelt—Franklin Delano—signed the papers establishing the Kenai National Moose Range, which subsequently became the Kenai National Wildlife Refuge in 1980 under ANILCA.

When we were chosen as delegates from the Kenai refuge to attend the Refuge Centennial celebration at the Pelican Island National Wildlife Refuge in Florida, it seemed like we had come full circle. There was much pomp and circumstance and many speeches, but it all seemed worthwhile; this celebration will only happen every 100 years. We had the opportunity to meet many other employees of the National Wildlife Refuge System who are as jazzed about their work as we are about ours.

The public turnout was overwhelming! We estimated that at least 350 people per day stopped by our Kenai National Wildlife Refuge exhibit to talk with us. (It's hard to beat the "Alaska mystique," no doubt!) There were 35 other refuges with exhibits, showcasing a wide variety of refuge habitats and recreational opportunities.

Representatives from the U.S. Postal Service and U.S. Mint unveiled the new Refuge Centennial postage stamp and coin. Perhaps you have seen the new stamp; it's the one with the brown pelican.

The Centennial celebration was an opportunity

to reflect on the 100 years of wildlife conservation progress and what that means to us personally. We thoroughly enjoyed telling everyone about all the Kenai National Wildlife Refuge has to offer: terrific mountain views, fascinating big mammals such as brown bears, outstanding fishing, great hiking, and back country camping that let you get away from it all. We do believe that we live in a little piece of heaven and that our jobs here at the Kenai National Wildlife Refuge are the icing on the cake.

Back home again, we are starting to plan a Refuge Centennial celebration on August 2nd at the Ninilchik Fairgrounds, with staff from all of the Alaska refuges

coming together for lots of “show and tell” about what the National Wildlife Refuge System has to offer in Alaska. Watch the paper for details on this upcoming event, and put on your boots for some great hiking on the Kenai refuge as spring unfolds.

Stephanie Rickabaugh works in the Biology Program and Kelly Modla works as a Law Enforcement Officer at the Kenai National Wildlife Refuge. Kelly is expecting the arrival of a new junior Wildlife Refuge user sometime in late spring. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Refuge biologists discuss role of science in Alaska wildlife management

by John Morton

Although the National Wildlife Refuge System is celebrating its 100th birthday this year, you might be surprised to learn that wildlife management was not really considered a science until as recently as 1933. That was the year that Aldo Leopold, often considered the founding father of wildlife ecology, published his cornerstone book *Game Management*. This landmark work created a new science that intertwined forestry, agriculture, biology, zoology, ecology, education and communication. Soon after its publication, the University of Wisconsin created a new department of “Game Management,” and appointed Leopold as its first chair.

From this start in the upper Midwest, wildlife management as a profession has continued to evolve and mature. In a 1978 textbook, Dr. Bob Giles defined wildlife management as the “science and art of making decisions and taking actions to manipulate the structure, dynamics, and relations of populations, habitats, and people to achieve specific human objectives by means of the wildlife resource.”

Well, there certainly is art and a lot of politics in managing wildlife, particularly on the Kenai, but that’s not the focus of this article. We’ll save that for another day. It’s the science in Wildlife Management that I’d like to discuss, and it’s something that continues to resonate (as one biologist recently told me) in the wildlife profession. In 1981, in what is now considered an opening volley over the bow (so to speak), Dr. Charles Romesburg published a paper in *The Journal of Wildlife Management* that called for more and better science in the profession. He suggested that we do fewer observational studies and more experimentally-based research.

In April, over 70 biologists working on the 16 National Wildlife Refuges in Alaska got together for four days at the Kenai Princess Lodge in Cooper Landing to talk about science. Dan Ashe, the former director of the National Wildlife Refuge System and now the science advisor to new director of the U.S. Fish and Wildlife Service, kicked off the Refuge Biologist Conference by giving us the perspective from Washington, D.C. He described the recommendations and products

that several national teams are developing on issues ranging from habitat monitoring protocols, to Geographic Information Systems, to exotic and invasive species.

We had a lot of technical presentations from a variety of scientifically-minded professionals. Sam Droege, a monitoring expert from the Patuxent Wildlife Research Center in Maryland, shared his rules-of-thumbs for improving our ability to detect changes in animal populations. Other presenters discussed statistical techniques for classifying vegetation, the geospatially-based Ver Hoef method for estimating moose populations, the use of remote sensing data to monitor changes in vegetation and land use, and Web-based approaches for database management.

We also discussed the need to monitor the ecological effects of wild and prescribed fire in Alaska. Dr. Dave McGuire from the Alaska Cooperative Fish & Wildlife Research Unit showed how moose populations can respond positively to wildfire in interior Alaska as long as 30 years after a burn. We learned that several Refuges in the northeastern U.S. are studying how varying the water drawdown in diked impoundments can provide foraging habitat for migrating shorebirds in the spring, as well as for waterfowl in the fall and winter. The message here was less about duck management, and more about how Alaskan Refuges might be able to coordinate research and monitoring across the state.

The U.S. Fish and Wildlife Service is not the only Federal land agency trying to get a better handle on scientific approaches to monitoring wildlife and habitat. Sara Wesser described how the National Park Service has created a series of networks across the U.S. that allow for regional database management, standardized monitoring protocols, and web-based information dissemination. Bea VanHorne described how the U.S. Forest Service is implementing a pilot program to monitor wildlife on permanent plots used for timber inventory. Carl Markon from the U.S. Geological Survey reviewed progress on a comprehensive landcover map of Alaska, based primarily on satellite imagery.

Now, some of these topics may have been a little bit too technically-oriented for some folks, even for number-crunching biologists. Sometimes the coffee just didn't seem like it had any kick to it. Fortunately, we were reminded why we all became wildlife biologists with some great stories from Will Troyer and Jim King, two biologists who retired from the USFWS. Will Troyer was one of the early managers at the Kenai and Kodiak Refuges. He told us how he learned to drug bears so they could be ear-tagged, including a deliberate poke in the bear's rear-end to make sure it was actually knocked out. One bear he poked turned out to be just sleeping on the riverbank, and was not one of his study animals. It's sometimes hard to figure out when the old-timers are telling you a story and when they're story telling!

Jim King almost single-handedly developed modern aerial surveys for waterfowl, and was one of the key players in identifying lands to be set aside as part of the National Wildlife Refuge System in Alaska. Even though Jim denied that his talk was to be inspirational, it very clearly served that purpose. I think most biologists in that room, if they didn't already have it,

got a much better sense of the living history and tradition of the Refuge System.

Although the purpose of the conference was, in part, to improve the level of science currently being done on Refuges, the outcome of Jim King's talk was also to remind us that there's more to being a refuge biologist than technical know-how. There's a culture of passion for living things that is part of being a professional wildlife biologist, and the feeling of satisfaction that comes from protecting and managing these resources. However, in a world that is more litigation-minded, and with a growing list of species vulnerable to extirpation, I think that wildlife biologists need to package that enthusiasm with tighter science. We need scientifically grounded data that are strong enough to stand up in court, as well as providing effective guidance for long-term management of our wildlife and land resources.

John Morton is the supervisory biologist at the Kenai National Wildlife Refuge. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Spring cleaning for swallows

by Todd Eskelin

As the birch leaves emerge and sprinkle green onto our passing winter landscape, I find myself digging into the garage and dusting off my golf clubs. Then, I hear a subtle chirping reminder that I have other duties to perform before I play. Last spring, I put up several birdhouses around my property and was rewarded with two families of tree swallows darting around the yard, consuming large quantities of flying insects. You know the ones I am talking about. With such beautiful weather so far this spring I have yet to hear the M word, but we all know they are coming. Swarms of little buzzing bloodsuckers will soon be drowning even the sounds of birds. Your 6 a.m. wake-up call may soon be replaced with sleepless nights of swinging into the darkness as they buzz by your ear.

From the garage I heard the familiar chirping of swallows scouting out nest sites in my backyard. I realized that I had neglected to clean the birdhouses from the previous year's use. Many people ask me if it is really that important to clean the houses out every year. In the wild, who cleans out the old nest materials? Well, this is my theory on the subject. There is no shortage of possible nest sites in the wild. If swallows were unsatisfied with the cleanliness of last year's nest, they would simply move on and find a new site. Unfortunately for me, that may not be in the vicinity of my yard where I cheer at every mosquito picked out of the sky by these fearless fliers.

So why clean the nests, anyway? There are several compelling reasons why we should remove the old material and scrub out the debris from the old nests. Bird nests are inherently dirty spots; they often become the home of many parasites, such as feather mites and fleas. Over time, a nest used repeatedly can become completely infested with parasites. During the summer, parasite eggs are laid in the nest materials and then the following year they hatch and completely infest the new hatchling swallows. In some cases this can actually reduce the survivorship of birds in the nest. Since I put up the nest box in order to entice the birds into my yard, I think it is only fair to try and keep the box tidy for them each year.

I have also noticed that the swallows in my yard pride themselves on the quality of nest materials they

collect. If there is no room for new materials due to excess leftover debris, they will simply move on. Some prefer to line their nests with moose hair, while others favor fine dry grass. Nests in my yard are often lined with delicate blonde hair from my golden retrievers!

If you are new to the game of nest boxes, here are a few pointers. It is quite a game, by the way. I know people that have put up nest boxes in their yard for years and have yet to attract any summer residents. They buy complicated, beautiful nest boxes and erect them everywhere, but just don't seem to entice any birds. Other folks I know hang small cardboard boxes under their eaves and cut a hole in the box with a pocketknife. They have four or five families of both tree and violet-green swallows every year. Like real estate, I think the trick is location.

You may read in books that the nests have to be facing in a particular direction, like south facing, to provide additional warmth. I find this is less critical than what is in front of the nest and what the nest is secured to. I have placed boxes in trees, secured them to the house and even erected freestanding poles. The best luck I have had is with boxes tucked up under the eaves on the corner of the house. Nest boxes that are attached to trees are often less desirable due to predators like the red squirrel. On most houses it is pretty difficult for a squirrel to predate a nest suspended under the eaves. Swallows prefer to come flying into the box low to the ground and then swoop up to the nest hole with a straight in approach. If your nest box is on the back of the garage and you only have 15 feet to the wood line, you will probably not have a lot of success enticing swallows. They want a wide-open approach.

Lastly, the site you choose should be free of unpredictable disturbances. If you have people coming in and out of your front door, this would not work well for a nesting site. Swallows are fairly tolerant of humans, but they have their limits. Disturbances that force both parents to leave the nest box and fly around result in unsuccessful nests. For you this means the birds will lose interest in your yard and will spend the summer hawking mosquitoes in my yard.

Todd Eskelin is a Biological Technician at the Kenai National Wildlife Refuge. He specializes in birds and

has conducted research on songbirds in many areas of the state. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previ-

ous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Refuge trail crews taking action after floods and windstorms

by Scott Slavik

Perhaps our early warm and sunny spring is Mother Nature's way of apologizing for the disappointing snow conditions of the past winter. If you're like me, you've long since swapped your cross-country skis and snowshoes for hiking boots and Extra Tuffs. Recently I've met quite a few Peninsula residents taking advantage of the recent warm weather and enjoying the trails on the Kenai National Wildlife Refuge. Although each person claimed to love Alaska winters, their attention was now focused on catching some great bug-free hiking time and spring sunshine.

If you've spent any time on Refuge trails lately, you've probably seen or heard the author of this article. My name is Scott Slavik. I work as a Backcountry Ranger on the Kenai Refuge, and the noise you heard was probably the "whirr" of my chainsaw.

In the past few weeks, trail users have had to confront not a few trail obstacles. The high winds of mid-March caused an above-average number of downed trees, especially on trails within beetle-kill or burn areas. Hikers have had to duck under, climb over, and scurry around fallen trees; this can be challenging, unsafe, and create additional routes and impacts to surrounding vegetation. The fall 2002 floods that swept the drainages of the Kenai Mountains and washed out several state facilities on the Anchor River and Deep Creek also flooded and eroded several trails on the Refuge. So, part of my work this spring has been erosion control, as well as tree cutting. In addition to the challenges on the trail, hikers in the Skilak Wildlife Recreation Area have also faced difficulties on the road. Indeed, Skilak Loop has been in pretty rough shape. Although currently open, parts of the road have been impassable due to severe break-up conditions and last fall's heavy rains. The Department of Transportation will begin road maintenance and grading next week, so the road should soon be improved.

We got started early this year in clearing some of the most popular routes of winter downfall. Currently we have cleared the trails along Swanson River Road. In the Skilak area we have cleared the Bear Mountain, Upper Ohmer, Hideout, and Kenai River

trails. Along the Sterling Highway, downfall has been removed from the Skyline and Egumen Lake trails. The Refuge's volunteer trail crew will begin work June 1st with further maintenance efforts and trail improvement projects continuing throughout the summer. You can always check with the Refuge Headquarters for updates and current trail conditions.

A few hikers I've recently met told me about their favorite trails and special spots on the Refuge that they return to again and again. I was impressed by their intimate knowledge and appreciation of the wildflowers and berry picking, and enjoyed listening to detailed descriptions of their special moments involving a chance encounter with wildlife, a particularly dramatic sunset, or a unique photographic opportunity.

Other hikers seem to be constantly seeking new challenges, unexplored territory, a higher peak, or another vista. For those adventurers, I've been recommending the Refuge's newest trail located off Upper Skilak Campground. Although still unnamed and needing a few "finishing touches," a few curious hikers have already explored the route. This trail leads east from the campground to a plateau just below Henton Peak and affords spectacular panoramic views of Skilak Lake. Like the Hideout Trail, it climbs through a recent (1996) burn with open views in all directions. It is approximately 2.5 miles round trip and gains 1300 feet in elevation. Hikers will be treated to abundant wild flowers, wildlife sightings, and a challenging day hike. Student Conservation Association (SCA) volunteers constructed the trail over the past three seasons. We expect to complete this trail and have a formal opening later this summer.

Also scheduled for this season are improvements to the Hidden Creek and Kenai River trails. Volunteer high school and college students will be working on these and other trail upgrade projects this summer.

Memorial day weekend is just around the corner, the RV's are heading this way, and we will all soon have to share "our Alaska" with our summer guests. You still have time, however, to enjoy a quiet and peaceful wilderness moment on one of the many trails

on the Kenai National Wildlife Refuge.

If you would like more information on Refuge trails and hiking opportunities, contact Refuge Headquarters for additional information or check out the websites below. If you would like to report downed trees or trail washouts that you have discovered, please give me a call at Refuge Headquarters (262-7021).

Scott Slavik is a Backcountry Ranger at the Kenai National Wildlife Refuge. Additional information on Kenai Peninsula trails can be found on Refuge Ecologist Ed Berg's website at: <http://chinook.kpc.alaska.edu/~ifeeb/index.html>. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Bark beetle time again

by Ed Berg

It's springtime in Alaska, and a young man's fancy turns to—spruce bark beetles—what else!? With romance in the air, the beetles are waiting expectantly for several days of 60°F temperatures for their annual mating flight. This is the only time of year that you will see the beetles outside of the tree; at other times you will need to take a stout knife and peel back some bark to see them at work eating the sweet inner bark.

The beetle mating protocol runs something like this: when the weather has warmed sufficiently, the female beetles emerge and fly to nearby live trees, or better yet to recently downed trees. They fly rather clumsily because they really aren't designed for long-distance flight, although they can be carried by the wind for long distances. When a female finds a suitable tree, she releases an aggregation pheromone; this is a chemical attractant that brings other females to the tree. When the females somehow determine that the tree is "full" of beetles (this must be an interesting story in its own right), they release a disaggregation pheromone that says, "the hotel is full," which repels latecomers.

The female beetle bores through the tough outer bark, and begins tunneling through the inner bark or phloem layer, where the sugar is stored. A male enters the burrow, finds the female, and they mate and the male dies. Unlike many insects, spruce bark beetles are monogamous: each parent has only one partner.

The female enlarges the burrow into a vertical maternal gallery three to four inches long and about 3/8 inch wide. She lays approximately 80 eggs along the sides of this gallery. During the summer the eggs hatch and the larvae (white grubs) fan out on both sides of the gallery, eating their way through the phloem. This is the really destructive phase, which essentially girdles the tree, just as effectively as if you took an axe and stripped off the bark all around the trunk.

The phloem layer is the plumbing that brings sugar produced in the leaves (i.e., needles) down to the roots for storage. When the plumbing is cut off, the roots starve and there is no food left to send up topside to the leaves the following spring to grow new leaves and restart the cycle. That is why trees hit by the beetles

last year are now turning into the "red needle" stage. These needles will fall off over the next year, but you can always tell the recent beetle-kill by the red needles.

The Forest Service flies annual surveys over the forests of Alaska, mapping red needle acreage, as well as other kinds of forest pests and disease conditions. I have just received a copy of the Forest Service's annual report of their surveys and it makes fascinating reading for forest watchers (see website below).

So, how is the bark beetle outbreak doing at this point in time? Basically, the outbreak is over and we are down to "normal" background levels of beetle activity. The problem, however, is that "normal" activity will probably be at higher levels from now on. Global warming is a fact of life, especially in the northern latitudes. We have been in a warm summers mode since 1987, with maximum summer temperatures in 1997. It's true that the post-1997 summers have been a shade cooler, by almost 3°F, because the North Pacific sea surface temperatures have cooled somewhat, especially since 1999.

The beetles love a run of warm summers to build up their populations, and they have essentially had a run of warm summers since 1987, the longest run on record, by far. Even with the post-1997 shallow cooling, the primary reason for the decline in bark beetle activity is that they have "eaten themselves out of house and home," especially on the southern Peninsula. That is, they have killed most of the large spruce trees that are their prime habitat.

In the central and northern Peninsula, however, there are still a lot of medium-sized live trees (six to eight inch diameter) that are coming on line as good beetle fodder. Soldotna-area homeowners are frequently telling me that they lost several trees over the last year and that they are worried about their remaining trees.

At non-outbreak (normal) levels of beetles it is possible to take defensive measures. The best defense is a vigorously growing tree: this means thinning your stand and pruning the lower branches so that sunlight can warm the trunks for part of the day. Fertilizing the trees is good, and watering them during dry period (such as right now) is also helpful. It is also important

to get rid of slash and cover up freshly cut logs with plastic. The absolutely best beetle habitat is a fresh horizontal log. Indeed, you can use a freshly downed tree right now as a beetle magnet or trap tree, which must then be burned before the beetles emerge next spring.

Some homeowners spray their trees, which lasts for two to three years, but spraying involves a choice about introducing pesticides into your living space. After reading Theo Colburn's excellent book *Our Stolen Future* (Plume, 1997) about the impact of trace amounts of pesticides on embryo development in wildlife (and humans), I have become quite conservative about putting more chemicals into the environment. I didn't spray my trees in Homer in the 1990s and I ended up cutting most of them down—dozens of beautiful big Sitka spruce. This was a gut-wrenching experience, but in the grand scheme of things I feel that I did the right thing.

At the present low levels of beetle activity I think that homeowners can take effective preventative measures without spraying and still enjoy their spruce trees for many years. This being said, I suggest that homeowners plant some new trees every year, so that new stock will be coming of age as the older trees are phased out, for whatever reasons. In Homer the Kachemak Heritage Land Trust will have a tree sale the Eagle Quality Center this Saturday, May 24. For reforestation advice and assistance Al Peterson at State Forestry (262-4421) administers the Land Owner Assistance Program, which has matching funds available for replanting on a scale of several acres.

For some current beetle numbers on the Kenai, the Forest Service reports that "red needle" acreage fell from 27,051 acres in 2001 to 8076 acres in 2002. Almost half of the 2002 mortality (3579 acres) was in the mountains of Chugach National Forest. The surveyors observed 1424 acres on the south side of Kachemak Bay, and 3074 acres strung out from Homer to Point Possession, with much of it concentrated south of Skilak Lake (3055 acres). All of this is peanuts compared

to the peak years of the mid-1990s when Peninsula totals ran from 300,000 to almost 500,000 acres of fresh kill per year.

Around Refuge Headquarters in Soldotna we deployed three sets of beetle traps last week. For the second year, retired Forest Service entomologist Richard "Skeeter" Werner has provided the traps and will identify and count the beetles. The traps are baited with chemical attractants (pheromones). There are specific traps and pheromones for spruce bark beetles, Ips (engraver) beetles, and wood-boring beetles. Last year we caught a lot of Ips beetles, only a few spruce bark beetles, and a fair number of wood-boring ambrosia beetles. We collect the traps every two weeks throughout the summer.

I checked the traps after the first week and found only a few spruce bark beetles. I doubt that the main beetle flight has taken place, at least in Soldotna, but it could occur any day now. Each year I ask readers to give me a call (260-2812) if they see any spruce bark beetles flying, and I would ask this again this year.

David Henry and I have recently finished a report on our studies of spruce bark beetle outbreak history in the Kluane National Park area in the Yukon. The bark beetle history is very different in the Yukon, and the report compares the Kluane and Kenai Peninsula histories for the last 250-300 years. I also wrote a separate appendix on the role of climate in determining bark beetle activity in the two areas. The report can be read on the Refuge website under "Biology Program" at <http://kenai.fws.gov/>.

The USFS *Forest Health Condition Report 2002* is at www.fs.fed.us/r10/spf/fhp/fhpr10.htm. Hard copies can be ordered from Ed Holsten at eholsten@fs.fed.us, 907-743-9453.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Restoring old cabins on the Kenai National Wildlife Refuge

by Molly Slocum

Midnight, June 21st you are sitting on the shore of Lake Tustumena near Andrew Berg's cabin. The colors of twilight surround you, painting the lake and mountains with pink, blue, and lavender hues. The only sounds reaching your ears are the water lapping at the sand and the wind rustling through the treetops. The year could be 1895; you are on a hunting or fishing trip, and you are now relaxing after a day of hiking in the high country. Or it could be 2003, and you are enjoying a peaceful summer solstice retreat.

The Kenai National Wildlife Refuge offers unique backcountry experiences with many historic cabins. Over the years cabins were built around the Kenai Peninsula to support activities such as hunting, fishing, trapping, and mining, as well as for year-round homes. Today these structures have historical value and are important living history that is worth preserving. These cabins symbolize the wildness of Alaska: a simple, rustic life and a close, primitive relationship to the Earth. Today they provide backcountry users with a historical perspective as well as a wilderness experience.

This summer the Kenai Refuge has a new crew of folks who will be restoring some of these cabins that are in danger of disintegration. The crew of four, along with volunteers, will work on replacing some of the cabin base logs as well as replacing bunks, tables, benches, windows, shelves, roofs and floors. The restorations are designed to maintain the original rustic atmosphere.

Restoring these cabins requires many hours of hard labor. Springtime starts with assessing the cabins, in addition to hauling all the building materials to the cabins. Currently the Finger Lakes cabin, located off Swanson River Road is closed while the work is in progress. The base logs are rotting and need replacing, as well as new bunks, tables, and benches. There are no dead trees near the cabin, so while the lake was still frozen we hauled five 20-foot logs across the lake, along with pier blocks, 40 five-gallon buckets of gravel for the foundation, and roofing material. Next we have to get all the materials from the lakeshore up the hill to the cabin to actually do the building work. This requires long hours of hard work, but there is no better

place to enjoy the warm, sunny spring days than outdoors next to a lake beneath the great blue sky.

I recently spent a weekend on Tustumena Lake assessing the condition of various cabins. We will be restoring another of Andrew Berg's cabins, which was built in 1902. Andrew Berg was a big game guide, and fish and game officer. After restoration, the cabin will be exactly the same as it was before; no changes will be made to the original design.

It is a shame to visit these historical places and find them defaced with graffiti carved into the old logs and trash littering the inside and the ground around the outside of the structures. This shows a lack of respect for people who lived here before us, who worked hard for their food and living. The refuge crew will also be sanding the logs to rid them of the graffiti, so that in the future backcountry users can enjoy a clean, peaceful, historic treasure.

Some of the other cabins scheduled for restoration this summer are Caribou Island Cabin, Nurses Cabin, and Pipe Creek Cabin on Tustumena Lake, and Doroshin Bay cabin on Skilak Lake. Trapper Joe Cabin, Vogel Lake Cabin, and Chickaloon Cabin will also be worked on. Most of these cabins were built in the early 1900's; however, a few were built more recently and have varying levels of conditions and repairs needed. Since the cabins were built before the Wilderness Act, they can still be maintained, even though some are located on Wilderness land.

The cabins are open on a first-come-first serve basis. It is expected that visitors will treat the cabins and surrounding property with respect, and not leave trash and graffiti everywhere. If this happens in the future, the cabins will be closed to the public. If you carry it in, carry it out. Leave the place neater than you found it for the next visitor; it might be you. These cabins provide us with a special historical aspect of a rustic, simple life, which can be considered the spirit of Alaska. It is important to preserve these artifacts of history so that others in the future can enjoy them.

If you are interested in volunteering with the upkeep and restoration of the cabins, contact Gary Titus at the Kenai National Wildlife Refuge at 262-7021.

Kenai and Alaska Maritime National Wildlife

Refuges will host a Refuge Centennial Celebration at the Ninilchik fairgrounds on Saturday, August 2nd. Come join us for music, exhibits, and a chance to meet Teddy Roosevelt, who established the first National Wildlife Refuge in 1903.

Molly Slocum began working at Kenai National Wildlife Refuge on the SCA backcountry crew in 2001;

she became a Firefighter in 2002, and worked this spring on cabin management. She is now working for the U.S. Forest Service on the backcountry crew out of Moose Pass. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Preparedness is the key to effective fire management

by Doug Newbould

“Be Prepared.” I remember learning that motto as a young boy, during my short stint as a Cub Scout in the hill country of southern Illinois. And though the phrase seems indelibly etched upon my brain, the reasons behind the memorization of that motto are now lost somewhere amid the clutter in the attic (my brain). Although that period of time in my life is rather foggy, I don’t think I knew then what “being prepared” really meant. I’m somewhat skeptical anyone under the age of twenty-something could have enough life experience to truly understand the physical, mental and perhaps spiritual implications of preparedness.

In defense of Scouting, I only had a couple of years of training as a Cub Scout, so there wasn’t sufficient time for me to practice what I was taught and learn the mission of the motto. What I know now is Scouting builds character in young people. It’s all about developing integrity and positive attitudes. And I think “Be Prepared” is about attitude—an attitude of readiness. It’s the readiness to help others: a neighbor, a community, a nation. I think Scouts often make the best public servants, because they are prepared to give of themselves to make a difference in the world.

Although I didn’t rise to the rank of Eagle Scout, or Arrow or even Webelo, I did pursue a career as a public servant. And now as a fire management officer, being prepared takes on a whole new meaning for me. In fact, Preparedness is one of the primary goals and major functions of my job. Preparedness in wildland fire management is both broad in scope and focused in its purposes. Without it, the fire management program at the Kenai National Wildlife Refuge could not function.

Fire management preparedness on the Refuge includes: development of preparedness plans and seasonal risk analyses, recruiting and hiring qualified firefighters and other fire management staff, training fire

personnel and maintaining qualifications, managing the firefighter physical fitness program, purchasing and maintaining firefighting equipment and supplies, daily monitoring forest fuels and weather conditions throughout the fire season, developing daily staffing and work plans based on fire danger, and last but certainly not least—wildland fire mitigation and prevention.

There are national preparedness plans and staffing levels, there are preparedness plans and staffing levels for Alaska, and there is a Refuge Preparedness Plan that defines the staffing levels for a given set of weather and fuel conditions or fire danger rating. These plans are in place to ensure organizational preparedness throughout the country. Preparedness is also a personal responsibility for every Refuge and other wildland firefighter.

Personal preparedness means keeping in shape (a real challenge for Alaskan firefighters in the winter), attending fire management training courses and maintaining Incident Command System qualifications, maintaining personal fire gear and personal protective equipment, and maintaining a state of fire readiness for response to fire emergencies (24-7) during the fire season.

I believe that preparedness is the key to safe and effective firefighting and the foundation for an efficient and productive fire management organization or program. So if you know any Scouts who are looking for work, tell them to give me a call. I’m always looking for people who know how to “Be Prepared.”

Doug Newbould is the Fire Management Officer at the Kenai National Wildlife Refuge. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

New willow fieldguide helps identify important plants

by Ed Berg

Barclay willows are in bloom now along the roadsides. These favorite shrubs of browsing moose grow well in disturbed soils along road right-of-ways, as well as high in alpine meadows above tree-line. Their plump catkins, which are actually clusters of many tiny flowers, are in full display right now, along with the emerging leaves and last year's brown "willow rose" galls.

Willows are benevolent plants on our landscape. They are at the bottom of the food chain for many species, most notably moose and snowshoe hares, and everything that eats moose and snowshoe hares. Beavers and caribou enjoy willows, as do ptarmigan and grouse that eat willow buds in the winter. Many insects lay their eggs on willows and their hungry larvae feed on the buds and leaves. Pollinating insects like bees and flies sip nectar from willow flowers. Human beings don't eat much willow, but they certainly consume a lot of aspirin, which was originally extracted from willow.

Dominique Collet of Sterling has written a new fieldguide on willow identification, called *Willows of Southcentral Alaska*. The book is richly illustrated with excellent watercolor paintings and line drawings, and is designed to assist non-specialists in identifying the local willows. The technical terminology is kept to a minimum, and the distinguishing features are highlighted in the pictures with pointer lines, similar to Peterson's bird fieldguides.

Willow cuttings are often planted for streambank restoration projects, e.g., Jim's Landing on the Kenai River. It is important to collect the right species for these projects (e.g., feltleaf and Barclay willow), because many willow species do not transplant well and will die (such as bebb and scouler willow). The Kenai Watershed Forum published this book, with funding from the U.S. Fish and Wildlife Service and support of many other agencies, especially with an eye toward the book's use in future streambank and landscaping projects.

Generally speaking, willows are hard to tell apart: there are 26 species in our area, out of about 350 species worldwide. Dominique's book has several identification keys that lead the reader step-by-step

through a chain of choices to the identity of a specimen of interest.

Unlike most flowering plants, the sexes are separate in willows; there are separate male and female plants. The flower clusters (catkins) of the male plants have showy yellow stamens that release pollen, whereas the female flowers have plump pods that will split open to release tiny seeds embedded in fluffy plumes of cotton. So, when identifying a willow in bloom, the first thing to decide is whether you have a male or a female plant. Following the steps of the "Summer Key" in the book, you can easily pin down the identity of your flowering specimen.

Oftentimes, however, a willow will not have its flowers available when you want to identify it. Some willows flower early in the spring and then drop their flowers (e.g., scouler willow); some don't flower until mid-summer, such as gray-leaf willow, and of course they all drop their flowers in the winter. For willows with leaves but no flowers, Dominique has provided a "Vegetative Key," which draws heavily of leaf characteristics such as size, shape, veins and hairs.

From a practical point of view, the "Winter Key" may be the most useful part of the book. For streambank restoration projects, willows have to be collected during the winter when they are dormant. There is no point in collecting species that won't survive transplanting, so this is where "the rubber meets the road." Landscapers gathering willows in the winter can use this book to tell which species to pick and which to leave behind.

Willows have contributed a lot to the history of the Kenai National Wildlife Refuge. From historical records we think that there were not many moose on the Kenai before the late 1800s. Prior to European settlement, the Dena'ina natives focused on caribou, and of course salmon, and moose apparently did not play an important part in their culture. Trapper and guide Andrew Berg reported a series of wildfires on the Benchlands between Skilak and Tustumena Lakes in 1871, 1891, and 1910. These burns probably stimulated prolific willow growth, which can still be seen today in the form of willow trees and dense tall willow thickets above Bear Creek and Moose Creek.

With abundant post-fire willow browse the Benchlands became a world-class hunting area for the “giant Kenai moose,” and by the late 1890s European hunters were arriving to spend their summers hunting for these moose and the other abundant game animals. At the same time local residents were hired as meat hunters, and the moose population was severely hammered. Caribou were hunted to extinction by the mid-1910s and wolves were extensively poisoned, some say to extinction, out of fear of rabies, during the same time period. This severe over-hunting led conservationists and hunters to petition Congress to set aside a game preserve to protect the moose and its habitat. After several decades of discussion, in 1941 President Franklin Roosevelt authorized the creation of the Kenai National Moose Range, which later be-

came the Kenai National Wildlife Refuge in 1980 under ANILCA. And this all started with the willows coming in after some burns!

Copies of Dominique’s *Willows of Southcentral Alaska* can be obtained free of charge at the Kenai Watershed Forum office in the Blazy Mall in Soldotna (260-5449).

Mark your calendars for August 2, 2003, when Kenai NWR and Alaska Maritime NWR host a Centennial Celebration of the National Wildlife Refuge System. The event is free to the public at the Alaska Fairgrounds in Ninilchik and lasts from 10 a.m. to 8 p.m.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Peak wildflower blooming time should not be missed

by Candace Ward



wild rose

Look for wild rose during June at roadside and woodland edges.

As we come to the summer solstice, it's time to enjoy a significant event in our local natural history calendar—the peak wildflower season. Take time to walk in the woods, by wetlands, and up in the alpine tundra to view this spectacle of nature.

Wetland blooms to enjoy include brown chocolate lilies, purple wild iris, pink bog rosemary, white cloudberry, and yellow monkey flower. Woodland favorites include white dwarf dogwood, pale pink twinflower, white starflower, and pale pink wintergreen. Disturbed roadsides are showy with purple lupine and deep pink wild rose.

Though mid-June is the time for the most concentrated wildflower blooms in the lowlands, a second wave of the flowers can be found in alpine areas from 800 to 2000 feet and higher. In late June and early July, look for blue harebells, pink moss campion, yellow spotted saxifrage, and white gentian.

A few commonly encountered wildflowers require caution—white flowered baneberry, purple monkshood and purple larkspur are all very poisonous. It is recommended that you wash your hands after even lightly touching these plants to prevent any of their oils from being transferred to your hands and eventually to your mouth. Another flowering plant to avoid is the large white-flowered cow parsnip that produces

an oil that causes severe skin irritation in some people.

Wildflower season is a great time to find the flowers of wild berries so that you can stake out good berry patches for late summer and early fall. Look for white wild raspberry flowers in disturbed areas by roadsides and trails. White lowbush cranberry (lingonberry) flowers tinged with pink can be found in woodlands and wetlands. White bell-shaped blueberry flowers are found in wetlands and alpine areas.



fireweed

Not only do Alaskans enjoy beautiful wildflower displays all summer, but also thanks to the hardy pink fireweed, we have one of the most colorful wildflower “exits” of any place in the world. In late July and August, roadsides, meadows, and mountainsides are a vivid pink with awesome displays of showy fireweed.

While Alaska is renowned for its scenery, fish, and wildlife, let's not forget how remarkable our state is

for its awesome wildflower displays. To protect our wildflower heritage far into the future, remember to view or photograph these beautiful blooms, but refrain from collecting wild flower bouquets so that there will be seeds for next year's blooms.



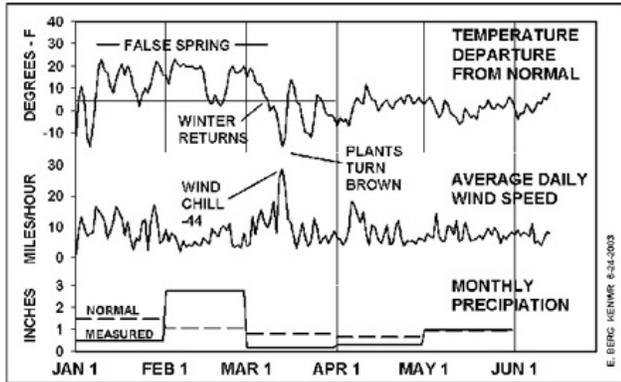
wild iris

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Candace Ward works at Kenai National Wildlife Refuge as a park ranger specializing in visitor service and education. Her favorite wildflower and wild berry guides are "A Field Guide to Wildflowers" by Verna Pratt, "Alaska's Wild Berries & Berry-Like Fruit" by Verna Pratt, and "The Flora of Alaska" by Eric Hulten. To learn more about Kenai National Wildlife Refuge, visit the website, www.kenai.fws.gov. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Why has the Labrador tea turned brown this spring?

by Ed Berg



Spring weather recorded at the Kenai Airport.

Many plants suffered frost damage from strong Arctic winds in mid-March, which followed an eight-week period of temperatures reaching more than 20 degrees above normal.

Have you noticed the brown halo above the ground along many Peninsula roads this spring? Our forests typically have a low shrub layer of Labrador tea with permanent green leaves, but many of the leaves are brown this year. This dieback can be seen very dramatically driving along Funny River Road, for example, especially on the south side of the road where our fire crew has thinned the spruce forest to create a firebreak.

Lowbush cranberries (lingonberries, mountain cranberries), leatherleaf, club moss and crowberries are also showing some brown leaves, although not as badly as the Labrador tea.

Plants exposed to the wind (north-facing open slopes, open powerline right-of-ways, treeless bogs) were more affected than the same plants in protected settings (south-facing slopes, in deep protected woods, etc.). Even on small mounds the leaves of evergreen plants on the north side were affected, but two feet away on the south-facing side the plants were OK.

As I said, all of these plants are evergreens, meaning that they do not drop their leaves in the winter. Although the leaves have died back this spring, the plants themselves generally do not appear to have been killed. The green parts are producing flowers,

and the dead leaves will probably be replaced over the next few seasons.

We have a key observation on this puzzle. Our former refuge supervisory biologist Ted Bailey retired two years ago, after 24 years on the refuge, and he now indulges himself by taking an extended daily walk. He keeps a daily journal of the walks, recording his observations on the comings and goings of wildlife, the plants, and the weather. This kind of daily record becomes extremely valuable over the years, and we wish Ted Bailey a long and healthy life as a chronicler of our changing environment on the Kenai. (Watch for Ted's upcoming *Refuge Notebook* on the daily work life of a red-breasted nuthatch family this spring.)

Ted Bailey's key observation is that the plants turned brown after a blast of cold arctic wind on March 12th, 13th and 14th. This windstorm closed the Anchorage airport and damaged many buildings in Anchorage. Wind chill values at the Kenai airport were -37°, -44°, and -40°, respectively, on those days.

The browned plants would normally be under snow cover and would thus be protected from extreme cold and strong winds, but this year there was very little snow cover at the lower elevations and the plants were fully exposed to the cold winds.

Even so, these plants are tough. They have evolved in a harsh winter climate, and all survive much more extreme winters in the Interior than we have on the Kenai. What was so peculiar about this particular cold period in March?

My hypothesis on this dieback is that the eight-week long "false spring" (from Jan 9th through March 8th) caused the plants to break winter dormancy. The plants relaxed too much and thought that summer was just around the corner. During this period in Homer, we had domestic flowers blooming in the garden and grass was greening up. (Native wildflowers, however, knew better.)

February was the warmest on record at the Kenai airport (which began recording weather in 1944), with the February average 31.4°F, as opposed to long-term mean of 16.6°.

Northern plants have various mechanisms of winter dormancy that harden their tissues against the cold.

In the first stage of hardening, water is moved out of the cells into spaces between the cells, so that ice crystals will not damage the cell membranes. In the second stage of hardening, the chemicals in the cell membranes are reorganized to be stable at lower temperatures. In the third stage of hardening, the water between the cells is frozen to non-crystalline glass-like form that does not have sharp points. These hardening phases must take place over several weeks, and the degree of hardening varies greatly from species to species. In the extreme, some tree species—properly hardened—can be dipped in liquid nitrogen at -321°F and still survive.

When a plant is warmed over a period of days, the hardening stages are reversed. Simply bringing the plant into a warm room is not sufficient to instantly break winter dormancy, but eight weeks is more than adequate. Our many days of maximum temperatures in the 40's during January and February should have been more than sufficient to initiate the de-hardening process. In a word, these plants were caught “with their pants down” when the cold arctic winds arrived on March 12th.

A similar “false spring” story comes from the Colorado Rockies. In 1989 a January thaw lasting six days (with mean maximum temperatures of 43.5°) was followed in February by a cold snap where temperatures plunged to -29°F for two nights. This caused needles at the end of lodgepole pine branches to die and turn red.

Many people have planted lodgepole pine on the Peninsula, and I would be curious to know if readers

have noticed any red-needle dieback on their lodgepoles, especially if their Labrador tea plants and other evergreen plants also turned brown.

In the Colorado case the extreme cold was sufficient to kill the de-hardened needles: wind wasn't a factor. In our case the air temperatures were relatively mild ($+1$ to 5° daily minimums), but the high winds presumably lowered the leaf temperatures well below the air temperatures. The wind chill calculation attempts to capture this cooling as it would affect human skin, and it is hard to say exactly into what temperature a wind chill of -44° translates for the inside of a Labrador tea leaf. Whatever that temperature might be, it's a good bet that properly hardened Labrador tea would have been able to withstand it, and that the problem this spring was the loss of proper hardening with the long “false spring.”

Information for this article was drawn from *Winter: an Ecological Handbook* by J. Halpenny and R. Ozanne (Johnson Books, 1989).

Mark your calendars for August 2, 2003, when Kenai NWR and Alaska Maritime NWR host a Centennial Celebration of the National Wildlife Refuge System. The event is free to the public at the Alaska Fairgrounds in Ninilchik and lasts from 10 a.m. to 8 p.m. Attractions include speakers, movies, displays, and kid's activities sharing Alaska's refuges and wildlife. Live music and delicious food will also be provided.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Red-breasted nuthatches: newcomers on the Peninsula work hard to raise offspring

by Ted Bailey

Red-breasted nuthatches appear to be relatively newcomers as nesting birds on the Kenai Peninsula. I did not see a red-breasted nuthatch in the Soldotna area until sometime in the mid- to late-1980s. The first time they were recorded during the annual spring North American Breeding Bird Survey (BBS) on the Kenai National Wildlife Refuge was 1995, thirteen years after the BBS was first initiated on the refuge.

Curious about their recent appearance, I examined other BBS survey data from the northwestern United States, Canada and Alaska to see when nuthatches were first recorded in these surveys. I found that the data indeed suggest a northward expansion of nuthatches into Alaska from Canada during the past 20 years.

Breeding bird surveys have been conducted in northwestern states and Canadian provinces since 1968, with red-breasted nuthatches reported in Washington and in neighboring British Columbia in very first surveys. But nuthatches were not reported on a BBS in the more northern Yukon Territory until 1974.

Eleven years later—in 1985—nuthatches were first reported on a BBS in Alaska. Furthermore, reports of nuthatches doubled in Washington in 1981, rapidly increased in British Columbia in 1990, in the Yukon in 1993, and in Alaska from 1994 through 1996, the same period we first began recording them on the Kenai refuge. Observers in Kachemak Bay and at Hope first reported them in 1992 and 1993, respectively.

Some of these increased reports may have been due to more observers and routes added each year, but the years of first reports suggest a northward expanding population. Nuthatches thus appear to be a relatively new breeding species on the Kenai Peninsula, perhaps nesting here only during the last decade or two.

It is remarkable that one can witness the establishment of a new species in an area within one's lifetime. With predicted trends in global warming, however, we may see more unfamiliar species arriving on the Kenai Peninsula in the future. Let's hope that they are all as benign as nuthatches! Since nuthatches nest in cavi-

ties in trees, I have over the years attempted to attract nuthatches to nest boxes near our house. These attempts have always been unsuccessful; nuthatches apparently rarely use nest boxes, preferring to construct their own cavities in trees.

This spring I was rewarded with an unexpected event; a pair of red-breasted nuthatches reared their young in an old birch snag at the edge of our yard. At first I thought they were merely storing food behind some loose bark about eighteen feet high on the far side of the snag. Then I discovered that they were already busy excavating a cavity where a large branch had broken off during a previous windstorm. Even more surprising was the fact that the wood they chose was solid and hard, not decayed and soft, at least at the surface.

Starting around March 15, the nuthatches began removing "BB"-sized or smaller bits of wood at a rate of about one piece every five seconds, hour after hour. Later, as they moved deeper into the center of the snag, the rate of wood removal slowed. After removing tiny pieces of wood for at least 35 continuous days, the nesting cavity appeared to be completed by April 18. A very rough calculation suggests that they made somewhere between 3,700 to 10,000 "wood removal actions" to excavate the cavity deep inside the birch snag.

Incubation appeared to have started by at least May 7, when I observed the male bringing food to the female inside. The nuthatches were very pugnacious and drove away any other bird that came within 20 feet or more of their nesting cavity. I have read that red-breasted nuthatches line their cavity entrance with sticky sap or resin to ward off predators, but at this stage I could see no resin around the cavity entrance. I thought this might not always occur. Then by May 14 until at least May 19, I observed the nuthatches bringing small bits of sap and resin and smearing it around the entrance to the cavity. By time they completed this phase of protecting their eggs and young, the thick clear sap could be seen running a couple of inches down the tree trunk from the cavity entrance. At an observed rate of one sap trip per one to five min-

utes, I roughly estimate that lining the cavity entrance with sap required 600 to 3,000 trips.

Diverse sources provided small pieces of sap. Some pieces came from nearby black spruce trees and other pieces from the sticky buds of cottonwood trees.

With the cavity entrance now lined with sticky sap, I wondered how the nuthatches would avoid getting themselves stuck. When I first observed the parents feeding the young on May 23, I noted that they would briefly hover—like a hummingbird—in front of the cavity and then dive into the opening without touching the sap-smear edge. When they left, they burst out like a rocket from deep inside, again avoiding the sap-smear edge of the cavity.

The young were fed insects and spiders. It was not uncommon to see the large dangling legs of a spider sticking out of a nuthatch's bill as it briefly perched on a nearby limb before delivering the food to the young inside. On a few occasions the adults attempted to catch moths in mid-air. On the first day that I observed the parents feeding their young, they made an estimated 100-300 trips with food.

Then suddenly after 14 days of feeding young and sometime in the early rainy morning of June 5, the nuthatches were all gone. The previous day I saw one of the youngsters inside with its head near the cavity entrance. I never determined how many young were inside, but nuthatches typically lay from 4 to 7 eggs. I was surprised that during the feeding period the young apparently never made a sound, perhaps another adaptation to minimize drawing the attention of predators.

I will probably never again have the opportunity to observe red-breasted nuthatches rear their young—from the beginning with excavating a nest cavity—to fledging the young. I feel privileged to have conveniently witnessed such an event in our backyard.

I once considered cutting the old birch snag down, but my wife convinced me to leave it as long as it had a few live branches on it. In theory, I knew that snags of old trees were valuable for cavity-nesting birds such as tree swallows, black-capped chickadees, and woodpeckers. However, I now place even more value on these snags after witnessing the role they play in insuring the continuation of a species. And further, I have a great admiration for the tremendous amount of work, ingenuity, and resolve that nesting red-breasted nuthatches must apply in order to raise their young.

Mark your calendars for August 2, 2003, when Kenai NWR and Alaska Maritime NWR host a Centennial Celebration of the National Wildlife Refuge System. The event is free to the public at the Alaska Fairgrounds in Ninilchik and lasts from 10 a.m. to 8 p.m. Attractions include speakers, movies, displays, and kid's activities sharing Alaska's refuges and wildlife. Live music and delicious food will also be provided.

Ted Bailey is a retired Kenai National Wildlife Refuge wildlife biologist who has lived on the Kenai Peninsula for over 27 years. He is an adjunct instructor at the Kenai Peninsula College and maintains a keen interest in the Kenai Peninsula's wildlife and natural history. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Kenai Wilderness has long call

by Dave Kenagy

I had just spent a cold, memorable, winter working at Denali National Park. The Park in winter was very different than in summer—no people—just snow and quiet. Now it was April, and spring had begun with a freshness and clarity that only happens in the interior. Park visitors had not yet arrived, and except for the sounds of trickling water, wind in the trees, and the occasional gray jay or ptarmigan, the place had an eerie silence about it. It was like a land just being born. It was wild Alaska.

On my day off I went out into the Park, to Primrose Ridge, to photograph Dall sheep. When I returned to Park Headquarters there was a note waiting for me. I had gotten a phone call from Kotzebue. Would I like to work at Noatak National Preserve for the summer? Wow, would I!

There was only one hitch. Before I could call the Chief Ranger at Kotzebue, I got a call from Ranger Rick Johnston, at the Kenai National Wildlife Refuge. Would I like to work in the Kenai Wilderness as a back-country ranger for the summer? Wow, would I!

Rick is a multi-talented fellow. But, if there is one exceptional talent Rick has, it is this: he's such a good talker he could sell leaves to trees. He sold me on the Refuge and the Kenai Wilderness. Instead of remaining a "Parkie," I became a "Refugee." That was 20 years ago.

I left Denali and headed down to the Kenai. I had been to the Kenai before, but just to visit, and I hadn't paid much attention to the topography and vegetation. I hadn't yet been on the "Canoe Trails," and now it would be my responsibility to patrol them and do the trail work. As I drove the Sterling Highway near Watson Lake, I looked up to the northwest, where I knew the "Canoe Trails" were located. All I could see were miles of stumpy little black spruce trees of the 1947 burn. My heart sank. Why had I given up the wilds of northwestern Alaska, and float trips on the Noatak River, for this? I had pictured the canoe lakes to be surrounded by handsome birch and white spruce, not wet tundra and scraggly black spruce.

Being the stoic that I am, I drove on. I would find out that summer that the Kenai Wilderness was even more incredible than Rick had described. The

high country took my breath away. The canoe system was sublime, even with all the garbage pick-up at the campsites. And, as I found to my delight, most of the canoe lakes were indeed surrounded by handsome birch and white spruce. I patrolled 1.3 million acres of wilderness to my heart's content, cleared trails, cleaned up trash, and got a good look at wild Alaska.

As I look back twenty years, there is much that has not changed about the Kenai National Wildlife Refuge. The wilderness that so delighted and inspired me 20 years ago is still here, and still wild and pristine. The Canoe System looks much the same, and has about the same number of visitors now as then. Even most areas outside the Kenai Wilderness are still characteristic of wild Alaska.

But, the surrounding communities have certainly changed. There were no traffic lights in Kenai or Soldotna when I arrived, and visitors pretty much abandoned the Kenai Peninsula once August rolled around. Sterling was not much more than a wide spot in the road. There were no big box stores. Traffic, even in the middle of summer, was tolerable. It's amazing how much small communities can change in 20 short years.

As you may know, this year is the 100th anniversary of the National Wildlife Refuge System. So, many of us here at the Refuge have been trying to peer into the future, and imagine what the Refuge might be like in another hundred years.

To aid in my peering, I did some research on population trends. The projections for the Kenai Peninsula for the next 20 years suggest an increase, but more modest than in the past; projections beyond 20 or 30 years are as murky as glacial runoff. Today, there are about 50,000 people living on the Peninsula: by 2023 there will likely be almost 70,000. During that same period the Anchorage/Matanuska-Susitna area is projected to grow from about 333,000 to about 425,000. Many of those folks will choose to spend their time on the Refuge, producing more traffic and crowding; and certainly more will visit the Kenai Wilderness. But, how about the next 40, or 80, or even 100 years? No one knows. Peering into the future is an exceptionally difficult task; I have given up.

As for the Kenai Wilderness, which was

Congressionally-designated in 1980, the picture is clearer. The wilderness we hike or canoe today shouldn't look much different to the hiker or canoeist 100 years from now. Congress has done a pretty good job of explaining the "why" and "what" of wilderness, so I'll give you their words from the Wilderness Act:

"In order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition, it is hereby declared to be the policy of Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness..."

Congress went on to describe the features that characterize wilderness:

"A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this chapter an undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions..."

I encourage you to experience the Kenai Wilderness, and since I cannot say it better than he, I'll let Edward Abbey, a champion of wild places, encourage

you even more: "So get out there and hunt and fish and mess around with your friends, ramble out yonder and explore the forests, encounter the grizz, climb the mountains, bag the peaks, run the rivers, breathe deep of that yet sweet and lucid air, sit quietly for a while and contemplate the precious stillness, that lovely, mysterious and awesome space." Amen.

My hope is that 100 years from now a ranger working somewhere in America, will get a call from a "Ranger Rick" here at the Kenai National Wildlife Refuge, asking, "Would you like to work in the Kenai Wilderness as a backcountry ranger for the summer?" I hope they have the same reaction I did; "Wow, would I!" I also hope that the Kenai Wilderness they see is still pristine, and full of wildlife, clean air and water, and the sights and sounds of wild Alaska.

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Dave Kenagy is the Volunteer Coordinator at Kenai National Wildlife Refuge and can assure you that an office with houseplants is no substitute for a wilderness experience. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Refuge trail crew has many refuge trails ready for hiking and canoes

by Scott Slavik

So, you've caught your limit of fish for the day, now what do you do? I would recommend heading out on the trail system of the Kenai National Wildlife Refuge. The refuge offers and maintains more than 200 miles of hiking, canoeing and portage trails. Trails range in difficulty from relatively easy family day trails to strenuous mountain routes. There is a trail type and hiking opportunity for just about every interest.

The refuge backcountry crew has been actively maintaining the most popular road-accessible trails, which now are in fairly good condition. Trail maintenance is accomplished by refuge employees, youth work programs, Student Conservation Association Volunteers and community volunteers. These various groups have been dealing with extensive windfall from several fall and winter windstorms, which left many trails blocked. Additionally, the spruce bark beetle infestation and resulting dead trees have made clearing affected trails an annual event.

Swanson River Road Trails: These trails are relatively short day hikes providing access to nearby lakes. They pass through gently rolling hills of spruce and birch with no significant gain or loss in elevation. These trails are a good choice for families with children due to their shorter distances and the level terrain they traverse. They provide good wildlife viewing and birding opportunities. Moose are present in good numbers and bear, wolf, and coyote tracks can often be seen along the trail. These trails may also offer the perfect solution for anyone seeking a quiet backcountry fishing experience. All trails along Swanson River Road have been cleared of downfall. The backcountry crew will perform additional light maintenance on each of these trails, throughout the summer. This includes trimming overhanging limbs and branches and managing the explosion of seasonal vegetation along the trail tread. Generally speaking, these trails are in good condition with no major problems. As with many of the Refuge's trails however, exposed root systems in the trail tread are to be expected.

For those seeking a bigger adventure above tree-

line, I would suggest one of the following trails.

Cottonwood Creek Trail: Located on the south shore of Skilak Lake, this trail can only be reached by boat or floatplane, but it provides quick access to alpine country. The closest boat launch is at Upper Skilak Campground; however, winds can develop suddenly without warning making a lake crossing extremely rough and dangerous. Spectacular views of Skilak Lake and the surrounding mountains can be enjoyed above timberline and on clear days Mt. McKinley can be seen to the North.

This trail was heavily damaged during the floods of last fall. The creek jumped its banks and carved a new drainage, which "washed out" approximately one-quarter mile of the lower portion of the trail near Skilak Lake. Users still access the trail at the original trailhead on the west side of Cottonwood Creek, but must now navigate "the wash-out" and cross the creek before re-connecting with the upper, undisturbed portion of the trail. The backcountry crew has cleared and flagged a route through the "wash-out" to a narrow point on the creek that must be crossed. At this time, trail users are "on their own" with regards to making a safe creek crossing. As of June 8th the creek was fairly shallow in several places, but deceptively swift! Hikers should be prepared to go in over their boots! After re-connecting with the original trail, there is a clear route to timberline. Although portions of the route are somewhat overgrown with alders and devil's club, all downfall has been cleared to tree line. The trail generally remains dry in the lowland forest, but can be very wet just below timberline. Berry picking can be good in late summer. This is an excellent area to view wildlife, including Dall sheep, marmots, bears, and various species of birds.

Surprise Creek Trail: Surprise Creek Trail provides quick access to alpine country, and climbs rapidly in elevation through a spruce and hemlock forest until it emerges above timberline. The Surprise Creek Trailhead can only be reached by boat. The closest boat launch is at Jim's Landing (on Skilak Lake

Road 0.1 mile from the east entrance junction with the Sterling Highway) on the Kenai River. This portion of the Kenai River is CLOSED to powerboats. The Kenai River can be extremely swift and dangerous. The trailhead is directly across the river from Jim's Landing boat ramp. The trail is clear of downfall to timberline, although it is significantly overgrown with low-hanging alders at the lower end and encroaching hemlocks at upper elevations. The trail is also plagued with areas of standing water and deep muddy sections. The route has been flagged in a few places above the cabin site where it is difficult to follow the trail. In its present condition, it would perhaps be more accurate to describe this trail as a "wilderness route," but hikers will be rewarded with panoramic views of the Kenai Mountains and Kenai River drainage.

Skilak Loop Road: All trails within the Skilak Loop area have been patrolled and cleared of downfall. This represents the completion of phase I of the backcountry crew's maintenance efforts. Additional maintenance will continue on all of these trails throughout the summer.

Hidden Creek Trail: Although clear of downfall and completely accessible, this trail still has a few issues needing to be addressed. This year's High School SCA crew will be working on repairing broken boardwalks and consideration will be given to a possible re-route or installing additional boardwalks.

Kenai River Trail: Clear of downfall. There are several short overgrown sections on the Upper River route that require further attention. The trail, however, is clear and accessible. The backcountry crew is currently developing a better signage program to route visitors through this network of trails. The High School SCA crew will also be spending time on this trail. One possible project on the west entrance includes a re-route at the steep hill near the Kenai River.

Seven Lakes Trail: (patrolled & maintained 5/8/03, 6/5/03 & 6/21/03) Clear of downfall. Plans to replace the vandalized directional sign at the intersection of the Hidden Lakes Spur are underway.

Swanson River canoe system: the following routes have been patrolled and are clear of downfall and have appropriate portage trail signage in place:

- Entrance @ Paddle Lake to Kuviak Lake
- Kuviak Lake to Gene Lake (East Passage – Redpoll, Berry, Campers, Swanson)
- Kuviak Lake to Gene Lake (West Passage – Junco, Lost, Red Squirrel, Woods)
- Lonely Lake to Mouse Lake (Lonely, Lo, Hat, Rodent, Pan, Mouse)

Hanson Horse Trail / Funny River Horse Trail:

The entire route from the trailhead near Brown's Lake to timberline is clear of downfall. The trail tread, however, is severely eroded and plagued with roots throughout and the upper section is fairly overgrown with alders. The backcountry crew removed an estimated 150-200 trees from the trail. The overwhelming number of downfall and lack of regular maintenance has caused a proliferation of detours that are as heavily impacted as the main trail. The crew attempted to obscure these old routes wherever possible. The typical deep pockets found on most horse trails are in abundance and sometimes 20" - 24" inches deep. The trail is relatively flat and runs through some beautiful stands of birch.

Pollard Horse Trail: This trail is generally cleared by moose hunters in the fall for horse travel, and is not maintained by Refuge crews. The access to the trail on Borough land between Yukon Loop and the refuge boundary is presently clogged with logging debris and is inaccessible to horses. There are some blowdowns in the first several miles of the trail on the Refuge. (Note added by Ed Berg)

It takes a lot of work to keep these trails open, and I would like to thank all of our backcountry trail crew and Student Conservation Association volunteers for the excellent job that they have been doing on these trails!

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Scott Slavik is a Backcountry Ranger at the Kenai National Wildlife Refuge. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

The forest detective at work

by Ed Berg

I often tell school kids that I am a “forest detective” at the Kenai National Wildlife Refuge. Officially my job is labeled “ecologist,” but basically I am paid to figure out what’s going on in the woods. Much of the time I study large-scale questions like, “Have we had large spruce bark beetle outbreaks in the past?” or “How is climate warming affecting the Peninsula wetlands?” But I also look at small-scale phenomena like, “What’s that red stuff growing on birch trees?” or “Why did the Labrador tea and lowbush cranberry turn brown this spring?”

When most people walk through the woods, they enjoy seeing the plants and the wildlife. Their senses are tuned to the sights and sounds and smells of nature, and they are enjoying the fresh air and just being outside. The forest detective enjoys these things, too, but my mind is constantly puzzling about what I am seeing: what is the history of this forest? When did it last burn? What will this forest look like in 50 or 100 years? Why is this kind of plant growing here? What insect has been eating this leaf? What is the name of this lichen, moss, bug, etc., etc.?

The list is endless, but so is the entertainment of contemplating these questions. The more I find out in the woods, the more interesting the questions that I can ask. For example, I have recently noticed a red coloration on birch bark that looks like old paint. I sampled this material and examined it under a microscope, and found it to be filaments of algae. I took several digital pictures of the filaments, at 400- and 1000-power, which showed the cell contents to be tiny orange balls that looked salmon roe.

Next, I did an Internet search and found a website with pictures of a similar algae. I sent an e-mail with my digital photographs to the website author, professor A. J. Silverside at the University of Paisley in Scotland, who confirmed my identification of the algae as *Trentepohlia*. *Trentepohlia* typically lives inside of lichens, providing sugars from photosynthesis to feed the fungus part of the lichen. The red filaments that I observed are free-living *Trentepohlia*, that presumably escaped from their fungal host in lichens.

Now, here is the question which this exercise has generated: Is *Trentepohlia* increasing? This spring I re-

turned to a site near Wasilla where I first noticed the red coloration a year ago on several birch trees along a path. Having now acquired a “search image” for this coloration, I found it on 20-30% of the birch trees in this forest. I have also begun to notice it on birch trees around the Refuge headquarters. Is this a real increase, or just my growing awareness of this organism? If it is a real increase, what is its significance? As far as I have found out so far, *Trentepohlia* is harmless, but an increase might be related to changes in air quality or climate, for example. For starters, I have marked and photographed some trees near the Refuge headquarters so that I can check next year to see if coloration is expanding. Solving these mysteries often takes time; if not this year, then perhaps next year.

A good detective is always looking for clues. But often the most interesting clues concern what is not present. These absences are more like “holes” in a suspect’s story that an acute detective will spot, as opposed to obvious things like the missing murder weapon. The forest detective, for example, may notice the absence of rotten moss-covered logs on the forest floor in an otherwise normal-looking forest. This absence indicates that the forest is of recent origin, typically as a post-fire forest where most of the old forest was burned up. Near tree-line, the absence of dead wood indicates that the forest has moved higher up, with a rising tree-line.

The absence of dead wood in forested muskeg indicates that the muskeg has recently been colonized by new trees, probably in response to a falling water table. In both the tree line and muskeg situations the absence of dead trees (either standing or down) shows that the expansion of the forest is both recent, and that it has not been reversed, as by a cold period in the tree-line case, or a return of a high water table in the drying muskeg. The absence of dead wood thus shows both the change and trend of the change in these two situations. This is a lot of information from something “missing,” which a casual observer might not notice.

The massive spruce bark beetle outbreak of the 1990s has been the subject one of my longest pieces of detective work. When I first started working on the beetle outbreak in 1993, we had no historical in-

formation about bark beetle activity prior to 1950 on the Kenai. The earliest record from Alaska was a 1920s outbreak in the Copper River area, associated with logging slash from timber production for the Anaconda mine. Over the last 10 years we have looked at 23 forest stands in the Kenai-Cook Inlet area, and 4 stands in the Yukon for comparison. By precisely measuring thousands of tree-rings we have detected growth pulses in living trees, which occurred after the stands were thinned by previous beetle outbreaks. From the growth pulses we have dated these outbreaks to the 1810-20s, 1870-80s, 1910s, and 1970s on the Kenai, and 1930-40s in the Yukon.

In this case the evidence of past bark beetle “crimes” is indirect, because the old beetle-killed trees have usually long since rotted away. (In the dry climate of the Yukon, however, we found standing beetle-scarred snags that whose tree-rings indicated that they died the period of 1934-42). Given the indirect nature of the evidence, we had to evaluate other possible causes of growth pulses, besides thinning by bark beetles. Fire is one possibility, so we were careful to select stands that showed no evidence of burning within the life of the oldest trees. Similarly, we avoided stands that could have been thinned by logging or firewood cutting, which would have been revealed by cut stumps. The only viable alternative cause of growth pulses, we decided, might be thinning by blowdown from windstorms. In a windstorm the largest trees are preferentially killed, just as they are in a spruce bark beetle attack.

Sleuthing the historical files at the Refuge office we found a remarkable 1904 report by a forester William Langille, which described the standing dead forest between Homer and Anchor Point. The bark had probably fallen off the trees, as 20-30 years had passed since they were killed, but the fact that Langille reported the trees as standing showed that they had not been killed by blowdown.

We next studied regional weather patterns and found that although there are occasional local blow-

downs of several hundred acres, the Kenai does not have regional windstorms, such as the hurricanes of the East Coast. Our forests, however, do show regional patterns of thinning, where at least half of the Peninsula is simultaneously affected, most dramatically with the southern Peninsula in the 1870-80s, and the northern Peninsula in the 1970s.

By the process of elimination, we deduced that forest thinning by bark beetles is the only plausible explanation for the periodic growth pulses that we see in the Peninsula tree-rings over the last several centuries. By way of truly direct evidence of bark beetles for these growth pulses, in 1994 Chris Fastie found an old bark beetle-scarred snag near Homer whose tree-rings indicated a death date of 1884, precisely the year that the major growth pulse began on the Homer bench. This is as close to the “smoking gun” as we have ever been able to get in this particular piece of detective work.

My current detective project concerns the drying of the landscape of the Kenai Peninsula. This is a subtle phenomenon, not as obvious as fire or bark beetles, but the changes may be every bit as dramatic over the next hundred years and beyond, as ponds and small lakes dry up, and the muskegs become forested. The evidence for this drying process is all around us, once you have developed a “search image” for the signs. Stay tuned: we’ll check out this “crime scene” in a Refuge Notebook next month.

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Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Centennial Celebration 2003

by Bill Kent

The Kenai and Alaska Maritime National Wildlife Refuges will host a Refuge Centennial Celebration Saturday at the Kenai Peninsula State Fairgrounds in Ninilchik, from 10 a.m. to 8 p.m.

The event is free to the public. Attractions include speakers, movies, displays, and kid's activities. Live music will be heard throughout the day. Delicious food and drinks will be provided by Marathon and UNOCAL Oil companies.

This year marks the 100th birthday of the National Wildlife Refuge System, which includes the two million acres of the Kenai National Wildlife Refuge with headquarters in Soldotna. On March 14, 1903, President Theodore Roosevelt signed the papers to set aside Pelican Island as the first national wildlife refuge. From that humble beginning arose the world's largest and most diverse network of lands dedicated to the protection and management of a vast array of wildlife.

Entering its second century, the National Wildlife Refuge System covers 95 million acres in more than 535 refuges and thousands of small prairie wetlands that serve as waterfowl breeding and nesting areas. There are wildlife refuges in every state, and at least one within an hour's drive of every major American city, providing much-needed refuge for people as well as wildlife. Every American should be proud to say, "Look what we have done in this country to protect our wildlife resources."

In order to help plan your day at the celebration listed below are schedules for speakers, movies, and bands.

Speakers:

10 a.m. - *Seasonal Migrations of Rainbow Trout and Dolly Varden in the Kenai River Watershed*, Doug Palmer, Kenai Fish and Wildlife Field Office, U.S. Fish and Wildlife Service.

11a.m. - *A Century of Birding on the Kenai Peninsula*, Todd Eskelin, Kenai National Wildlife Refuge.

Noon - Bird TLC (Treatment and Learning Center) Bird Education Program: Alex Carter, Golden Eagle; Ruth Dorsey, Rough Legged Hawk; and Kristen Guinn, Great Gray Owl.

Note: Bird TLC will also do "walk-by" presenta-

tions with the birds on the Fair Grounds from 10 a.m. to noon and from 2 p.m. to 5:00 p.m. Bird TLC will use the small outdoor stage.

1 p.m. - Secretary of the Interior Gale Norton and other dignitaries at outdoor stage.

2 p.m. - *History of Hunting Guides on the Kenai Peninsula*, Gary Titus, Kenai National Wildlife Refuge.

3 p.m. - *Kenai Peninsula Brown Bear Project*, John Schoen, National Audubon Society.

4 p.m. - *The Up's and Down's of the Killey River Caribou Herd*, Rick Ernst, Kenai National Wildlife Refuge.

5 p.m. - *Exploring the Kenai Canoe Trails*, Mike Adlam, Blue Moose Lodge.

Movies:

10 a.m. - *America's Best Kept Secret: The National Wildlife Refuge System* (10 min.).

10:15 a.m. - *Alaska's National Wildlife Refuges* (29 min.).

11 a.m. - *Kenai National Wildlife Refuge: Where Wildlife Comes First* (10 min.).

11:15 a.m. - *Alaska Maritime National Refuge: Life on the Edge* (10 min.).

11:20 a.m. - *Arctic National Wildlife Refuge* (5 min.).

11:30 a.m. - *Arctic Kingdom: Life at the Edge* (85 min.), a great natural history film sharing marine and land wildlife of the Arctic. The video also shares how the video production unit did their photography under very challenging conditions.

1 p.m. - Secretary of the Interior Gale Norton and other dignitaries at outdoor stage.

2 p.m. - *The First and Last Frontier*, the story of wildlife and cultural contact in Alaska by American and European settlers and explorers (55 min.).

3 p.m. - *Braving Alaska*, a film following the lives of Alaskans living the "bush" lifestyle throughout Alaska adjacent to several national wildlife refuges (55 min.).

4 p.m. - *Toothwalkers: Giants of the Arctic Ice*, an excellent film on walrus with segments filmed in waters of several national wildlife refuges (55 min.).

5 p.m. - *A Mystery in Alaska*, an excellent new film on the decline of the Stellar Sea Lion with segments

from Alaska Department of Fish and Game and U.S. Fish and Wildlife Service biologists on research vessels. Great underwater and above scenic photography of wildlife including humpback whales, brown bears, salmon, eagles, and much more (55 min.).

Bands:

10:15 a.m. - Little Su, composed of award-winning songwriters Karen Boylan and Ellen Lockyer. Expect catchy original tunes, hand-crafted lyrics, sweet harmonies, pretty good harmonica, and smokin' guitar.

11:30 a.m. - Hobo Jim. Be entertained by one of the Peninsula's premiere local folk musicians. Hobo Jim is well known on the Peninsula in Soldotna, Kenai and Homer and has made many Alaskans leave warm homes to brave the winter cold to enjoy his wonderful sense of humor. Come listen to a phenomenal songwriter, performer and most especially, entertainer, Hobo Jim.

12:45 p.m. - Keith McGough as President Theodore Roosevelt.

1 p.m. - Secretary of the Interior Gale Norton and other dignitaries (speeches and awards).

2 p.m. - Spur Highway Spankers, one of the Kenai's hottest local bluegrass bands, the Spankers

have been entertaining bluegrass fans in Alaska for decades. Performing at many bluegrass festivals, the Spankers are always a exciting favorite.

4 p.m. - Katie Skrha. Kenai born and raised, "The Alaskan Songbird" is a gifted young songwriter who is blessed with a hauntingly beautiful voice. During the summer months, you can usually find Katie singing every evening on stages across the Kenai Peninsula.

6 p.m. - Dreamtrybe. All the way from Austin, Texas. Consistently placing in the highly coveted Austin Chronicle Music Awards, Dreamtrybe's music is well-crafted, energetic rock, so come finish the evening with this awesome band from Texas and maybe even dance a song or two on the lawn of the fairgrounds.

There will also be many exhibits provided and staffed by twenty-eight partners of Alaska Maritime and Kenai Refuges. The day promises to be enjoyable for the entire family. Hope to see you there!

Bill Kent is the Supervisory Park Ranger at Kenai National Wildlife Refuge. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

A hunter's wish

by Robin West

I grew up as a hunter. Hunting is what I enjoyed doing more than most things—what I dreamed about, what I saved my money for, what I did with my free time. It probably is the reason more than anything else that led me to my profession of fish and wildlife management.

Over the years, the time I spend planning and undertaking hunting trips has diminished greatly, but those few precious days that remain continue to be a cherished portion of my annual calendar. It is not so much the desire to stalk and take an animal that defines why I hunt, but the love of wild places and wild things in God's great creation, the escape from the hectic pace of the everyday world that surrounds us to that of a more simple time and setting, and the never ending sense of wonder of participating in the natural order of things.

Each trip brings life-long memories: the smell of rotting vegetation as you pull a hip-booted foot out of the cold mud of a duck marsh, the sound of migrating sandhill cranes above the clouds, the taste of a ripe blueberry that stains your hand as you put it to your mouth, the feel of the wind and rain on your face as you return across open tundra to the welcome warmth of a tent and sleeping bag at the end of the day, the first sight of your prey, whether it be a trophy moose in a distant alder patch, or a snowshoe hare ready to bound away beneath your feet.

While hunting was commonly practiced by nearly every family in years past, it is no longer so. In the United States it is estimated that less than 10% of the population now hunt. This is true for a variety of reasons but probably most related to the lack of necessity of hunting to put food on the table by most people, and due to diminishing opportunity in time and places to hunt.

Of course there are those who also would like to see all hunting disappear, as they believe it to be archaic, cruel, or unnecessary. I don't argue with these people, for it is a right of democracy to act upon differing personal values and speak freely about them. I suppose I am frustrated along with other hunters, however, when people use such freedoms to try and impose restrictions on the freedoms traditionally en-

joyed by others. And while less than 10% of Americans hunt nowadays, a similar number call themselves anti-hunter and are adamantly opposed to the activity.

The 80% of the populace that remain are simply non-hunters. They don't hunt, but don't feel too strongly one way or another if others hunt. They are the majority. In the long haul it is how they feel about the issue that will determine whether society as a whole will accept hunting in America. Not the hunters; not the anti-hunters; but the non-hunters. Everyone reading this, and everyone who doesn't, falls within one of these categories regarding their attitudes on hunting, and everyone's values and personal convictions count. Those of us who enjoy hunting can never forget that.

We must not label those who disagree with us as people whose views do not count. We must police ourselves and work to educate others. We must go out of our way to follow the regulations, to not leave messy camps, or shoot signs, or leave entrails from harvested game within view of public roadways. We must take care of our harvest so as not to waste any, and to share it with others. With such ethics, hunting will have support of the general public. Without them, I fear we will ultimately lose many, if not all, of the hunting privileges we now enjoy.

The Kenai National Wildlife Refuge is just one of 540 refuges in the National Wildlife Refuge System, most of which are open to hunting. All National Wildlife Refuges in Alaska—approximately 80 million acres—are open to hunting. These are public lands that if properly managed will sustain fish and wildlife for many future generations to enjoy. And while some do question the acceptability of hunting within a "refuge," our management premises are simple. Quality habitat and good management yield healthy wildlife populations to be enjoyed by hunters, wildlife viewers, photographers, and researchers—by anyone who appreciates wildlife. Whether you hunt or not, please come out and visit your Refuge, bring friends and family to share some great memories of the great outdoors. And if you do hunt, please remember the impression you leave on others may contribute to the long-term future of your chosen sport.

I wish everyone a safe and enjoyable fall season.

Robin West is a life-long hunter, fisherman, and outdoor enthusiast. He has worked for the U.S. Fish and Wildlife Service in Alaska for 25 years and currently is the manager of Kenai National Wildlife Refuge. For

more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Loon conservation efforts on the Kenai

by Annie Widdel

Spending a few nights in the Swanson River Canoe System provided me a great opportunity to admire some of the finest that Mother Nature has to offer. Among those charms I witnessed on my weekend in the Canoe System, was the presence of the common loon. Listening to the loons summon their mates across a bay or hearing territorial calls ring out from surrounding lakes while my shoulders relaxed and I tumbled off to sleep was one of the most memorable parts of the trip. Loons have the power to stir the imagination and wake long-quieted wild feelings; I feel that loons deserve our close attention and stewardship.

Recently, I had the opportunity to learn about lead poisoning in waterfowl, and especially in loons. Lead poisoning, principally from birdshot and fishing tackle, is estimated to kill 1.5 to 2.5 million migratory waterfowl in the U.S. each year. I was particularly distressed to see that fishing tackle-related deaths due to lead poisoning are actually increasing.

Ignorant of the damage my own tackle box was wreaking, I was upset when I peered inside and found empty bags of lead split shot. Previously, I hadn't paid too much attention to a sinker fallen from my line, but in light of my recent self-education, I am embarrassed. Loons and other water birds that dig in the bottom of lakes and ponds for their food are at the greatest risk of lead poisoning. They swallow lead pellets when they probe the bottom for food, mistaking them for food items like seeds, small snails or clams, and insects. Lead sinkers can also be accidentally eaten in place of gravel because loons, like other birds, eat gravel to help grind food in their gizzard. Ingested lead is absorbed after being broken down in the gizzard and passed into the blood stream where it binds to red blood cells and plasma proteins and is stored in bones and vital organs.

Because lead is processed the same way as calcium, it can affect nerve impulse transmission by competing with calcium and preventing the release of neurotransmitters, resulting in paralysis. This paralysis is an observable indicator of lead poisoning in birds; it causes shaking, disorientation, decreased ability to dive or fly, slow reaction time, and droopy wings. Even when

the symptoms aren't blatantly obvious, a bird afflicted with lead poisoning is more vulnerable to disease and predation, and will have trouble finding food, building a nest, or feeding young. A loon will become emaciated and often dies within two to three weeks after eating lead, because the lead paralyzes the digestive tract and starvation follows.

Loons are slow to reproduce; a successful breeding pair fledge a chick every two years. Because this is a long-lived animal, which invests greatly in the care of each chick, the population is slow to rebound from damage. Loon populations are already declining in the Lower 48. Although the common loon is reported most often in lead poisoning cases, many other species are also negatively affected including swans, geese, herons, cranes, ducks, and eagles.

Armed with this new information I opened my tackle box with the question of what can I do as an angler? I found that there are a lot of alternatives to lead fishing tackle, and the estimated additional cost is a mere \$4 a year. Fishing weights and jigs made from non-toxic metals such as bismuth, tin, stainless steel, tungsten, recycled glass, natural granite, and special putty are available. If your local tackle shop doesn't carry these items, please don't be shy to ask them to stock their shelves with some of the non-toxic alternatives.

There are other things we can do as anglers to protect wildlife. Something as simple as picking up discarded fishing line and debris seen lying about can make a big impact in the numbers of injured wildlife. We should never leave old tackle on the shore or in the water, and lead tackle should be disposed of on "hazardous waste" days at the landfill.

I like to think that it is our responsibility to instill in our children a sense of respect for wild creatures and their habitats. Setting a good example is one of the best ways to encourage this respect. By making the effort to use some of the non-toxic alternatives, and explaining our effort to the kids, we can show the kids that we really care, that "we walk our talk." This way we can preserve the creatures that draw our attentions and feed our imaginations, and we can pass this sense of awe forward to the new generation.

If you are interested in loon conservation, you might consider joining the local community “Loon Watch” organization. In order to help biologists keep tabs on local loon populations, Loon Watch has been established to provide biologists with information about loon presence, nest success, and disturbances. Please contact the Kenai National Wildlife Refuge at 262-7021 for more information.

Additionally, the Kenai Watershed Forum is holding an informational canoe trip tomorrow, Saturday, Aug 16, 10-3pm at Peterson Lake, 12 miles east of Sterling. During the canoe trip, refuge wildlife biologist Liz Jozwiak will tell about studies with loons and

swans, along with a peek at some upcoming research using satellite technology to track loons on their annual migration paths. Interested folks should be at Peterson Lake at 10am. Several canoes will be available, but it would be good to bring your own canoe if possible.

Annie Widdel is a volunteer in the biology program at the Kenai National Wildlife Refuge. She is from Grand Forks, North Dakota, and graduated last year from the University of North Dakota. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Veteran warden brings career to Kenai

by James Neely

Descending through the dark clouds that had obscured any visual stimulation since we departed Oakland, I caught my first glimpse of this great land as the plane descended to Anchorage. The Chugach Mountains, Turnagain Arm, and to the south a place that I had read about in *Outdoor Life*, *Field and Stream* and countless other hunting and fishing magazines—the Kenai Peninsula. This was Alaska! The place I dreamed about calling home.

It was the early 1970s and I was heading overseas for Uncle Sam. I would be carrying a gun and a badge, but believe me, the scenery would leave a lot to be desired. As we made our approach to Anchorage, the stewardess of the Flying Tiger DC-8 said that we would be delayed for several hours for repairs. Settling in at the airport in front of the big glass panes, looking out at the distant landscape, I recall thinking that I could get “delayed” here forever.

In 1976 my buddy Mike and I were police officers in a college town in northwest Pennsylvania. We had made our minds up that we were going to cash in and head North. We’d work our way across the States, up through Canada, and settle in Alaska. Maybe I could get a state trooper job and hopefully a game warden assignment someday.

Of course we had done all our homework on land deals, interim oil and fishing jobs, and all of that. Then, I had a chance to attend the Pennsylvania State Police Academy, so we delayed our plans and agreed that as soon as I returned, we would give our notices, pack our bags and head out.

I remember thinking we would need a good canoe, so I used an overtime check and bought a glass Sawyer guide model. Wanted to be ready. Well, when I returned, Mike had met a girl and, as they say, the rest is history. At least Mike was.

In 1981, I had the good fortune of being selected to attend the 18th class of the Ross Leffler School of Conservation, otherwise known as the Pennsylvania Game Commission Training School. Over nine thousand applicants vied for a handful of District Game Protector commissions.

For nearly a year we lived, studied, ate, slept and breathed game warden subjects. We were housed in an

early 1900s hunting lodge in the middle of State Game Lands 44. Nothing fancy here, folks. The main building slept fifteen souls in two tiny dorm rooms, and the classroom building slept another fifteen upstairs.

The “old school,” now replaced by a modern facility in Harrisburg, was hard-core game warden training. You got up at the break of dawn for PT, ate a big home-cooked breakfast, cracked the books hard, and then you walked outside into the woods and did it. Natural history, ecology, dendrology, land management, and the breadth and width of conservation law enforcement subjects filled the curriculum.

During the fall hunting season, October through December, we worked under the tutelage of seasoned District Game Protectors who showed us the ropes. We lived in the game warden’s house, ate the game warden’s food, and experienced a lot of the same family/job stressors that this demanding line of work dishes out. Faye and I were married during our Christmas break.

I spent the next five years managing a 400 square-mile game protector district in the “mountains” of Pennsylvania. Lots of deer and bear, lots of woods, and lots of poachers. Living off venison was a way of life for some folks, and bragging about the biggest buck, no matter if it was shot out of the truck window with a spotlight at 3 a.m., was a favorite pastime. I kept ten deputy game wardens a lot busier than their wives and children would have liked.

It wasn’t all outlaws and late nights though; I became acquainted with a lot of great folks who shared my love of Penn’s woods. I occasionally instructed at Penn State’s Wildlife Sciences program at the DuBois campus and helped a number of promising students get their start in a “ride-along with the game warden” program. Between my collateral duties as a bear research handler, firearms and self-defense and arrest tactics instructor, and my volunteer work with local conservation organizations the time passed quickly.

Never forgetting my desire to live in Alaska, and now that I was a game warden, I started looking at how I could combine the two interests. Several game protector associates had made the transition from the Pennsylvania Game Commission to the U.S. Fish and

Wildlife Service, and they encouraged me to apply for a special agent position.

I knew that the Alaska Region had occasional openings and I thought this might be my ticket North. Unfortunately, no positions were available. On the advice of one of my special agent friends, I made the transition to federal law enforcement by accepting a position with the Federal Bureau of Prisons in a brand new correctional facility on the outskirts of the half-million acre Allegheny National Forest.

Faced with environmental issues and no one on his management team with environmental expertise, the warden quickly promoted me into management. I spent the next twelve years managing employee training and development and overseeing our environmental compliance issues. Although the job was rewarding in many ways, something wasn't what I really wanted.

About a year ago, my dear wife Faye directed me to a job advertisement for the U.S. Fish and Wildlife Service on the Kenai National Wildlife Refuge in Alaska. When I found out it was a game warden job, I don't think I had a good night's sleep until last September 9th when I received a phone call that started with "Congratulations!"

In January, I began a fourteen-week training program at the Federal Law Enforcement Training Academy in Georgia. The curriculum was a demanding study of constitutional law, criminal procedures, defensive tactics, physical efficiency, firearms instruction, pursuit driving, criminal and traffic investigations, interpersonal communications, narcotics identification, counter-terrorism, report writing, and myriad of related police skills. Training was six days a week, starting at 5 a.m. and typically ending as I fell asleep studying around midnight.

I remember being challenged by the leadership at the Kenai Refuge, just prior to leaving for the Academy, with the words that, "Here at the Kenai

Refuge, we set the bar high. We expect you to graduate at the top of your class." I remember responding, "I'll promise you this, I'll graduate at the top of my age class!"

Finding that I was ten to twenty-years senior of the rest of the class of twenty-two, I thought I've got my work cut out. On graduation day, I am proud to say that I had held up my end of the Kenai tradition by graduating as the sole "Honor Student," achieving top overall marks in academics, firearms and physical efficiency.

After my training at the Academy, I spent another week of Refuge Officer Basic School at the USFWS National Conservation Training Center in West Virginia studying federal wildlife protection law and agency specific regulations.

In May, Faye and I completed our household move and currently reside at Moose Range Meadows with our English setter "Ammo," amidst the colorful local flora and fauna (spelled black spruce, red salmon, and brown bears.) By the way, that old Sawyer canoe made the trip as well. We recently attended a meeting of the neighborhood residents and were warmly received. Faye and I look forward to making many good friends in the community.

I consider myself most fortunate indeed to have the chance to fulfill what has been a life-long dream. Alaska in general, and the Kenai National Wildlife Refuge in particular is a special piece of God's creation. I am honored to play a small role in its conservation legacy.

The Kenai National Wildlife Refuge is pleased to welcome Refuge Law Enforcement Officer Jim Neely to the staff. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Vanishing ponds/lakes show drying

by Ed Berg



A pond where the water has fallen more than 10 feet in the last decade.

I have claimed in this column over the last several years that the Kenai Peninsula is drying out. This is always a tough claim to make as we head into the fall rainy period. On the scale of years and decades, however, I think we are indeed drying out, sort of like a business whose annual profits are slowly declining despite seasonal periods of high income. You can see this loss in our annual water budget, which is the water available after precipitation has evaporated from the soil and been breathed out by plants. In our case the water budget has been declining irregularly since the late 1960s. Our water income has declined slightly, but the main offender is the warmer summers.

Summer warmth makes the plants breathe out (transpire) more water, and it evaporates water from the soil and water surfaces. This warm summer water loss is like a tax that subtly erodes our water budget.

Using weather data from the Kenai airport starting in 1944, I have calculated the annual water budget before and after the drought of 1968-69. I estimate that since 1967 our available water has gone down from 5.8 inches to 3.0 inches. This is like a 48% drop in water “profit” over the last 35 years. (Homer showed a similar decline after 1989, from 10.2 to 7.0 inches, a drop of 31%.)

I had an opportunity this summer to see how this water shortfall translates into a drying landscape.

Grad student Eric Klein from Alaska Pacific University and I spent the summer visiting 84 sites in the central Peninsula, looking at drying ponds, falling lake levels, and spruce invasion of wetlands.

We were assisted by refuge biotech Doug Fisher, who is a high school teacher from North Dakota and a four-year veteran of my field crew, and by volunteer Al Magness, a forester drying out from wet summers on the Tongas National Forest in Southeast.

The first thing we observed is that some places are dying out, and others are not drying out at all. Some lakes and ponds are down, but many appear to have quite stable water levels.

When looking at lake levels as climate indicators, I should first say that only closed-basin (“land-locked”) lakes are of interest. Lakes that have outflowing streams are like an overflowing bathtub; as long as the water coming into a lake equals the water flowing out, the lake level will be stationary, regardless of the volume of flow.

Lakes with outlets tell you nothing about the climate, unless it gets so dry that the water stops flowing. The two middle Jean Lakes where the Sterling Highway enters the mountains are an example of this rather extreme situation, where the connecting stream has dried up and the lake levels are down several feet. These shrunken lakes are now climatically interesting.

So, for starters, we avoided lakes and ponds with outlets, and focused on closed basins. Even so, we found many closed-basin lakes and ponds where the water level was basically stable, falling at most a few inches over the summer.

On the other extreme, we found a pair of ponds where the water has fallen more than 10 feet in the last decade (see photo). Less dramatically, we observed many former ponds and shallow lakes that were colored “blue” on the 1950 USGS topographic maps that are now simply grassy pans, often with small spruce and birch saplings poking up through the grass.

So, why have some closed-basin lakes and ponds dried up, and others appear to be quite unaffected? The key factor appears to be the presence of a large peat “sponge” around the lake or pond. We took soundings of the peat soils at our sites with a 4-meter

(13-foot) soil auger, and many times found that we couldn't hit a solid bottom in 4 meters. This was a great surprise to me; I had no idea that we had such thick peat deposits on the Peninsula.

I think that thick peat around a lake or pond acts as a reservoir or buffer that keeps the lake or pond from drying out. *Sphagnum* moss, a chief component of peat, has tremendous water holding capacity.

Civil War surgeons knew that a dry ounce of sphagnum moss can hold a pint of blood in a wound dressing, and gardeners generally consider sphagnum peat to have a water holding capacity of about 15 times its dry weight.

Lakes and ponds that are surrounded by flat, wet peatlands in a closed basin are probably only the tip of a water "iceberg;" a much greater volume of water can be stored in the peat than is visible in the standing body of water.

So, we learned that only certain closed-basin lakes and ponds are "climate sensitive," and that these lakes and ponds generally lacked a peat buffer zone. Some good examples are Picnic and Campsite Lakes on Mystery Creek Road, and Jigsaw Lake at the end of Swan Lake Road. These lakes show exposed aprons of mineral soil without much recruitment of woody vegetation, which suggests that their water levels have been down for less than a decade.

There are numerous examples of dry ponds in the rolling "kettle moraine" topography along the Swanson River Road and Swan Lake Road, and west of the Swanson River oilfield to the Beaver Creek gasfield. The bluejoint grass (*Calamagrostis*) sod is usually well established in these pans, indicating that they have been dry for several decades.

These observations of a drying landscape probably come as no surprise to hunters and hikers who roam the hills of the central Kenai Peninsula. Long-

time horse packers have told me, for example, that it is harder nowadays to find places to water their stock in the high country. Pilots comment on the "bath tub ring" around some of the closed-basin lakes on the northern Peninsula.

I would think that with all the beetle-killed forest there should be more water on the landscape, because there are fewer trees transpiring water. The climatic drying, however, seems to have more than counter-balanced any hydrological reprieve that the dead trees might have offered.

The timescale of the drying that I have discussed here is several decades long, probably since the 1968-69 drought, from which we have never really fully recovered. This drying has no doubt intensified during the warm summers of the 1990s, which greatly facilitated the spruce bark beetle outbreak. In my next *Refuge Notebook* I will take a look at the drying landscape on a much longer, hundred-year timescale, as shown by the advancing black spruce forest on the Peninsula's extensive peatlands.

As a final thought, I would say that with global warming, I don't expect to see this drying trend turn around anytime soon. If you are buying lake front property for your retirement years, you might want to avoid closed-basin lakes or else plan to build a long pier.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. Ed will be teaching his one-credit "Geology of Kachemak Bay" class at the Kenai Peninsula College, starting Sept 9th in Soldotna and Sept 12th in Homer. Class schedule is at http://chinook.kpc.alaska.edu/~ifeeb/cycles/cycles_index.html. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Refuge plan to be revised

by Robin West

It has been said in a variety of ways that an organization without a plan has no road map, and without a road map that the arrival at a particular desired destination is left to mere chance. This is certainly true in administering a large area of public lands such as the Kenai National Wildlife Refuge, and it is time for us to begin revising our existing plan.

The Refuge Comprehensive Conservation Plan (Conservation Plan) provides for the overall direction and management of the Refuge. The Refuge's original Conservation Plan was initiated in 1980 and finalized in 1985. The public involvement process, from scoping of issues, to providing comments on a draft plan, is a lengthy one, but it provides ample opportunity for all those interested to get involved. Conservation Plans are designed to have a life of about 15 years and we are overdue in our plan revisions. Much has changed since the mid-1980s: new laws and policies, increased public use, more people living on Refuge boundaries in the "wildland-urban interface" and increased concern over wild fire in these areas, changes in salmon management, concern over Kenai brown bears, subsistence, and a variety of other issues which have evolved significantly in recent years.

The plan revision process for the Refuge will begin later this year. We will hold several public open house meetings this winter in Kenai Peninsula communities and Anchorage, and will provide workbooks for people to use to help them formalize their scoping comments. We will provide regular newsletters and post planning updates on the web (<http://kenai.fws.gov>). Once all of the goals and issues have been identified, options will be developed and a draft Conservation Plan (in the form of a draft Environmental Impact Statement) will be prepared and released for review—probably in 2005. After public review and comment on the draft document, including public hearings, a final Conservation Plan will be prepared.

While theoretically there are no issues that are off the table for discussion in the planning process, the reality is that there are many side-boards that will direct the work: the U.S. Constitution, various statutes, regulations, policies, and Executive Orders, to name some. Regulatory changes could result as part of the plan re-

visions. I know that anytime new regulations are mentioned, many people get immediately concerned, but new regulations are not necessarily all bad. They can both restrict and liberalize public use opportunities.

One potential proposal, for example, for new regulations is a change that would legalize the take of some natural resource products for personal use. Currently, it is technically illegal to remove most natural objects from the Refuge, but everyone knows that berries and mushrooms are collected and a shed antler finds its way home now and again. I personally would like to see some regulatory acknowledgment that addresses such incidental and non-commercial use of natural resources and hope that this issue will be evaluated in the planning process.

The most specific guidelines that we must follow in the planning process are the mandated purposes given to us by Congress when the Refuge was established. These include the conservation of fish and wildlife and their habitats in their natural diversity; fulfillment of international fish and wildlife treaty obligations; assurance of adequate water quality and quantity; providing opportunities for research, interpretation, environmental education, and land management training; and providing for opportunities for fish and wildlife-oriented recreation.

The planning process is long and can seem somewhat bureaucratic. I am at a loss about how to change this significantly to meet our legal obligations and provide everyone a reasonable opportunity to participate at each level of the process. Everyone's ideas are important. I encourage everyone to get involved and bear with us as we go through this multi-year exercise. The good news, I think, is that our current plan is still effective so our operational guidelines in the interim should continue to work pretty well. Hopefully our new updated plan will be even better!

To get on the Kenai National Wildlife Refuge Comprehensive Conservation Plan mailing list, please write, fax, or e-mail our planning team leader, Rob Campellone at: U.S. Fish and Wildlife Service, Division of Conservation Planning and Policy, 1011 East Tudor Road (MS 231), Anchorage, AK 99503-6119. Also, please feel free to give me a call or stop by at the Refuge

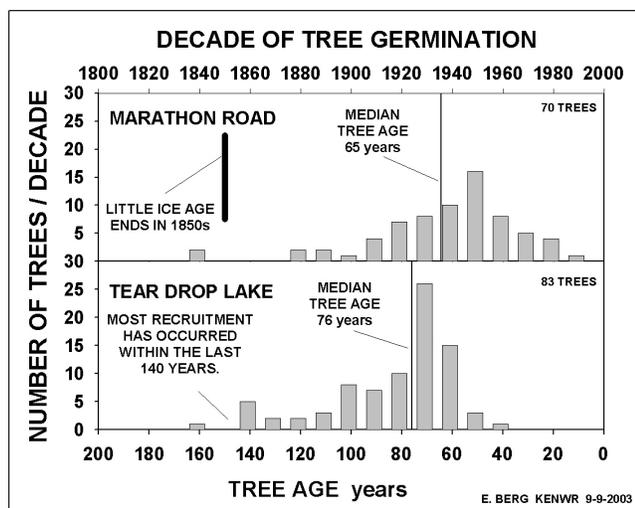
office to chat with me about the forthcoming process.

Robin West is the manager of Kenai National Wildlife Refuge, one of 542 refuges in the United States that make up the National Wildlife Refuge System. For

more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Black spruce forests spreading onto muskeg peatlands

by Ed Berg



Marathon Road and Tear Drop Lake's tree recruitment began in earnest in the mid-1800s

I have long puzzled about the diffuse halos of small black spruce trees that surround many lakes and muskeg areas on the Kenai Peninsula. You can see these halos when you fly over the lakes and muskeg of the northern Peninsula, as well as in the big muskegs along the Sterling Highway between Soldotna and Anchor Point. The typical pattern is a normal mature forest on an upland that grades into smaller and more scattered black spruce trees as you move out onto a flat-lying muskeg. As the muskeg gets wetter and wetter, the trees get smaller and are found mainly on slightly elevated hummocks.

I see two possibilities to explain this pattern: first, that these halos are stable transition zones (ecotones) that have been sitting there for hundreds or thousands of years. In this case the small trees should be old stunted dwarfs, growing slowly with extremely tight tree-rings, and living right on the edge of their tolerance to water-logging. The other possibility is that these small trees represent new forest invading a drying wetland. In this case the trees should be young, with normal ring-widths. On this interpretation, the trees are small because they are young, not because they are stunted; it's kids versus dwarfs.

This question is interesting because it could be a test of long-term climate change on the Peninsula.

Muskeg areas are basically peatlands where peat has been accumulating for thousands of years. This peat is derived from *Sphagnum* moss and sedges, and not from woody material such as we find in the soils of a forest. Peatlands are very acidic and decomposition is very slow, as shown by the mummified human remains found in peatbog burials in Europe.

If a peatland has been forested for thousands of years, there should be well-preserved dead wood in the peat. If you only find trees and dead wood on the top of the peat, then something has changed: forest is now growing where before there was only moist *Sphagnum* moss and other wetland plants. What was an open wetland has now dried out enough to start becoming a forest.

To evaluate these two possibilities, we have been doing some detailed studies of tree ages in wetland situations. Basically, we are finding that the small trees are indeed young and that the wetland forests are new forests; we have kids, not dwarfs.

Here is a striking example: the area north and east of the Kenai airport is dotted with black spruce "islands," that cover about 10% of a large flat peatland of about 6500 acres. The older, taller trees in the center of the islands give the islands a distinctive peaked appearance. On the aerial photos the forest islands look like spreading colonies of fuzzy mold, especially when you look at a sequence of photos from 1950 to the present.

You can see these black spruce islands driving north on Marathon Road from Kenai, along the east side of the airport and further north. We spoke with employees at Marathon's Beaver Creek gasfield at the end of the road. Some of them have been driving the road for more than 20 years, and they commented on the dramatic growth of the forest during the time they have been making this daily drive.

To get some specific numbers on the timing of the forestation process, we ran a transect through one of the spruce islands, where we counted the tree-rings on every tree in a one-meter wide belt that was 50 meters (164 feet) long. To do this we took core samples with an increment borer from stems larger than two inches diameter. For smaller trees we dug or pulled up the

entire tree by hand and cut out sections several inches to a foot long near what appeared to be the original base of the tree.

Back in the lab we polished the samples with a belt sander and counted the rings under a microscope. Some of the trees grew very slowly, and a stem one inch in diameter could be 90 years old. Because it was difficult to tell the exact location of the tree base (which would show the maximum number of rings and give the true age), we counted two or three disks cut from each stem section, and used the maximum number of rings as our best estimate of the stem age.

One virtue of digging and pulling all the small trees out of the peat moss is that we could see that there was no dead wood under the moss. This was a new, first-time forest. There were no old buried stumps or downed logs beneath the damp, lush *Sphagnum* and feather mosses.

We used a soil auger and found that the peat was only about one meter thick under the forest. We found abundant volcanic ash in the peat, but no charcoal. This area lies west of the 1969 Kenai burn, so the youth of these stands cannot be attributed to regrowth after a fire.

As shown in the graph for Marathon Road, most of the older trees began recruiting in the 1870s, and most of the trees have recruited since the early 1900s. In the soil auger samples in the forest we saw only peat mosses and sedges, and no woody material. We are getting a radiocarbon date on the bottommost (basal) peat, and I would expect that the peat began forming 6-8000 years ago, based on other Kenai Peninsula peat dates.

This means that for 6-8000 years this area was wet peat bog with few shrubs and probably only occasional black spruce trees on growing on hummocks. Then, for some reason about 130 years ago the forest began to move invade. Generally this is the end of "The Little Ice Age," a climatically cool period in the northern hemisphere that lasted from about 1300 to the mid-1800s.

Grewingk Glacier in Kachemak Bay, for example began retreating in 1858 and it (and other western Kenai glaciers) have been pulling back ever since. Treeline on the Kenai has been rising since that time as well, and the widespread spruce bark beetle outbreak on the southern Peninsula in the 1870s was likely associated with this warming.

On the Kenai a warmer climate, and especially warmer summers, can mean a drier climate through

increased evapotranspiration of water from the soil and vegetation. At the Kenai airport we only get 19 inches of total precipitation per year, about the same as Fargo, North Dakota. The cooler climate of the Little Ice Age probably left more water in the muskegs prior to the 1850s, which made them too wet for trees and shrubs, but perfect for peat moss.

In 1999 we made a similar transect south of Brown's Lake in Funny River. This transect ran from a mature black spruce forest on a hill down across a muskeg to the edge of pond that we called Teardrop Lake (for its shape). Again, this proved to be a young, first-time forest, on top of two - three meters of *Sphagnum* peat with no woody material in it. As the graph shows, tree recruitment began in earnest here in the 1850s, a bit earlier than at Marathon Road.

When we returned to Tear Drop Lake this summer, I was amazed to see how the *Sphagnum* moss had grown over many of the small saplings that we had cut and cast aside in 1999. We measured two to three inches of *Sphagnum* growth in four years.

The *Sphagnum* moss at Tear Drop Lake was mostly the dry, compact, brown type (*Sphagnum fuscum*) that grows fairly slowly, and is a further indication that this wetland is drying out. At a nearby wet pond edge site we found that as much as 10 inches of a moist, loose type of *Sphagnum* had grown up since 1999, completely covering some of the logs that we had cut. I had no idea that *Sphagnum* moss could grow so fast.

At Marathon Road most of the present black spruce reproduction is vegetative cloning from buried branches, called "layering." When moss grows vigorously, it can cover up the lower branches of trees. The branches sprout roots, and in time a new stem grows up from the buried branch. This process often produces a cluster of smaller children around the skirts of the parental tree. Genetically, these stems are identical, even if the original connection to the parent has rotted away. Since we were interested in recruitment through seed germination, rather than vegetative propagation, we excluded stems from our study that were obviously attached to another tree.

We expect to do more of these transects in some of the large muskegs, because they show quite clearly the profound change that our wetlands have been undergoing for the last 150 years. This kind of data also put the global warming issue in a longer-term time perspective.

Basically, the Kenai climate has been ameliorating through some combination of warming and dry-

ing over the last 150 years, since the end of the Little Ice Age. The amelioration process has dramatically accelerated in our area, especially with warmer winters since 1978 and warmer summers since 1987. My expectation for the future is that the black spruce forest will continue to expand into the muskegs until they eventually become continuous forests. Snow machiners will not appreciate forest closure of the

muskegs, but by that time they will probably have airborne snowmachines and thick forest won't be a problem anymore.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Refuge System Centennial Celebration continues next Saturday

by Bill Kent

Regular readers of the Refuge Notebook series know that 2003 is the Centennial year of the National Wildlife Refuge System. There have been many events across the country celebrating President Theodore Roosevelt's 1903 Executive Order first establishing the world's only system of lands specifically set aside to protect and manage wildlife and wildlife habitat. We hope you will join us for one last event next Saturday, September 27th.

The Kenai Peninsula State Fairgrounds in Ninilchik was the site for a wonderful celebration in August that drew more than 2,000 people. U.S. Department of the Interior Secretary Gale Norton and other dignitaries helped Kenai and Alaska Maritime Refuges commemorate the Refuge Centennial that day. The fantastic turnout and participation of more than twenty of our partners confirmed the importance of these two refuges to the citizens of the Kenai Peninsula.

The next Centennial event on the peninsula is taking place at 1:00 p.m. on Saturday, September 27th. Needless to say, you and your family are invited to participate, just in case you missed the Ninilchik event. The Kenai Refuge will be opening a new hiking trail at Refuge Headquarters, on Ski Hill Road that day. Designated the Centennial Trail, the new route is a new loop off the popular Keen Eye Trail, and is nearly one mile long. This trail will take users through boreal forest, and alongside small lakes and wetland areas that promise new wildlife viewing opportunities at the headquarters area.

As a final celebratory event of the Centennial of the National Wildlife Refuge System, there will also

be a short ceremony to commemorate the burial of a time capsule. The capsule will contain mementos from the Refuge staff, which relate their thoughts and remembrances of this memorable year, and in the case of some of us "old timers" the preceding years worked on National Wildlife Refuges. We hope that in 100 years, the staff of Kenai Refuge will unearth the capsule and gain an understanding and appreciation of the first one hundred years.

A large boulder will be placed over the capsule, and will have a bronze plaque mounted on it that recognizes the importance of the Centennial of the National Wildlife Refuge System. The Refuge staff has sincere hope that everyone who uses the Centennial Trail will take the time to read the plaque and reflect on what a truly marvelous gift both of the Presidents Roosevelt provided him or her.

Finally, I personally take this opportunity to tell you I am grateful to have worked on National Wildlife Refuges over the past twenty-six years, and that Americans like you have supported and helped protect them. I have witnessed many remarkable wildlife events and truly enjoyed trying to convey to visitors the wonders of a remarkable system of lands and waters. I hope my descendants are able to enjoy Refuges and celebrate a Bi-Centennial in 2103.

Bill is the Kenai Refuge Supervisory Park Ranger and lives in Sterling; his daughter will begin her freshman year at the University of Washington later this month. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Refuge intern reflects on busy summer of fieldwork and travels

by Annie Widdel

Serving as an intern at the Kenai National Wildlife Refuge offered me the opportunity to come up to Alaska for the summer and fall months. Originally hailing from Grand Forks in eastern North Dakota, I had spent the last six months prior to my Alaskan departure working near Hilo on the Big Island of Hawaii. Friends voiced concern that my going to Hawaii would result in the island stealing my heart and with that I would vanish from their lives. I responded that Hawaii didn't pose a threat; there was no need to worry until I made it to Alaska. While working in Volcanoes National Park I got a call from John Morton, the supervisory biologist at the Kenai refuge, asking me if I'd like to help out on the Kenai for the summer. Enthusiastically I accepted; I'd been waiting for this opportunity for months. Never having been to Alaska before, I didn't know exactly what to expect, but I knew I'd love this place.

As a Biological Science Research Volunteer, I lent a hand wherever it was needed. I assisted with songbird surveys in Mystery Creek, and near Birch Lake, which is located off of Swan Lake Road. These surveys involved recording the bird species we heard and saw at a series of points throughout a grid. This information will be used for monitoring purposes as well as comparisons between prescribed burn areas and unburned forest.

I also helped Jack Dean with long nose sucker research, and I inventoried nest productivity for cormorant and mew gulls on Skilak Lake. Later in the summer I assisted Ed Berg in a study of black spruce invasion into wetlands, caused by climate warming.

One of the sweetest memories from this summer's work is waking early on June mornings for bird surveys. Getting up just as dusk was just giving way to dawn and arriving in Mystery Creek just as the sun spills over the Mystery Hills—absolutely beautiful.

My work here has provided new experiences in wildlife science and the opportunity to work along side and learn from some excellent scientists. Working and living on the refuge also gave me plenty of time to play here on the Kenai, as well. And truth be told, although

I enjoyed the work immensely, the play was even more memorable.

Throughout the Kenai refuge there are countless beautiful places where one could lose oneself, figuratively as well as literally. The refuge serves not only as habitat for the animals whose presence we enjoy so greatly, such as moose, bears, lynx and wolves, but also as a place for people to enjoy nature. I was smitten with the landscape within seconds of my first good look at the refuge lands in May when I hiked from Fuller Lakes over the Mystery Hills ridgeline and down the Skyline trail. That hike produced heart-breaking views that will be remembered for a lifetime and with that hike, I forfeited my heart to Alaska.

I spent the vast majority of the summer outside, checking out the canoe systems and numerous trails around the region, and especially the fishing. Busy until sunset, I often got in too late to call home to friends and loved ones. After leaving numerous unreturned voice mails, my mother left a guilt-wrenching message on my answering machine, pleading with the other residents to please call her back if her daughter doesn't live there. That one hurt, but the fishing was good, and it was too gorgeous to stay inside long enough to chatter on the phone. I called home to explain, and she understood, I think.

The long days bred an industrious feeling that dominated my summer. There was a feverish sense that instigated motion, and so the summer was filled with everything except sleep. Armed with long days of sunshine (fueled by global warming) and half as much sleep as my body was accustomed to, the summer was stretched out to a satisfactory length instead of the more common feeling it gives me, that of being cheated by this swift moving season.

The need for fieldwork started to decline as the end of summer approached, so in late August I enjoyed a few weeks off and traveled north to investigate the interior and some other parts of the state I had not yet seen. I spent some time hiking in Denali, fishing in Valdez and hanging out in Fairbanks. I was in the Interior just in time to watch the fall colors set fire to

the landscape. Upon my return to the Peninsula it was strange to find so much green down here, but fall tagged along behind me and showed up, blessing the Kenai with its presence a week or two later. It was still a beautiful surprise even though I knew what to expect.

Of the countless reasons making my time here memorable, it's the intangible things that have left the greatest mark on me. I'm sure everyone who visits these northern latitudes gets excited about the lengthy days, but they are intoxicating if you are not used to them. I think it's easier to appreciate the changing photoperiod when you've spent a season here watching the daylight wax and wane. An extended stay allows one a much more thorough feeling for Alaska than just a quick jaunt in the RV. I've had the pleasure of arriving when green was taking hold of the landscape and watching the wildflowers escort us through the months. The lupine and the wild rose yielded to the

dandelions, and crimson brushed the fireweed when summer gave way to fall.

Under autumn skies punctured with stars not seen since May, I reflect back on the summer months. The wonderful people I've met and the inspiring places I've visited will stay with me for a lifetime. Taking home valuable occupational skills that will aid me in my career future, and a wealth of new experiences makes me very appreciative of the opportunity to live and work on the Kenai National Wildlife Refuge.

Annie Widdel is a volunteer intern with the biology program at the Kenai National Wildlife Refuge. She is from Grand Forks, North Dakota, and graduated last year from the University of North Dakota. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Refuge budget is lean and mean

by Pam Ables

Happy New Year! Uncle Sam celebrates October 1st as the beginning of a new fiscal year. This is the time of the year when the bean counters evaluate what the Refuge did with taxpayer money and report that information to Washington, D.C.

Washington is on record as proud of the streamlined budget of the National Wildlife Refuge System. One Washingtonian back east was reported to brag, “The Refuge System is Lean and Mean,” when it comes to getting lots of work done with so little.

The National Wildlife Refuge System operates on approximately 1/10th the cost of other land management agencies. The Kenai Refuge cost \$2.27 an acre to operate in fiscal year 2003. This is quite a bargain when you consider that nearly 2 million acres is managed for so many recreational opportunities.

As I prepare the Refuge’s Comprehensive Accomplishment Report for the past fiscal year, I am amazed at the local community’s selfless support of the Kenai Refuge and the employee’s altruistic dedication to getting the work done at little or no additional cost.

This is a landmark year for the Kenai Refuge in many ways. Although nothing so obvious as the 2003 Centennial Celebration, I record many accomplishments that others don’t normally see. Here are a few little known but impressive facts about the Kenai Refuge from my 2003 report.

- The Kenai Refuge had 106 permanent and seasonal employees and volunteers this summer (May – August).
- The Refuge volunteer staff contributed 14,317 hours of service in 2003. Volunteer staff helped with wildlife surveys, visitor information and, campground and trail maintenance, just to name a few.
- The Refuge volunteers saved taxpayers \$360,200 with their work for fiscal year 2003.
- This year 546,300 people visited the Kenai Refuge. Refuge uses include guided fishing,

hunting, camping and field trips, just to name a few. I can only imagine the number of visitors we have, if it were actually possible to count each individual person using the refuge. I speculate that we would meet or exceed Denali National Park for use.

- Our Law Enforcement officers wrote more than 450 Notice of Violations for 2003.

This year was special to the staff at the Kenai Refuge. As you may have heard, it marks 100 years of the National Wildlife Refuge System. The staff and others took a lot of time contemplating what to put in the time capsule buried at the Centennial Trail head this past Friday. A century from now, the capsule will be opened and hopefully our careful contemplation of its contents will have communicated our intentions.

As the Information Technology Specialist here at the Refuge it was especially hard for me to think of something to contribute to the time capsule. Currently, much of technology is outdated after 6 months. How do you consider what format to leave a video, or other media so that 100 years from now it can still be viewed? Try to find someone who can get data off the old 5.25” inch floppies of a decade ago—impossible! Needless to say, I hope I made the right choices.

The new fiscal year is here. We have no idea what is in store for this fiscal year as Congress has yet to pass a budget. Will we have to cut programs? Will we get new programs? Who knows...? 2004 will not have the pomp and circumstance of the Centennial year, but with the continued support of our community volunteers and seasonal staff, I am confident that we’ll mark another record success when I prepare the 2004 Accomplishment Report next year.

Pam Ables has worked for the U.S. Fish and Wildlife Service in Alaska for 18 years. She lives in Kenai with her husband, Myke, daughter, Destiny and son, Levi. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Using ground beetles to track Kenai Peninsula climate change

by Ed Berg

When I see a beetle crawling along the ground, I see a walking thermometer. A beetle thermometer doesn't tell you an exact temperature, but it can tell you a temperature range, as a climate indicator. There are warm climate beetles and cold climate beetles, just as there are warm and cold climate plants (and people!).

All insects, being cold-blooded, have their preferred temperature ranges. But beetles—and especially ground beetles (carabids)—are abundant and conspicuous in Alaska. You probably noticed these long dark beetles scurrying along the forest floor, especially if you turn over a log. They are most active at night, when they are catching other insects. Alaska ground beetles typically range from about a quarter to three-quarters of an inch long. Their head and shoulders stick out in front, giving them rather sleek elongated look; the color is usually black or dark brown. They are tough predators on smaller bugs and aren't above a bit of cannibalism in a cage or pit trap.

On the Kenai refuge we have initiated a long-term study using ground beetles as climate change thermometers. Here is the basic idea: we deployed 24 pit traps (cottage cheese containers) up a steep mountain-side (the Skyline Trail), covering an altitudinal range of 2100 feet. The temperature gets colder going up the mountain; soil temperatures this summer were generally 2 to 4° lower in the alpine zone than at the base of the mountain.

We collected the beetles from the pit traps every two weeks. Once we have the beetles identified, we expect that they will be stratified along the mountain-side in distinct zones, i.e., temperature zones. We will probably repeat this survey for the next two summers to be sure that the beetles are consistently stratified from year to year. Then—and here is the payoff—every five or 10 years we will repeat the survey to see if the beetles have moved up hill (as expected with global warming) or downhill (in the unlikely chance of climate cooling).

An experiment like this involves a lot of work. The easy part was the six trips up and down the Skyline

Trail, collecting the beetles, reading the maximum-minimum thermometers and taking soil temperatures at each station. Back in the lab, refuge volunteer Al Magness pinned and labeled each of the 233 larger beetles, and stored the smaller beetles and miscellaneous other insects and spiders in alcohol, with one bottle for each trap for each collecting period, resulting in 100+ bottles. Dominique Collet helped us organize the collection, and the mountain transect design was suggested by Scott Elias of Royal Holloway College of the University of London.

The hard part is identifying the all the beetles. There are 237 known carabid beetle species in Alaska, out of the estimated 40,000 species described worldwide and 2200 in North America. Identifying a beetle requires hours of patient work under a microscope, inspecting the tiny parts and using identification keys that lead through a series of choices to the correct species name. Each step in the key requires a choice, such as “head more than two millimeters wide” versus “head less than or equal to two millimeters wide.” If you make a bad choice at any step, you go down the wrong path. Local entomologist Matt Bowser has started working on the collection and tentatively thinks that there may be many duplicates of a fairly small number of species, which will make things easier.

Although we are expecting to do a good part of the identification work ourselves, we will need to have an expert at some museum or university verify our identifications. Experts have cabinets full of known beetles, and the real “moment of truth” comes when the expert compares a tentatively identified beetle with a known specimen in the reference collection. The two beetles either look the same or they don't. If they don't look the same, you go back to the key and try again. If they do look the same, you declare victory and add the name to your species list.

In time we will build up our own local reference collection of verified beetles, which will greatly speed up the identification process.

I chose ground beetles for this study because, in

addition to being easy to catch, ground beetles are often used for studying ancient climates. Each beetle species has a preferred range of temperature; if you have ten beetles from a peat deposit, let's say, you can ask what is their shared temperature overlap? If they all can operate in a July temperature band of 50-55°F., you can infer that the July climate spanned at least 50 to 55°F at the time the peat-producing vegetation was growing.

Here is a hypothetical example of how this method can be used to reconstruct past temperatures. Suppose we sampled layered sediments exposed in an eroding bluff, where the sediment age spans the 16,000 years since the end of the last major glacial period. The best sediments would be clay, silt or fine sand rich in organic material; peat is also good if it is composed of sedges rather than sphagnum moss (which tends to be highly acidic and a rather sterile habitat for insects).

We might collect fifty to one hundred pounds of sediment from each layer, and then wash the sediment through a fine sieve to concentrate the organic material. We would then mix the damp organic material with kerosene and water. Kerosene sticks to insect parts much better than does water, and kerosene does not stick to wet plant material. Since kerosene floats on water, the insect parts are concentrated in the floating kerosene, which can be poured off and screened to obtain a pure residue of insect parts.

Ten to twenty layers might be sampled in this way in a typical study, each layer yielding a group of species that shares a common temperature range. The layers would be dated with radiocarbon if they were younger than 40,000 years. (Radiocarbon has virtually all disappeared after 40,000 years.) The beetle method can estimate maximum temperatures in an area to plus-or-minus 4 degrees and minimum temperatures to plus-or-minus 9°F. This amount of sensitivity would not allow you to distinguish the climate of Homer from Anchorage, but it would definitely separate Cook Inlet from the more continental sites of the Interior. It is also more than sufficient to document the shift in climate at the end of the last ice age, when summer temperatures were 15-20°F cooler than now.

Climate researchers have more typically used plant pollen in sediments to study past climates. Pollen is almost indestructible and preserves well for tens of millions of years in sedimentary rocks. For reconstructing past climates, the basic idea is similar to the beetle method, using plant temperature ranges for a number of species to infer a shared temperature in-

terval at a given point in time.

The pollen method, however, can't pick up sudden changes in temperature, which have recently become of interest in the global warming debate. Studies of oxygen isotopes in the two-mile long ice core from Greenland that spans 110,000 years have revealed a number of sudden shifts, where climate warmed or cooled by as much as 15°F over periods of ten years or less. It generally takes plants (especially trees) 500 to 1000 years or more to migrate into or out of a region and come into equilibrium with a new temperature regime, so the plant pollen record misses the timing of such sudden shifts.

Insects, on the other hand, can migrate rapidly and establish themselves in new area in a few years, either by wing power or wind power. That is why we chose beetles rather than plants to monitor the changing climate along the Skyline Trail. I grant that spruce tree-line has moved uphill on this mountain over the last 100+ years with the warming climate, but the tree response is still painfully slow compared to what we should see from the beetles.

One fascinating fact that I have learned from studying the beetle-climate methodology is that beetle temperature preferences haven't evolved through geologic time. Morphologically, beetles are one of the most highly evolved groups of organisms, as shown by the fact that one out of every five organisms is a beetle. On a geological scale, beetle body shapes evolve rapidly, but their chemistry and hence their temperature tolerances are "set in concrete." The same species of beetle can have the same temperature tolerance range for five to 10 million years. If the climate changes, the beetles simply migrate; they don't evolve.

I think that this thermal rigidity is probably due to the hundreds of temperature-controlled reactions that go into ordinary body chemistry, and I would expect that it is true for cold-blooded organisms in general. The synthesis of a single protein from DNA involves many enzyme-moderated steps, with each enzyme having its own optimal temperature that is in turn controlled by its own DNA.

A change of body shape might require only a single gene mutation, but a change in temperature tolerance requires hundreds of simultaneous mutations. A blast of radiation from a super-nova might produce a lot of simultaneous mutations in an organism, but most of them would be harmful and the organism would die. So, even though a bug might mutate with longer legs or stronger wings or DDT resistance, it's going to keep

its temperature preferences quite the same, thank you!

Information for this article was drawn from *Quaternary Insects and Their Environments* by Scott Elias, 1994, Smithsonian.

Ed Berg has been the ecologist at the Kenai National

Wildlife Refuge since 1993. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

A wolf conference that comes once a decade

by Elizabeth Jozwiak

I had the privilege to attend and present a paper at the 2003 World Wolf Congress. This was an international wolf conference that brought together scientists, researchers and educators from over 24 countries. More importantly, the conference provided a forum to assess the role of “leading edge” science in wolf ecology and management across the globe.

Not many people realize that wolves exist in other areas of the world, not only on the North American continent. Wolves can be found in the French Alps, Italy, Norway, Finland, Sweden, Portugal, Slovakia, Poland, Russia, and Mongolia. The conference was definitely an assemblage of a diverse group of people with varying values, attitudes, and expertise. It’s amazing however, that many of the attendees and presenters actually share similar challenges when working with wolves in a human dominated environment.

A wildlife biologist is faced with several issues while working with wolves. Managing healthy populations of wolves in areas open to harvest provides one set of challenges; managing for the persistence of wolves in protected areas (such as in Yellowstone National Park) provides another set of challenges.

One of the important “take home” messages from the conference was two-fold for me. While many people around the world view wolves as an integral component of the natural ecosystem and a wilderness icon, many other people fear wolves, or conflict with them because wolves impact their interests. When wolves live close to human settlements, the human-wolf relationship profoundly influences wolf management.

Consumptive users of wolves in Alaska and Canada such as trappers and hunters have a special interest in wolf management. Wolf pelts are sold commercially, and wolf trapping constitutes a source of income for some communities. Some sectors of the hunting community kill wolves to reduce their impact on prey populations. Livestock ranchers (in the lower 48 states) and sheep herders (Italy, Scandinavia, Poland) who occupy wolf ranges also have a special interest in wolf management because wolf depredation can impact their economies. More recently, people in the tourism industry have also developed an economic interest in wolves, and have raised a powerful voice for

wolf conservation.

So why attend a world wolf conference? Should we not stay focused on managing wolves here on the Kenai Peninsula? As a wildlife biologist, I need to look “outside the box” of our own specific situations to examine how other wolf managers are dealing with their respective challenges, which could “spark that creative light bulb” in our own management programs.

I was not the only Alaska representative at the conference. Layne Adams from USGS, Alaska Science Center in Anchorage, presented a paper on the importance of salmon (chum and chinook) as a food source to wolves in Denali National Park from summer to early winter. Recent studies have shown that wolves that inhabit coastal areas feed on salmon, and are an important food resource. Wolves in the Interior are thought to rely primarily on caribou and moose, with other food resources contributing very little to their diet. Through stable isotope analysis (looking at the bone carbon and nitrogen and from tissues of dead wolves) Layne was able to determine that salmon were also on the menu of Denali wolves.

Mark McNay, from the Alaska Department of Fish and Game (ADF&G) in Fairbanks, presented a paper on the reproductive characteristics of heavily hunted and trapped wolf populations in Interior Alaska. Most wolf packs usually have one dominant breeding female which produces pups. Mark found that 40%-80% of secondary females were also found to be pregnant when they were examined with a portable field ultrasound scanner, and that pregnancy rates were highest after intensive trapping. Many of these secondary females contributed wolf pups to the pack, and pup survival among these multiple litter packs varied.

The paper that I presented at the conference discussed the response of wolves to changing harvest levels on the Kenai National Wildlife Refuge. Wolves have been studied on the Refuge with the support of the ADF&G since 1976. I believe the Kenai Refuge has the longest running wolf monitoring program on any national wildlife refuge in the country.

While the Refuge’s efforts and objectives have changed throughout the last 27 years, we continue to monitor the health and population status of wolves

primarily with the use of radio telemetry. Earlier work with wolves in the 1970s and early 1980s by Rolf Peterson involved looking at the interaction of moose with this newly expanding wolf population on the Kenai Peninsula.

Our most recent focus has been to examine the response of wolves to a lower harvest in the 1990s and up to the present. Recent data suggest that wolf populations have not increased proportionally with the lower wolf harvest, as they did in 1970s and 1980s. Wolves appear to be at a low, but stable, density at this time on the Kenai.

At the conference I had the opportunity to discuss some of my thoughts and hypotheses as to what may be occurring on the Refuge that is limiting wolf population growth. Declining food sources, higher rates of

wolf dispersal, lower wolf pup survival, and the effects of disease were all competing theories that I discussed with colleagues at the conference.

All in all, I have an appreciation for the outstanding work that is being done by biologists in other parts of the world. I look forward to attending the next world wolf conference ten years from now!

More information on the World Wolf Congress is available at <http://www.worldwolfcongress.ca>.

Elizabeth Jozwiak is a wildlife biologist for the Kenai National Wildlife Refuge. Liz has worked with wolves, lynx, and other furbearers on the Kenai Peninsula for over 15 years. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Horses and the Kenai National Wildlife Refuge

by Richard Johnston

I'm the first to admit there are few subjects that I know less about than horses. I had hoped to get through raising two girls without having to buy, lease, board or spend money on man's four-legged buddy the "horse." Don't get me wrong; I've always appreciated the utility and tradition of horse ownership and use. But there always seems to be more important things to do with my time and dollars than the long list of "projects and expense" associated with horses.

Well, my long horse-free life came to an end this summer. Our family is now the proud owners of a Welsh Pony/Morgan cross and a registered appendix quarter horse. I have to admit it's been interesting. They seem to easily recognize inexperienced owners and exploit vulnerabilities like traveling salesmen. The willing dispositions and perfect behavior exhibited during sale negotiations have been replaced by more typical stubbornness and focus on the feeder. The amount of hay alleged to be adequate for horses of their size and weights seems to temporarily distract them from chewing on the few remaining trees in their new home. Actually, though, I'm optimistic. No one has been stepped on except me; and my daughters have at least shared the less desirable duties of horse and paddock care. Our two "steeds" have done reasonably well with the move to their new home and new owners. However, it will be some time before they'll be packing out game or winning any barrel competitions.

Like most people, I took the occasional trail ride when growing up, but it was a summer internship in Okanogan National Forest where I really got to experience the usefulness and requisite pain of riding. I was assigned to accompany the U.S. Forest Service, Winthrop District grazing specialist and a long time rancher on a cattle grazing allotment inspection. Both were bow-legged from years in the saddle and I'm sure had no compassion for a city kid who had ridden less than several miles in a lifetime. I discovered first hand what being "saddle sore" was all about. We rode over twenty miles that day gaining and losing thousands of feet of elevation. By days end, I was in such misery, that I had to walk my horse the last two miles home. The Wilderness terrain we traversed that day

was rugged and closed to motorized vehicles. Horses made the remote terrain accessible and were part of a long Cascade Mountain tradition of equestrian use. Congress recognized the history and tradition of horse and pack animal access on western federal lands by authorizing horse use in the 1964 Wilderness Preservation and Management Act. Commercial, administrative, and pleasure use of horses and pack animals was authorized for recreational access. Even pre-existing livestock grazing leases were allowed under the Act.

Like many Forest Service and Bureau of Land Management District Ranger posts, the Winthrop District of Okanogan National Forest had over fifty head of horses and mules to assist in the management duties.

Refuge staff have recognized the potential value of transport and pack animals in support of refuge management, however the tradition of government horse and pack animal use has somehow alluded fifty years of management. The long Alaska winters, expense, and lack of horse knowledge may have played a role in the Refuge's limited horse use. The Refuge has occasionally contracted for horse access but foot travel, boats, and aircraft are more prevalent methods of official access. Several Refuge employees have acquired horses and donated use of their private stock for official duties. Local volunteers with horses have also cooperated with Refuge trail crews to accomplish remote trail maintenance. Many projects that occurred during the summer of 2003 in the Funny River area would have been difficult without "four-legged" support and equipment packing muscle.

One of my duties at the Kenai National Wildlife Refuge is to manage the commercial visitor services program. Commercial providers offer a variety of access and support for recreational use of the refuge. Several guides, including transporters, big game guides, sport-fishing guides, and recreational trail ride guides use horses and/or mules to access remote areas of the Refuge.

Two thirds of Kenai Refuge was designated as Kenai Wilderness in 1980. Although Congress allowed for more liberal use of aircraft, snowmobiles and motorboats within designated Wilderness in Alaska, many portions of the Kenai Wilderness and other

Refuge lands remain accessible only on foot or by horse.

In a conversation with a local ferrier, he noted that there might be nearly one thousand horses on the Kenai Peninsula. While driving around road accessible areas in southcentral and interior Alaska seeing pasture lands and grazing horses is common. In part, this occurrence of pastureland can be attributed to the early federal homestead requirements. Homestead entry rules required agricultural clearing of land in order to “prove up” on a homestead. Land clearing, leveling and planting of a pasture mix was the preferred method of meeting the agricultural requirement. Consequently, enough land became available for hay production to support horses and other livestock on a local scale. Many local horse owners import hay from the lower 48 or the Delta area, but “homestead pastures” continue to play a role in the Kenai Peninsula horse culture.

One designated Refuge trail was developed and even named specifically as a horse trail. Horse packers gained access to the remote Kenai bench lands for trophy moose hunting on the Funny River Horse Trail. My first Kenai Refuge experience with horses was when I contracted with one of our permitted packers to support a moose hunt in 1982. I was impressed with the stamina, endurance and memory of the Ninilchik packers’ horses. The Funny River Horse Trail was difficult to follow, even back in 1982 when it was used more often than today. In looming darkness my horse was able to follow a difficult to find trail he had not been on for eight years. The 20 year old gelding and other horses in the line were also able to find camp after a long days ride in un-trailed terrain simply by releasing the reins and letting the horses follow their own lead to camp. Perhaps more impressive was their weight carrying ability. After a successful hunt, a mare that was packed with 66+ inch moose antlers carried the load without protest even after becoming lodged several times between narrowly placed trees.

Conflict with other users is fairly common on many trails throughout Conservation areas in the western United States, but has been largely avoided on the Kenai Refuge. In part minimal conflict can be attributed to different destination interests and good common sense on the part of horse users. Only one trail is closed to horse use. Fuller Lake trail was never built or routed to sustain the wear associated with hoofed animals. After receiving extensive repairs and maintenance in 1994 and 1995, the Fuller Lake Trail

was designated hiking only. Horse users were able to achieve access to the Mystery Hills via alternative routes.

As any experienced horsemen and a few ill fated others can tell you, the remote Kenai Wilderness is no place for an inexperienced horse, unless accompanied by a string of experienced horses, or an inexperienced horse with an experienced rider. Similarly it is no place for an out-of-shape horse packing heavy loads of gear and moose meat. According to knowledgeable horse handlers, horses are just like human athletes... they need to build endurance and strength.

Every few years a group of hunters are abandoned far into the Kenai Mountains by runaway horses. In most cases these animals are children’s pets or young animals that have been impressed into service by Dads who have drawn a Caribou or Moose permit and are scrambling to get access. Far worse than unfortunate hunters walking out with their gear on their back is a more dangerous situation that can occur when undernourished horses are taken on a difficult pack with less than adequate rations.

Experienced horsemen seem to agree that starting a “pack” trip with a well nourished horse and plenty of supplemental feed is critical. On at least two occasions equine rescues have been initiated by Refuge Officers having observed animals in poor shape while on pack trips on Refuge lands.

A particularly bright spot for me about horse ownership has been the local Kenai Peninsula community’s willingness to share information and advise about getting set up for horses. At least a few have chidingly requested mercy for some future time, when I might ride into their moose camp and find a sub-legal antler size moose hanging from the meat pole.

At my current rate of progression it will be some time before I, in any official capacity, will be much risk of riding successfully into a poachers camp. But you never know. I’ve been reading my daughters *Young Rider* magazine and some say I’m a quick study.

If you would like information about Refuge trails, special use permits and regulations contact Rick Johnston at Refuge headquarters at 907-262-7021.

If you would like information about horses you would be well advised to contact someone else such as a long time Kenai Peninsula horse owner or one of several visitor service businesses that provide trail rides and/or packing services on Kenai National Wildlife Refuge.

For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous

Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Map making arrives in the 21st century

by *Andy DeVolder*

Two weeks ago when I was carving pumpkins with a group of friends, we were using those cool new patterns to trace our designs onto the pumpkins. The designs were on flat pieces of paper that we taped to the pumpkin, then we pricked our pattern into the skin of the pumpkin and cut out the design using handy little saws that came with the patterns. One thing I wondered aloud was how well the flat pattern fit on a curved pumpkin? There was considerable distortion in the pattern when it was wrapped around the curved surface, however we made the best of it and all of the jack-o-lanterns came out great, even Martha Stewart would have been proud. Transferring a flat design to a rounded pumpkin is the same sort of problem that map makers have been contending with for hundreds of years.

As the new fish and wildlife biologist here at the Kenai National Wildlife Refuge, my primary responsibilities are in managing the geographic information system, or GIS, and the loads of geographic data associated with it. Creating and thinking about maps is one of the things that I do on a daily basis. As early as AD 140, the Greek thinker Ptolemy produced a map of the earth that was spherical, but it was not until the voyage of the Victoria (1519-1522) when Ferdinand Magellan circumnavigated the world that we had conclusive evidence that the earth was not flat but round. From that first map, up to today, the issue of how to draw a round earth as flat image with minimal distortion has been a nagging map-making dilemma. Over the years, many different ways to represent the surface of the earth have been developed. Each way is called a map projection and the three used most in Alaska are the Albers Equal Area Conic, State Plane and the Universal Transmercator (UTM) Projection. Each projection has benefits over others, but unless you are making maps those are unimportant details.

As I mentioned GIS is more than making maps; it can be used to answer resource based questions or create models of real world processes. For instance, if you wanted to know how many lakes with a specific fish are within a certain distance from a good trail or road, we could plug that question (also called a query) into the GIS and create a map of lakes that meet those cri-

teria. Since it is nearly impossible (and not practical) to inventory every acre of the two million the refuge manages, GIS can be used to produce models of the entire refuge.

You may recall the Kenai Lake fire that began in late June of 2001. Since firefighter and public safety is the primary concern of the Forest Service they requested a GIS analyst to help them map the fire. I responded to the call and arrived at the Kenai Lake Work Center in Crown Point. The first thing that fire managers wanted to know was the location of homes and other structures to formulate an evacuation plan if needed. I started by using the Kenai Borough parcel database information to discriminate between residential structures and vacant lots. I printed a series of detailed maps using high resolution satellite imagery as a base for firefighters to use in the event of rapid evacuation. Thankfully no evacuation was needed, but the maps provided the base for their effort to inform home owners of the potential for an evacuation. Throughout the week that I was on scene, I made other maps showing the progress of the fire, location of safety zones, drop points, fire crews, and public information maps. As you can imagine, having accurate and current maps provided for a high level of safety for firefighters and also served to inform the public of fire suppression progress and safety plans.

We are all very familiar with the spruce bark beetle infestation that has killed nearly every mature white spruce on the Kenai Peninsula. We are also all to familiar with the dry summers we have been having, burn bans, and increased wildfire risk. Do you know where the greatest wildfire risk on the Kenai Peninsula is? It could be in your back yard (I though it used to be in mine before we got the trees removed), however many factors contribute to wildfire risk including fuels, ignition sources and topography. Using GIS we can combine these factors into a model that will show where the range of wildfire risk for the Kenai Peninsula. As you might expect, the areas around towns and homes (where ignition sources are) that have spruce bark beetle-killed trees show the highest wildfire risk, and areas in the hinterlands of the refuge even with spruce bark beetle-killed trees show a lower risk (very

few ignition sources). Of course models do not totally represent the real world, rather it is our best estimation based on the available information.

Technology has evolved by leaps and bounds in the short time that I have been professionally doing GIS work. Computers have become faster and storage capacity has also increased dramatically, both of which contribute to faster modeling and more complex map production. One of our newest tools is a combination handheld GPS/GIS field computer. This little unit weighs about three pounds, has a nice GPS unit with five meter accuracy and a full color screen to display digital topographic maps, aerial imagery. We can load information about land ownership, vegetation types, and location of roads on to this unit too. When we get out to do field work, we can now record our observations or surveys directly to a digital file, or display our location in real time on digital topographic maps as we walk through the woods. We can also have the GPS record where we walk, tracing a line (such as along a stream) or capturing vary accurately located points perhaps to identify an eagle nest. Using GPS to locate features on the ground such as signs, outhouses,

campgrounds, and access points will help us make better more accurate maps, which in the long run helps you, the refuge user. So GIS and GPS technology is not just for biological resources it is for anything that has a spatial location...which I suppose is everything! Now that's job security and many opportunities to out from behind my computer and get in the field.

Next time you look at a map, think about what went into making it accurate and reliable and the long history of map making. Be safe when you go out tonight and when you see all of those carved pumpkins give some thought to Ptolemy, Magellan (from who a company and a line of GPS receivers is named) and modern computer based GIS technology.

Andy DeVolder has worked for the Spruce Bark Beetle Mitigation Program in Soldotna and the U.S. Forest Service in Seward and now is the Biologist/GIS Data Manager for the Kenai National Wildlife Refuge. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Cabin restoration program, summer 2003

by Gary Titus

Thursday October 30, 1930, "... been busy putting things to order and finding lots of tings missing—so much that if it contius I will have to lock the cabin—it is rotten when people get so low that they can't respect an open door ofering shelter to any one who my happen along" -Andrew Berg.

It really is 'rotten' when people disrespect ownership and kindness, yet most people have not sunk as low as one might expect in the seventy-three years subsequent to Andrew Berg's journal entry. Berg's cabin is still standing on the shores of Tustumena Lake with its door unlocked, offering shelter to anyone 'who may happen along.' And so far, people have respected the open door and treated the cabin quite well.

Berg's Home cabin is one of the numerous historical cabins scattered across the Kenai National Wildlife Refuge. There are over 120 cabin sites on refuge land alone, but at many of the cabin sites only a few deteriorated logs remain. Berg's Home cabin, and about twenty other cabins, have survived the odds of time and weather and remain as reminders of our Alaskan heritage.

Hikers, hunters, fishermen, and boaters staying in the refuge often use the cabins that are still upright. Most of these cabins have been on a "first come, first served" basis and free for public use, but with the increasing number of visitors in the refuge, the use of cabins has greatly increased. In most cases, increased use has coincided with increased vandalism and other more 'rotten' things, such as irresponsible fires (which have now destroyed two cabins). To some people, the cabins on the refuge are a nuisance—worth much less than all the hassle they cause. Others would like the cabins protected from abuse and preserved as Alaskan cultural heritage sites. Still others would like to see more cabins built for public use—including fee cabins along trails, much like those in the Chugach National Forest.

During the spring of this year, the refuge received much needed funding to address the future of the various cabins on the Kenai National Wildlife Refuge. Before a new program to protect and preserve cabins throughout the refuge could be developed, many is-

ues needed to be assessed: Are the cabins safe for continued public use? How will we regulate the use and safety of these cabins? How can we work to preserve those that remain standing? The refuge manager and a team of refuge officials are currently creating a cabin management plan that will take charge of the future of each cabin, and also decide upon locations for new public use cabins. In the meantime, six highly used cabins were chosen for restoration.

The first official cabin restoration program on the refuge began this summer. With goals to stabilize as many cabins as possible, a crew of Iven Sjodin, Josh Hightower, and Temperance Taylor—under the direction of Gary Titus—restored six cabins to their original height, function, and stability.

The restoration process itself is very intense and full of back-aching labor. Cabins must be lifted out of the ground, so that rotten logs can be replaced with beetle kill replicas. The log replacing process is a long, yet very rewarding process. One by one, each rotten log is removed and replaced, matching the notches as well as the fit between the logs. Gradually, with every new log, the cabin rises up to its full height. Afterwards, the cabin is left on concrete blocks atop gravel pads to prevent further settling. Finally, each cabin is prepared for public use with new floors, bunks, and outhouses.

After digging, hauling logs, adzing, axing, eating, and sleeping next to each cabin for one to three weeks, respect for the pioneers who constructed these cabins comes naturally. In fact, it only takes hewing a few feet of a cabin log to really realize and appreciate the hard work put into each cabin. Each cabin has its own history with its own unique construction that is definitely worth preserving: while Trapper Joe was in desperate need of a square, Andrew Berg's notches are beautiful fitting dovetails, and the two cannery Nurses chose not even to mess with notches.

As our sweat dripped over each cabin log, all we could do was hope that the public would see the restored cabin and appreciate our labor enough to refrain from disrespecting or vandalizing it. So far, reports in the logbooks at each cabin have been appreciative. Also the cabins are being kept clean and free

of graffiti, which is a major encouragement.

The summer of 2003 has been a test summer to see what a crew could accomplish in the short summer months. With the help of volunteers Bill Nelson, Shelly Dockins, Josh Thatchik, and an engaging Youth Conservation Corps crew, we finished restoring Caribou Island Cabin in two labor-intensive weeks. Restoring Doroshin Bay Cabin, Berg's Home Cabin, Pipe Creek Cabin, Trapper Joe Cabin, and Nurses' Cabin this summer were also each massive accomplishments in themselves. Still, numerous cabins remain in need of attention.

In the future, we hope to protect the remaining cabins on the refuge, preserving them as historical monuments as well as public use cabins. Working as the Refuge Cabin Manager, Gary Titus has assessed

the needs of each of the remaining historic cabins. Overall, each cabin needs at least two weeks of intensive restoration. This means that the next few summers will be full of hard work.

So the 'door is always open' for anyone wishing to help in the restoration process. If you would like to volunteer, please contact Gary Titus at the Kenai National Wildlife Headquarters (262-7021).

To learn more about the public use cabins on the Kenai Wildlife refuge, visit <http://kenai.fws.gov/> click 'Learn More' and then click on 'Refuge History.'

For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

The 2003 fire season: remembering those who have fallen

by Doug Newbould

It is an easy thing to grow numb. All you have to do is watch the news, listen to the radio or read the newspaper on a regular basis. Death and destruction assail our senses every day. There is a human condition that can result from overexposure to sensory stimulus. Some call it information overload, others desensitization. Whatever it's called, repeated exposure to the words, the imagery and the sounds of destruction can numb us to human suffering and environmental catastrophe.

The 2003 wildland fire season has been just another in a series of newsmakers. The headlines have almost daily, trumpeted the latest casualties and property losses. Words like firestorm, holocaust and conflagration are tossed around like ping-pong balls in a lottery machine. The "Halloween Fires," so far, caused the deaths of at least twenty people and destroyed thousands of structures in southern California. Restoration will cost billions. Before California, there was devastation in Oregon, in Montana and in New Mexico.

But there is one piece of information that seems to be missing from the national news stories. Have you heard how many wildland firefighters died in the line of duty this year? I haven't. So I searched several wildland fire management websites and came up with a list of twenty fallen firefighters through August 2003. I know at least one firefighter died in California since then.

Another twenty wildland firefighters perished in the record fire season of 2000. From my perspective, I

don't think this information is making it into the national consciousness. Perhaps the same can be said about the structural firefighting community. In 2002, ninety-nine firefighters (80 structural and 19 wildland) from 36 states gave their lives in the line of duty.

Lest we forget these fallen heroes, there are two national firefighter memorial sites. The National Fallen Firefighters Foundation has developed a beautiful memorial park in Emmitsburg, Maryland, about an hour and a half drive north of Washington, D.C. They conduct a national firefighter memorial service every year. This year's memorial was Sunday, October 5th. For more information you can visit the website at: www.firehero.org, or you can write to: Post Office Drawer 498 / Emmitsburg, MD 21727.

The second memorial is located at the National Interagency Fire Center in Boise, Idaho. The Wildland Firefighter Monument honors "the men and women who fight our nation's wildfires." You can learn more about this monument and the firefighters who have died in the line of duty at: <http://wffoundation.org/monument.html>.

Let's do our best to honor those who give their lives to protect ours.

Doug Newbould is the Fire Management Officer at the Kenai National Wildlife Refuge. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

The wacky ways of winter

by Nicole Johnson

Two weeks ago, I was startled and amazed at the same time. As I walked out the front door of the Kenai National Wildlife Refuge Visitor Center there was a little animal that stood out like a sore thumb. There it was, an ermine sitting on the front tire of one of the government trucks. It would dash out into the open and quickly scamper back to the truck. The ermine's white fur stood out among the parking lot's black asphalt and the green grass. Normally, it would blend in with the snow-covered area, but not quite yet.

Many of us experienced the unusually warm 2002-2003 winter. According to the National Oceanic and Atmospheric Administration's National Climatic Data Center it was the second warmest winter in Alaska with an astounding 10.1° F above average temperature. The winner of the warmest winter in Alaska was in 2000-2001. Any guesses as what it will be like this year?

I know many people who are not fond of snow or cold temperatures. Then there are others, myself included, that can never get enough of the soft, fluffy white snow. Whether you are a fan of snow or not, do you ever wonder how wildlife deals with the challenges of winter, and the challenges of a warmer winter?

If you know a child that was a 4th-6th grader last winter who visited the Kenai National Wildlife Refuge, they might be able to answer some of your questions. The theme of our environmental education program, "Wildlife in Winter" focuses on how Alaskan wildlife adapts and survives in winter. In 2002, we piloted this program and reached 118 students in five classes.

Word spread and the program is growing stronger. We had 18 classes register, and we reached 597 students in 2003.

Snow is an optimal part of this field trip experience because we introduce the students to snowshoeing and how it is similar to energy conservation methods used by wildlife in winter. We also use the snow to demonstrate the importance of the subnivean (below snow) layer. We also discuss how and why wildlife benefits from camouflage in winter. As you can guess we were scratching our heads last winter with the lack of snow. We even asked the students to do a "Snow Dance" to make it snow.

Like the ermine, and other wildlife are adapting to the changing seasons, we decided to incorporate the possibilities of warmer weather into our program. We now have activities that do not require snow. They illustrate how a mild winter might benefit or be a detriment to wildlife. I cannot help but wonder how the ermine is blending in now.

For interested teachers, the "Wildlife in Winter" field trips are scheduled during February and the beginning of March. To schedule a field trip please call the Environmental Education Office at the Kenai National Wildlife Refuge at 262-7021. Also, if you want to go snowshoeing this winter on our field trips...do the snow dance with your students!

For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

The battle for Trapper Joe's Cabin

by Iven R. Sjodin

J. Lignurgaris was always considered a trapper of good reputation. During the summer of 1950, he constructed a cabin within the boundaries of the Kenai National Moose Range near the Chickaloon River on the shores of Trapper Joe Lake.

When contacted, Mr. Lignurgaris's explanation for this new construction was to replace his old cabin located less than 3/4 of a mile away. Trapper Joe's Cabin was built with an ax and a crosscut saw from spruce trees cut near the construction site. This new cabin was not very large, only 12 x 14 feet. However, there was enough room to sleep and eat comfortably.

There is an ample application of moss chinking between the double-notched, two-sided logs, which holds in the heat generated from the small wood stove. There are two bunks and a small table that is situated under the window overlooking the lake. By the doorway across the room, there is a double-burner Coleman cook stove sitting on a small table. It is an adequate shelter for any trapper.

Refuge Historian Gary Titus had been working on plans for this as well as many other historical cabins on the Refuge. He called me in the spring after going over my application and invited me to join his crew and be a part of the restoration process. He has a wealth of knowledge pertaining to the history of all the known cabins located within the boundaries of the Kenai National Wildlife Refuge. He applies this knowledge with great pride when restoring these treasures. I enthusiastically accepted.

Things were not looking good for me the morning we were to fly supplies to Trapper Joe Lake. The first battle was to find a nomex flight suit to fit my ample frame. No such luck! I am six foot, three inches tall and weigh in at about three hundred pounds. The only suitable apparel available were yellow and green firefighting clothes that were two sizes too small. The reflection in the mirror reminded me of an over-stuffed sausage. Nevertheless I was ready to fly. (If the buttons on my shirt didn't fly off first.) The helicopter was no more comfortable than my clothes.

From the window of the helicopter I observed the harshness of the terrain. I could only imagine the battle it must have been just to hike to this remote location. I crouched below the blades of the helicopter and

headed up the hill toward the cabin. When I arrived I noticed that there were no trees of any size to do the necessary repairs. Knowing this earlier, we had found trees that had lost their battle with the spruce bark beetle miles to the south at Lower Ohmer Lake Campground. At that time the logs had been cut and peeled. These two-sided logs were then hauled by trailer to the end of the road, strapped to a long line and flown in to give Trapper Joe Cabin new life.

During the restoration it became apparent that gravel had been excavated from the nearby lakeshore to serve as a foundation. After years of settling the logs had sunk into the earth and begun to rot away. Here the next battle began: an army of ferocious carpenter ants had hollowed out a log on the fifth round and taken up residence. To eradicate these invaders we sprayed and stomped but they kept on coming. Wave after wave they attacked, even calling out their miniature air force. Finally they retreated, perhaps to return another day.

Also on the agenda was the replacement of the old outhouse. Although it was quaint, it was tilting into the hole on the back corner, leaving a large gap in front of the door. If you were brave enough, you could leap in onto the few rotten boards that made up what was left of the floor. Risky business for someone of my stature. We were all relieved to see the new one built and ready for use.

The summer of 2003 has proven to be one of the most productive seasons in the Kenai National Wildlife Refuge for cabin and trail work. The restoration of Trapper Joe Cabin was just one of the memorable adventures experienced by the "Cabin Crew," consisting of Gary Titus, Temperance Taylor, Josh Hightower, and Iven Sjodin.

If anyone has any further historical information regarding Trapper Joe or any other old cabins on the refuge, please contact Gary Titus at the Headquarters on Ski Hill Road in Soldotna (907) 262-7021.

Last summer Iven Sjodin worked on the Cabin Crew at the Kenai National Wildlife Refuge. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.

Ireland and the Kenai, oceans apart but with some common features

by Ed Berg

My wife Sara and I recently made our first trip to Ireland. We stayed with Sara's niece and her family in Dublin and took a three-day bus tour around southern Ireland. The bus trip was a great introduction to the geography and history of Ireland, and we are eager to make a return visit. On the face of it, Ireland is very different from the Kenai, yet there are some interesting parallels, especially as regards the future, as well as the past.

Like the Kenai the Irish landscape is geologically young, with the glaciers pulling out about 13,000 years ago. A key difference is that Ireland has been farmed for 6000 years. The human hand has touched this landscape virtually everywhere; only the mountaintops have what we would call natural or undisturbed vegetation. We visited the ruins of castles that dated as far back as the fifth century AD, and there are hundreds of burial mounds and stone tombs that date back more than 5000 years. Ordinary people live in houses that are several hundred years old, with generations of remodeling. This kind of timescale makes Alaskans feel like we were born yesterday.

I had expected the Irish countryside to be green, treeless, and rather barren. To be sure, there are such places especially along the west coast, but most of the countryside that we saw consisted of small farms on rolling hills with lots of stone fences. We saw extensive pine plantations, as well as Sitka spruce which has been widely planted in the British Isles and northern Europe for decades. Record Sitka spruce in Ireland grow to more than 50 meters tall and two meters in diameter.

Ireland was once heavily forested, during the worldwide Hypsithermal warm period following the last major glaciation. In Alaska the Hypsithermal climaxed about 9000 years ago. The Kenai was much dryer at this time, with summers two to four°F warmer, and lake levels were lower in closed-basin lakes. The "climatic optimum" of the Hypsithermal moved eastward across North America and arrived in Ireland about 7000 years ago. The slow rise and fall of the Hypsithermal temperatures brought thick de-

ciduous forests to Ireland, which dominated the landscape for about 4000 years. By 5900 years ago, however, natural disease and farming began to scale this forest back, according to the pollen record in lake sediment cores.

At 5100 years ago the pollen record shows that elms declined dramatically, probably due to something like the Dutch elm disease which wiped out elms in the eastern US in the 1970s. The Dutch elm disease is a fungus spread by bark beetles, and Irish researchers have found beetle scars on preserved tree trunks dating to 5100 years. Some Irish archeologists argue that the elms may well have been cut down by the early farmers for forage (elm leaves are nutritious for livestock), and as part of the general land clearing going on at that time. The presence of bark beetle scars on the wood, however, seems to make a persuasive case for the disease explanation.

Human beings first arrived in Ireland about 9000 years ago, and on the Kenai about 8000 years ago. The early Irish persisted as hunter-gathers for about 3000 years, but they didn't live on a very bountiful landscape, and began importing livestock and farming technology from Britain and western Europe about 6000 years ago. On the Kenai we have been blessed with rich salmon resources since the end of the glacial period, and the native people never had to resort to agriculture.

Generally speaking, when humans turn to agriculture, they begin to have a very heavy impact on the land and tend to create unsustainable ecosystems. In North America our current manifestation of this is a heavily petroleum-dependent field cropping which destroys topsoil much faster than it can be created. In Ireland the early farmers didn't have prairies, so they cleared the forests for farmland. As wood became in short supply, they turned to harvesting peat for fuel.

I have recently been studying peatlands and peat formation on the Kenai, and I was rather shocked to see that peat is harvested commercially in Ireland as a fuel. Peat bogs are ditched and drained, and the peat is harvested with large combine-like machines. The peat

(called “turf”) is then ground up and compressed into fuel logs that you can buy at convenience stores like charcoal briquettes.

Huge quantities of peat are used for electric power plants in Ireland, although it is considered a very inefficient fuel. The largest bogs have pretty well been stripped, but rural people still dig peat with a shovel, and you see it stacked in farm sheds just the way we stack firewood for the winter. I was told that people like the smell of peat burning in the stove and have the same kind of nostalgic fondness that we have for wood smoke.

Like the Kenai, Ireland didn’t always have a lot of peat. Peat formation appears to have gotten underway with the Hypsithermal warm period at least 7000 years ago, although conditions were still too dry for the peat mosses (i.e., *Sphagnum* moss) to really flourish. This early peat was highly “humified” or broken down into a fine-textured organic material where you can’t distinguish the individual plant parts, like stems and leaves.

In time the peat deposits grew thicker and higher, which allowed the surface of the bogs to dry out and facilitated the invasion of trees. This produced extensive forested peatlands, similar to the black spruce woodlands that are now forming on many muskegs on the Kenai. The forest phase was relatively short-lived, however, because *Sphagnum* moss thrives under the shade of trees and soon began to engulf the trees, producing what are called “raised” bogs.

In a raised bog the nutrients are all coming from rainfall; the bog surface is too far above the water table to draw up mineral-rich groundwater from below. The nutrients—however dilute—have to be washed out of the air. Few plants can grow in such a nutrient-starved environment, but *Sphagnum* moss excels at survival in this “no man’s land” of vegetation. The *Sphagnum* grows higher and higher, until the bog acquires a dome shape, several meters higher than the ground surface surrounding the bog.

On our bus tour we stopped at a commercial peat mine, just to see how it is done. Many acres of exposed brown peat were visible, and I assume that at least a meter of peat had already been removed. (Peat deposits in Ireland can be as much as 12-13 meters thick.) A two-meter deep trench had been cut to drain the remaining peat. As I looked at the cut face of the trench, I could see that the lower meter of peat was dense, dark and very compact. On top of this layer I could see a stump and some logs, a remnant of the

old forested peatland. Above the wood layer, the top meter was a lighter, looser peat. With my hand lens I could see the individual moss leaves in the top layer, which were grown during the later raised bog phase of the peatland.

When I first saw a museum exhibit on raised bogs, I assumed that the raised bog phase was due to a climate change, i.e., a climate cooling or more rainfall, after the forest phase. The experts however are divided on this issue: some say that raised bogs are simply following a natural succession process, that as the bog grows higher, it gets less water from below, which allows forest invasion, which in turn fosters the rapid growth of *Sphagnum* moss. Further evidence against the climate-change hypothesis is that in different bogs, radiocarbon dates of raised bog initiation vary by several thousand years. If climate change was the cause, the bogs should have all shifted into the raised bog phase at the same time.

The story is made more complex, however, by the fact that the climate in Ireland did indeed cool down starting about 4500 years ago, which no doubt accelerated raised bog growth along its successional path. This climate cooling appears to have initiated another mode of bog formation called a “blanket bog,” a phenomenon that would have done Alfred Hitchcock proud. Blanket bogs are relatively fast growing areas of *Sphagnum* peat moss, which can grow up hill (on as much as a 20° slope) and invade forests. Raised bogs began to creep out of their lowland homes, and new blanket bogs began to develop in upland areas at higher elevations.

These blanket bogs swallowed up forests and farmland, covering stone fences and dwellings and roads. The farmers fought back by putting down corduroy roads of logs on top of the bogs, but thousands of these roads were swallowed up by the unstoppable green wave of moss. The blanket bog invasion has continued into the present day, with 16% of Ireland now covered by peatlands. As peat mining has progressed, the buried roads, stone fences and tombs, and houses have progressively been uncovered, much to everyone’s amazement.

We don’t have true raised or blanket bogs on the Kenai, even though we have some thick peat deposits, at least as much as seven meters thick. Most of the peatlands that we call bogs or muskegs on the Kenai would actually be classified as “fens” rather than bogs, because they are fed by mineral-rich ground water and support a variety of sedges and woody shrubs, as well

as *Sphagnum* peat moss.

The absence of raised bogs and blanket bogs on the Kenai is probably due to our low annual precipitation, being as we are in the rainshadow of the Kenai Mountains. Our 19-25 inches of annual precipitation (at Kenai and Homer, respectively) are well below the 50 inches of western Ireland, where most of the bogs (and rain) are concentrated.

During our visit to Ireland a disastrous “bog burst” occurred which took out a number of homes down slope from a bog. Since blanket bogs can form on a slope, they are akin to a huge plastic bag full of water lying on the slope. Developers sometimes make the mistake of trying to mine peat or punch a road along the edge of a bog, which releases a wave of fine-grained peat slurry, much like a mudflow on the Homer bench.

One particularly heartening aspect of our visit to Ireland was seeing that the Irish economy has picked up and become quite vigorous over the last decade. In the past Ireland was very much the underdog of the British Isles. I recall that when I was a post-graduate student in London in 1970, every social problem was blamed on the Irish immigrants who flooded into London because there was no work in Ireland. Every petty

burglary in our neighborhood was attributed, often correctly, to unemployed Irish youth.

Today the Irish economy (known as the “Celtic tiger”) is booming, and the real estate market in Dublin makes San Francisco look cheap. In rural western Ireland we saw many new homes (probably second homes) under construction, especially near the coast. As the population grows and people have extra money in their pockets, the beautiful Irish farmland could be swallowed up in subdivisions. This struck a familiar chord for the 25 years that I have been watching (and participating) in subdivision sprawl on the Kenai. It would be nice to think that the Irish with 6000 years of land development experience might look ahead and consciously plan how they want their land to be used in the next round of development.

Details for this article were drawn largely from an excellent book on the ecological and cultural history of Ireland, *Reading the Irish Landscape* by Frank Mitchell and Michael Ryan, Towne House, 1997.

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Commentaries of a game warden

by Chris Johnson

I have worked on the Kenai National Wildlife Refuge for the past 14 years as a law enforcement officer. My actual title is “Refuge Officer” but I prefer to call myself a “game warden.” Over the years I have gathered all sorts of tales from my adventures and have heard all kinds of excuses and reasons from people about why they had to do it. I will share a few of my stories with you. As I sit down to write this article I have to laugh and shake my head as I recall some of these incidents, and this in turn reminds me of other incidents. I will try to keep this article to just a few stories and if readers enjoy the topic, I am sure that I can find a few more to tell in a future article.

Part of my patrol area is Hidden Lake. Hidden Lake is a popular camping location in the spring and summer for families but in the winter I would say Hidden Lake is the most popular location for ice fisherman, after Lake Trout on the Peninsula. There was a core group of ice fisherman that was there almost every day. I don’t know if they were just getting board or wanted to spice up their ice fishing experience. I realized this group was fishing with live bait, which is illegal. This became a game of cat and mouse. I would try and sneak up on them to catch them with their live bait on their lines. They would post look outs with spotting scopes to keep an eye out for the game warden. If a game warden was spotted they would send a chase vehicle out to warn the fisherman. With receiving that information the fisherman would quickly cut their lines. When the game warden would finally reach their destination he would discover only a dangling lines in empty holes. This game became a challenge for me. I would devise different strategies to approach the lake undetected. Eventually, I caught these anglers with live bait several times and several times I found only dangling lines in an empty hole.

It was late fall on the Kenai River just below Skilak Lake. It was spitting snow and about 20°. I was hiding in the bushes, and I observed a man land a large Rainbow trout. I watched him kill the fish and put it in his boat. I decided to contact the man at Lower Skilak boat ramp. The season for Rainbows was open and the only requirement was that if you retained a rainbow over 20 inches, it had to be recorded on the back

of your fishing license. Well, I contacted the man at the boat ramp and he told me he had not caught any fish. I searched his boat high and low, because I knew he had kept the fish. While I was searching the boat, the man was quirming around a lot. I thought he was really nervous about something or real cold. Well, after about 15 minutes the guy couldn’t handle it anymore and told me the fish I was looking for was down his pants. The man opened up his pants and pulled a 24-inch Rainbow trout out of his pant leg. He had failed to record the fish on his license and was afraid that I was going to take the fish from him. I gave him a pen.

In this next story the moose gets its revenge and shoots back. I responded to a call about a sub-legal moose found dead off of Marathon Road. I hiked into the kill area with a State Protection Officer and the reporting parties. The Protection Officer and I proceeded to start quartering and skinning the moose in the hopes of recovering a bullet. As we finished with each quarter of the moose, we moved it out of our way. We finished skinning and examining a hindquarter with the hoof attached and moved it over to our pile of already examined meat. About three feet from that location, one of the reporting parties had set his rifle down against a tree stump. We set the examined quarter down and then started working on another quarter.

About two minutes later a shot rang out and tree bark plattered all around us. One of the reporting parties dropped to the ground like he had been shot. My first thought was that one of the men with us had shot. My next thought was that we were under fire from somebody claiming the moose. After several minutes we were able to sort out that the rifle leaning against the tree stump had gone off, after the hoof of the moose quarter we had just moved fell and hit the safety and the trigger. The man that dropped like he had been shot actually had been hit by tree bark and was OK. After that we got down on our knees and prayed and thanked god no one had been hurt.

I was working in the Kenai Russian River Ferry area, and I was in uniform standing right behind this guy that had a snagged fish on his line. The man landed the fish and then clubbed it. He took the hook out of its tail and put the hook in its mouth. He then

unhooked the fish and turned around to put the fish in his backpack. Well, when he turned around and saw me standing there in uniform, his eyes got as big as saucers and that fish went about twenty feet in the air and came right back down on top of the surprised snagger.

To combat the illegal and dangerous practice of hunters shooting from their vehicle or on or across a road, we use a decoys set up just off the road. We have had a number of close calls from people shooting at animals from on or across the road. In one occasion a hunter was shooting at a spruce grouse that was on the road near the peak of a small hill. The hunter missed his shot and hit the mirror of a vehicle coming up the hill. In another occasion there was a father and son parked in there camper along the side of the road sleeping. Somebody took a few shots at a couple grouse in the road approximately 100 yards down the road. Two shots entered the camper just inches away from the father and son sleeping in the camper. There also have been several occasions when hunters have shot their own vehicle when trying to shoot at game from their vehicle. When a hunter comes along and shoots at our decoys, we pop out of the trees and have a little meeting with the hunter and we discuss the merits of shooting from their vehicle or from or across the road. One afternoon I set my decoy up on Swanson River Road; along comes a car and out pops a guy with a .22 rifle. He stands right in the center of the road and opens fire on the decoy. I come out of the trees yelling, "Game Warden, put your gun down!" The guy does not hear me. He's got tunnel vision and

audio exclusion an effect to the human body when its under stress commonly called the fight or flight syndrom. Anyway, he keeps shooting at this bird like it was coming to eat him. He fires 14 rounds and then starts to reload before I can get him convinced that the bird was not going to get him.

The grouse decoy doesn't just get wayward hunters. I have had my decoy stolen by a hungry coyote. The coyote looked at me, looked at my decoy grouse, then back at me, then figured he could beat me to the bird and grabbed the decoy. I tracked him for about a quarter mile where he must of stopped to take a bite out of his stolen meal and left the decoy. I have also had the decoy attacked by a hawk. The hawk just flew down and knocked over the decoy and another time a raven flew down and started picking at the decoy until I shoed it away.

It has been fun reminiscing about old times. Retelling these stories has jogged my memory of other incidents. Other officers have reminded me of other stories and similar situations, in which they have been involved.

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Warm wishes & winter warnings

by Robin West

I was on my way to pick up a child at school from an evening activity recently when it began to snow. You know how it looks: so many big white flakes flying toward your headlights that it reminds you of “going to warp speed” in a Star Trek movie. The view is beautiful, peaceful, and hypnotic. It was during this experience that my mind began to wander—how wonderful the mesmerizing sight of snow falling in front of me on the road—how dangerous both the road conditions were becoming and the daydreaming that was taking my mind off watching the road, other cars, pedestrians, a snow machine racing along side, or a moose that could step out from the shadows at almost any moment. I found myself controlling my daydreaming state, but only partially. I began to think of all of the close calls I had experienced in my 25 or so winters in Alaska.

It is written somewhere that God watches over children and fools. I am glad of it, for I have been both a child and a fool. I thought back to my first Alaska hunting adventure. I was so excited about becoming a resident that I could not wait to hunt caribou until the next fall. I embarked on a December fly out hunt which resulted in a caribou being taken, but also in a tale of survival. Upon taking an animal nearly seven miles out of a makeshift camp, I could not make it back to the tent and warm sleeping bag in the short daylight hours available. It was the longest night I ever spent, waiting for a blizzard to stop and daylight to occur, with nothing but the clothes on my back, a rifle, and a boned-out caribou which froze rock solid by morning in my backpack.

I thought back to the time I was following my trap line in Interior Alaska and decided to take a short cut across a frozen stream, breaking through the ice and catching myself with my arms (the ice holding then before I went in over my head). I pulled myself out and rolled in powdery snow, my arms and legs immediately stiffening like I had them surrounded by icy stove pipes. Another time I skied into a cabin that was located on a remote island (it was November—too early in the season really) approaching the lake after dark

and crossing to the island where a moose had crossed sometime earlier. In the morning I was shocked to see that the only ice on the lake at all was in the area where the moose had crossed, and where my ski tracks followed. And then there was the time that my partner and I left a trap line cabin in the extreme cold to fly back to Fairbanks because we wanted to watch the Super Bowl... It was more than eighty below at flying altitude and the ice fog was so thick at the airport that it was closed. We came in too steep when attempting to land at an alternate site along the Chena River and super-cooled the engine on the Cessna resulting in a VERY hard landing with a “dead stick.”

Oh, and of course there were the multiple times that I didn’t get the snow tires put on the car soon enough, or I reacted poorly to the driving conditions, resulting in vehicles spinning, sliding... well you know... But I am still here today; thankful, and hopefully a little smarter.

With much of the Kenai National Wildlife Refuge recently opened to snow machine use, people of all ages, skill levels, and with a variety of equipment will be heading out to enjoy winter activities in remote areas of the Refuge. I encourage all riders to be especially cautious of crossing water bodies, avoiding rocks and stumps that are just barely visible, and control speeds to avoid collisions with other people, trees, and wildlife. Please take necessary survival equipment with you, let someone know where you are going and when you expect to return, and be sure to help out those you encounter along the way that may need a little assistance.

My wishes for each and everyone in Alaska this season is to have a safe and wonderful winter. Be prepared, be safe, and have a great holiday season and 2004!

Robin West is the manager of Kenai National Wildlife Refuge. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.