

Refuge Notebook

Volume 1 • 1999

This volume was compiled in 2014 by Matt Bowser from the Kenai National Wildlife Refuge's archive of *Refuge Notebook* articles. Formatting has been improved and some hyperlinks (URI's) have been updated, but the articles have otherwise remained unchanged.

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Learning about past helps with predicting the future

by Ed Berg

Welcome to Refuge Notebook.

This is day one, page one of a new weekly column devoted to life and happenings on the Kenai National Wildlife Refuge. We staff members and friends of the refuge have signed up for this project because we think we have some interesting stories to tell. We hope that the more our readers learn about the refuge, the more they will appreciate it and help take care of it.

That being said, let me tell you a bit about my work on the refuge. As the refuge ecologist, I deal with the Big Picture. The “eco” in “ecology” comes from the Greek work “oikos” for house. So I study the “house” or the habitat wherein the animals (that’s us, too) and plants live out their daily lives.

My chief angle for studying the Big Picture is to look at the past. If you know the past, maybe you can predict the future. When I first came to this job, we had no idea if spruce bark beetles had been in the Kenai Peninsula forests in the past. We knew very little about forest fires before European settlement. By studying tree-rings, we now know that the bark beetle outbreaks occurred regionally in the 1820’s and 1880’s, and that fires were much less frequent (but did occur) before the 1850’s.

Fire and bark beetles are two disturbances that rebuild the forest house. Moose and hares for example need fire to produce the hardwood (willow, birch, and aspen) browse that gets them through the winter. Indeed, our most productive wildlife areas are the “middle-aged” burns, such as the 1969 burn west of Swanson River Road. These browse-filled burns support moose and hares, and everything that eats moose and hares, such as wolves, lynx, and bears.

With fewer fires before European settlement, there were probably fewer moose on the Kenai. At the Bufflehead oil well site I looked at the innermost tree rings in birch trees more than 200 years old. I could see that these trees had wide inner rings and grew rapidly when they were little shrubs. Modern birch shrubs are heavily browsed and you can put 40 rings (years) in the size of a dime. This suggests there weren’t a lot of moose browsing the Bufflehead site 200 years ago.

So, one conclusion from such studies is that if we want more moose, we need more fire on the refuge landscape. Toward this end, you’ll be hearing from “firebugs” Larry Adams and Doug Newbould who manage our prescribed burning program.

Another conclusion is that bark beetles are a natural part of our spruce ecosystem, and that they like warm summers and drought-stressed trees. If the present warming trend continues (i.e., if global warming is real), I’m predicting more beetles and more wild-fires.

So, there’s my case for studying the past. There may not be any crystal balls, but we can certainly look to the past to see where we fall on the big trends. Like the stock market, these trends can change, but then that’s what keeps ecologists (and stockbrokers) employed!

I’ll tell you more about some of these findings and prognostications in future columns. In the meantime, enjoy that snow!

Ed Berg has been an ecologist at the [Kenai National Wildlife Refuge](#) since 1993. He also teaches geology at the [Kenai Peninsula College](#) and serves on the [Kenai Peninsula Borough Trails Committee](#).

Winter activities abound on Kenai National Wildlife Refuge

by Bill Kent

Most folks who use the resources of the Kenai National Wildlife Refuge do so during our splendid Alaska summers. Fishing, hiking, camping and wildlife watching are favorite pursuits of refuge visitors. I wonder how many of you know about the opportunities available during our long, dark Alaska winters? The days are getting longer and warmer now, and this is the prime time for winter activities on the refuge.

One of the most popular winter activities is ice fishing; many of the lakes with good populations of trout are accessible with a short drive onto the refuge. Engineer and Hidden Lakes in the Skilak Loop are very popular destinations, as well as lakes along Swanson River and Swan Lake Roads. But as the weather warms, watch out for thin ice; we have been known to drop a vehicle or two in the late spring.

Snowmobile enthusiasts make good use of the refuge areas that are open for snowmachining. A large portion of the popular Caribou Hills lies within the refuge, and there are excellent trails leading into the northern parts of the refuge.

I should note that we ask snowmachiners to stay below timberline in their travels. This restriction is designed to avoid disturbing the caribou that are feeding on the windswept high plateaus and exposed mountain slopes. You can pick up a map at our Visitor Center that shows which areas of the refuge are open or closed.

There are good cross-country ski trails at our headquarters/visitor center on Ski Hill Road south of Soldotna. These trails are not as fancy as the groomed Tsalteshi Trails at Skyview High School. Our trails are narrow and rolling, and offer you a different and quieter skiing experience – and your chances of seeing a

moose or other wildlife are quite good.

At this time of the year, long-distance skiers can pick up good snowmachine trails that lead for miles into the backcountry, such as the Funny River horse trail, or the Doc Pollard Trail from Kasilof to Tustumena Lake. On a bright, sunny day you can ski forever on these trails, especially if they have an inch or two of fresh powder or have been groomed by the snowmachiners.

Have you ever thought about winter camping? Many of the refuge campgrounds remain open through the winter, and a good number of folks have discovered the contrast with the crowded summer days. Winter camping exposes you to a new world – it is VERY quiet in the campgrounds, and the sounds of the refuge in winter are quite different from the hustle and bustle of summer. It's getting to be a good time for owl listening, for example, because owls set up housekeeping about his time of year. Check out the great horned owls along Swan Lake Road in the evenings.

Winter wildlife watching can be quite rewarding on the refuge, particularly for moose and bald eagles. Don't approach those moose too closely, however; they've had a tough winter and any excitement uses up valuable calories that they need to survive until green-up. They are getting a bit stubborn now and aren't too quick to move out of the way.

Hopefully, you have already discovered some of these great winter activities on the Kenai National Wildlife Refuge. Two million acres is a lot of backyard, and wintertime makes a lot of it much more accessible than it is in the summertime.

Bill Kent is the Supervisory Park Ranger who is responsible for visitor services at the Refuge. He and his family live in Soldotna.

Assessing the pulse of life on the Kenai National Wildlife Refuge

by Ted Bailey

When you visit a doctor's office for medical exam, the first thing the nurse checks is your pulse and blood pressure. Those measurements along with your temperature and the color of your tongue, often give the doctor a pretty good idea of your current health and well-being. Sometimes further tests, such as blood and x-rays, may be required before the doctor can draw more specific conclusions about your health.

Although wildlife biologists are not doctors, we use similar approaches to check the health of wildlife on the Kenai National Wildlife Refuge. Because wild animals won't come to biologists for annual check-ups, we have to go out to observe or physically capture them to check on their health. We need to know about their health because the basic purpose of the Refuge, as mandated by Congress, is to conserve wildlife populations and their habitats. This means we have to know where our creatures live, the status of their health, and whether their numbers are going up or down.

Many, but not all, wildlife species are regularly monitored on the Refuge. We can readily observe large conspicuous animals such as moose and caribou from an aircraft under certain conditions; usually, their numbers, sex and relative age are fairly easy to determine. Other species, such as bears, wolves and lynx are secretive; they hide out in dense cover and are tough to monitor. Furthermore, they are often the most problematic species to conserve, so we make extra efforts to assess their populations, using radiocollars. When we capture an animal to install a radiocollars, we weigh it, take body measurements and a blood sample, and usually give it a shot of vitamin B and an antibiotic. By radio-tracking the animal weekly or monthly, we can determine reproductive success (for females) and causes and rates of mortality.

We monitor trumpeter swans and bald eagles by flying over their nests where we can see the number of young chicks, and monitor small birds of the forests and fields with Breeding Bird surveys along Refuge roads in June. These Breeding Bird Surveys are done at the same time each year in conjunction with similar surveys throughout North America. We usually

can't see these birds in the thick cover, so we depend on listening for their distinctive songs and calls. We monitor wood frogs during their brief egg laying period in the early spring by counting their egg masses along the edges of small ponds.

We find that it is important to monitor wildlife populations over a period of many years or decades because some species fluctuate greatly from year to year, while others may not change appreciably for ten years or more. For example, even though we have hundreds of lakes and ponds on the Refuge, the nesting trumpeter swan population has seldom exceeded 40 pairs per year since 1957, and it appears that nesting swans are extremely sensitive to human disturbance, especially float planes, boats, and canoes.

Moose and snowshoe hare populations are directly related to the post-fire age of the forest and the amount of available hardwood browse, although severe winters and other factors also influence their numbers. Wolf and lynx populations are determined by the numbers of moose and snowshoe hares, respectively, and the impacts of trapping and hunting. Our wood frog monitoring (which began with the help of Soldotna High School science students in 1991) indicates that many small breeding ponds used by wood frogs are disappearing because of increasingly hot summers and lower water tables.

The key point about wildlife monitoring is that the numbers only make sense over a period of years. Any species can have a bad year, or a very good year, but what is the long-term trend? This spring, for example, should be a good time to check again on the wood frogs. With all the snow, pond levels should be up. If we don't see lots of wood frog eggs, we will suspect that the long-term decline since 1991 is real and we'll have the data to show it.

Ted Bailey, a Supervisory Wildlife Biologist, has been responsible for the [Kenai National Wildlife Refuge's](#) biological programs since 1977. He and his wife Mary live near Soldotna. They previously lived in South Africa where Ted conducted research on leopards.

Friends can make all the difference to Kenai National Wildlife Refuge

by Amy George

It seems like everybody could use a friend at one time or another. Believe it or not, even the federal government needs friends. You might not realize it, but federal land is probably in your backyard.

Maybe you've taken summer guests fishing on the Upper Kenai River, hiking on Skyline Trail, on a float plane to Tustumena Lake, or canoeing along the Swanson River. If you've done any of these outdoor activities, you've recreated on Kenai National Wildlife Refuge, which is public federal land. Public lands are here for you to enjoy.

The Refuge covers nearly 2,000,000 acres of the Kenai Peninsula. If all of that land was privately owned, you might not be able to access your favorite fishing spot. You might not be able to hunt moose at Mystery Creek or Bear Creek or Moose Creek. There would be no Skyline Trail. Life would be very different.

But when the Federal Government (Washington D.C.) makes decisions about public lands that are unpopular, it often becomes difficult to see a difference between Kenai National Wildlife Refuge and Washington D.C., which is why Kenai National Wildlife Refuge needs friends.

Friends of the Refuge, by raising public awareness of the Kenai National Wildlife Refuge, can bridge the gap between the Refuge and the broader community. Friends that have a mission to support and work with the Refuge can become advocates for the Refuge. In return, these Friends can better involve the broader community with the Refuge.

Friends of Kenai National Wildlife Refuge is a public, non-profit organization made up of citizens from all over the Kenai Peninsula who share a passion for our public lands, and especially for the Kenai National Wildlife Refuge. Their mission is to "conserve the unique natural, cultural and recreational values of Kenai National Wildlife Refuge and to promote awareness of its importance to the surrounding communities."

This diverse group will be directly involved with the Refuge and the surrounding communities in a variety of ways, from building trails and preserving historical sites, to assisting with wildlife and plant surveys, to developing more public involvement programs.

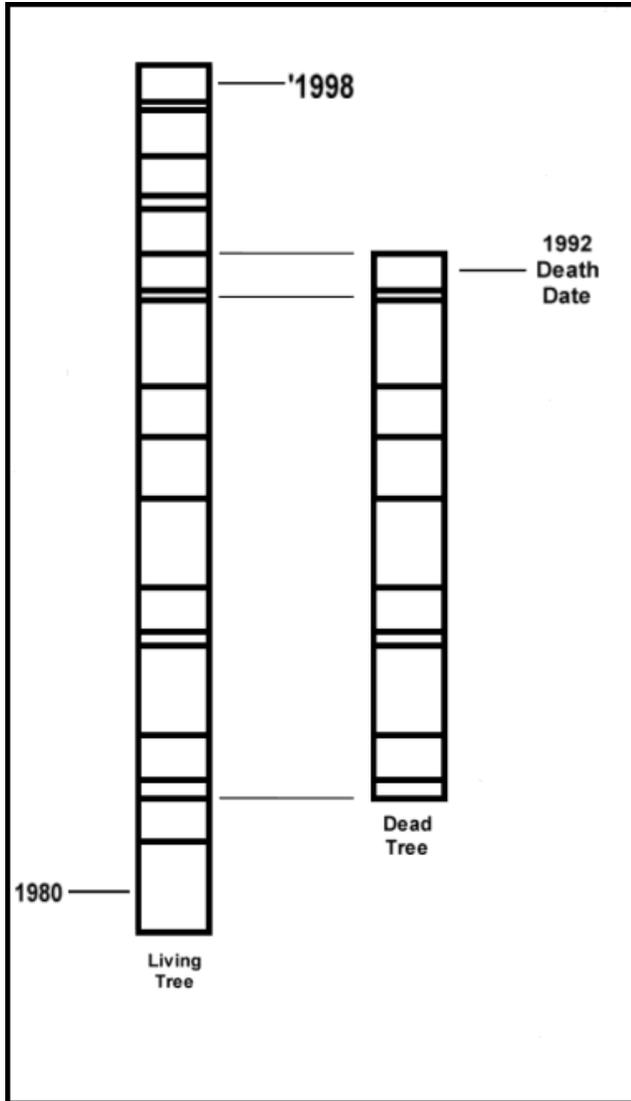
Anyone can join Friends of Kenai National Wildlife Refuge, which is a public, non-profit group. All meetings are open to the public. There are no "hidden agendas," no "anti" sentiments toward one Refuge land use or another. Rather, Friends of Kenai National Wildlife Refuge hopes to ensure that our community feels a sense of ownership in the Refuge, thus becoming good stewards and advocates of all our public lands.

If you would like more information about the Friends group, call Amy George at 262-7021.

Amy George is the volunteer coordinator at the [Kenai National Wildlife Refuge](#). She has been well-known to Kenai-Soldotna area students and teachers since 1993 from her former role as Fire Education coordinator for the Refuge.

Dead trees can tell some tales

by Ed Berg



Dead men may tell no tales, but dead trees can often tell better tales than live trees, especially if the trees have been dead for a long time. Take for example a log from a turn-of-the-century trapper's cabin or from a 13th century Stave Church in Norway. Tree-rings in such wood can tell exactly the year when the tree was cut, or more precisely, when the tree died (its "death date").

Tree-rings are one of my favorite tools for my forest ecology studies on the Kenai National Wildlife Refuge. To use tree-rings, however, I have to precisely date every ring of a tree. This dating starts with the last (outermost) ring and counts backward, so I have

to first determine the date of the outermost ring, i.e., the death date of the tree.

To determine the death date, I first extract a sample (or core) of wood from the tree with an increment borer, which is a threaded $\frac{3}{8}$ " steel tube. The borer is screwed into the tree, aiming for the center. The sharp end on the tube cuts out an $\frac{1}{8}$ " cylindrical wooden core like a dowel rod. I glue the core to a grooved wooden stick, and sand it to a furniture-grade polish so that the rings are clearly visible.

Next I measure the width of each ring under a good binocular microscope at 20-60x power. In the Refuge lab we have a sliding bench micrometer hooked up to a computer, which can accurately measure ring-widths to 0.001 millimeter or 0.00004 inch. This amazing device is similar to a lathe with a very fine screw, and it uses an electronic pickup borrowed from an industrial milling machine. It takes me about 20 minutes to measure a core with 200 rings (years).

With my 200 ring-widths in hand I use the computer to compare these widths with an average set of ring-widths (called a chronology) that I have collected from live trees. I started with live trees because I know the dates of the outermost rings if the trees are alive when I core them. The computer matches fat and thin rings in the core with fat and thin rings in the live trees (see drawing). This matching process can be done by eye, using narrow marker years, but the computer does it much faster.

Once I have properly lined up the core with the live tree chronology, I can simply read the death date of the core off the matching ring on the chronology. It's a simple idea, but it takes good measurements to make it work. It also requires a fair amount of climate-driven year-to-year variation in the width of the rings; it doesn't work if the trees are always fat and happy, and put on the same nice wide rings every year.

Graduate student Andy DeVolder is studying fire history in black spruce north of the Kenai River, and has used death dates and fire scars to determine fires in 1708, 1762, 1801, 1828, 1833, 1834, 1849, 1867, 1874, 1884, and 1888, and 1898.

Refuge postdoctoral researcher Chris Fastie dated an old white snag with spruce bark beetle scars near

Homer with a death date of 1884. This death date coincided with a massive 1880's growth release (pulse) in trees which we studied on the west side of Homer, assisted by Stan Eller's biology classes at Homer High School. The 1884 date together with beetle scars helped confirm our idea that growth releases occur in small surviving trees after the beetles kill the large trees.

I am currently dating old logs in a big log jam on

the Killey River in order to find out how often the Killey has flooded over the last hundred years. Historian Gary Titus has located a number of cabins that trapper Andrew Berg built around Tustumena Lake between 1890 and his death in 1939. We are interested in dating the logs in these cabins, if we can find solid wood to core.

Ed Berg has been an ecologist at the [Kenai National Wildlife Refuge](#) since 1993.

Check out KNWR opportunities at Peninsula Sportsman Show

by Mark Chase

This past weekend, the Great Alaskan Sportsman's Show was held in Anchorage at the Sullivan and Ben Boeke Arenas. Thousands of Alaskans, not only from Anchorage but from many parts of the State, dropped by to wander the aisles of vendor displays and attend seminars on topics ranging from fly-tying to log home building.

Vendor booths included, among others, retailers, fishing and hunting guides, charter operators, and local, state and federal groups and agencies. There were even credit and loan companies on hand for those who maybe found more than they anticipated. Chances were, if you had a question about fishing, hunting, or other forms of Alaska outdoor recreation, there was someone in the building who had an answer.

Next weekend, the Kenai Peninsula hosts our very own sportsman's show at the Soldotna Sports Center. While the show is not of the same magnitude as the Anchorage show, it does showcase the Peninsula community with respect to vendors, groups, and agencies. The Show is a wonderful opportunity for the sporting (whatever outdoor sport that may be) community of the Kenai Peninsula to get together and get excited about the upcoming, and all too brief, peak recreational season on the Kenai.

As in Anchorage, the Kenai National Wildlife

Refuge will have a staffed booth to discuss recreational opportunities and issues related to the Kenai NWR. Refuge managers, rangers, biologists, and educators will be available to discuss issues important to you about Refuge.

With the passage of the National Wildlife Refuge Improvement Act of 1997, co-sponsored by our own Congressman Don Young, fishing, hunting, and other wildlife dependant recreational activities are now priority public uses for not only the Kenai Refuge, but for all National Wildlife Refuges in the country.

It is the intent of the Refuge to manage the land and uses of the land in such a manner as to be able to provide these quality recreational opportunities for generations to come.

So, while you're wandering the aisles in search of that new rod and reel, backpack or boat, stop by the Kenai Refuge booth and lets talk about the great places on the Peninsula to put your new outdoor garb and gadgets to their intended use.

Believe it or not, it has to break-up sometime, and ultimately spring will come to the Kenai. Until then, "A little more ice fishing, anyone?"

Mark Chase is the Deputy Refuge Manager at the Kenai National Wildlife Refuge. He and his wife Julie and two children have lived in Soldotna for five years.

How much snow is enough on Kenai National Wildlife Refuge?

by Robin West

With spring coming, many Kenai Peninsula residents are starting to think about fishing, canoeing, and hiking. As the area snowpack lingers, however, a few die-hards are trying to get in that last x-c skiing adventure or snowmobile trip.

In an article in last Friday's Peninsula Clarion, the Refuge announced closure for snowmobile use on April 21. While many people have already put their machines away for the season, a few have inquired as to why the Refuge would close now when we still have so much snow. I thought I would try and explain why this was done.

Refuge regulations allow for snowmobile use on portions of the Refuge between December 1 and April 30, if snow conditions are adequate to protect underlying vegetation. Public announcements are made each year to open and close the Refuge between these time periods.

While some restrictions on snowmobile use, including announced opening and closing dates, have been in place since snowmobiles were first used on the former Kenai National Moose Range, we have only been keeping exact records of these dates for the past 23 years. The maximum number of days (151) that the Refuge could be open has only occurred once (winter of 1994-1995). Two winters (1980-1981 and 1985-1986) the Refuge was not opened at all.

The average number of open days over the last 23 years has been 103 days; this year the Refuge was open to snowmobile use for 138 days.

The decision to open or close to snowmobile use affects the whole Refuge and sometimes there is adequate snow cover at higher elevations but not in the lowlands. Likewise, this time of year, while lots of snow may still be available up high, riding on frozen streams, and some lakes, becomes increasingly hazardous.

While our decisions are primarily based on protection of wildlife and habitat, we always do the best we can to consider human safety factors as well.

Snowmobile use is kind of a "love-hate" activity it seems. Many folks believe that the use is gener-

ally harmless to wildlife and habitat, and argue vehemently that no restrictions are needed on the activity. Others can't understand why snowmobiles are allowed at all on a National Wildlife Refuge, especially in the Wilderness Areas. We hear from both groups of course, and to be honest, our regulations are a compromise to some extent, and generally folks who feel strongly about any particular issue are never completely happy with a compromise.

From my standpoint the compromise is working. Some large areas are off limits to snowmobile use on the Refuge (e.g., above treeline, the Skilak Loop area, the Canoe Systems), and all areas are off limits when there is inadequate snow cover. At the same time, there are large areas of the Refuge available for extended periods of time in most winters.

The access to Refuge portions of the Caribou Hills is a unique example of opportunity for snowmobile use. This is a Congressionally-designated Wilderness Area that if it occurred anywhere in the lower 48 states, it would be off limits to any kind of motorized use.

The opportunities and compromises that have evolved over several decades on the Kenai continue to serve us reasonably well and I don't see them changing too much in the future. The biggest threat that could potentially affect snowmobile use is the increased encroachment into closed areas we have noticed in recent years.

For the most part the snowmobile fraternity has proven to be a conscientious group. It is the few individuals that harass animals occasionally with their machines, or knowingly lay trails that others will follow into closed areas, or vandalize signs or facilities, that are always remembered.

I encourage folks to get the word out to others, and if you are not familiar with the Refuge snowmobile regulations, stop by the Refuge office before next season and pick up a copy. Keep your fingers crossed for a warm spring and for lots of snow by next December 1 for the next snowmobile opener!

Robin West is the Refuge Manager for [Kenai National](#)

Wildlife Refuge. Robin has worked for the Fish and Wildlife Service for 20 years in Alaska. He lives with his wife Shannon and three children in their home off Kalifornsky Beach Road.

Delicate balance: snow geese, lemmings, arctic foxes

by Robin West

April 17, I saw some of the first snow geese arriving on the Kenai River Flats near Warren Ames Bridge. Along with small flocks of Canada and white-fronted geese, and a few mallard and pintail ducks, these migrating birds signal that Spring is indeed arriving. Over the past several years people have questioned whether the snow geese are returning in the numbers that they used to.

People seemed most interested in this type of information when the City of Kenai was sponsoring their \$10,000 Snow Goose Classic. While we don't know exactly how many birds will return each year, or when they will first arrive, we do know quite a lot about the overall health of the snow goose population and where these birds spend most of their lives. And while we are fortunate to be able to see these birds essentially every year, only a small proportion of the approximately 90,000 Wrangell Island snow geese ever pay us a visit.

Snow geese returning to the Kenai River Flats each spring are heading to nesting grounds on Wrangell Island located about 90 miles off the northeast coast of Siberia in Russia. They are returning from wintering areas in the Central Valley of California, or from the Skagit River coastal area near northern Washington and southern British Columbia. Most of the birds returning up the Pacific Coast, and to the Kenai River Flats, are from the Northern (Washington - B.C.) wintering area. The majority of the California wintering snow geese migrate through the Canadian prairies and Arctic Alaska on their return to Wrangell Island.

The Northern and Southern wintering geese can usually be distinguished from one another by the red staining that occurs on the Northern birds' heads and necks, which is caused by feeding on grass roots and tubers in wet iron-rich soils. We see this red staining on many of the birds passing through our local area.

Many of the birds stopping to feed for a few days before resuming their journey are last year's young; these yearlings are more grayish in color than the nearly pure white adults.

The snow geese arrive on Wrangle Island in mid to late May and complete their nesting in June. Young family groups leave the nesting colony and go to the

northern coast of the island by early July and begin returning to wintering areas in August and September. While these birds are rarely seen on their return flights in the Kenai area, many will stop for a spell in Western Alaska near the Yukon-Kuskokwim River Delta.

The population status of these birds has not always been the best, declining from approximately 150,000 birds in 1970 to a low of about 56,000 geese in 1975. For the past several years, however, the birds have been doing well, increasing steadily since 1994.

The life of a snow goose is not always easy. Late springs and bad weather in nesting colonies can essentially eliminate successful nesting in any given year. Arctic foxes can take as many as 80 percent of the eggs, and an additional 30 percent of the goslings may be taken by snowy owls, foxes, and glaucous gulls.

Historically humans have also taken their toll. Until the 1950's there were two distinct snow goose colonies on Wrangell Island, but Russian geologists and settlers decimated one of the colonies by using the birds for food. Out of concern for the geese, the Russian government designated the island as a "Zakaznik" (emergency nature reserve) in 1961. Full fledged "Zapovyednik" (wildlife preserve) status came in 1976.

Goose hunting was closed in 1976 on the island, and throughout the whole Magadan District, but the new regulations also eliminated fox trapping, and 200-600 foxes had generally been taken each year in the past. Increasing fox numbers increased the rate of predation in the snow goose colony, particularly in years of low lemming numbers when goose eggs and goslings were the only abundant food available.

Over the years a balance seems to have been struck that has allowed the snow geese and Arctic fox to both prosper on their island home, but the nature of their existence is somewhat cyclic and some years are certainly better than others.

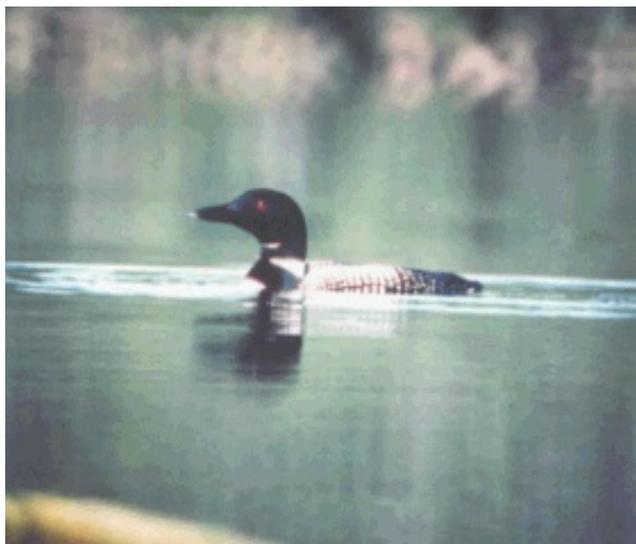
How many snow geese arrive on the Kenai River Flats each spring, and how long they stay is largely a function of how break-up is progressing throughout their migratory path. If the Flats open up early, and before other coastal areas, we can expect good numbers of the snow geese to stop over.

Robin West is the Refuge Manager for [Kenai National Wildlife Refuge](#). He spent a month on Wrangell

Island in Russia in 1990 studying black brant and snow geese.

Southcentral loons awaiting breakup to get to nesting grounds

by Liz Jozwiak



With the late spring thaw and most lakes still ice covered, many residents have been asking where do the loons go if the lakes are frozen? Good question. Since loons can only land safely on open water, most are awaiting breakup along the open waters of Cook Inlet, and a few have been seen already on the lower Kenai River.

If the next time you observe a merganser-sized bird flying wide circles over a lake, take a second look, it may actually be a loon doing a reconnaissance flight checking for open water.

Loons spend their winters in waters along the Atlantic and Gulf Coasts, and in the Pacific Ocean along the coast from Alaska to Baja California. They can easily transition to fresh water nesting lakes in the summer because of a salt gland under the skin above each eye.

Of the 3 species of loons that occur in Southcentral Alaska, the most frequently observed loon is the common loon, a large stout diving bird with a black head, pointed bill and distinctive black and white markings on its wings and back. Less abundant is the Pacific Loon which is smaller, and silvery-gray headed with a white-striped black throat and white bars on its back.

The most secretive, and least frequently observed loon is the red-throated loon, which is similar in size

to the Pacific loon, but has a distinctive red throat patch, pale gray head, and plain back. Very little is known about the biology and nesting habitats of the red-throated loons in our area.

Male loons usually arrive on the same lake from year to year to secure the territory before the female gets there. It was always thought that a loon pair mated for life, however current banding studies have shown that about 20% of the time an individual may take a new mate for the year. Both the male and female have the same markings, but if you observe a pair side by side, the female is just a bit smaller.

Usually only 1 pair of loons will occupy a lake, but this really depends on the size and shape of the lake. Larger lakes can support more than 1 pair of breeding loons, provided there are enough secluded bays, coves, and nooks. Territories of a common loon pair can range from 100-500 acres. A pair will nest in late May/early June, and will build a nest within inches of the water.

While loons are powerful flyers and graceful swimmers, they are extremely awkward and vulnerable on land, especially when nesting. Loons incubate eggs for 27-31 days, and you are likely to see only one loon out on the lake during this time. Both adults share the incubation duties, and will trade places periodically. One or 2 chicks are born in late June, and ride on their parents' backs so the adults can provide protection from predators both above and beneath the water. It also allows the young to conserve energy and body heat. If you don't see any loon chicks by the middle of July, most likely the eggs didn't hatch or the pair didn't nest at all.

This summer you may see local lake residents observing loons on some of the local and private lakes from Kasilof to Nikiski, and on the Kenai National Wildlife Refuge. These newly dubbed "Loon Rangers" are participating in the Kenai Loon Watch project. They will be monitoring loon behavior and biology from a safe and non-obtrusive distance as part of the Alaska Loon Watch Program.

The data collected by Kenai Loon Watch volun-

teers will give biologists baseline information on the status of loons and their nesting success on lakes in our area.

Loons are an integral part of Alaska's beauty, a living symbol of clean air, clean water, and a high level of environmental quality. Although Alaska has a healthy populations of loons statewide, there are some concerns about the future of loons in areas that are heavily used by people. Fortunately, studies in other states have shown that loons and people can coexist if care is taken.

Breeding loons need an undisturbed nesting site, and a quiet bay to raise their young. There are several things you can do this summer to help keep Kenai loons healthy and productive:

Enjoy loons from a safe distance. If you see a loon rising out of the water running and splashing across the surface, you are too close. If the adult loon has

been scared off its nest, the eggs can chill and die, or be eaten by a predator.

Stay clear of loons and their nesting areas while boating, canoeing, or skiing. Wakes can destroy their shoreline nests and drown chicks.

Pick up discarded fishing line and tackle.

Keep dogs leashed and confined. Loose dogs and other animals can destroy nests and eggs along lakeshores.

Join the Kenai Loon Watch project and become a "Loon Ranger". Contact the Kenai National Wildlife Refuge at 262-7021 for more information.

Elizabeth Jozwiak is a biologist at the Kenai National Wildlife Refuge. Liz has worked for the [Kenai NWR](#) since 1988, and recently completed her masters degree on the effects of harvest on wolves on the northern portion of the Kenai Peninsula.

Some 'Flowers' will never enhance wilderness experience

by Candace Ward and Ed Berg

Have you ever hiked into a remote lake only to find a fire pit full of trash? Or returned to a favorite fishing spot and found human waste? Or lots of toilet paper "flowers" behind a campsite? If you're like us, you were probably just a bit ticked off!

Each year the Kenai National Wildlife Refuge and other land management agencies in Alaska rely on the good graces of the majority of the outdoor users who don't make a mess when camping and hiking. Many folks go an extra mile and pick up stuff that mess-makers have left behind.

The Refuge and other outdoor groups are working to promote the "Leave No Trace" idea. This program provides a basic philosophy of how to protect and enjoy public lands while doing a variety of recreational activities.

"Leave No Trace" has seven basic principles:

Plan Ahead and Prepare: Proper trip planning helps day trippers and campers accomplish trips safely and have fun while minimizing damage to natural and cultural resources. By taking the time to plan ahead and prepare, aggravation and disaster can be avoided.

You'll never have to trowel a ditch around your tent in a rainstorm, if you bring the right tarp and choose a sturdy tent. Food can be re-packaged into reusable containers such as ziplock bags and polyethylene jars. Trips can be scheduled for off-peak times to avoid having to open up a new campsite because the best campsites are full.

Camp and Travel on Durable Surfaces: It's important to protect natural vegetation to prevent erosion and scarring. In high use areas, campers should try to concentrate their activity. It's best to use trails whenever possible and to select campsites that are already well used.

In fragile areas like alpine tundra, try using a campsite for one night and moving to a new site for the next night. When alpine hiking, spread out and hike on rock and snow fields to avoid creating a trail.

Often there are a lot of gray areas when applying this principle. However, if you get into a mind set of thinking about how to minimize the damage your boots and campsite make, you can really make a difference. Stepping in that mud puddle in the middle of

the trail can save a beautiful rose or buttercup at the trail's edge.

Dispose of Waste Properly: Trash, litter, and human waste left in natural areas detract from the beauty of wild places. Simple rules to live by are:

-Pack out what you pack in.

-Prevent contamination of natural water sources. Soapy, gray waste water needs to be dispersed 200 ft. from fresh water sources.

-When disposing of human waste, dig a cathole 6 - 8" deep and 200 ft. from water. Deposit waste and fill hole with soil.

-Pack out your toilet paper in a small ziplock baggie. Toilet paper "flowers" can last for years and are one of the most obnoxious reminders of mindless camping. You can start young children off right by giving them a ziplock baggie and instructions, before handing them toilet paper and sending them into the bushes "to take care of business."

Leave What You Find: Allow others a sense of wonder and discovery. Leave rocks, plants, wildlife, and archeological artifacts so others can enjoy them.

Minimize Campfire Impacts: Some people can't imagine camping without a campfire. Yet, there are some situations where a campfire is harmful. In the high country it's best to use a lightweight gas or butane stove. Avoid fires that blacken bare rock outcrops. The campfire scars of the Lewis and Clark expedition of the early 1800's are still visible (and have been allowed historians to track the expedition day-by-day through the mountains of the West.)

In areas where it is practical to have a ground fire, think small. Use dead and down wood no bigger around than your wrist and no longer than your forearm. Be sure to build your small fire on mineral soil to prevent creeping ground fires in the forest duff.

Respect Wildlife: When encountering wildlife, give them space to retreat and enjoy them from a distance. Avoid traveling in sensitive habitat like wetlands or in areas that may be critical to wildlife such as nesting and breeding areas. Never feed wildlife. Hang your food bag when tall trees are available or use a plastic bear barrel. Never take food into your tent, nor leave food in a pack on the ground.

Be Considerate of Other Visitors: Respect the privacy of others. Let natural sounds prevail. Most people come to visit natural areas to enjoy nature and to socialize with their family and friends. Realize that your entertainment may be someone else's pet peeve. An evening of storytelling may be more fun and respectful to your neighbors than playing loud portable radio music or target practicing with a pistol. After hearing about the Leave No Trace Program, many folks may agree whole heartedly and adopt new ideas for their outdoor adventures. Others may give familiar excuses - we can do what we want, wilderness is limitless, it will heal in time, and it's too much trouble.

Refuge visitors frequently express surprise at how much human impact there is on our Peninsula public lands - trash, giant fire pits, numerous bullet holes in trees and signs, off road vehicle scarring, human waste left on the ground unburied, toilet paper flow-

ers, and beer cans for starters. Putting Leave no Trace into practice can keep human impacts to a minimum, so that the Kenai will retain its beauty and wilderness values.

Fortunately, the Leave No Trace philosophy is alive and well with many local residents and visitors. Scouting organizations and school children at Tustumena, K-Beach, and Mt. View Elementary Schools participate in Leave No Trace Programs. At the Refuge headquarters we talk about Leave No Trace with visiting groups and with people seeking information about where to go in the back country. The idea is catching on, and with luck maybe we won't see so many of those white "flowers" next spring!

Candace Ward has been a park ranger at the [Kenai National Wildlife Refuge](#) for 15 years, specializing in visitor services and education. Ed Berg has been the Refuge ecologist since 1993.

Tracking Kenai Peninsula brown bears good for research

by Rick Ernst

Seeing a brown bear is a thrill for most folks. Something to be remembered for a long time, if not a lifetime. Bears invoke a sense of awe and power. They are a symbol of vast, wild country.

I am one of the lucky ones. My job is to track and observe these elusive critters. The Kenai National Wildlife Refuge is working with biologists from the Alaska Department of Fish and Game, the Chugach National Forest and Kenai Fjords National Park to study and conserve brown bears on the Kenai Peninsula. Wildlife Forever and the local Safari Club provided financial support for this study.

One of the best ways of gathering information on bears is through radio telemetry. This interagency effort has captured more than 80 brown bears since 1995. Almost all have been females or sows. The oldest bear captured was 22.

Captured bears were ear-tagged, measured for total length, skull width and length and chest girth. Blood and hair samples were collected to help determine nutritional condition and health status. A premolar tooth was extracted for age determination. Currently 35 sows and two boars are collared.

Bears have been captured from all over the peninsula – from Johnson Pass to Homer, and from the Swanson River to the Snow River near Seward. All have been fitted with radio transmitters and some include satellite or (global positioning system) transmitters. This technology has provided fascinating insights into the lives of Kenai brown bears.

Some of the things we have learned about these bears is they den not only in the Kenai Mountains but also in the lowland forests. Dens occur in uplands of mixed aspen and spruce, avalanche chutes, mountain-side caves, alder thickets and under fallen beetle-killed spruce. Dens occur from near sea level up to 5,000 feet.

The first bears entered dens in mid-September, and the last entered dens during late November. Male bears tend to emerge from their winter slumber first, followed by lone sows and then sows with cubs. While

tracking bears on May 2 and 3, almost all were still located in or near den sites. Some bears roam large distances while others have relatively small home ranges. One bear in 1996 roamed from Mystery Creek in May and June to North Kenai in July and then to the upper Swanson River in September. Males typically have larger home ranges than females.

While brown bears are generally solitary (excepts for sows with cubs), they do concentrate where food is plentiful. The peninsula has several streams choked with salmon in late summer, and bears use this food source to the fullest. It is not unusual for 15 to 35 brown bears to be feeding on salmon along a short stretch of river or stream. These areas need protection to ensure bears' nutritional needs are met for their long winter sleep.

Telemetry also has provided an indication of mortality of brown bears, both natural and human caused. This past year, we located one radio collar in the Kenai River and another in a small lake south of Soldotna. The unreported killing of brown bears is an important management concern for this species.

Local interest in brown bears was evident by the recent success of the first Brown Bear Festival held at Skyview High School last November. The festival provided a forum for getting information out to the public about brown bears and how we can best co-exist with bears and resolve some potential problems. We can all help protect bears by storing garbage properly or hauling it to an approved dump site, keeping pets and small livestock in a secure building at night, not providing suet and birdseed during summer months and storing pet and livestock feed in bear-proof containers.

Protection of habitat is critical to any species. Conserving bear habitat and populations is a purpose of the Kenai National Wildlife Refuge, and one of my jobs is keeping track of bears.

Rick Ernst is a wildlife biologist and pilot for the refuge. He has lived here since 1993.

Snow, fallen trees obscure some Kenai National Wildlife Refuge hiking trails

by Dave Kenagy

The long days of spring are here, and it's time to head 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 assessing the condition of road-accessible trails and has found most trails to be in good condition. Only a few need significant maintenance. Trail maintenance is accomplished by refuge employees, youth work programs, Student Conservation Association Volunteers and community volunteers.

These various groups will be 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.

Both the upper and lower portions of the Kenai River Trail were especially hard hit by winds. There are more than 100 blowdowns, mostly small diameter trees, along the upper section. The lower section has fewer blowdowns but does have several tangles of very large trees where the trail parallels the Kenai River. Detours around those areas, though numerous, are short and relatively easy. Clearing the Kenai River Trail will be a top priority for backcountry crews.

Despite favorable spring weather, heavy snows and a late breakup combined to leave most trails wet and muddy later than usual. A few trails have sections still covered by soft snow. Trails with extensive wet or muddy sections include the Kenai River (upper), Skilak Lookout, Fuller Lakes, Seven Lakes, and the Drake/Skookum Lakes Trail. Trails with snow at higher elevations include Skilak Lookout, Fuller Lakes, Bear Mountain and Skyline Trail. Snowshoes could be

handy on these trails.

Now for some "good news." Old man winter was mostly kind to the Swan Lake and Swanson River Canoe trails. The canoe system trails are both designated National Recreation trails within the Dave Spencer Unit of the Kenai Wilderness and have been upgraded over the past several years.

Canoeists can expect to find them in good condition, though some muddy and wet conditions will be encountered on portages. As always, rubber knee-high boots are recommended. And a fishing pole might be a wise addition for an early season trip.

If you have questions regarding a specific trail or backcountry area, call or stop by refuge headquarters. We have begun a new "backcountry report," which provides information on current conditions and activities along trails, lakes, rivers, and remote backcountry areas.

It is updated twice a month, after backcountry crews complete patrols and maintenance.

Whether you're hiking road-accessible trails or traveling in remote backcountry, be prepared for all conditions. In addition to your normal gear, always carry spare food, water, warm clothing, rain gear, map, compass/GPS, and signaling devices, and let someone know of your plans.

Also, be sure to practice "Leave No Trace" and backcountry bear safety techniques.

Have a good adventure, and remember to provide refuge staff with information about your trip that would be useful to other backcountry users.

Dave Kenagy is a recent addition to the [Kenai National Wildlife Refuge](#) staff. He is a former Kenai Peninsula Alaska State Parks ranger and refuge backcountry ranger. He rejoins the refuge staff after several years of working in the private sector and for other land management agencies.

Interpreting nature's smoke signals no lost art on Refuge

by Doug Newbould

Can you interpret smoke signals? If you are old enough to read and understand this article, I'll bet you can.

Oh, I'm not talking about the kind of smoke signals we used to see in those old B-Westerns. I'm talking about the smoke we see and smell everyday here on the Kenai.

We all make observations about smoke, and we all react to it whenever we smell it or see it. I would even go so far to say that smoke is one of the most powerful signals we encounter in our environment, especially when you consider the effects it can have on us - both emotionally and physiologically.

How do you react to the smell of some savory meal smoking on the barbecue? How about the smell of a campfire on a cool summer evening? What kinds of thoughts go through your mind when you smell incense, or pipe smoke, or a cigarette in a restaurant?

Did I touch any nerves there?

OK, so what about your reaction to the smell of diesel smoke, burning tires, burning plastic or an electrical fire? Do you react in a certain way to different colors or amounts of smoke, or to its location in the atmosphere?

Sure you do. Thick, billowing clouds of black smoke are probably a lot more threatening to most people than soft, hazy white smoke...wouldn't you agree? I rest my case...I think we all interpret smoke signals, almost everyday.

As a wildland firefighter with the U.S. Forest Service and the U.S. Fish and Wildlife Service, I have been learning how to read smoke signals for almost 25 years. About ten years ago, I even completed a course in "smoke management".

Some of you know my boss, Larry Adams. Larry has been a Fire Management Officer on the Kenai for more than ten years, with the Alaska Division of Forestry and here on the Refuge. He has more than 35

years experience interpreting smoke signals. In fact his first job in natural resources was manning a fire tower in the Rockies, daily scanning the forests for the first wisps of smoke that signal the beginnings of a wildfire.

Larry also did a stint as a smokejumper, the most romantic of firefighting positions. Personally, I never understood what would possess a man or a woman to jump out of an airplane into a burning forest, risking life and limb. What's so romantic about that? I guess you'll have to ask him about that sometime.

When Larry and I look at the smoke from a wildfire or a prescribed burn, we can usually tell a lot about that fire: its size, its intensity, its rate of spread, or even the type of fuels that are burning. We can also make judgements about the weather by watching smoke: wind speed, wind direction, atmospheric stability, and the presence of inversions or approaching frontal systems.

We also use our noses to seek out those invisible fires, creeping slowly through the duff. We call them sleepers, because they can wake up days after a fire is thought to be out, or days after a lightning storm passes through an area. Sleepers have a very characteristic odor, usually just a delicate, slightly pungent aroma. You might even say we are smoke connoisseurs!

Those of you who know me, probably agree that I have the nose for the job (Mom always says it's a proud nose).

Both Larry and I would like to tell you more about fire management on the Refuge and perhaps about our firefighting careers...we love to tell "war stories". And remember, "Only You Can Prevent Wildfires!"

Doug Newbould is the Assistant Fire Management Officer at the [Kenai National Wildlife Refuge](#). He has lived happily in Kasilof with his wife Denise, son Brandon and daughter Megan since 1991.

Be properly ‘armed’ before doing ‘combat’ on upper Kenai

by Bill Kent

The 15 miles of the Kenai River upstream from Skilak Lake, known as the upper Kenai River, will open for fishing today. Many people know this area primarily for the “combat” fishing at the confluence of the Russian and Kenai Rivers and may not think about this portion of the river the same way as the lower reaches below Skilak Lake. However there are differences and similarities you should keep in mind when visiting this part of Kenai National Wildlife Refuge.

Everyone fishing the Upper Kenai should review the state fishing regulations carefully. There are restrictions on harvest limits, types of gear, and area closures which are unique to this area.

For instance, no rainbow trout may be harvested there, in keeping with the management strategy devised by the Alaska Department of Fish and Game; only unbaited, single-hook, artificial lures are allowed there as well, unless otherwise provided; the limit for sockeye salmon is six daily, except in the 1,800-yard area at the confluence of the Kenai and Russian rivers, where the bag and possession limit is three. Please, if you fish the upper Kenai, review the regulations carefully. And if you have questions, contact Fish and Game (262-9368) or refuge headquarters (262-7021).

Copies of the Regulations are available at most stores which sell fishing licenses, Fish and Game office and at refuge headquarters. The Regulations are complex, and can be expensive to violate. Fish and Game’s recorded message (262-2737) provides an excellent summary of weekly fishing conditions around the Kenai Peninsula, including the Upper Kenai River.

To get to the action fishing, take the Russian River Ferry across the Kenai River to the mouth of the Russian River. There is a sign on the Sterling Highway marking the ferry parking lot, which is newly remodeled. Parking is \$6, \$7 over vehicles longer than 20 feet. The ferry ride costs \$5 for adults and \$3 for kids (3-11) and it runs from 6a.m. to 11p.m. The boat ramp

costs \$5, which covers parking for one vehicle.

Boaters usually put in at the Kenai River Bridge in Cooper Landing, just below Kenai Lake and at the ferry. Jim’s Landing is the last takeout before the Kenai Canyon. If you pass Jim’s Landing, the next takeout is Upper Skilak Lake campground. Please note that Jim’s Landing is closed to fishing.

The riverbanks of the Upper Kenai are just as fragile as the banks below Skilak Lake. Riverbank fishing closures are scattered along the river from the bridge at Kenai Lake to Jim’s Landing. These areas are posted “Closed” with Fish and Game or refuge signs and are described in the fishing regulations.

The thousands of visitors who use the upper Kenai can generate a great deal of litter and trash. When you use this area, please take out everything you brought in, – and maybe a little bit more. If everyone carried a litter bag and picked up one extra piece of trash, the place would be spotless.

A few words about bears: they like fish, they use the Upper Kenai River, you may encounter one, and if a bear wants your fish, give it up – there are other fish. Practice bear safety anytime you are fishing anywhere on the Kenai River, but especially where human development is limited. And remember, food runs So the bottom line with bears is not to run away.

One final suggestion for those using the upper Kenai is to be courteous to others using this space. Many times we get caught up in our own endeavors and do not remember that we are ambassadors for the Kenai Peninsula and the state of Alaska. It does not matter if the person next to you is from the Kenai Peninsula, Anchorage, Kalamazoo, or Timbuktu. Treating others like you would like to be treated is just common courtesy, and goes a long way to making everyone’s experience a good one.

Bill Kent is the Supervisory Park Ranger at Kenai Refuge. He lives in Soldotna with his wife and daughter.

Baby birds: knowing when to help, when to stay away

by Liz Jozwiak

Many of our readers have probably started to see baby birds fluttering around the house and backyard by now. Some of the luckier few have also glimpsed a newborn moose calf or two, or have seen baby snowshoe hares scurrying around.

It's also the time of the year when the Kenai Refuge receives calls from the public about injured or abandoned baby birds and nestlings.

Most songbirds such as the warblers, juncos, thrushes, and sparrows arrive on the Kenai Peninsula to breed by early June. Flycatchers and pewees arrive a few weeks later. These songbirds are also known as "neo-tropical migrants" because they winter as far south as Central and South America, and migrate to Alaska to breed.

All songbirds are born helpless, as are woodpeckers, hawks, owls, crows and ravens. Their eyes are usually still closed, and they have few or no feathers. They are completely dependent upon their parents for warmth and nourishment.

Waterfowl and grouse-type birds, on the other hand, are usually feathered and able to feed themselves within a few days after hatching.

It is our human nature to help a baby bird which looks as though it has fallen out of a nest. The chick either tried leaving the nest prematurely, may have fallen out or was learning to fly. In some cases our help is appropriate, in other cases it is not.

If you find a naked helpless baby bird on the ground, try to locate its nest. It should be close by. Look in heavy brush, hollow tree branches, and in shrubbery. Some birds such as juncos and robins are ground nesters, so the nest may not be in a tree, but on the ground or in shrubs.

Even if you find another nest of the same species with nestlings in it, put the baby there. This is especially successful for swallows, or if the baby is still naked and blind. If the baby bird seems warm and active, put it back in the nest immediately.

Don't worry that because you have touched the chick its parents will abandon both it and the nest. The parent birds may abandon a nest that they are building if it is bothered, but they are not likely to abandon a nest once the eggs have hatched.

If you find a feathered baby bird that is not in a dangerous situation (dogs, cats, roadways), it is best to leave it alone. The parents are probably nearby and will take care of the baby. If there is danger nearby, return the baby to its nest, or at least move it out of harm's way.

If you find a baby duck, shorebird or grouse, try to locate the parents and the rest of the brood. Release the baby nearby and leave the area so that the adults and baby may find each other by calling. These babies are feathered and can feed themselves even if the parents do not find them right away.

The worst-case scenarios are where the parents have been injured or killed, the nest blown down or destroyed, the baby injured, cold, or lethargic. In these situations I suggest calling Cindy Sherlock (262-1459, 252-5103). Cindy is a licensed wildlife rehabilitator in the Kenai-Soldotna area who specializes in baby songbird care.

Well-meaning people bring us a baby birds every spring. Some of these baby birds are cold and weak and need immediate care, but the healthy feathered ones should have been left alone.

While the Kenai Refuge is fortunate to have a network of experienced baby bird rehabilitators, humans nevertheless make poor substitutes for bird parents. If you happen across a small ball of feathers learning to fly, resist the temptation to rescue it. Its parents are probably not too far away.

Elizabeth Jozwiak is a biologist at the [Kenai National Wildlife Refuge](#). Liz has worked for the Kenai NWR since 1988, and recently completed her masters degree on the effects of harvest on wolves on the northern portion of the Kenai Peninsula.

Going, going, gone...Wildlife Refuge inventories lake loss

by Ed Berg

In my travels around the Kenai Peninsula, I am seeing many falling pond and lake levels. Docks of some lakes no longer reach the waterline. Exposed shore aprons of shallow lakes are beginning to revegetate with alders and cottonwood seedlings. Drops of 1 to 4 feet are not uncommon on central Peninsula lakes.

It appears that we are drying out!

Total precipitation (rain plus snowfall) varies a lot from year to year but doesn't show any long-term trend, at least to my eye. Temperatures however show a "jerky" upward trend since the 1940's, remarkably like the stock market.

Despite some cool periods, Kenai shows about a 3° F rise in mean annual temperature and Homer shows a 4° F over the last 50 years. This means more water is being evaporated from the landscape and that the trees are breathing out more water, i.e., evapotranspiration is increasing.

Lake level drop is most noticeable on "closed basin" lakes, i.e., lakes with no stream outfall.

These watersheds lose water only through evapotranspiration and underground flow. An "open basin" lake, on the other hand, is like an overflowing bathtub; the inflow may increase or decrease, but the water level can stay the same because of the overflow through a stream outfall.

With enough drying, an open basin lake can turn into a closed basin lake with no overflow. This has happened with Upper Jean Lake (near the mountains, just north of the Sterling Highway). Upper Jean Lake used to supply a stream which fed two unnamed smaller intermediate lakes and then Jean Lake itself. This stream no longer flows, and the level of Jean Lake lies 2 feet below the outfall. The level of one of the intermediate lakes is 4 feet below its old outfall. This is radical drying out.

We are also losing a lot of ponds. There are (or were) many small kettle ponds in the rolling moraines running northeast from Kasilof through the Funny River Horse Trail, Sterling, and the Swanson River - Swan lake Road areas. These moraines were formed about 13,000 years ago by ice lobes coming from the west side of Cook Inlet during the last glacial period. As the glaciers melted and pulled back to the west,

they left huge blocks of ice half-buried in the outwash deposits of sand and gravel. When the ice blocks melted, they left "kettle" ponds.

On the 1950 topographic maps and aerial photos these ponds appeared in blue (water-filled), but many are gone from the current (1984) topographic maps. They are now grassy pans, with varying degrees of spruce and hardwood invasion. Kettle ponds are important wood frog breeding habitat, so it seems that wood frogs are the first victims of the "Kenai drought."

To assess lake level changes, I am inviting Kenai Peninsula lake residents and lake users to contact me about on their local lakes. I have prepared a three page field guide explaining the basic ideas and a data sheet for observations.

The field guide describes how to visually estimate lake level drop and to describe live or dead vegetation on the exposed lakeshore. I am also seeking information about changes in fish and wildlife, aquatic vegetation, water quality, and human usage. This information will provide a baseline of data for our ongoing water quality program.

New vegetation on exposed lakeshores can provide a good clue as to how long the lake level has been down. If for example woody seedlings or saplings have established, these can be aged by counting the growth rings or terminal bud scars. If only annual weeds are growing, the water level probably dropped in the last year or two.

I am especially interested in observations of long-term lakeshore residents and lake users because they can best judge the long-term trends: has the lake been changing (falling, rising) steadily for a period of years, or does it go up and down with some sort of cycle?

More recent observers, of course, can report the present lake conditions, and this too is valuable, especially when the inventory is repeated in future years.

The Kenai National Wildlife Refuge doesn't have a big budget for this inventory, so we are depending on local folks to help us with information. Give me a call at 260-2812 and I'll mail you a field guide and data sheet, which you can fill out at your leisure. I can schedule some time during the week to come by and discuss your lake personally with you, or we could

meet at the Refuge headquarters on Ski Hill Road. I am also available to talk to community groups. If you are interested in more information about climate change on the Kenai, check the website for my memo “Climate Change on the Kenai Peninsula,” or call me for a printed copy.

Ed Berg has been the ecologist at the [Kenai National Wildlife Refuge](#) since 1993. He also teaches geology at the Homer and Soldotna branches of the [Kenai Peninsula College](#), and serves on the [Kenai Peninsula Borough Trails Commission](#).

Gift of a rose invites kiss of death

by Ed Berg



I always enjoy those pink wild roses blooming along the roadways at this time of year. They aren't as showy as the \$40/dozen cultivated types, but they certainly liven up the countryside. But have you noticed the green roses? The roses on willow bushes? These green roses also occur on the roadways but most folks never notice them at 60 mph.

If you don't believe that roses grow on willows, take a look at the willow bushes along a road or in an abandoned field. You will see last year's dried up brown roses, and the new green roses will be forming during the next several weeks.

Here is the innocent part of my story (the grisly part follows shortly). The willow "rose" isn't a flower at all, it is a "gall" or insect house, which the plant is tricked into building for a small fly (midge) of the Cecidomyiidae (Gall Midge) family. In the spring before leafout time, the gall-maker midge lays an egg on the terminal bud of a willow branch (especially on the common roadside Barclay willows). The egg hatches into a grub (larva) which promptly burrows into the bud.

Keep in mind that plant buds have a "growth spot" (meristem) at the base of the bud where new cells are produced. The new cells are piled on top of old cells to add length to the stem, as a bricklayer would build a tower. (Human beings fortunately don't have meristems - otherwise they would grow from the feet upward or the head downward!)

The gall-maker grub burrows into the meristem

and starts eating those tasty new plant cells. This prevents the stem from elongating (i.e., growing). Recall too that the leaves in a leaf bud were formed late last summer, and have been stored all winter in compressed form inside the bud (the plant's version of a Zip drive, so to speak). Each leaf in a bud is a tiny "miniature" waiting to be pumped up with water in the spring.

So, the stem can't elongate when the meristem has been eaten, but the tiny leaves can still expand as they normally do, and the leaves simply come out on top of one another in a pile (called a "rosette"). The leaves are arranged in a circular pattern, because they would normally spiral around a fully-extended stem. (You may never have noticed that leaves spiral around a stem in many plants, i.e., in those with "alternate" rather than "opposite" leaves, but take a look at a willow stem and you will see that the leaves spiral counter-clockwise up the stem.)

After the willow rose has formed, you can split it open with a knife and see the orange grub about $\frac{3}{16}$ inch (4 mm) long in the center. Notice that there may be a variety of other insect residents in the gall hotel, but the orange grub is the responsible party.

Now here is the grisly part. If you take the orange grub out with tweezers and dissect it with a needle under a microscope (at least 20 power) you will often see a tiny translucent larva inside the grub (in about half of the grubs). This is a "time bomb," i.e., a larva of a parasitic wasp. This bomb is planted as an egg in May when the midge grub is still lying exposed on the unopened leaf bud. A tiny wasp injects (oviposits) its egg into the midge grub. The wasp egg hatches into the translucent larva, which lies dormant inside the developing orange grub throughout the summer and the following winter. But in the following spring, the wasp egg hatches and the orange grub must surely feel something strange moving in its bowels, as it is being eaten from the inside out. (I used to think cancer was bad, but now...)

After consuming its host in the spring, the wasp matures into an adult about 3 mm long, which tunnels out of the gall and seeks another fat, unsuspecting midge larva on a willow bud.

Fans of the movie “Alien” will recognize the inspiration of the alien implantation theme in this movie. The horror of being eaten from the inside out is not to be missed by Hollywood!

My good friend Dominique Collet of Sterling is a student of gall insects and their parasitic predators, and he has provided the details of this story. Dominique has found two other galls on Kenai Peninsula willows - a swollen stem gall and a beaked gall on branch tips. He has also found about a dozen species of parasitic wasps that attack the gall makers.

Some wasps oviposit their eggs into the eggs or larvae of the host, as described above. Others have long ovipositors (that look like stingers but aren't) which drill through the gall wall, depositing the eggs beside the grub in its chamber. In July and August you can see these latter types as small metallic green (or purple wasps) hovering around willow roses. The females have a long ovipositor tucked under their body and they look pretty scary, but are entirely harmless to human-sized critters.

We probably owe much of our quality of life to parasitic wasps, because they are one of the main gate keepers of the insect world, because they keep insect populations in check. Thousands of species of parasitic wasps have been identified, and some have

been employed as biological control agents for noxious insects, such as cabbage white butterflies, the coffee berry borer, and stable flies. If we did not have parasitic wasps for gall midges, Barclay willows would be so heavily infested with willow roses that they would not form flowers and seeds, and would not reproduce. If only we had a good parasitic wasp for the spruce bark beetle!

A final speculation: the humble gall makers may possibly carry the secret of a cure for human cancer. Many gall makers somehow take charge of the host plant's cell reproduction machinery. They make the plant produce a lot of tissue in unnatural shapes (like stems swellings and beaked galls) which become the gall dormitories for the insect offspring. Plain and simple, these galls are tumors: you'd be calling the surgeon if some insect did that to you. If we can figure out how gall insects turn on the plant's cell-making machinery, maybe we can also figure out how to turn it off, and therein might lie a cure for cancer.

Ed Berg has been the ecologist at the [Kenai National Wildlife Refuge](#) since 1993. He also teaches geology at the Homer and Soldotna branches of the [Kenai Peninsula College](#), and serves on the [Kenai Peninsula Borough Trails Commission](#).

Using fire as a land management tool on the Refuge

by Doug Newbould

All fires that burn live and/or dead vegetation on public and private lands are now called “wildland fires”, whether caused by lightning, arson, a careless cigarette, a landowner burning waste, or a land management agency implementing a prescribed burn plan. Unwanted wildland fires are still known as “wildfires.” The national fire management community is now using the term, “fire use,” for what used to be known as “prescribed fire” or “controlled burning.”

Whatever you might call it, fire can be a very effective land management tool when used properly. It can also be very destructive, as we saw in California a few days ago when several homes were destroyed by a prescribed fire that escaped its planned boundaries. And of course, there was Yellowstone Park in 1988, when lightning fires were allowed to burn for many weeks before any suppression action was begun...and the entire face of one of our national treasures was changed for a lifetime.

While these headline-making events remind us of the dangers of wildfire, it is unfortunate that they also may cause a great deal of fear among the general populace. We all need to have a healthy respect for the destructive nature of fire, but I don't believe it is good for us to fear fire. Fear is a powerful emotion, and it can be the root of an even more powerful one — panic.

You may remember the scenes from Oakland several years ago, when a brush fire swept through subdivisions destroying hundreds of homes, and panicked residents created such a gridlock in the streets that firefighters and other emergency services could not respond to the incident.

Panic is most definitely not the response we want when the next wildfire threatens neighborhoods here on the Kenai Peninsula. We all need to react quickly, but calmly and intelligently to every emergency. And the way we can achieve that kind of measured, cool-headed response is through planning and practice. Every home, every neighborhood and every community needs an emergency response plan for fires, earthquakes, volcanic eruptions, power outages, and floods. And then we all need to practice, practice, practice. If you are unsure how to go about making such plans, contact your local fire department or local government

office for help.

I got off on a bit of a rabbit trail there - a worthwhile pursuit I think, but let's get back to the subject of fire use. Fire has been used as a management tool for many centuries in North America. Indian tribes on the Great Plains set prairie fires to regenerate grasslands and to control wildfires. The Ute tribe used fire about once every seven years to control regeneration in stands of lodgepole pine, a commodity they used for trade with other tribes. Today, land managers throughout North America are using fire to reduce hazardous buildup of forest fuels, to improve wildlife habitats, and as an ecosystem management tool - to re-establish historic fire regimes and landscape vegetation patterns.

Here on the Kenai National Wildlife Refuge, we are using fire to reduce hazard fuel buildups and to create a fuelbreak along Funny River Road. Some of the smoke you saw and smelled over the Fourth of July weekend was from a prescribed fire we ignited on July 1st in the Mystery Creek area.

The Mystery Creek project area is located about seven miles north of the Sterling Highway, between the Moose River and the Kenai Mountains. The objectives of this prescribed burn are to: 1) reduce black spruce hazard fuel east of Sterling; 2) improve browse for moose and hares by regenerating hardwoods (birch, aspen and willow); and 3) provide opportunities for training and research during the implementation of the burn plan.

Since the middle of June, we have successfully completed Unit 4 of the project, with about 450 acres burned. We hope to complete units 5 and 6 in the coming weeks. We will do our best to keep you informed of our progress, so when you see a smoke column in the Mystery Creek area, you'll know that we are making progress on the burn plan. If you have any questions or comments about the fire management program at the Refuge, or about developing a response plan for your home or neighborhood, please call me or Larry Adams at 260-5994.

Doug Newbould is the Assistant Fire Management Officer at the [Kenai National Wildlife Refuge](#).

Moose and pizza: a matter of taste?

by Ed Berg

Two weeks ago in this column I told the story of those strange green “roses” growing on willow bushes. The willow roses, the reader may recall, are actually growth deformities called “galls,” which are induced by a small fly (midge) larva. The midge larva eats the stem’s growing center and prevents the stem from elongating, so that the leaves emerge on top of each other to form a “rose.”

Now here is the puzzle: why do moose dislike eating willow roses? Observant moose watchers will notice that about mid-winter there are still a lot of willow roses (now dry brown leaves) on the willow bushes, whereas the ungalled branches are heavily browsed.

My attention was first drawn to this phenomenon when I discovered an old 1982 report in the Refuge files by former Refuge biologist Ed Bangs. (Ed has since moved into the public eye as the director of wolf reintroduction in Yellowstone Park.) Ed tagged stems on fifteen willow bushes, and found that the moose ate about three times as many ungalled as galled branches. This is probably about the same degree of preference that one would find in teenagers for, say, pepperoni pizza over plain cheese pizza.

To convince myself that this browsing preference was real, I repeated Ed’s study in more detail in the winter of 1994-95. I tagged sixty-five Barclay willow bushes along the roads near my place in Funny River, and carefully matched the tagged branches (with galls and without galls) so that they were about the same height above ground and same stem diameter. In the fall I labeled the branches with twine (which would be harmless if eaten) - one turn of twine if ungalled and two turns if galled. When I checked the bushes in April, I found that the moose had eaten 78% of the ungalled stems and only 52% of the galled stems. This wasn’t as strong a preference as Ed found, but it looked real enough.

During this same winter (1994-95) Nikiski High School senior Ethan Ford came into our office in search of a science project. We hatched the idea of doing some feeding experiments with live moose at the Moose Research Center (MRC), and soon enlisted the assistance of Curt Shuey the MRC caretaker, Refuge biologist Richard “Mac” McAvinchey, and former ADF&G

moose biologist Chuck Schwartz. (Chuck too has moved onto grander experiments, and is now working on brown bears in Montana).

We did two experiments with “tame” moose at the MRC. In the first experiment we offered to the moose five gallon buckets with willow branches frozen in snow: some buckets had only galled stems and others had only ungalled stems. Each (of five) moose was offered a pair of buckets (galled and ungalled) for ten minutes, and we computed the amount eaten by weighing the buckets before and after the feeding. Ten minutes was plenty of time because these moose were hungry, and willow is like candy to a moose. The preference was clear: they ate almost three times as much ungalled as galled stem (by weight). This result confirmed with tame moose what we had seen along the roadsides with wild moose, and it wasn’t too surprising.

The second experiment was more interesting, to my way of thinking. When teenagers prefer pepperoni over plain cheese pizza, the preference is based primarily on taste and not texture. So, do galled stems taste bad to moose? One extreme possibility is that the tiny (4 mm long) midge larva has a powerful bad taste. We couldn’t see any easy way to test this, although we could have collected a bunch of larvae and spiked the moose pellet rations with them. But the larva seemed so small that we decided to assume that it was flavorless. A more interesting possibility is that the larva stimulates the plant to produce a bad tasting chemical that would help protect both the insect and the plant from being eaten.

Many plants have elaborate chemical defenses that either poison their would-be consumers or else greatly reduce palatability. Have you ever noticed the powdery white scale on birch bushes around here? These scales are papyrific acid, which the plant secretes when it has been damaged by browsing. These scales make birch very unpalatable to hares, and to moose to a lesser extent, and hares will starve rather than eat heavily scaled birch.

To test for a taste effect, we prepared more buckets of galled and ungalled willows, but this time we clipped off the galls from the galled branches and also

clipped off the current year's growth on the ungalled branches. The branches in each bucket now looked exactly the same, and had the same texture. If the moose preferred one bucket over another, it would have to be a matter of taste, we reasoned. (This is like taking the pepperoni off of a cooked pizza, and telling someone that this is just a plain cheese pizza. Can they tell the difference?)

The moment of truth came: we presented each moose with the two identical-looking buckets, and lo! they ate the same amount from each bucket. Hypothesis rejected! Taste was irrelevant!

It appears, then, that texture is the key thing: the moose simply don't like eating a mouthful of dry leaves. In any case the larva has evolved a pretty good defense against being eaten by moose. We observed that the tame moose would sometimes bite off the willow rose and drop it, before continuing to eat the rest of the branch. In this case the larva still has its winter home in the rose, and maybe some extra snow

overhead for added protection. Texture seems to be a pretty good defense for the larva, and a bad taste might not add that much more.

Ethan Ford wrote a nice paper on this study and won a prize at the Alaska Statewide High School Science Symposium in Fairbanks. He is now a senior at [UAF](#) studying wildlife biology and is planning to continue for a Master's Degree, reports his mother Carol Ford. We hope that Ethan will consider our two million acre laboratory at the Kenai National Wildlife Refuge when it comes time to pick a thesis research topic.

Refuge Notebook columns are available on the Web at <http://www.fws.gov/refuge/kenai/>.

Ed Berg has been the ecologist at the [Kenai National Wildlife Refuge](#) since 1993. He also teaches geology at the [Homer and Soldotna branches of the Kenai Peninsula College](#), and serves on the [Kenai Peninsula Borough Trails Commission](#).

Grand flying heritage

by Rick Johnston

Imagine flying at 3,000 feet over the Tustumena benchlands in an open cock pit Travel Air 7,000 biplane. Your Travel Air Pegasus is equipped with floats and your pilot is Alaska flying legend Russell Merrill. The year is 1929 and aviation is new to the Kenai Peninsula and every flight an adventure. Tustumena Lake unfolds before you like a vast prairie before a galloping stallion. The world, for the moment, is yours for the taking. Seventy years later, both residents and visitors to the Kenai Peninsula have many opportunities to almost duplicate such wonderful flight-seeing adventures over the Kenai National Wildlife Refuge.

Although the open cockpits of the early biplanes have been replaced by the relative comfort of Cessnas, DeHavilands and Pipers, aviators and passengers can still experience many of the same sights, wildland viewing, and emotions shared by the early fliers. Wildlife and wildlands still provide the same allure that they did for pioneering pilots like Russell Merrill, Ed Young and Matt Nieminen, who flew for Anchorage Air Transport. Thanks to the foresight of early Peninsula residents and visitors who sought to protect this rich legacy of wildlands, the Kenai National Wildlife Refuge remains much the same as when the first airborne hunters, fishermen, and explorers experienced it from the air in the 1920's.

Aviation on the Kenai Peninsula, like most places in Alaska remains an inseparable part of the culture and history, not to mention the source of some tales of adventure and misfortune.

In the Interior some areas have tundra flats or other natural features that facilitate aircraft operations, but it is the numerous and well distributed lakes on the Kenai Peninsula that make it one of the best flying destinations in Alaska and indeed in North America. There are hundreds of lakes that can be safely landed on, many of which provide outstanding outdoor recreational opportunities.

Managers of the Kenai National Wildlife Refuge (and its predecessor the Kenai National Moose Range) have used aircraft in every aspect of management since the arrival of the first Moose Range manager in 1948; World War II flying veteran Dave Spencer was chosen for the top post in part due to his flying skills.

There had been a lot of moose poaching on the Peninsula, and the Bureau of Sports Fisheries and Wildlife wanted biologist/pilot Spencer to solve the problem.

The Grumman Widgeon and Grumman Goose became the workhorses on the Kenai Refuge and throughout Alaska. Then, as today, aircraft were used for wildlife surveys, radio telemetry, vegetation mapping and inventory, fisheries management, law enforcement patrols, cargo and crew transport, fire suppression and management, and search-and-rescue. Many lost hikers, hunters and other Refuge visitors have been located by Refuge pilots.

Refuge manager/pilots such as John Hakala, Will Troyer, Averill Thayer, Bob Richey, Vern Berns and others flew tens of thousands of hours over the Kenai Peninsula and the Kenai National Wildlife Refuge during their distinguished flying careers. The safety record of these Refuge pilots was second to none despite often difficult flying conditions. Many of the hours were what the Department of Interior calls "special use" flying which require a high level of skill and training due to low level flying or inherent risk of particular assignments.

John Hakala caught his first glimpse of the Kenai from the air while piloting a B-25 during a military training flight out of Anchorage. He didn't know then that he would later pilot Refuge aircraft during two separate duty assignments as Refuge Manager, and retire on a popular float plane lake in the Soldotna area.

Refuge managers have often sought the assistance of local flying services, especially for helicopters. At least one Kenai Peninsula-based helicopter service is used statewide on difficult wildlife capture projects. Many of these sought-after skills were honed right here on the Kenai Peninsula and Kenai National Wildlife Refuge.

Private air taxis from Lake Hood in Anchorage and from locations on the Kenai Peninsula have been transporting hunters, fisherman, sightseers and trappers to Refuge destinations since the early days of Anchorage Air Transport. Several Kenai Peninsula air services had financial arrangements with early trappers for remote drop-offs and pick-ups, and mid-winter supply flights. Greg Brown, a lifelong Alaskan,

was by all accounts a very skilled pilot and outdoorsman and transported people to many remote locations via his Kenai-based airplane. Brown's Lake formerly within the Refuge was named after Brown.

The Kenai Peninsula is extremely popular as a float plane destination, and also experiences a large volume of commercial and general aviation usage. According to the FAA there are 5,699 active pilots within an hour's flight of the Refuge, and more than 8,000 general aviation and commercial aircraft in Alaska. Aircraft use in a popular area near such a high population of pilots and commercial flight services has not been without problems. Trumpeter swans and floatplane fisherman often prefer the same lakes, sometimes resulting in displacement of nesting trumpeter swans and lower swan productivity due to disturbance.

Some visitors using lakes accessible by roads and trails have been distressed by busy aircraft operations. Furthermore some with airplanes have used them as a tool for unfair or unethical advantage for hunting big game. As early as 1970, Refuge and state game managers published aircraft and wildlife regulations to reduce airplane-wildlife and airplane-people conflicts,

and to insure fair chase for Peninsula wildlife. The northern lowlands of the Kenai Refuge became one of the first places in Alaska to restrict the use of airplanes for hunting moose during the first ten days of the season. Subsequently state and federal laws and regulations such as the prohibition from hunting the same day airborne were passed.

Often the pilots themselves have proposed regulations to guide their use of Refuge lands. Today, the Kenai National Wildlife Refuge has perhaps the best set of aircraft use and access regulations insuring wildlife values and visitor experiences, while continuing the rich aviation tradition of the Kenai Peninsula. For visitors seeking flights over or to destinations on the Refuge, there are several permitted and reputable air services ready to meet most flying needs. For more information on the flying history on the Kenai National Wildlife Refuge, contact me or visit the Alaska Aviation Heritage museum on Lake Hood.

Rick Johnston is a Ranger/Pilot at [Kenai National Wildlife Refuge](#) and has been flying for the Refuge since 1985.

Alaska's unlikely littlest big predator leaves its mark on ecosystem

by Robin West

Frequently, visitors will ask staff at the Kenai National Wildlife Refuge what is the fiercest predator that lives in the area. Images have been conjured up of a large brown bear killing a moose with a single swipe of a paw, a pack of wolves taking down a caribou, or a wolverine, full of spit and vinegar, taking on creatures twice its size. For me, however, I think of an animal quite smaller, one that is barely noticed, but one that if it were 10 times larger, I would think twice about falling asleep in the woods.

About 15 years ago, I would fly regularly to a small remote cabin about an hour out of Fairbanks to run a small trapline. The cabin was barely large enough to stand upright in and had numerous cracks between the logs and chinking that guaranteed if the temperature were 30 below outside, the inside temperature would match it within an hour of the fire going out in the small sheet metal stove.

When the lantern would be turned off at night, the inside of the cabin would come alive with red-backed voles searching out bits of food and nesting material. The nightly racket and resulting mess led me to setting a half dozen mouse traps baited with oatmeal and peanut butter. The first night, after setting the traps, it was mere seconds after turning off the lantern that I started to hear scurrying about, then SNAP ...SNAP.

Soon all six traps had been set off, but then the noise increased. The traps sounded like they were being dragged across the rough lumber floor. I swan a flashlight across the darkened room only to find all six traps, containing dead voles, and four of them being fed upon by Alaska's littlest big predators, tiny shrews.

Many people think of shrews as mice, but they are very different in behavior, morphology and taxonomic classification. Unlike mice, which are classed as rodents, shrews are insectivores. Shrews are found throughout much of Alaska.

On the Kenai National Wildlife Refuge, the most prevalent shrew is the masked or common shrew.

Dusky shrews and pygmy shrews also may be found in the area. The average length of these animals is just a few inches and they generally weigh only a few grams (about what a stick of gum weighs). They are dark grayish colored with lighter colored bellies, have long pointed noses and long whiskers, short tails and tiny sharp teeth.

Shrews are solitary and always on the go. They are active in winter as well as summer, and, though they have very short legs, they can run fast enough that they often appear to be a small blur as they coot out in front of you. They must eat regularly and require good insulation from cold or they will die in a few hours.

At best, a shrew's life will end of natural causes at between 1 and 2 years. Predatory birds, cats, weasels and other predators, including other shrews prey upon them. Sometimes the preyed upon shrew is left intact after it has been killed, probably because of its strong musky odor.

Shrews eat insects and plant material but will consume any kind of fish or meat they can get. They have tiny eyes and poor vision but a good sense of hearing and smell. They are best at preying upon larger creatures when confined closely with them, such as when both animals have been caught in a live trap or pitfall.

In such situations, it is not uncommon for shrews to kill and feast upon mice and voles 3 to 5 times their size. Frozen carrion also may be fed upon, and I have witnessed small, thumb-sized holes drilled all the way through small animal carcasses in winter.

Shrews may be Alaska's smallest mammal, but their distribution, abundance, courage and bit appetites make them visible to almost everyone at some time or another. So the next you think you see a mouse, maybe instead you have caught a glimpse of Alaska's littlest big predator.

Robin West is a wildlife biologist by training and is the refuge manager of the [Kenai National Wildlife Refuge](#).

The Kenai Refuge's mysterious missing flying squirrels

by Ted Bailey

Most residents of the Kenai Peninsula are familiar with the red squirrel, also known as *Tamiasciurus hudsonicus* to biologists. Red squirrels are common throughout most forested areas and sometimes even make their homes in people's garages, storage shed, or attics. During winters they may dominate bird feeders, chase away our feathered friends and eat their food. Red squirrels can also be efficient predators. One study of the fates of young snowshoe hares in Canada revealed a significant percentage was killed by red squirrels.

Another Alaskan squirrel - the northern flying squirrel - is a completely different animal that occurs in Interior, Southcentral and Southeast Alaska. In Interior and Southcentral Alaska, the flying squirrel's scientific name is *Glaucomys sabrinus yukonensis*. It occurs in forested areas and is present in the Anchorage area. The flying squirrel, however, appears to be absent from the Kenai National Wildlife Refuge, perhaps the Kenai Peninsula. We have never observed a flying squirrel or received any reports from the public of flying squirrels on the Kenai National Wildlife refuge and are not aware of any published reports in the scientific literature of flying squirrels on the Kenai Peninsula.

One reason that may help explain its apparent absence is that flying squirrels are primarily nocturnal, or active at night. They are, therefore, much more difficult to observe than red squirrels. An adult flying squirrel averages only about 5 ounces, and with its broad, flattened, feather-like tail is about 12 inches long. Flying squirrels do not actually fly but leap from trees and while "in flight" extend a furred membrane between their front and rear legs that enables them to glide from tree to tree or to the ground. They have large dark eyes and their fur is soft and silky, usually brown on top with grayish sides and a white belly.

Studies of flying squirrels in Interior Alaska revealed that they use tree cavities, witches' brooms and drays as dens. Witches' brooms are clumps of abnormal branches in spruce trees caused by tree rust diseases. Drays are ball-like nests of mosses, leaves and lichens lined with shredded bark and lichen and also are constructed by red squirrels. Witches' brooms also

were used by flying squirrels during the coldest winter months. Then, two or more squirrels crowd together for warmth and become dormant in a deep sleep. Flying squirrels feed on fungi, such as mushrooms and truffles, berries and other foods, sometimes stealing the dried fungi cached in tree limbs by red squirrels. In Interior Alaska, tree lichens are another important food in the winter.

Flying squirrels in Interior Alaska traveled in a circular route as far as 1.2 miles in one night within an area of about 20 acres. In a year's time they used up to 13 different den trees and used trees with witches' brooms as dens more often than trees with cavities. Although dens are important to flying squirrels, they may forage away from their den for up to 7 hours on a given night.

Many species prey on flying squirrels, including great horned owls, goshawks and marten. In Alaska, about 50 percent of all flying squirrels between 1- and 2- years old die or are killed by predators each year. Few live longer than 4 years. In the Pacific Northwest, northern flying squirrels are the primary prey of the controversial spotted owl. Flying squirrels occurred in 78 percent of the regurgitated pellets of spotted owls in one northwest forest.

The quality of forested habitats determines the presence and abundance of flying squirrels. In studies in the Pacific Northwest, flying squirrel densities and body size were higher in old forests than in young forests. Tree cavities and witches' brooms necessary for den sites and the presence of specific types of fungi for food appears to be important habitat components for flying squirrels.

The reasons flying squirrels appear to be absent from the Kenai National Wildlife Refuge, and perhaps the Kenai Peninsula, are unknowns. The open, glacial flats in the upper Turnagain Arm area may be a physical barrier to their natural dispersal from mainland Alaska. Or, periodic disturbances of many forests on the peninsula by bark beetles and fires may have influenced the quality of flying squirrel habitat. Or, perhaps flying squirrels are present on the refuge and the peninsula but we do not know about it. If you believe you have seen a flying squirrel on the refuge

- or elsewhere on the peninsula - we would like to know. Phone in your observation to the refuge at 262-7021 and leave your name and phone number and we will return your call. For additional information on Alaska's northern flying squirrel see the Alaska Department of Fish and Game Wildlife Notebook Series

on the internet.

Ted Bailey, a supervisory wildlife biologist, has been responsible for the [Kenai National Wildlife Refuge](#)'s biological program since 1977. He and his staff monitor and study variety of refuge wildlife.

Lost in the woods

by Robin West

Most years the Kenai National Wildlife Refuge gets actively involved in search and rescue efforts to find someone who gets turned around while out hiking or hunting. I say “turned around” because most of us don’t like to use the word “lost.” Sometimes, however, folks just plain get lost. It can happen to anyone. The condition in which we ultimately find these folks is largely dependent upon how prepared they were physically and mentally before they went into the woods.

Everyone who travels in the woods should carry a personal survival kit and suitable outdoor clothing. I suggest the minimum survival items should include dependable fire building supplies, something with which to build a small shelter (such as a tinfoil space blanket), and some high-energy foods. Clothing should include layers of warm material that will retain your body heat even if wet (such as wool or polar fleece). Always tell someone where you are going, when you expect to get back, and what to do if you don’t make it back on time. This can make a huge difference in having a short and successful search and rescue effort versus a long and wide-ranging wild goose chase.

Many people are carrying cell phones nowadays, and these have definitely helped locate some lost souls. They are especially valuable if there is any possibility of a medical emergency that might require a helicopter Medivac.

Keeping from getting lost has been a life-long goal of mine (and someday I may achieve it). Having, and knowing how to use, a good compass is the key. I say a good compass in remembering a story my Dad once told me about the Tate’s Compass Company. Supposedly the compasses were so unreliable that a saying was formed: he who has a Tate’s is lost. Seriously, most compasses function adequately, but they can be adversely affected by being in close proximity to metal (such as belt buckles, knives, gun barrels, or the hood of a car). Also, regular readings should be taken with the compass at the beginning of a trip. Pulling out the compass after you are already lost may be of little value unless you have previous knowledge about the general lay of the land. Finally, remember that magnetic north lies 24 degrees to the east of true north on

the Kenai Peninsula.

I find it extremely easy to get completely turned around on Refuge forests. The sky is often cloudy, so the sun direction isn’t available. Our forests tend to be very homogeneous and look the same in every direction on a cloudy day, and the trees are often tall and dense enough to block the view of the mountains to the east. Road noise from the Sterling Highway is helpful if you are within a few miles of the Highway. If you are in the Swanson River Road area or further north, you can get oriented by noting that the larger planes often fly on a northeast-southwest line between the Kenai and Anchorage airports.

Nowadays backcountry travelers can use a GPS (global positioning system) unit, which is a neat compact device that act as a receiver for location information transmitted from satellites. If you plan on using one of these instruments, be sure and practice with it before you get off the beaten path. They can be very confusing when you are cold and wet, and don’t know which button to push.

GPS owners should know that some GPS units on and after August 22, 1999 might be affected by the “end-of-week rollover.” This is sort of a Y2K issue that has important safety implications. The GPS end-of-week rollover happens every 1,024 weeks (about every 20 years). When the GPS counter rolls back to zero weeks, any of the following could happen: the unit will be unable to locate satellites, more time than usual may be necessary to locate satellites, or, the unit may appear to be working correctly but will display inaccurate information. You may wish to check with the manufacturer to see if you should expect problems with your particular GPS unit after August 21.

I suspect that a few folks will be caught by surprise and get angry when their GPS units don’t perform up to their expectations in the near future. As for me, I intend to blame my non-Y2K compliant GPS, as well as my Tate’s compass, if I happen to get turned around in the near future.

Robin West is a wildlife biologist by training and is the refuge manager of the [Kenai National Wildlife Refuge](#).

Who are those kids...and what are they doing?

by Bill Kent

You have probably noticed those young people (wearing blue shirts with a patch depicting an eagle) driving government vehicles, helping you in our Visitor Center, presenting campfire programs at Hidden Lake, or keeping our hiking trails free from downfall and encroaching vegetation. Ever wonder just who or what they were... or why they did not wear a uniform like the other employees at Kenai Refuge? They are volunteers sent to us by an organization begun in 1955, an organization whose founder believed that student volunteers could complete important projects on public lands that would otherwise not be done. Elizabeth Cushman Titus also felt that students would benefit in many ways from their experiences in the field, and would increase their understanding of the environment and their place in it.

The most successful volunteer efforts at Kenai National Wildlife Refuge over the last 15-20 years has been our partnership with the Student Conservation Association (SCA), a private non-profit organization with headquarters in Charlestown, New Hampshire. Tens of thousands of hours of work have been completed at a minimal cost through this cooperative effort. Many of the Refuge's visitor services, as well as important biological data collection, would not have been possible without the young people provided to us by SCA.

Most of the participants are classified as "Resource Assistants"; generally these are college students who are looking to gain work experience in a particular field such as biology, environmental education, visitor services, or other disciplines found in resource agencies. These participants' experience furthers their academic, career, and personal goals. Their work period lasts from twelve to sixteen weeks, and includes specialized and/or required training necessary to work on a refuge, park, or other agency facility. For example, Resource Assistants on Alaska National Wildlife Refuges must complete mandatory Bear Safety and Watercraft Safety training before beginning their assigned duties.

Hiking trails on Kenai Refuge have benefited tremendously from Resource Assistants' efforts and

through another SCA program, the "High School Work Crews." High school students from across the country pay for the opportunity to construct or maintain trails in backcountry areas on public lands across the country. (Think about that the next time you hear someone demeaning teenagers.) Many, if not most, of these teenagers raise the money to participate through after-school employment, fund-raisers, and by soliciting "scholarships" in their communities. Many of these fifteen to eighteen year-olds are away from their homes for the first time; for some it may be their first airplane trip. They and their well-trained adult leaders camp out the entire time they are working. Crews working on the Kenai Refuge are here for a total of five weeks; the last week is a recreation week reward for their hard work, and is spent hiking and camping on one of the longer backcountry trails on the Peninsula such as the Resurrection Pass Trail.

You may be asking "that's great, but you said this volunteer labor had a cost – what is that cost". A Resource Assistant's cost is \$3,000 to \$3,600 (which includes the round-trip airfare from their homes), dependent on the length of their work period. The High School Work Crews' costs range from \$10,000 to \$20,000 (this also includes the airfares for crew and leaders), based on the size of the crew; we have found that the most efficient is the smallest sized crew for work on Kenai Refuge: eight volunteers and two leaders. Both of these programs' costs is one-third to one-half the cost of a seasonal employee and allows us to stretch our shrinking budgets while obtaining excellent work products.

We are proud to have these student volunteers assisting the Refuge staff, and we think they leave with a better understanding of the mission of the National Wildlife Refuge System and Kenai Refuge's role in it. The next time you encounter one of these SCA volunteers, I hope you will give them a well deserved "thanks" for a job well done.

Bill Kent is the Supervisory Park Ranger at Kenai Refuge; he, his wife and daughter have lived in Soldotna since 1991.

Refuge environmental ed programs shift into high gear

by Candace Ward

Fall is an exciting time in the environmental education program at Kenai National Wildlife Refuge. As we kick off a new school year, we expect to see students, their parents, and teachers coming to the Refuge for field trips. Not only do students benefit educationally from our field trips, but also they enjoy learning outdoors in beautiful fall colors before the winter snow falls.

At the Kenai National Wildlife Refuge the environmental education program seeks to teach young people ecological principles and how they apply to daily life and to wildlife populations on the Refuge. Through our programs we hope young people come to understand and appreciate their public lands and learn to care for and protect them in the future.

Our environmental education programs include:

1) Animals and their Senses - This program is for K-1st grades and helps children learn about their own senses and those of animals. It lays a foundation for empathy and respect for wildlife at a young age. In many cases this program helps children develop a life long interest in and concern for wildlife.

2) The Role of Predators in Nature - Are wolves really like the big, bad wolf in Little Red Riding Hood? What is the true story of predators? Predators play an important role in maintaining healthy wildlife populations of grazing animals such as moose, caribou, and snowshoe hare. Yet, people often view them in negative way. Through this program children in 2nd-3rd grades learn about the real role of predators and their importance in the natural world.

3) The Role of Fire in the Ecosystem - Fire is an essential part of change in Alaskan ecosystems. Fire can be both beneficial and harmful to wildlife. In this program 4th-6th grade youth learn how certain wildfires help wildlife and habitat. They also learn when fire is unsafe and not appropriate.

4) Wetlands and Wildlife - Wetlands are often viewed as “wastelands” by many people. However, wetlands serve diverse and life sustaining functions for both people and wildlife. Through this educational

unit students in 4th grade through middle school learn about the variety of wetlands in Alaska. They also find out how the clean water they drink and the fish they eat are linked to preserving healthy wetlands.

5) Leave No Trace - Through an overnight field trip at the Refuge Outdoor Education Center, students in 5th to middle school learn the six principles for safe, low impact outdoor experiences. Students use problem solving skills to make decisions on trip planning, low impact travel routes, preparing safe drinking water, safe use of camp stoves, bear safety, and how to properly deal with trash and human waste. Students learn skills that will serve them well throughout their entire lives and will also help protect their public lands.

Since 1983, over 40,000 Kenai Peninsula youth have participated in environmental education field trips to Kenai National Wildlife Refuge. We have enjoyed the support and participation of educators including parents, teachers, and youth leaders. We feel encouraged when we hear comments from students, such as - “I never knew anything lived in the lake till this field trip,” or “wolves have to hunt to survive not because they are mean,” or “packing out my trash really isn’t so hard.” It’s also exciting to get feedback for students who tell us that through our programs they learned to love nature and enjoy outdoor activities.

If you are interested in learning more about Kenai National Wildlife Refuge’s Environmental Education Program contact us at 262-7021 or check out the Refuge website at <http://www.fws.gov/refuge/kenai/> and click on the Kenai Peninsula.

Candace Ward is a park ranger at Kenai National Wildlife Refuge, who has facilitated the Refuge Environmental Education Program since 1984. She enjoys sharing nature with kids of all ages and pursues outdoor activities including hiking, canoeing, wildlife observation, and northern lights watching while soaking in her hot tub.

Previous Refuge Notebook columns can be viewed on the web at <http://www.fws.gov/refuge/kenai/>.

Fire helps control moose?

by Andy Devolder

If you have ever tried to keep moose away from your shrubs and young trees, you know what an appetite moose have for woody vegetation, especially in the winter. They don't like spruce, but love to browse the hardwoods, such as willow, birch, and aspen. These sun loving species grow quickly after a forest fire, but after several decades the slow growing spruce will over top them and shade them out. Without periodic fires to clear out the spruce, the moose simply can not find enough to eat in the winter and their population declines.

The 300,000-acre 1947 burn in the central peninsula created record high moose numbers in the late 60s. The 80,000-acre 1969 Swanson River burn north of Kenai and Soldotna is still one of our best moose hunting areas. We know the story of these two large burns quite well, but what about earlier burns? Has the Kenai had large fires in the past? And if so, how frequently?

Early accounts from hunters, trappers and homesteaders often mentioned fires, but were usually vague as to locations and fire sizes. Fire records from the Alaska Fire Service and the Bureau of Land Management contain valuable data, but only for the past 50 or 60 years. However, a reliable source of older fire history information can be found in the trees themselves.

I recently completed a study of the fire history of Kenai lowland black spruce forests. With tree ring dating I was able to use fire scars and tree ages to date 10 previously unknown fires within the lowland black spruce forests on the refuge. The earliest fire that I could date occurred in 1708 and the most recent fire (prior to 1947) occurred in 1898. From my research, I concluded that fires occurred in 1708, 1762, 1828, 1833, 1834, 1849, 1867, 1874, 1888, and 1898. The sizes of these fires ranged from merely a point to more than 74,000 acres. Since tree ring evidence of older fires is lost with each younger fire (because trees are burned in each successive fire event), these fire sizes are probably not the true sizes, but only the extent that I could determine using tree ring analysis of many different trees.

on average from the early 1700s to the turn of the

20th century, fires burned every 20 years somewhere within lowland black spruce forests on the refuge. This means that somewhere in these forests during the past 300 years there has been substantial areas of young trees to support moose populations. Since the 1946 and 1969 burns were very large fires, there now large areas of forest that are "even aged" i.e., stands that originated after a single fire event. My research, however, suggests that in the past the Kenai lowlands were much more patchy with stands of different ages, due to the smaller fires.

The benefits of having a patchy age structure are twofold. First, as noted, young forests tend to have substantial amounts of willow and birch regeneration which is good moose browse. So we need an ongoing supply of "adolescent" forests.

Second, and from the human point of view, perhaps the best reason for having different aged forests across the landscape is for fire protection. Black spruce forests less than 30 years old are basically "fireproof" and therefore act as effective firebreaks.

Once black spruce reaches 60 to 70 years of age, its flammability increases rapidly. Large areas of old, mature black spruce could, in the future, present dangerous problems if weather conditions and ignition sources were present in the right combination.

For this reason, on the refuge we look to "prescribed burning in order to remove or isolate hazardous fuels before accidental or natural ignition creates fires that are difficult to control.

The refuge has a prescribed burning program in the Mystery Creek area which seeks to create a good firebreak between the large beetle-killed forest in the mystery foothills and Kenai mountains and the areas to the west, including Sterling, Soldotna, and Kenai. With luck, a good burn will generate some excellent hardwood browse to keep the moose (and their various two- and four- legged predators) fat and happy in the winter.

Andy Devolder is a forest ecologist and a biological science technician working at the [Kenai National Wildlife Refuge](#).

Blaze brings regrowth?

by Ed Berg

It was about this time in 1994 that the Windy Point Fire south of Tustumena Lake was in high gear. It had been a very dry August with 0.8 inches of rain, at the end of a very dry summer with rainfall down 50 percent overall.

The fire started from an abandoned campfire on the south shore of Tustumena Lake on August 30. We watched it putter around for a week, then it took off on the seventh day, with flame lengths of 150 feet, and the smoke column reaching 20,000 feet.

We took no suppression action because it is our policy to let fires burn in remote areas, if there is no threat to human life or property. The fire was ultimately extinguished by October rains and cold weather, with a final score of 2,800 acres burned.

The fire was resident on the landscape for a long time—probably about six weeks. This allowed it to burn through the duff to mineral soil. When we surveyed the area the following summer the ground was washed clean of ash and we hiked for miles over bare mineral soil. It was as if someone had come into the room and simply removed the vegetative carpet; we were right down to the mineral subfloor. Occasionally we found patches of unburned carpet, often a peaty sphagnum moss layer as much as 12 inches thick. We saw only a few scattered grass plants, and never any indication of a prefire grass sod.

The fire burned in an old forest of upland black spruce on the rolling hills and marshy areas, with white spruce and birch on the hilltops. We counted tree rings on the burned black spruce, and found that the oldest trees dated to about 1,760, indicating that the area had not burned for at least 230 years. We found no evidence of earlier fires, such as charred wood or burn poles, so it is likely that the area had not burned for many centuries.

The remarkable fact about this burn is the dense regrowth of birch seedlings on the mineral soil.

These seedlings began to appear the year after the burn, presumably from seeds blown across the snow. On a white spruce-birch survey plot we recorded 1,628 birch seedlings per square meter in 1997 (decreasing to 890 in 1999). On the black spruce plots, which were hundreds of meters from seed trees, we recorded about

1 birch seedling per square meter, with little mortality from 1997 to 1999.

The densely packed seedlings on the white spruce-birch plots are apparently competing severely, as shown by their high mortality in the last two years and their small size of about 6 inches on the sparse black spruce plots, the birch seedlings are now 2- to 3- feet high and are well on their way to providing excellent winter browse for moose and hares, as shown by the browsed stems and numerous hare pellets.

It takes this kind of deep mineral soil burn to get good browse regeneration. We have seen this before, in the 1969 Swanson River burn, as well as the 1987 prescribed burn in the Skilak Loop. These were deep burns that have produced tremendous birch crops and are now some of our best moose areas. At Windy Point we estimated mineral soil at about 90 percent.

This contrasts sharply with early spring burns like the 1996 Crooked Creek and Hidden Creek burns, where we estimated mineral soil exposure at about 1 to 2 percent, and we expect that these burns will be dominated by grass for many decades.

Our four-day surveying trips to the Windy Point burn are always touch-and-go on the unpredictable Tustumena Lake. Refuge mechanic Mark Wegner takes us to our campsite at Windy Point in a Boston Whaler, towing a 15-foot Achilles inflatable which we use for commuting along the shore to our various plots. In 1995 typhoon Oscar came up during the day. When we returned to our boat about 6 p.m., there were 4- to 6- foot waves, driven by a powerful southeastern wind coming down off Tustumena Glacier. There was no question of trying to return to camp by boat, so we spent a stormy and rather sleepless night huddled in our Mustang suits under an improvised blue tarp lean-to, feeding the campfire and dining on candy bars.

This year we spent a couple of afternoon hours sitting in the rain waiting for the wind to die down and contemplating another sleepless night in our Mustang suits. Fortunately the wind slowed, and we were able to launch the Achilles and move to another plot. When we returned to our rain soaked camp in mid evening, we found it necessary to “pre-dry” the firewood over a gas camp stove in order to get it to burn. Next time

we are bring fusees and Sterno paste for fire starting.
Ed Berg has been the ecologist at the [Kenai National](#)

[Wildlife Refuge](#) since 1993. He has led the vegetation surveys of the Windy Point burn in 1995, 1997, and 1999.

Peninsula wildlife require large areas to survive

by Ted Bailey

How large of an area do you require to survive? If you live and work in Soldotna and obtain all of your essential "survival" items such as groceries, household goods and gasoline in Soldotna, your area could be as small as 1-2 square miles, depending on where you live, work and shop. (Pleasure trips to Anchorage and vacations to Hawaii don't count because you can survive in Soldotna without them. We're talking basic survival!)

However, if you live in Soldotna but are employed in Kenai, your area of use will be much larger, perhaps 10-30 square miles. Your area will now include some additional space between Soldotna and Kenai as well. Within this space you may not only travel to Kenai by driving the Spur Highway, but you may also purchase food or gasoline along the way. It is important that you are not prevented from getting to Kenai or from using the resources along the way.

Now consider a situation where there are no grocery stores and the only way you can survive is by gathering native plants and by fishing and hunting. Now your survival area is much larger. It may include portions of the Kenai River or perhaps the Kasilof or Russian Rivers or Cook Inlet.

If you depend on moose, caribou or mountain sheep for food, your area of use may also include the Swanson River area, the Tustumena Benchlands or the Kenai Mountains. Your survival area has now grown to 100-500 square miles or more, depending on how successful you are catching fish and getting a moose, caribou or sheep.

If you are raising offspring, your area of need becomes still larger and more complex because you must have a safe place to rear your children and a safe place to leave them when you are off fishing or hunting. Your area must have adequate escape cover to help protect the offspring from other potentially dangerous individuals of the same or of different species.

These are the same basic problems wildlife face each day in order to survive, and they do this without the benefits of human intelligence, social programs, ingenuity, and technology. How large an area (or "home range") do wild animals need in order to survive?

It depends on several factors including the species, the quantity, quality, and distribution of the food supply, and special needs such as denning places and escape cover from enemies. In general the smaller the species the smaller the area needed to survive.

Species that eat plants (herbivores) generally require less area than similar sized species that hunt prey (carnivores) because plants are much more abundant and easier to obtain than crafty, evasive or defensive prey. In the early 1980's we deployed over 50 radio collars on free-roaming moose on the Kenai Refuge. We found that cow moose had an average home range of 43 square miles, while bull moose averaged 47 square miles.

However, about 43% of the radio-equipped cows and bulls had distinct summer and winter ranges and were thus classified as migratory moose. This meant that some moose left their summer range and moved to an area with more accessible winter browse or less snow. Some bulls moved from summer ranges to winter ranges as far as 14 miles and some cows moved as far as 27 miles.

In other areas of Alaska moose have an average seasonal home range of at least 36 square miles. It thus takes a large area to support an Alaskan moose.

Lynx also require large areas, given their relatively small size. Their home range size varies with the abundance of snowshoe hares, which cycle every 10-13 years. In the mid-1980's when hares were in peak abundance in the 1947 burn, the average home range size of a female lynx was 41 square miles and that of male lynx 87 square miles.

The home range overlap between adult males averaged only 4% while that of adult females was 5%. Within the home ranges of these breeding adult lynx were their offspring from the current or previous years and nomadic or dispersing lynx from other areas. Nomadic or dispersing lynx usually were usually non-breeders looking for a place to live among the established resident breeding lynx.

Nomadic lynx often move over an area much larger than resident lynx and do not have an established home range. During 1997-98, the latest peak in snowshoe hare numbers, resident female lynx home

range varied between 9-17 square miles and that of resident males between 27-33 square miles, depending on habitat and snowshoe hare density.

The size of an area needed by a lynx increases with decreasing snowshoe hare density. It may eventually become two to ten times as large when hares are scarce. Large home ranges notwithstanding, in the early 1990s some adult female lynx still died of starvation because so few hares could be found even with expanded home ranges.

It takes an even larger home range to support wolves. On the Kenai Peninsula, wolf pack territory size is influenced by the number of wolves and the density and vulnerability of moose. In the late 1970's the average size of a wolf pack's territory was 246 square miles or about 6 times that of a cow moose.

Wolves living in mature forests where moose densities are low have pack territory sizes many times larger than wolves living in young forests where moose densities are higher. For example, a small pack was able to survive one winter in a moose-rich area of only 68 square miles, whereas a large pack that lived in mature forest used an area of 600 square miles.

Brown bears probably require the largest home ranges, but this is difficult to accurately quantify because of the uneven distribution of the bears' food supply. Salmon are very important food for brown bears on the Kenai Peninsula.

Some brown bears radio collared and monitored on the Refuge by the Interagency Brown Bear Study Team fed intensively on salmon in one stream then moved 15-30 miles to other streams to feed on different runs of spawning salmon.

In the spring after leaving their den, some bears search over large areas for carcasses of winter-killed moose or for fresh young plants growing in wet areas or in avalanche chutes. If one were to connect all of these feeding places into a single area of use for these particular bears, the area might be many hundreds of square miles in size. Even more important than the size of the area is the ability of the bears to move unhindered and safely between important feeding places, while using the habitat along the way.

These connecting habitat areas are as important to bears as the area between Soldotna and Kenai for people who live in one town and work in the other. From our radio-collar studies, we see that it takes a very large area to support a single moose, a resident breeding lynx, a pack of wolves, and a wide-ranging brown bear on the Kenai Peninsula. With a human population growth rate of 2.2% per year on the Kenai Peninsula, lots of land is being subdivided and developed, and our former large areas are shrinking.

This may not be noticeable from one day to the next, but the cumulative loss over five or ten or fifteen years can be pretty severe if you are one of those critters that lives off the land. In the next century, public lands on the Kenai are the only hope for preserving large areas for wildlife, and these lands will only be preserved with solid public support and far-thinking political leadership.

Ted Bailey, a supervisory wildlife biologist, has been responsible for the [Kenai National Wildlife Refuge](#)'s biology programs since 1977. He and his wife Mary live near Soldotna.

Refuge open house this Saturday

by Candace Ward

We would like to invite everyone to our annual Open House on Saturday, from 11:00 a.m. to 3:00 p.m. Our 1999 theme is "Helping Wildlife & Wildlands." Refuge and Fishery Resources Office staff will have activities and displays demonstrating how their programs help conserve the wildlife and wildlands of Kenai Peninsula. The Friends of Kenai National Wildlife Refuge will host the event and will have information on volunteer programs for wildlife and wildlands on the Refuge.

We will have:

- A free harvest soup lunch, from 11:00 a.m. - 2:00 p.m.

- Kid's activities, including a drama "If You Give a Moose a Muffin" (11:30 a.m., 12:30 p.m., 1:30 p.m. and 2:30 p.m). The Fire Program will present special contests with prizes and an opportunity for kids to dress up as firefighters.

- The Anchorage Bird Treatment and Learning Center will have a live golden eagle on display from 12:00 p.m. to 2:00 p.m.

- Free National Wildlife Refuge Week posters, bookmarks, and blue goose tattoos!

Our displays will include:

- "Friends of Kenai National Wildlife Refuge" - Find out what the Friends Group is doing to help the Kenai National Wildlife Refuge. Through their efforts projects are accomplished to help the Refuge that otherwise would not be possible. Find out how you can become a Refuge Friend.

- "Fish Are Wildlife, Too!" - The U. S. Fish & Wildlife Service Kenai Fishery Resources Office will explain how to age fish, use radio telemetry to follow fish in the wild, and will give demonstrations with fish puppets.

- "Loons, Lynx, and Brown Bears - Oh, My!" - Find out from Refuge biologists what's new and ex-

citing with these Refuge animals. Discover how you can assist our Loon Watch Program.

- "Spruce Bark Beetles - Past and Future" - Spruce bark beetle outbreaks are historically part of the natural cycle of the Kenai Peninsula boreal forest ecosystem. See where the beetles have been during the last two hundred years on the Peninsula and what we can expect from them in the future.

- "Tools of the Trade" - Learn how firefighters protect the community from uncontrolled wildfires and how they manage controlled burns that benefit wildlife and provide firebreaks.

- "Ranging with a Ranger" - Discover how our rangers travel into remote areas of the Refuge to rescue visitors and to protect wildlife.

The Refuge Open House is part of National Wildlife Refuge Week for 1999. National Wildlife Refuge Week celebrations began four years ago to bring together refuges and their neighboring communities. These events let refuge staff and volunteers share their work with local residents and help the communities better understand the purposes of refuges and the benefits they receive from living next door to these very special public lands.

No other nation on earth has the National Wildlife Refuge System found in the United States. With more than 500 refuges from Alaska to the South Pacific, the National Wildlife Refuge System seeks to conserve our nation's diverse wildlife and the habitats they need survive. Please join us on this Saturday to celebrate our own very special Kenai National Wildlife Refuge.

Candace Ward is a park ranger at the [Kenai National Wildlife Refuge](#), who coordinates the Refuge's visitor services and environmental education programs.

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

Prescribed fire: the Peninsula's safety net

by Larry Adams

I am fortunate that I work in an area where most local people understand that, in general, our wildlife benefit from forest fires. Probably less understood is the fact that every time we have a wildfire or a prescribed burn, that part of the forest has been "fire proofed" for many years to come. The more "black areas" that we can make, or allow to happen, in a patchwork fashion and under controlled conditions, the harder it will be for uncontrolled wildfires to make huge catastrophic fire runs.

These large "black areas" don't stay black forever. Both spring and summer wildland fires will kill the very flammable spruce, but spring fires often have a green blanket of plants and flowers by the late summer. Summer fires usually burn deeper and expose more mineral soil. Seeds carried by the wind during the fall and the early spring land on this soil and soon give rise to a new forest of willows, aspen, and birch. Stands of spruce provide cover for moose, but the trees themselves don't provide the big critters with any food. The new broadleaf trees and plants make up a tender "dinner plate" for more moose and hare. Where you have all that extra red meat running around, you'll find a bunch of happy wolves, bears, and lynx.

The slower growing, but longer lived spruce, will eventually over top the birch and aspen and create a very flammable situation again. This may take 70 to 100 years. As you drive along the western half of Skilak Lake Road, notice how 40 or 45-foot tall spruce are racing the 50-foot aspen towards the sky. The aspen will lose this race. Most of the forested areas along the western half of the Loop road burned during the 1947 Fire, a 310,000 acre blaze. The area is still fairly "fire proof." Oh, yes, we have our leaf fires and enlarged campfires in old burned areas, but no fires have raced and gobbled up hundreds of acres a day in the 1947 Fire area since that year. The 1991 Pothole Lake Fire burned 7,900 acres, but when it hit the boundary of the 1947 Fire near Hidden Lake Campground it stopped. When the 1996 Hidden Creek Fire burned into the 1947 Fire just south of the Skilak Loop Road, the fire dropped to the ground and we were able to easily control it. The 1969 Swanson River Fire surely would have burned more than its final size of 80,000

acres if it had not run into the western extension of the 1947 Fire.

My main job at the Refuge is to conduct prescribed burns for wildlife habitat and hazard reduction by making some of these "black areas". To reduce the risk of having an escaped fire during one of these burns, or over-cooking the soil, the Refuge fire staff has a number of tools and techniques available. We take duff moisture samples to see exactly how much moisture is in the moss and organic duff layers of the forest floor. These samples are brought to our lab where they are weighed, dried, and weighed again. After the math is done we can say with certainty how dry the forest floor is. We do the same test on black spruce needles—black spruce being our most troublesome fuel type in Alaska. For a comparison of how much moisture the twigs and branches might have in them we place in the forest precisely weighed 1/2 inch wooden dowels. These are weighed on site each day to see how much moisture they have gained or lost. The amount of moisture in all these forest fuels tells us a lot about how our fires will, or will not burn, and how much equipment we will need to control the fires we will light.

The Refuge has remote fire weather stations that take weather readings every hour. With our handheld radios we can trigger these stations to tell us what the weather is doing right then. These weather stations also beam up this weather data to satellites that, with the help of the internet, we are able to read on our office computers.

With my 36 years of fire control experience I can add up in my head that hot temperatures, strong winds and low humidities will give us a bad fire day. In recent years my job has been made a little less nerve racking as I am now able to run all the measured weather ingredients through my fire computer to see if I might have missed anything that might be a recipe for disaster.

The Refuge fire staff wraps all these weather conditions, personnel and equipment needs, and the needs of the wildlife and vegetation into a written "fire plan." It is reviewed at four levels to make sure it is a good plan. Then we get an air quality permit from the

Alaska Department of Conservation. Then with a little help from fire personnel at the Soldotna Forestry Office, and from the Seward Ranger District, we set out to have us a prescribed burn. Hopefully, the result will be a safer forest for all of us, and a more “user friendly” Refuge for those wild animals that help make the Ke-

nai, the KENAI.

Larry Adams is the Fire Management Officer at the Kenai National Wildlife Refuge. He and his wife, Toni have lived in Sterling for 16 years.

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

Devil's Club good for man and bear alike

by Ed Berg

If you've ever tried to recover your balance by grabbing a handy stem of Devil's Club, you can see how the plant got its name. Grabbing such a stem is a mistake you only make once. The numerous short spines provide a handful of pain and can fester if not removed right away. But properly schooled, there is much to be enjoyed with *Echinopanax* (*Oplopanax*) *horridum* (horrible spiny panax) in spite of its unfriendly names.

Devil's Club is a plant of mature forests. It is very sensitive to fire and takes a long time to reestablish after a fire. A healthy stand of Devil's Club is generally an indicator that the forest hasn't burned for many decades, perhaps several hundred years. The plants are clonal: if you follow the roots (underground stems) in a patch, you will often see that they are all connected and are genetically one individual. I assume that many seasons of growth are needed to establish a single patch, which is probably why we don't see large patches in younger forests.

At the Bufflehead Road site, north of the Swanson River oilfield, we counted Devil's Club 3,548 stems along a 760 meter transect, with an average density of about 2 stems per square meter or 7,650 stems/acre. This is a very mature white spruce and birch forest that hasn't burned for at least 300 years, according to the oldest (non-rotten) trees that we cored. The understory is thick grass and Devil's Club, and not much else. This is pretty typical of our very mature stands of the northern Kenai.

The black and brown bears love forests like this in the summer and fall, because they can eat a phenomenal number of clusters of the bright red berries. Kenai Refuge grad student Todd Eskelin collected and dried clumps of Devil's Club berries at the Bufflehead Road site and estimated berry production at 54 pounds per acre (dry weight). Berry production was low that year (1996), due to dry conditions, so much higher production could be expected in a good year. Former ADF&G biologist Chuck Schwartz located 4 to 8 radio-collared black bears per square mile in this area, which was an underestimate of bear density because he also observed many uncollared bears. Bear densities were much lower in the nearby 1947 and 1969 burns (0.5

bear per square mile) which have not yet produced much Devil's Club.

In the old growth forests of Sitka spruce on the south side of Kachemak Bay, Devil's Club often forms a more or less continuous canopy above the forest floor, broken occasionally with Rusty Menziesia and Blueberry. A rich medicinal smell (one of my favorites) fills the nostrils when you walk through such a canopy and bruise the Devil's Club stems.

This medicinal smell can be captured in Devil's Club tea, which is made from the bark of the "roots." It is easy to collect the bark of the roots, because the spines don't form on the underground part of the stem. Fall is the best time of the year to collect the bark, because like many herbs, the plant has spent all summer sequestering its special compounds in the roots.

I view Devil's Club tea as sort of a "poor man's ginseng," free for the taking in our local forests. Devil's Club is a close relative of ginseng (*Panax* species in the Araliaceae family) and they are both said to contain similar compounds of medicinal value, although I have not searched the literature to confirm this fact. In Chinese folklore ginseng is "good for what ails you," and it is an important herb in traditional Chinese medicine, especially as a male toner. I have visited shops in Chinatown in San Francisco devoted exclusively to the sale of different varieties of ginseng - Korean, Chinese, Wisconsin, etc.

When I collect Devil's Club bark, I peel off the bark of the root with a knife and dry it in a paper bag for a week or two. I then store the bark in a jar with a tight lid to preserve the aroma. As with ginseng, tea can be made by putting a few pieces in a cup and adding boiling water. The tea is a definite stimulant, although less "nervy" than the caffeine in a cup of ordinary black tea.

I like to eat the young leaf buds early in the spring. When the buds are an inch long, they can easily be twisted off and eaten raw, and are quite tasty. Once the buds become longer, they get bitter and the spines stiffen. The red berries are considered inedible for human beings, but I have never read that they are actually toxic.

I did an Internet search on "Devil's Club" and turned up more than 600 hits, many of which were

herbal pharmacies extolling the medicinal virtues of Devil's Club and selling it for as much as \$12.50 for two ounces, under such names as "Wild Alaskan Armored Ginseng." Traditional Native uses of Devil's Club are for rheumatism, stomach troubles, colds, coughs, and fevers. My wife was interested to see that Devil's Club is used to treat late-onset diabetes (Type II) associated with menopause. Jan Schofield in her book "Discovering Wild Plants: Alaska, Western Canada, the Northwest" (Alaska Northwest Books, 1989) advises diabetics to monitor blood sugar levels because Devil's Club use may lower insulin requirements.

You won't find Devil's Club north of the Alaska Range; it is a creature of the Pacific Northwest coastal forests and favors moist but well drained forests. It is especially abundant in British Columbia, where it is an important food source for grizzly bears and has important medicinal and ceremonial roles in the coastal Indian cultures.

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://www.fws.gov/refuge/kenai/>.

Share the Refuge with a child; it will open up a brand new world

by *Richard Johnston*

Having worked on, played in and explored the Kenai National Wildlife Refuge for nearly twenty years, there are few Refuge experiences I haven't at least sampled or places on the Refuge I haven't explored. As a pilot, I think I've seen the Kenai mountains in about every shade of beautiful that there is. It is easy to be humbled by the overall beauty and wildness of the Kenai Refuge, especially at 3,000 feet on a gin clear October morning with a V of sandhill cranes silhouetted against the eastern mountains. I recall certain wildlife sightings and hunts that some might say were once-in-a-life time, but when friends and Refuge visitors ask me about my favorite Refuge experiences, I smile and reply, "Anywhere on the Refuge and sharing just about any activity with a child."

Kids have a very simple and powerful way of observing and experiencing the many wonders of nature. We often hear adult conversations about past trips or planned outings on the Refuge. These knowledgeable conversations might concern harvesting an elusive 60 inch moose, catching that once-in-a-lifetime trout, getting that perfect bear photograph, summiting a difficult peak or a twenty mile off trail traverse. But listen to the conversations of two children on the Refuge and you may really come closer to the heart of what the Kenai Refuge is really all about...and what any of us can experience on any day in the presence of a child.

The kids may be talking excitedly about a small squirrel they saw, or about a passing cloud reflection on the Kenai River and how it looked like a buffalo. Two very small cowboys may be astride horse-like aspen branches temporarily serving them as trusty steeds, with all this adventure in a small greenbelt between two campsites in a roadside campground. As far as they're concerned, they are Lewis and Clark and the sights, sounds and smells of their little exploration forest are on the edge of nowhere and the year is 1850. No doubt children love to see a large bull moose or to catch a big fish as much an adult, but I believe they are natural appreciators of the simple and ethereal, and are particularly expert at seeing and experiencing the

more subtle side of the Refuge.

I recollect leading a school fieldtrip many years ago where I was distressed that we hadn't seen any of the normal wildlife that day. I kept coming up with explanations that would have shamed the best you-should-have-been-here-yesterday tales of a Kenai River fishing guide on a slow day. One of the kids started asking questions about this small fungus growth on a downed log. Pretty soon the focus of the entire fieldtrip switched from seeing moose to The Great Conk Hunt of the Kenai, 1983. It was then that I wished I'd paid more attention to the small stuff; I realized that I didn't need an obliging moose to make these kids' day. A small amount of "interpretive knowledge" on my part could really enhance their modest adventure. They were simply glad to take the day and the outdoor adventures as they might come. The naturalist interpreters on our Refuge staff have learned from such experiences to direct more attention to the small and subtle aspects of the trailside, such as insect effects, fungi, edible plants, wild smells, and bird calls. When they do this, every small trip can be a big adventure for the kids.

Young residents of Kenai Peninsula and their families are particularly fortunate to live with such an abundance of wildland and wildlife opportunities. Whether it's taking a child hunting, fishing or hiking, the Kenai National Wildlife Refuge has a place and season that is made to order for you. For example, the many short day trails within the Skilak Recreation Area and along Swanson River road are perfect for an outing and the exploration pace of kids. Small children like my four-year-old love to stop often and are much less concerned with the final destination than the "journey" and the infinite adventures that a mile of trail provides.

Skilak Lookout, Skyline, Bear Mountain, Hidden Creek, Kenai River are just a few of the Refuge trails that by virtue of length, degree of difficulty and natural features (e.g., things to climb on) are made to order for kids. Hidden Lake Campground is a very popular destination; children of all ages find enough adventure

in this campground to fill several days.

A kid-size trail called Bernie's Trail, named after a late Refuge biologist, is a great place to spend the afternoon. And nearby, the Refuge has a new trail called Hideout Trail that will be formally opened to the public next spring. It was recently completed after two seasons of volunteer labor by high school Student Conservation Association volunteers. It is a great trail for kids and if you can believe my four year old, it is destined to be one of the Refuge's most popular family day trails. On a recent September trip I accompanied three other adults and four kids ages four to thirteen to the top of Hideout Trail. There were berries, scenery and adventure for everyone, especially with the fall colors and smells.

One of the best kept secrets of the Kenai is the excellent trout fishing on many roadside lakes and other lakes within a mile of the road. It has been my experience that kids much prefer catching a stringer of frisky trout to less predictable king salmon safaris. And my kids just can't get the concept of stowing away their poles after Dad has helped them catch a Kenai king.

Small game hunting on the Refuge is a great way to introduce children to the responsibilities, skill acquisition and rewards associated with hunting. These clear cold October mornings are superb for spending one-on-one hunting time with a future woodsman. I'll wager that you may rediscover why you started hunting in the first place, and it probably wasn't to fill the freezer.

Bringing children afield should be taken very seriously, especially when hunting. There are many safety

considerations for being out on land and water, particularly as temperatures drop and days grow shorter. A compass, warm clothes and a hunter education certificate addressing safety and hunter ethics are very good starting points.

There are many trust issues that an adult should fully consider while mentoring a young hunter or fisherman. Adults should be skilled and willing to share their land and hunting ethics with their young charges. As a Refuge Officer I find few experiences more rewarding than checking the bag of a successful young hunter who has done everything by "the book" and who is accompanied by a proud and thoughtful adult. Conversely, there are few experiences more disheartening for me than citing or arresting an adult who has encouraged a young hunter or fisherman to break game laws or has done so himself in a youngster's presence.

If you are thinking of taking a child on the Refuge this month, be well prepared: pack your smile, compass, sack lunch, warm clothes, and water. Don't be in too big a hurry, leave a trip plan behind, and keep an open mind. You just may find adventure where you least expect it and a lot closer to the road than that 50 miler you did with your neighbor last year.

For more information on great family hikes and other adventures on Kenai National Wildlife Refuge, contact Rick Johnston or other Refuge staff at Refuge Headquarters (262-7021). Rick Johnston is a Ranger/Pilot for the Kenai National Wildlife Refuge. Previous Refuge Notebook columns can be viewed on the Web at <http://www.fws.gov/refuge/kenai/>.

Mapping Refuge resource information: a high tech challenge

by Sue Schulmeister

The old cliché that a picture is worth a thousand words is especially true on the Kenai Refuge. Most people are visually oriented and like to see a map rather than text or tables. We have piles of paper maps of property boundaries, animal locations, roads, trails, campgrounds, and oil and gas development areas, and we are now learning how to put these maps on the computer.

Take locations of trumpeter swan nests, for example. In the past Refuge biologists flew aerial surveys and marked swan nest locations on a paper map, noting additional information on a data sheet. (This shifting of one's gaze back and forth from a sited critter to map and data sheet in a tightly banking aircraft is not for the weak stomach!)

After about 30 some years of accumulating maps in a file cabinet, it becomes harder and harder to retrieve information to answer such questions as: Which lakes do swans nest on?, Do swans nest in the same places year after year?, Does disturbance cause swans to vacate nest areas they have traditionally used?, Are numbers of swans nesting on the Refuge increasing or decreasing? Fortunately, computer spreadsheets and databases have arrived which retrieve and analyze some of the basic information, but these programs still don't "visualize" the data so that you can really see what is going on.

Now, however, we have a new high tech tool called a "Geographic Information System," or GIS, which can make computer maps. (The teenage version of this technology is games like SimCity and SimAnt, where the user creates a landscape for the game activity.)

A GIS is a combination of computer hardware, software, and geographic data, which can describe places on the earth's surface with geographic coordinates like latitude and longitude, and store information associated with a given place. With GIS, biologists can answer questions like, How large is the home range of a lynx?, What kind of plants occur in the areas the moose like best, or How has the forest changed over time? For swan nests we can display a map on the computer screen showing all the swan nests recorded

on the Kenai Peninsula, either all at once or year-by-year, and with a click of a mouse we can look at the information for each nest.

For old surveys, we can take location data off of paper maps, either by hand or with a scanner, for entry into the GIS computer. With our new surveys, we use a GPS (Global Positioning System) electronic device mounted in the aircraft. When the plane is directly overhead of an animal, we press a button on the GPS and the location is automatically recorded in a digital memory. Back at the office we can download the GPS locations into the GIS computer and display them at the click of a mouse or print out a hard copy map.

We still use radio collars to locate many animals, such as wolves, lynx, and brown bears, but this requires many hours of flying time to find the animals and get in position to make the GPS measurement of their locations. A new generation of collars has a GPS device in collar, which transmits the animal's location every few hours. We can call up the satellite and download several days' locations into the GIS computer without ever leaving the office. These GPS collars are more expensive than the old radio collars. We have deployed GPS collars on brown bears and are planning to deploy a few more on moose this winter.

The GIS technology is great for printing beautiful poster-sized maps of any spatial information that you can imagine. We see GIS employed at every level of government from the Fire Department to the Borough, State, and Federal land management agencies. Nor has it been lost on the military. The real power of GIS, however, goes well beyond pretty maps to its ability to visualize complex questions. For example a real estate agent or the Borough Tax assessor might ask for a map of all privately owned parcels greater than 5 acres, above 800' elevation, on south-facing slopes, and valued at more than \$50,000.

It is possible to make such a map because the information is stored in the computer in "layers," just like a stack of paper maps. For the Kenai Peninsula there is an elevation layer (like a contour map), an ownership layer (a plat map), a hydrology layer (streams and

lakes), and layers for roads, school and voting districts, power lines, and fire risk. Two foresters Marvin Rude and Andy DeVolder are now preparing a forest vegetation layer from aerial photography, which will show the tree species, and size and density of trees. This layer will be used to develop a forest fuels layer, which together with current weather forecasts will allow fire fighters to model the direction and rate of spread of a wildfire across the landscape. These GIS fire propagation models are already in use in the Lower-48 and

they can be very useful in predicting where a fire will be in 12 or 24 hours.

As you can see the possibilities of Geographic Information Systems are endless. We certainly looking forward to studying the “big picture” of Refuge wildlife on a much grander scale than we would have ever thought possible a few short years ago.

Sue Schulmeister is a Wildlife Biologist and GIS specialist at the Kenai National Wildlife Refuge.

Be FireWise - prepare now for next fire season

by Doug Newbould

The snow is beginning to accumulate, the mercury has been hovering between zero and the freezing mark, and the sun is heading south - as are many of our friends and neighbors. Sounds like a good time to hunker down next to the ol' woodstove with a good book, and catch up on some of the sleep we lost in July. "Well, hold on there just a minute, pal. There's still something you need to do before you start hibernating," says a nagging little voice in the back of my head. "You still need to cut those dead spruce out back and cut more of that brush there next to the shed and burn those slash piles you made last spring!" "Aw man! I already had my boots off," I say, whining to myself. "But you know I'm right," says the little voice, a tad too cheerfully.

Perhaps you've had a similar conversation with yourself recently, or maybe it's one of those honey-do's down near the bottom of your list. Whatever the case, NOW is the best time to throw on the Carharts and make your property fire-ready, BEFORE the next fire season sneaks up on us. Perhaps you have already done everything that can be done to make your home and property safe from the threat of wildfire. Are you absolutely sure you haven't missed anything? Or perhaps, you don't really know how to get started. In either case, there is a program you need to know about - it's called FireWise.

The FireWise Community Action Program is a program developed nationally by fire management professionals, to improve the chances your family and home will survive a wildfire. The Alaska Wildland Fire Coordinating Group (AWFCG) has adapted the FireWise program for use in Alaska. The FireWise program is available to Kenai Peninsula residents through Project Impact, the Borough's disaster preparedness project. FireWise materials have been assembled in folders for distribution to area residents, free of charge.

Each folder contains a fire risk assessment form and six pamphlets, which describe the steps you can take to prepare your home and property for a wildfire.

The majority of the FireWise action steps are easy to do, inexpensive and self-paced. The six elements of the program are Landscaping, Access & Signs, Emergency Water Supply, FireWise Construction, Home Planning, and When Wildfire Threatens.

You can get your FireWise kit at several locations on the Kenai Peninsula: your local fire department, the state Division of Forestry office in Soldotna, or here at Refuge Headquarters on Ski Hill Road. Once you have your folder in hand, you can begin to develop a FireWise Action Plan for your home and property.

If you are really motivated, you can bring your neighbors into the process and develop an action plan for your neighborhood, subdivision or community. There are special "train the trainer" materials available to assist individuals or community groups who want to develop neighborhood action plans. If you or your group wants FireWise training, or you have questions about the program, you can contact me at 260-5994, call the Division of Forestry at 262-4124, or call your local fire department.

The important thing to remember about the FireWise Community Action Program is the word "Action." All the planning you might do won't count for much if you fail to implement your plan. As one of my favorite fire chiefs is so fond of saying, "Every FireWise home is one less home we'll have to worry about when the Big One happens!" And I agree. At the very least, a FireWise home will be a home we can try to defend from a destructive wildfire. A home without defensible space, might be a home we cannot safely defend. So get up, put your boots back on and head down to the firehouse for your FireWise kit. That book you've been planning to read will still be waiting for you when the snow gets too deep to work.

Doug Newbould is the Assistant Fire Management Officer at the Kenai National Wildlife Refuge. You can get more information about the Refuge or view previous Refuge Notebook columns on our website at <http://www.fws.gov/refuge/kenai/>.

Wildlife telemetry

by Rick Ernst

Advances in technology are rapidly changing every facet of our lives. Miniaturization has downsized computers from room-sized machines to desktops, laptops, and now to computers that fit in the palm of your hand. The telephone, which used to be a large box on the wall, now fits in your pocket and doesn't have wires.

This technological revolution is also changing the way we study wildlife. Telemetry (the transfer of data through radio waves) has been used by biologists to follow animal movements since the 1960's. Initially, telemetry transmitters were heavy and bulky, and could only be used on large land-dwelling animals, but with miniaturization, we can now study a wide diversity of species, from whales to bats.

Radio and satellite telemetry technology is currently being used to follow Cook Inlet beluga whales, and the Kenai Refuge is using telemetry to track the movements of brown bears, wolves, lynx, caribou, fish, and moose this winter.

So how does telemetry work? Components of a telemetry system include a transmitter which is worn or attached to the animal and emits a continuous signal, and a receiver which picks up the signal with its antenna. Transmitters use a discrete radio frequency or channel. Some telemetry manufacturers use digital coding so that several transmitters can use the same frequency. The transmitter can be attached to an animal using a variety of methods such as neck collars on big game animals, wing transmitters on birds, and implanted (internal) transmitters in fish. Some transmitters deployed on birds use a harness, whereas transmitters are glued onto seals and sea lions with a strong adhesive.

Transmitters can vary from several pounds to less than an ounce. Putting a transmitter inside a collar along with batteries and antenna can significantly increase the weight, so we follow a general rule of thumb that a collar's weight not exceed 3-4% of the animal's body weight. For example a 250 pound caribou will carry a 1.7 pound radio-collar, which is less than 1% of the caribou's body weight. Transmitter size and weight obviously become more critical with smaller animals such as fish, birds, or bats.

Refuge Biologist Ted Bailey and I spend a good part of our workdays flying over the central and northern Kenai Peninsula searching for radio-collared animals. We listen to the steady beep-beep-beep signal from the radio-collars, and I fly in smaller circles until we are directly over the animal, at which point we record a GPS location. If the animal has not moved for 6 hours, the collar goes on "mortality mode" with a slower beeping, and we generally know that we will need to hike in to recover the collar. The Refuge has accumulated more than 12,000 locations of wolves, coyote, lynx, trumpeter swans, bald eagles, caribou, moose, and martens. The Interagency Brown Bear Study Team has collected over 8000 brown bear locations since 1995. We plot these locations on computer maps using our Geographic Information System (GIS) so that we can study the habitats the animals use.

The USFWS's Fisheries Office and Alaska Department of Fish and Game have placed transmitters in many Dolly Varden trout, and are finding that Dollys move more than 100 kilometers (60 miles) up and down the Kenai River between spawning and feeding areas. These transmitters turn on at 8am and off at 4pm to extend battery lifetime to two years.

We are excited about a new approach using satellite telemetry which allows us to track animals "without leaving the office," once the collar is installed. Some collars on brown bears use a global positioning system (GPS) that searches the sky for signals from at least 3 different satellites to obtain a 'fix' or location and then stores this information in digital memory inside the collar. When we recapture a bear, we download the GPS locations directly from the collar into a computer for analysis. A second type of satellite collar transmits a coded signal to a satellite, where the "real time" locations are stored and downloaded each day when the satellite passes over one of three ground stations in France, Virginia and Alaska.

So why do we use radio telemetry? We find that radio telemetry provides an efficient means for studying animals with wide-ranging movements (caribou, wolves), nocturnal species (active at night), hibernating animals (bears) and animals that inhabit rough terrain and dense vegetation. With this technol-

ogy, we collect valuable information on daily movements, habitat use and preferences, home range size, birth rates, survival, migration routes, wintering areas, nesting or calving sites, and mortality. This information, coupled with careful planning of harvest quotas and habitat protection and enhancement, can help us maintain stable wildlife populations and hope-

fully avoid sharp population declines and management crises.

Rick Ernst is a Wildlife Biologist/Pilot at the Kenai National Wildlife Refuge. Previous Refuge Notebook columns can be viewed on the Web at <http://www.fws.gov/refuge/kenai/>.

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 opened November 10 for many of the Peninsula's furbearers. To trap on the Kenai Refuge you must have attended our trapper orientation class. The class covers State and Refuge regulations, principles of furbearer management, trapping tips, and trapping ethics. It is only required for your first year of trapping on the Refuge, although old grads are always welcome to attend. Every trapper over age of 16 must have a valid State of Alaska Trapping License and must secure a Trapping Permit from the Refuge each year.

In addition to the State regulations, the Refuge has its own special regulations, which are designed to maintain healthy furbearer populations and to reduce the harvest of non-target species (such as birds of prey). These regulations also seek to reduce conflicts between trappers and other winter outdoor users of the Refuge, and to promote humane trapping methods.

Let me explain some of these regulations and the philosophy behind them. The first thing to say is that the basic rules and bag limits for trapping, as for hunting and fishing, are set by the State of Alaska. These rules and bag limits apply to all public (Federal/State/Borough/City, etc) land and to all private property in Alaska. You can't shoot two moose in one season just because they are in your backyard. On the Refuge we add further rules in keeping with our mission as a National Wildlife Refuge. For example, for trapping on the Refuge we require that all traps and snares be identified with a name tag or an ID mark registered with the Refuge, whereas the State of Alaska has no such rule. We have many trappers using the Refuge, and we feel that identification encourages trappers to take responsibility for the hardware they are putting out in the field. Identification also helps recover lost traps.

Similarly, we require that all leghold traps be checked at least every four days in northern and west-central parts of the Refuge (Game Management units 15A and 15B-West) and at least every seven days throughout the rest of the Refuge. Conibear and drowning sets must be checked at least once every

seven days throughout the Refuge. These trap-check requirements are directed at promoting humane trapping and the timely release of non-target animals. Experienced trappers know that checking traps regularly increases the efficiency of the trapline, and can avoid bad publicity about trapping.

Traps and snares are prohibited within thirty feet of "sight-exposed" baits. Sight-exposed bait includes animal parts (such as dead fish) placed to visually attract an animal to a trap. This regulation is aimed at reducing the take of non-target animals, especially birds of prey like eagles and hawks which hunt by sight. The thirty foot rule is also good trapping practice because any furbearer you catch won't be so near the bait that it frightens off other furbearers.

We ask that trappers (and hunters) report all tags and radiocollars taken from furbearers within three days to Refuge headquarters at 262-7021. Our biologists studying these animals don't need to 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, two miles of campgrounds and trailheads, and within the Skilak Wildlife Recreation Area. This regulation is designed to reduce user conflicts (such as pets in traps) and to 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 will reduce the likelihood of injury to a non-target animal which is going to be released.

When lynx season is closed, "cubby" and flag sets are not allowed. A cubby set is a structure (natural or man-made) which guides the animal into an area where bait is placed and a flag or wing is used to attract the animal into the trap. Lynx are very curious and this type of set (especially with a castor-type lure) can be very effective for them.

For beaver, only one set per lodge per season is allowed in the lake-and-muskeg area of the Refuge (i.e., Game Management Unit 15A, north of the Sterling Highway). Each lodge that is being trapped during the current season must be visually marked with

a pole vertically set in the ice, so that other trappers will not place sets on the lodge. This regulations is designed to avoid completely trapping all the beavers in a lodge and leaving no breeding stock for the next season.

Trappers are required to submit an accurate furbearer harvest report to the Refuge after the end of the trapping season. The information is very useful to the biologists and managers, because determining population levels of most furbearer species is extremely difficult. Harvest records reflect the annual trapping effort and provide a useful index of the health of furbearer populations as well as showing trends over time in these populations. This is one of the best ways that trappers can actively participate in management of furbearers.

This winter the Refuge will be purchasing skinned carcasses of wolverines and collared lynx and wolves. We want only the intact carcasses. Our biologists use the carcasses to study the overall health of the population. A check for scars on the uterus, for example,

will show how many offspring were born this year. The carcasses must be from the Refuge. The rates are \$50.00 for female wolverines, collared lynx and collared wolves.

On Saturday, November 20, the Refuge will be holding the annual Trapper Orientation class from 9:30am to 12:00 at Refuge Headquarters on Ski Hill Road. As noted above, this is a mandatory class for trapping on the Refuge for those that have not attended the class in the past. After the class, starting at 1:00pm, we will have a snaring seminar and field demonstrations on trapping. The snaring seminar is not mandatory for trapping on the Refuge, but as a bonus those attending the seminar will be granted a seven day snare check on the Refuge portions of Game Management Unit 15A and 15B-West.

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

Wolves on the Kenai National Wildlife Refuge

by Liz Jozwiak

The wolf represents different things to different people. Some value the wolf as a symbol of the Alaska wilderness and as an essential part of the natural wild landscape. Others consider the wolf a game animal, like other furbearers which are harvested for the value of their pelts. Some people view wolves as aggressive and unpredictable predators, against which their children and livestock must be defended. People may not have strong opinions about voles, but they generally have something to say about wolves!

On the Kenai National Wildlife Refuge we monitor wolves with the goal of keeping a healthy sustainable wolf population. In cooperation with the Alaska Department of Fish and Game (ADF&G), we attempt to resolve occasional predation issues, and to educate the public about Kenai Peninsula wolves, their movements and lifestyles.

As most Peninsula residents know, wolves and other carnivores such as lynx, coyote, brown, and black bears are native residents of the Kenai Peninsula. But the history of wolves on the Kenai is a story in itself. Early records indicate that wolves were commonly observed on the Peninsula in the late 1890's about the time a gold rush brought prospectors to the area. By 1915, wolves were almost completely exterminated from the Kenai Peninsula because of predator control programs using poison, along with heavy hunting and trapping. Then in the early 1960's wolves began to repopulate the Peninsula. It is still a mystery whether most of the recolonizers dispersed from the mainland, or whether a few of the surviving lone wolves (whose tracks were sporadically sighted between 1935-1950 by trappers and biologists) were the seed crop of our present day Kenai wolf population. Recent DNA studies revealed that the Kenai Peninsula wolf population is genetically similar to mainland Alaska wolves. This suggests that there may be a low level of mating between Kenai and mainland wolves through occasional migrants from the mainland or that the Kenai Peninsula wolf population has not had enough time to develop unique genetic characteristics.

Since 1976, Refuge and ADF&G biologists have radio collared almost 200 wolves in the northern por-

tion of the Refuge in an ongoing effort to learn more about their predator-prey relationships, pack size, territory, genetics, and susceptibility to disease. This is one of the longest monitored wolf populations in Alaska. Some interesting findings came from an early study (1976-1981) when 3 to 7 wolf packs were monitored by Rolf Peterson from Michigan Technological University. Rolf estimated the territory size of wolf packs averaged 255/mi², wolf density averaged 7 wolves /1,000 mi² on the northern portion of the Kenai Peninsula, and he determined that the Refuge wolf population was largely regulated by human harvest. Rolf found that a wolf pack in winter consumed 1 moose / pack / 4.7 days when moose densities were high within the 1947 burn habitat. Most of the moose consumed by wolves were old, suffered from debilitating conditions, and were more vulnerable because of average to above average snowfall during the study period. Wolf predation on moose appeared to be much less between May and September. Wolves are by nature a resilient species, and as long as they are free from disease, and their food supply remains plentiful, the population can sustain a harvest of up to 40%. However, when harvests in the late 1970's exceeded 40%, wolf densities declined the following years.

Hunting and trapping pressure has declined from the highs of the 1970's and early 1980's. As part of my Masters Degree research, I looked at how wolves responded to different levels of harvest. Logically, if wolf densities declined after years of high harvest, one would expect their numbers to go up after years of low harvest. I analyzed 10 years of wolf telemetry and harvest data between 1982 and 1993, expecting to see wolf densities increasing after several years of low trapping pressure. I was surprised to find just the opposite: wolf densities did not increase in years when very few wolves were trapped or hunted. Instead, wolves dispersed from packs more frequently when the harvest was low. I also found that a greater proportion of juveniles (1-2 year olds) dispersed than did pups or older adults. Dispersal however has its costs. Dispersing wolves have about half the survival rate of those which remain with their packs. Generally, dispersers have a higher probability of being killed by other wolves or

being harvested by humans.

The higher dispersal rate after years of low harvest may be just one factor among several that have affected wolf densities in recent years. Disease and parasites also play a roll. Blood samples over the last 15 years indicate that many adult Kenai Peninsula wolves are experiencing higher exposure to canine parvovirus or to canine distemper virus. Parvovirus is likely to kill wolf pups before they are 3 months old, and is believed responsible for lowering wolf numbers in winters in Minnesota. Lice appeared in wolf packs on the Kenai Peninsula in the early 1980's, most likely from contact with feral domestic dogs, and this parasite is still present in the population. We don't know exactly how many wolves there currently are on the entire Peninsula, but Rolf Peterson estimated the wolf population in 1980 at approximately 186 wolves, however a Peninsula-wide wolf census is needed to obtain a current estimate.

Recently we have been able to examine a second wolf population using ADF&G's 1998 relocation of 18 wolves to the Kenai Peninsula. These wolves were removed from Interior Alaska near Tok as part of the State of Alaska's Forty Mile Caribou Management Plan. Relocating wolves is an extreme case of dispersal because individuals are not simply taken out of their packs but are moved a great distance into new terri-

tory. As in most relocation programs, 50% mortality was expected in these transplants. It was higher in the Kenai case, with 78% mortality after a year and a half. Of the 18 wolves released, 8 were harvested, 5 died of unknown causes, and one was apparently killed by a moose. Four translocated wolves continue to be monitored by biologists the Kenai NWR and ADF&G: the two females are together in a pack of about nine wolves, whereas the two males appear to be loners.

Two of the introduced wolves achieved the remarkable feat of escaping from the Kenai Peninsula. Female #94 traveled over 200 miles northward in the first month and was radio-tracked to the Knik glacier east of Palmer. One of the males was harvested just north of Talkeetna last winter. These kind of directional homing movements towards their release locations, also reported in other translocation studies in Michigan and Minnesota, may be one of the most interesting results of such experiments.

Liz Jozwiak is a wildlife biologist at the Kenai NWR. She recently completed her Masters Degree at Colorado State University where she analyzed the effects of varying harvest levels on the Kenai wolf population.

Ted Spraker is the Area Wildlife Biologist for the Alaska Department of Fish and Game on the Kenai Peninsula. He has a Masters Degree from the University of Wyoming.

Friends group hosts first potluck ski party and wax clinic

by Amy George

Mark your calendars for Saturday, December 11 and join Friends of Kenai National Wildlife Refuge at their first Potluck Ski Party and Wax Clinic. Before the first snowflake began to fall this year, members of the Friends group and local youth from Soldotna High School worked with Refuge staff to clear and prepare the ski trails for the winter. For those of you who have used the trails, you know how difficult it can be to ski over the logs and through the alders after a good dump of snow. Hopefully the alder problem has been removed, and the Friends will be putting together a maintenance schedule to keep the trails clear of downed trees and brush throughout the season.

The highlight of this Ski Party and Wax Clinic is welcoming former U.S. Ski Team biathlete Gustave Hanson from Anchorage. Gus now works as a Swix representative, and will be kind enough to give a free wax clinic this Saturday at the Refuge Visitor Center. (And for those folks new to cross-country skiing, now

might be a good time to get some great tips from a pro!) In addition to Gus' clinic, Walter Ward, owner of Wilderness Way will be here with a skid automatic hot waxing machine. For a \$5.00 donation to Friends of Kenai National Wildlife Refuge, he will hot wax your skis with Swix racing glide wax, prepping you for a relaxing day on the ski trails and showing you what it's like to ski with properly waxed skis. (If you want Walter to wax your skis, please remember to bring them clean and dry!)

Once you've had your skis waxed and are ready to go, join us on the newly cleared trails for an afternoon of skiing and socializing in our beautiful winter wonderland, weather permitting, of course! Meet at the Refuge Visitor Center at 10:00 a.m., bring a potluck dish to share and warm up with after a day of skiing, and plan to have fun in the snow! Please call Amy at 260-6163 for more information.

Peninsula snowshoe hares on the decline

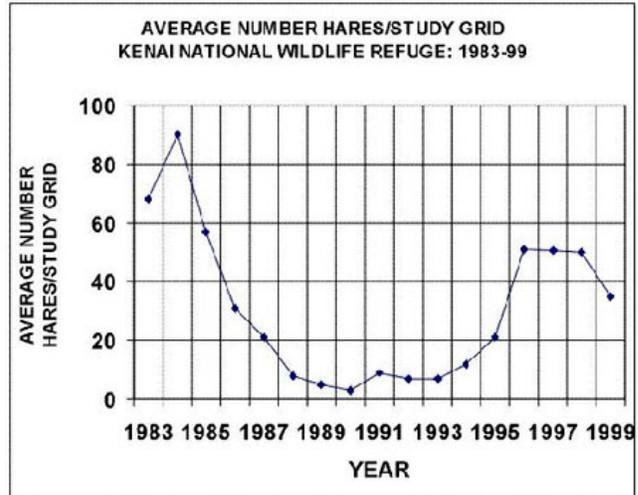
by Ted Bailey

Snowshoe hares have reached their peak population density and are declining again in numbers on the Kenai Peninsula. Each year since 1983 we have been monitoring the snowshoe hare population on the refuge. In each of 2-5 study grids 49 box traps are set in a 7 × 7 trap array and all live-captured hares are ear-tagged, sexed, weighed and released over a 14 day period. The same study grids are sampled year after year and the traps are set in the same places during the same time periods for consistency of data from year to year. The numbers of snowshoe hares captured and recaptured, the specific box traps they are captured in, and the distances between capture locations are used to determine the numbers and densities of snowshoe hares in the area. In addition and as an alternate method of estimating the snowshoe hare population, the pellets of hares are counted in the same one square meter area near each trapsite year after year.

Periodically the vegetation in the study grid is assessed by counting and measuring distances to trees, sapling stems, and dead saplings killed by hares girdling the bark. The numbers and percentages of stems browsed by hares and moose are also counted.

The average numbers of snowshoe hares captured per study grid since 1983 is shown in the accompanying chart. The snowshoe hare cycle is one of the most frequently cited examples of a cyclic animal population in textbooks on animal ecology. In general, snowshoe hares show cyclic fluctuations of up to 5-25 times in density across North America with peak densities every 8-11 years. But we have discovered that snowshoe hares on the Kenai Peninsula are an asynchronous population meaning that they are out of phase with the rest of snowshoe hare populations across North America and mainland Alaska. However, at least one, possibly two, other studied snowshoe hare populations also appears out of phase with the continental hare cycle which last peaked in 1990-91. The previous cyclic peak on the Kenai Peninsula occurred in 1984-85 and the current peak appears to have been in 1997-98. The Kenai Peninsula hare population is not only out-of-phase with other North American and mainland Alaska populations, it was also longer between peaks. The number of years between the last two peaks was 12-14

years dependent on which year you begin and end counting.



The exact reasons for the asynchrony and longer length of the snowshoe hare cycle on the Kenai Peninsula remain uncertain. Two of the known areas where snowshoe hares are out of phase are at the opposite sides and near the ends of the distribution or geographic range of snowshoe hares in North America. Newfoundland lies at the extreme eastern end of their range and the Kenai Peninsula lies near the western extremity of their range. Snowshoe hares did not naturally occur in Newfoundland but were introduced there in the late 1800's. Both areas share some common characteristics. Both are isolated from the nearby mainland because they are islands (Newfoundland) or near-islands (Kenai Peninsula). Furthermore, the climates in both areas are coastal. The coastal or maritime influence on local weather patterns might be great enough to change the synchrony.

A factor which may be responsible for the continental-wide synchrony of the hare cycle are sunspots which also are on a 10-11 year cycle. Many investigators have noticed the high correlation between the sunspot cycle and the snowshoe hare cycle but the precise factors in the environment influencing hares remains unknown. Because sunspots are also correlated with weather patterns, snowfall, wildfires and other environmental factors, it is specu-

lated that perhaps sunspots influence the climate and are thus responsible for synchronizing the hare cycle. Some recent research has suggested a connection between sunspots, ultra-violet radiation, the ozone layer in the earth's atmosphere, and warmer temperatures at higher northern latitudes.

An understanding of basic snowshoe hare biology and ecology is necessary in order to attempt to understand the snowshoe hare. At the input end of the population equation is reproduction. Reproduction is an important aspect of snowshoe hare biology and under ideal conditions hares can produce many young. Hares do not breed until one year following their birth. Then, each female has 1-4 litters per summer and between 1-14 baby hares (leverets) are born per litter. Early born litters nurse for about 24-28 days but later-born litters may be nursed longer up to 40 days. Under less than ideal conditions - when hares are declining - they may only have 2 litters per summer. At the other end of the population equation are the fates of hares. The causes of death and mortality rates of hares are another important component of the cyclic population equation.

Most snowshoe hares die of predation. Although snowshoe hares can live 5-6 years in the wild, over 70% are taken by predators each year. In some areas that have been intensively studied, between 81-100% of the monitored hares were killed by predators each year. Hares are an important food of both avian predators (raptors) and terrestrial (ground) predators. When hares are small they are taken by smaller predators including red squirrels, weasels (ermine), hawk-owls and other smaller raptors.

Adult hares are taken by great horned owls, goshawks coyotes, and lynx.. Since great horned owl and goshawks take both young and adult hares, they may be especially important as predators on snowshoe hares throughout the cycle. Higher proportions of snowshoe hares are taken by predators during the decline and low phases of the cycle than during the increase and peak phases.

And hares living in small patches of habitat appear to suffer higher mortality rates from predators than hares living in large blocks of habitat. Habitats themselves also have an influence on snowshoe hare densities. A recent summary of snowshoe hare habitat selection information indicated that hares appear to select habitats for protective cover from predators rather than for food and that dense understory vegetation is more important to hares than higher tree

canopy closure. On the Kenai Peninsula, peak snowshoe hare densities in the 1947 burn declined about 50% between the 1984-85 to 1997-98 peaks. Measurements of vegetation in these habitats suggests less food is available to hares in the winter because of heavy browsing by hares during the past cycle, competition with and concurrent heavy browsing by moose, and a less dense protective understory. In contrast, hare densities in the younger 1969 burn were higher than in the 1947 burn area during the 1997-98 peak because of a more abundant food supply and increasing protective cover from spruce trees in the understory. Hares appear to avoid open habitats despite the presence of food because they are subject to higher predation rates in open habitats.

Although hares have been known to disperse up to 12 miles, most spend their lives in a home range of 12-25 acres. Hares do not maintain territories, their home ranges overlap, and the home ranges of male hares are larger than those of female hares.

Hares move less in the winter than in the summer possibly to conserve energy and minimize exposure to the cold. In the winter, hares take advantage of warmer microclimates under dense shrubs. These obstructions intercept outgoing radiation from the snow at night and reradiate it back to the snow surface making it warmer than in open areas. Hares appear to need about half a pound of browse each day. To extract the most nutrient value from a low protein winter-browse diet, they excrete fibrous pellets quickly through their digestive system, and then reingest, or eat their own soft pellets again, to extract additional proteins and other nutrients.

Some woody plants (birch, alders, poplars) naturally contain, or respond to browsing by hares by producing, secondary compounds that make the plant unpalatable to feeding hares. Much of the work on this interesting aspect of snowshoe hare and plant ecology has been done by Dr. John Bryant at the University of Alaska in Fairbanks. For example, the numerous, resinous, small "bumps" one sees along the small stems of birch that are being browsed by hares and moose contain these compounds which makes them unpalatable to hares.

Despite the information and experiments on snowshoe hare populations a single and precise explanation of the snowshoe hare cycle is still forthcoming and may be unrealistic. It is unlikely that there is a single, simple cause and the more information we obtain, the more questions arise and the more complex we re-

alize the unique phenomenon really is. One aspect most biologist agree upon is that the cycle is caused by the complex interactions between hares and their food plants and between hares and their predators. Factors such as mass starvation, diseases and parasites, and stress-related hormones may contribute to but appear to play secondary roles in the cycle. Someday a complex ecological model may be developed that is close to

reality, but in the meantime populations of snowshoe hares will continue to rise and fall into the foreseeable future.

Ted Bailey, a supervisory wildlife biologist, has been responsible for the Kenai National Wildlife Refuge's biological programs for over 20 years. He and his staff monitor and conduct studies on a variety of refuge wildlife populations. He and his wife Mary live near Soldotna.

What do you do at the Kenai Refuge, and how do I get your job

by Bill Kent

“How do I get a job like yours?” “Was a college degree a requirement for your job?” “How do I get a summer job at the Refuge?” These and similar questions are directed to the staff at Kenai National Wildlife Refuge throughout the year.

I want to provide some background information as to how we did get these jobs. If you are reading this article, you probably have an interest in your “backyard neighbor,” the Kenai Refuge, and you may well have an interest in wildlife and natural history. Those readers not seeking a career change can file this information away in the “that’s interesting” part of their brain.

But, for younger readers, and for those considering a “life change,” perhaps this article can be the catalyst which encourages you to take that first step toward a career of working on a National Wildlife Refuge. Let’s take a look at the type of tasks performed on a Refuge on any given day, and how the Refuge staff is structured to get those jobs accomplished.

National Wildlife Refuges are managed for wildlife and for the habitats that critters need to survive...that is our primary mission. We make decisions regarding how many acres are needed for moose, or how to meet the “large undisturbed areas” requirements of brown bears. Consequently, many, if not most, of the jobs on a Refuge are filled by people with college degrees in wildlife biology or wildlife management, or closely related biological fields. Refuge Managers, Biologists, and Fire Management Officers are only a few of the positions included in this category. These positions require, at a minimum, a Bachelor’s degree in one of those fields. In recent years, because of the intricate concepts required to manage wildlife in an increasingly complex world, more of these positions now require post-graduate degree. The Kenai Refuge, for example, has two employees with Ph.D.’s and three with Masters degrees on the staff. Wildlife Refuges nationwide need employees with expertise in forestry, fisheries, range management, ecology, hydrology, and botany, as well as traditional wildlife biology.

Any Refuge Manager who has directed a Refuge for a few years will quickly tell you that the back-

bone of the Refuge staff is the administrative employees. These are the folks who you meet first, if you call or write our office. The administrative staff at Kenai Refuge handles a myriad of tasks, from making payments to businesses, answering and responding to phone calls and electronic mail, organizing and maintaining files, insuring the Refuge computer system is functioning properly, and (perhaps their largest task) making sure that the managers and other staff do what they should to keep the endless government paperwork flowing smoothly. Although a degree is not generally required for these positions, most of our administrative staff have taken college-level courses to improve their skills.

The Kenai Refuge has campgrounds, roads, trails, office buildings, heavy equipment, trucks, boats and other equipment and facilities. Have you ever wondered who keeps these things functioning and repaired? Our maintenance staff consists of mechanics, equipment operators, carpenters, welders, and other skilled professionals. Most of these people have multiple skills which are utilized on a daily basis. It is not uncommon to operate a road-grader in the morning, then perform vehicle repairs or work on a project in the wood shop in the afternoon. Many of us feel that the maintenance staff has the most interesting work on the Refuge because they get to do a variety of jobs in the course of a week. Like our administrative positions, these positions do not require a college degree; however, the skills needed for successfully performing these jobs require extensive training and a wide variety of experience.

The last group of employees at the Kenai Refuge are those I am most familiar with: the Public Use staff. We are responsible for managing all the human activities on the Refuge. These activities include operation of the Visitor Center, environmental education and interpretive programs, campground operations, Refuge brochures and other publications, law enforcement, commercial-use permits, and administration of the contract for the Russian River Ferry area. Many of these positions require a degree in park ad-

ministration, recreation, or in environmental education; for example, I have a B.S. Ed. degree in Park Management/Outdoor Recreation from the University of Georgia.

Most of our law enforcement officers have a college degree, in a variety of disciplines, including Park Management, Criminal Justice, and Wildlife Biology. We sometimes have summer seasonal positions in the Public Use program, and many recent college graduates with a major in one of the areas listed above gain valuable work experience at this or other Refuges.

“Well, that is all very interesting,” you say, “but I want to know how to get one of those jobs.” “How do I prepare myself, and how do I apply?” If you are a high-school student, or are in the first two years of college, and you think being a wildlife biologist or refuge manager is a career choice for you, then you should take as many natural sciences courses as possible. Once in college, the biology department faculty can steer you into the best major courses for the area in which you want to concentrate. The Personnel Officers at the U.S. Fish and Wildlife Service’s regional offices have publications available which provide current information on colleges and universities which offer majors in wildlife biology and/or management. The same offices can also help direct you to schools offering majors in park management or outdoor recreation.

Those interested in the maintenance arena should consider getting as much experience as possible in the operation and maintenance of motor vehicles, heavy equipment, and watercraft. Experience in welding, carpentry or other skilled trades is also valuable.

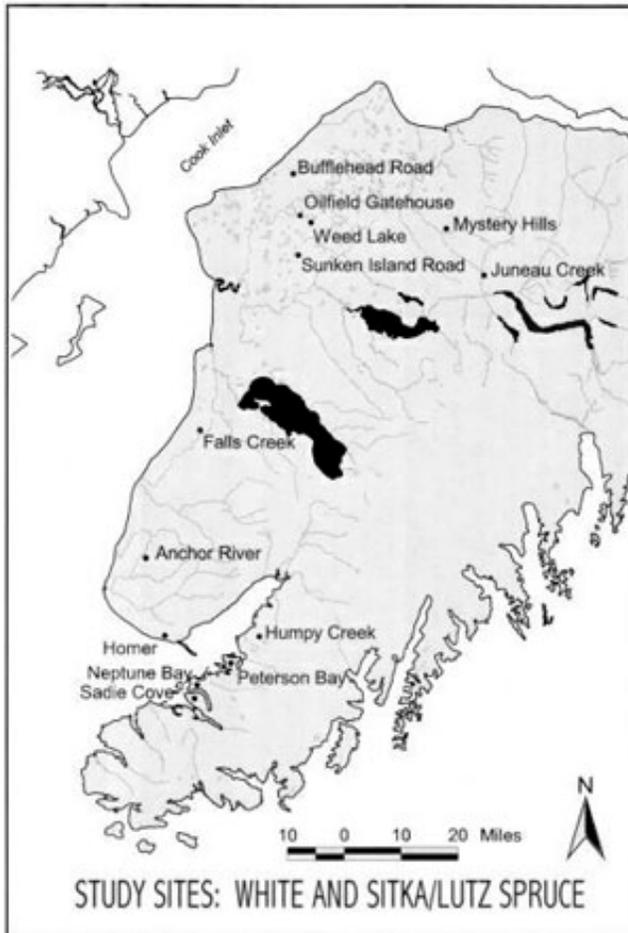
All positions on the Kenai Refuge are filled through a competitive process, with clear procedures established for applying through the US Fish and Wildlife Service Regional Personnel Office in Anchorage, which can be reached at (907) 786-3301. The Office of Personnel Management (OPM) also assists with recruitment for a wide variety of Federal positions through their website, where you can search for positions by job title or by agency (<https://www.usajobs.gov/>).

For high school students the Youth Conservation Corps (YCC) is an excellent introduction to working on a Wildlife Refuge. We hire ten high school YCC students every summer for eight weeks, and applications are due at our office by April 15, 2000. We also recruit about eight college-age students as volunteers through the Student Conservation Association (SCA) program. This is a national program, with information available at (603) 543-1700. We pay SCA volunteers \$90 per week subsistence, as well as free housing and airfare costs. We also have summer positions in vegetation surveying and fire management. These positions require college-level training in these subjects, and Federal job applications (Form 171 or equivalent) must be postmarked to our Regional Office in Anchorage by January 3, 2000. Applications can be picked up at Refuge headquarters on Ski Hill Road.

Bill Kent is the Supervisory Park Ranger for the Kenai National Wildlife Refuge. He has lived in Soldotna with his wife Lisa, and daughter Riley since 1991. Previous Refuge Notebook columns can be viewed on the Web at <http://www.fws.gov/refuge/kenai/>.

Spruce Bark Beetles in the past

by Ed Berg



When I first began my job as the ecologist at the Refuge in 1993, the spruce bark beetle outbreak was just shifting into high gear. I could see the beetles in the trees around my house out East End Road from Homer, and the Forest Service's 1993 aerial surveys reported red-needle (fresh beetle-kill) forest at 367,000 acres for the Kenai Peninsula. It was getting serious.

As an ecologist, my first question was: has this happened before? Is this a recurring disturbance like fire and windthrow, or is it a singular attack like the chestnut blight of the 1920-30's or the Dutch elm disease of 1950-70's? These two European imports changed the face forests and city streets throughout the East Coast and the Midwest.

So, was this now happening in Alaska? An invasion from the Outside, attacking our grand old spruce trees?

I reviewed local historical records and found little about past bark beetle activity. The earliest report on the Kenai was in 1950, around the edges of the 1947 burn near Skilak Lake. The Forest Service annual surveys picked up a lot of beetle-kill in the early 1970's from Pt. Possession to Sterling. (These surveys always showed local pockets of recent beetle-kill somewhere on the Peninsula in every survey. This is typical background low-level infestation, and it is normal for a variety of forest insect pests and diseases. Like bacteria and colds, these ailments are always present, but at low levels.)

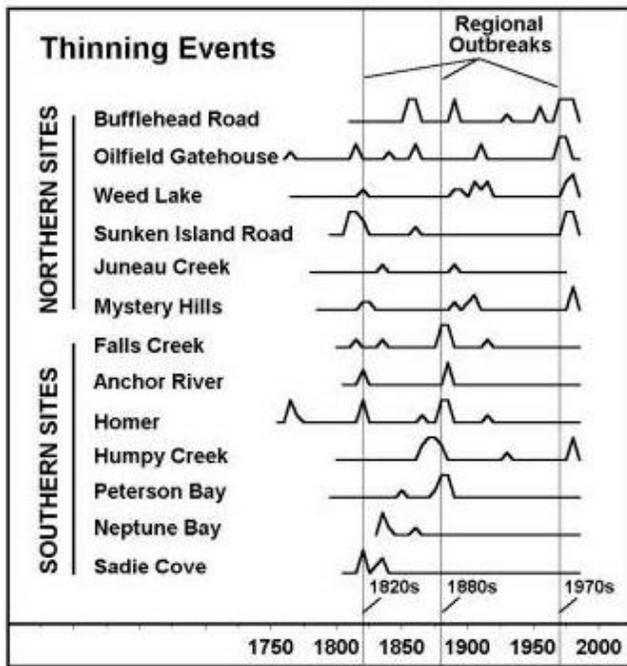
But what about major outbreaks? Had these occurred before? There simply was no historical record, but in a young state like Alaska, that doesn't mean much. In Norway they have been actively fighting the engraver beetle *Ips typographicus* for three hundred years with trap trees and thinning treatments. In a country like Norway you can go to the library to do ecological research, but here we have to go to the woods and start from scratch.

I found studies from Colorado where tree-rings showed evidence of massive bark beetle outbreaks in the 1940's and 1850's. The basic idea was that beetles kill the larger trees, and then the smaller (suppressed) trees are "released" from competition. They grow faster and put on wider rings.

Detecting growth releases in tree-rings requires very precise microscopic measurements of these tree-rings. I had done a bit of this work, called "dendrochronology," as a graduate student and knew more-or-less what kind of equipment was needed. I was able to hire a recent Ph.D. Chris Fastie who was well-trained in dendrochronology and was familiar with Alaskan conditions. To measure the tree-rings we bought a sliding bench micrometer and a good binocular microscope.

The sliding bench micrometer is adapted from an industrial milling machine and has a very sensitive electronic pickup, which allows easy measurement of tree ring-widths to an accuracy of 0.01mm. (The period at the end of this sentence measures 0.48mm, for example.) The measurements are recorded in a computer at the push of a button. Once set up, I can easily

measure 200 rings (years) in 20-30 minutes, and the data are stored in a computer file, ready for statistical analysis.



The accompanying map and graph summarize our bark beetle history studies to date. You can see the big outbreak of the 1970's along the Swanson River area (northern) sites, where a lot of dead beetle-kill trees are still standing (with death dates of 1970-71). The survivors released well in this area, although some of them have succumbed in the 1990's outbreak.

In the southern sites, the big release was in the 1880's, although on the south side of Kachemak Bay it appeared as early as the 1820's. Many (but not all) sites up and down the Peninsula showed at least a low-level release in the 1820's.

The release at Humpy Creek in the 1980's was due to a blowdown. In 1981 Jim Peterson of AK Division of Forestry reported a 300 acre blowdown in this area (at Mallard Bay, to be precise). Ed Holsten from the Forest Service watched minor red-needle activity percolating in this area during mid-1980's. Red needles began to spread rapidly in 1988 as summers warmed, and Mallard Bay became the "epicenter" for the outbreak on the south side of Kachemak Bay.

Some of the isolated releases on the graph may be due to blowdowns, but like Humpy Creek-Mallard Bay, they may well have been followed by beetles, because bark beetles love downed trees. (Beetle production from a downed tree is many times greater than

from a standing tree. This is why a freshly downed tree can be used as a trap tree - it is the favorite bark beetle habitat and it pulls them in like a magnet.)

The regional thinning on the graph (1820's, 1880's, 1970's) represent thinning (not blowdowns) of the forests covering thousands of acres. Nevertheless, most of the release events on the graph are small in comparison to the present bark beetle outbreak, with only 5-10% of the trees releasing in a stand in a given five-year period. This is low-level outbreaking, even on a regional scale.

Only one area - the north (Homer) side of Kachemak Bay in the 1880's - shows evidence of the kind of profound thinning that is occurring today in the southern Kenai forests. In 1994 we studied a recent clear-cut on the west side of Homer that showed a very exaggerated 1884 growth release in virtually every tree. We cut more than 500 slabs from a 4.5 acre tract, assisted by Stan Eller's biology classes from Homer High School. This was a very mature forest in the 1880's when the beetles hit it hard, and the survivors were highly suppressed understory poles averaging 3.5" in diameter. These were the same kind of skinny 2x4-sized poles that are still green in the otherwise dead forests in the same area today.

We had one particular bit of serendipitous good luck with the Homer site. Chris found a 1904 forestry survey of the Kenai Peninsula by William A. Langille, who in Alaska was the right-hand man of Gifford Pinchot under Teddy Roosevelt. Pinchot was in the process of creating what became (in 1905) the US Forest Service, and Langille became the supervisor of the new Alexander Archipelago Forest Reserve (today's Tongass NF) from 1905 to 1911.

In his 1904 report Langille puzzled about the standing dead forests between Homer and Anchor Point, with 40-100% mortality of the larger trees, and the thriving understory of smaller trees which were not "thrifty" (i.e., they had too many branches for clear saw lumber, indicating an open canopy with little competition). This 1904 understory is precisely what we sampled ninety years later as large 2' diameter trees, each with a pole-sized core of tight rings in the center. The fact that Langille reported the trees as "standing" indicates that this was not a blowdown, and he was unsure why they had died.

Langille visited this forest some 20 years after the large trees had died. The bark had probably fallen off, and Langille (who was not a college-trained forester) most likely would not have known how to recognize

beetle scars on old trees.

To a researcher with a trained eye, however, the beetle scars were probably fairly evident. Chris Fastie, for example, found an old leaner snag tree a few miles north of the Homer site with the maternal beetle gallery scars still quite visible. (These scars are about 3" long, parallel to the trunk.) Cross-dating the tree-rings yielded a death date of 1884 for this tree, which is the exact same year that most of our Homer trees began their dramatic release. We often say that this 1884 beetle-killed tree is as close to the "smoking gun" of direct evidence as we have gotten in our investigations of bark beetle history.

The upshot of these studies is that we have indeed had regional bark beetle outbreaks in the past, but not on the massive scale of the 1990's outbreak. In the past the forest recovered, either through released growth of suppressed survivors ("advanced regeneration") or through seedlings, often on nurse logs and stumps. The new factor today is the warmer climate. In my next article I will show how recent warmer summers have turned up the volume on beetle activity, probably through drought-stressing the trees.

Ed Berg has been an ecologist at the Kenai National Wildlife Refuge since 1993.