What will the new year bring?

by Robin West

Have we just finished the first year of the new millennium or are we just entering it? I don't know, but I do know that we are entering another new year along with its opportunities and uncertainties. Dusting off the crystal ball, I'll look ahead to predict a few things that the new year may bring to the Kenai National Wildlife Refuge.

The year 2001 brings the 60th anniversary of the Kenai Refuge. It's hard for me to imagine that President Roosevelt had time on December 16, 1941 to review and sign the Executive Order that established the Refuge (since this was merely days after the attack on Pearl Harbor). Even though there was not yet a road to the Kenai Peninsula, and only a sparse human population in the area, the values and wonders of the Kenai's wildlife and fisheries were recognized and set aside for special recognition and protection. The same values today draw people to the area, who often choose to live here because of the quality of life, even at the expense of higher paying jobs that they might find elsewhere. This is a testament, I like to think, to the success of the Refuge's mandated purposes for wildlife and habitat protection, clean water, and wildlife-dependent recreational opportunities. We expect to have some sort of 60th birthday party this year and we will have an open invitation to everyone to come and help us celebrate.

The winter of 2000/2001 has so far been abnormally mild, both in temperatures and amount of snowfall. While this is an unpleasant situation for winter recreation enthusiasts, it is good news for the wildlife. Lack of deep snow allows the moose to stay at higher elevations and take advantage of food they can't normally reach this time of year, and equally important, lack of snow helps keep the moose off the roads. Mild temperatures and low snowfall help most—but not all—wild creatures survive a difficult time of year. Wolves, however, find it much easier to catch their prey in deep snow. Scavengers such as raven and ermine benefit from the ill fortune of others by feasting on winter-killed animal carrion.

The outlook for fishing seems to be good for next year, and local sockeye anglers will have a new place to try their luck. Two new public fishing areas will open in 2001 within the Moose Range Meadows Subdivision just upriver of Soldotna. This is an area of public easements overlaying private land that have been closed to public access for several years to protect bank habitat. These new sites will provide parking, restroom facilities, boardwalks, and fish cleaning tables, and will be wheel chair accessible.

While South-central Alaska escaped major wild fire events in 2000, the Lower 48 certainly was not as fortunate. I see 2001 as a marked turning point for fire management on Federal public lands throughout the United States. Increased funding and attention should start producing more partnerships and education efforts for fuels reduction projects, wildfire prevention outreach, prescribed fire implementation, and wildfire suppression activities. Additionally, while it is certainly too early to tell, if low precipitation continues throughout the winter, dry conditions in the spring could increase local fire dangers.

It has been approximately 15 years since the Refuge Comprehensive Conservation Plan was completed and it is approaching the time when it will need to be updated. Public scoping for potential plan revisions could begin as early as fall 2001. The entire process is lengthy, probably taking about three years, and will provide ample opportunity for public involvement.

Plans are also underway for a new visitor center on the Refuge to assist the increasing number of visitors traveling to the Refuge each year, and expand outdoor education opportunities for local schools. While we won't be breaking ground in 2001, we do hope to make good progress in planning and design, and invite anyone interested to share their ideas with us.

Hunting opportunities should be as good or better than in 2000. While snowshoe hare numbers are down, other small game populations are doing well, and moose hunting success should be better in 2001. Additionally, there will be some new caribou hunting opportunity in the Tustumena Benchlands due to a steadily growing herd there.

Hikers will find some new places to stretch their muscles. The new Hideout Trail is now open and should provide some great views for hikers throughout the year. It can be accessed about a mile west of

the Andrew Berg cabin is most likely white spruce, given its large diameter (8") for an 88-year-old tree. The black spruce chronology correlated rather poorly with the white spruce chronology (at c = 0.33), indicating that white and black spruce respond somewhat differently to climate in this area. This is not unusual, and normally we try to avoid mixing species when cross-dating. Nevertheless, four of the five radii cross-dated to 1934, which is surprisingly good. The fifth radius dated to 1910, which is clearly a spurious correlation.

Cross-dating shows the death date of the tree, not when the building was constructed. A cabin could be built several years after the tree was killed, but not before that time. As noted, Andrew Berg's diary tells us that he began building this cabin in 1935. One might expect, however, that he cut many of the trees the year before in order to let them cure over the winter, so 1934 is an entirely acceptable death date for this log.

The dark part of a tree-ring is called the "latewood" and it typically forms in late July and August in this area. The late wood of our sample was just beginning to form and was not complete, indicating that the tree was probably cut in late July of 1934.

We would like to use this method to date older wood, say from archeological sites. Our present chronology could be extended back from 1601 by another 500 or 1000 years by adding more dead (and probably buried) wood. This would cover many of the Dena'ina house pit sites in the Soldotna–Kasilof area.

In western Prince William Sound, grad student David Barclay collected dead trees exposed by recent retreat of various glaciers. Using cross-dating, he developed a chronology back to 873 A.D. That chronology could be used to date archeological wood between Seward and Whittier, but it probably wouldn't work on this side of the mountains because the climate is so different.

Generally, if wood has been kept underwater or below the water table in the ground, it can remain sound for hundreds of years. Foundation excavations, drained lakes and wetlands, gravel pits, river bank erosion faces—any of these could turn up long-buried wood that is still pretty solid with useable rings.

So, let me put out a call to all home builders, excavators, and backhoe operators: if you dig up any solid logs, please give us a call at 260-2812 or 262-7021 so that we can get a sample (e.g., a disk). Your old logs might be the keys to unlocking some exciting archeological history of our Native predecessors.

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

Dating historic cabins and archeological sites with tree-rings

by Ed Berg

We've had lots of fun moving the old Andrew Berg homestead cabin up to the Refuge Headquarters. Our Youth Conservation Corps teenagers brought the logs up from Tustumena Lake last summer, and Refuge Historian Gary Titus mobilized many community volunteers for the cabin raising party in September. The new spruce shake roof is on, and the cabin is closed in for the winter.

Readers of this column may recall my articles about using tree-rings to date old wood. There are many old cabins on the Refuge; some are no more than a relict corner of logs protected by an overhanging spruce, others still have upright walls, and some are still in use today. Many of these structures can be dated with tree-rings because they were made with locally-grown trees.

Gary Titus wasn't quite convinced that such dating was possible, so I said we should put the idea to a test. We know from Andrew Berg's diary that he started putting up the logs for his cabin on April 21, 1935. If we were to date a log from this cabin, it shouldn't date any later than 1935.

To start the dating process, Gary sawed off a disc from a discarded log and sanded it well with a belt sander using 400-grit paper. I then took a sharp needle and scored five radii on the sanded face. The next step was to measure the width of the tree-rings year by year along each radius. This would give us five independent sets of ring-width measurements. We measured the ring-widths in our lab with a remarkable device called a "sliding bench micrometer," which is connected to a 60x microscope and a computer. With this machine we can easily measure ring-widths to 0.01 millimeter. We recorded each measurement on the computer by pressing a button. It took about 20 minutes to measure the 88 rings (years) of a single radius.

Next came the magic, called "cross-dating." With cross-dating, the measured (but undated) ring-widths of the sample are statistically compared with a reference series of dated ring-widths called a "chronology." Once the sample is properly lined up with the chronology, the age of each ring of the sample becomes known. The year of the outermost ring is the "death date" of the sample.

We used a chronology averaged from 91 trees in the Tustumena Lake area. Over the last several years Andy DeVolder and I have developed this chronology, starting with 48 live white spruce (with known outer ring dates), and subsequently adding many dead trees from the 19th century. The dead trees were cross-dated against the live trees, and then added to the chronology to extend it back in time. The chronology now covers the period 1601 to 1996.

In order to effectively cross-date dead wood, there must be some year-to-year variation in ring-widths, because cross-dating is based on the idea of matching up relative ring-widths between the unknown sample and the known chronology. The "fat" rings of the sample are matched with the fat rings of the chronology, and the "thin" rings are matched with the thin rings. If all the rings are the same width, this can't be done; one match is as good as another, and hence useless.

The disc from the Andrew Berg cabin was not especially promising; many of the rings were about the same size. This condition is described as "complacent" and it indicates a benign site with favorable growing conditions. For effective cross-dating we like a "stressed" tree, where the tree is sensitive to differences in growing season temperatures or precipitation, and there is much variation in ring-width from year to year. Furthermore, this tree was rather young, with only 88 rings.

Nevertheless, all five radii from the sample dated quite convincingly to 1934, with correlations ranging from c = 0.37 to 0.71 and a mean of c = 0.49, between the individual radii and the white spruce chronology. (A correlation of c = 1.00 is the highest possible score—a perfect correlation.) This is a remarkably good result, especially given a complacent sample, with only a moderate number of rings.

To further test the robustness of the methodology we cross-dated the five radii with a black spruce chronology, using 15 trees from the Windy Point burn area, covering the period 1769 to 1993. The log from

The wily coyote

by Elizabeth Jozwiak

The box says Acme Explosives: the target is that pesky roadrunner that zips through the desert canyons with one goal in life to tantalize Wile E. Coyote. In cartoons the coyote is always the victim of his own schemes; he gets bulldozed, blown up, and otherwise clobbered in every episode. In real life however, the tables are turned; it is the coyote that has the brains, the cunning, and the determination to survive.

Coyotes are actually doing quite well across North America. While most other larger carnivores such as the brown bear, wolf, and lynx have declined because of human encroachment and habitat loss, the coyote has adapted to living in the urban and suburban environment.

Prior to the arrival of European settlers, coyotes were found in the central part of the U.S. and in northern Mexico. Today their range extends from Panama to Alaska, including all of the continental U.S. states. The elimination of wolves from much of their historic range in North America has allowed the coyote to move in and increase its population and range with little competition from anyone.

In Alaska coyotes were first noted in the early 1900's. Populations were reported on the mainland of Southeast Alaska, and then slowly expanded northward into the upper Tanana Valley from which they radiated out in all directions. There are fewer coyotes north of the Yukon River. Coyotes probably expanded to the Kenai Peninsula when wolf numbers were extremely low due to predator control efforts in the 1920's -1950's. Coyotes filled the niche the wolf left, and may have reduced or eliminated the Peninsula's red fox population through competition.

However, all that changed when wolves returned and naturally recolonized the Kenai Peninsula in the 1960's. Coyotes continue to exist, but now they share the Peninsula with another (and larger) canid species, which does not tolerate them very well. In most cases, wolves are fiercely protective of their territories, and will kill any coyote they encounter.

Kenai Refuge studies of this rather unique coexistence of wolves and coyotes suggest that there is little direct competition for food resources. From scat analysis we have found coyotes to rely primarily on snowshoe hares, porcupines, small mammals, and road kills, while wolves preferred moose. Coyotes have also learned to avoid wolf packs because a confrontation usually results in the coyote's death. However, on one occasion several winters ago, as I watched a wolf pack feed on a moose kill, I observed a wary coyote come out of the trees and sneak quick bites of the moose carcass after the wolves retreated into the woods to rest. Studies in Minnesota and Michigan have documented coyotes living on the periphery of wolf packs and scavenging off their kills after the pack leaves the area.

Coyotes living close to human populations are usually safe from wolf encounters. Being true generalists, coyotes can change their diet from natural wild prey to accommodate whatever is available in an urban setting. Most of the time, coyotes go out of their way to avoid humans, but they are discovering that humans are a good source for food. This behavior can sometimes lead to conflicts with humans that own livestock and domestic pets.

Coyotes are opportunistic; they will kill and eat small dogs and house cats, and will even make a meal out of pet food or table scraps that are left outside. If certain precautions are followed, these kinds of encounters with coyotes can be minimized. Not allowing your domestic pets to roam freely and securing your livestock will probably keep a coyote from eyeing your turkey, cat, poodle, or rabbit as its next meal. Keeping your trash containers closed, and pet food in the house or barn will make these resources unavailable to coyotes.

The coyote, being one of the Kenai Peninsula's newest residents, has found its niche on the Peninsula, both within the wilderness of the Kenai Refuge as well as in our backyards. The next time you hear the coyote's high-pitched yips, barks, and howls, think about how this clever coyote has learned to "roll with the punches" and "go with the flow." If only we humans could be so adaptable!

Elizabeth Jozwiak is a wildlife biologist for the Kenai NWR. She studies a variety of Alaskan birds and mammals, but her current interest focuses on wolves. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

infested trees (leaving useable firewood for property owners). Some local neighborhoods have been very successful using the FireWise process. Your local fire chief, the fire managers at State Forestry and I are all willing to help you get started with a FireWise project in your neighborhood. Developing a source of firewood in your area can be an important part of the project, as well as the fire prevention aspect.

In almost ten years of public service here on the Kenai, I have worked with many people who were having trouble finding firewood to heat their homes. I know it isn't easy. But it is possible to access a supply of firewood with a little ingenuity, tenacity and effort. And please remember to be safe out there in the woods. Use proper techniques and personal protective equipment during your wood-cutting activities so you can enjoy many toasty fires this winter.

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

Firewood gathering on the Kenai Peninsula is not as easy as it seems

by Doug Newbould

You might think that with the millions of dead spruce trees on the Kenai Peninsula, getting a load of firewood should be a simple task. At almost any point on the road system where you can see mature stands of white spruce, you can bet that some of the trees are dead—victims of the spruce bark beetle. So, with a seemingly endless supply of dead firewood, why is it so hard to get a few cords laid up each year for those cold winter months?

In a word, the answer is—access. Whether it's a firewood permit for a special wood-cutting area on public lands, written permission to cut and remove wood from a private landowner, or enough snow on the ground for you to take your snowmachine out to that dead snag you've been eye-balling for the past six months…access is the key to successful firewood gathering. And I'm talking about legal access here. We all need to understand that every tree in the United States of America (including Alaska) is somebody's property. You own the trees on your land, your neighbor owns his/her trees, and we all own the trees on public lands—collectively.

If there were a wood-cutter's bible, the first commandment would be: "thou shalt not covet the trees on thy neighbors' lands." The second commandment should be: "thou shalt have written permission to remove any tree or wood product from any lands other than thine own." (Note: the *Refuge Notebook* editor has complained that I tend to get a little bit preachy in my columns, and I guess this proves him right.)

Ok, so how does one go about getting access to some firewood? Well it helps if you are resourceful, tenacious and hard-working. Or, you need enough money to pay someone else to be resourceful, tenacious and hard-working. The easy way is to pay for someone to deliver firewood to your house. You can expect to pay from $50 to $200 per cord of wood—depending on the species and quality of the wood; whether the wood is delivered in log or firewood lengths; if it's cut in rounds or split; and whether it's unloaded in a pile or stacked neatly. A cord is 128 cubic feet or a 4' x 4' x 8' stack of wood: that's a full-sized pickup truck bed with side racks loaded to the top of the cab.

If you don't want to pay someone else to get your firewood or you're one of those strange people (like me) who enjoy the whole process of firewood gathering (except for the sore back of course), here are some ideas about where to go:

Kenai National Wildlife Refuge [262-7021] - Personal use firewood permits can be purchased at Refuge Headquarters on Ski Hill Road in Soldotna. Permits are $20 (non-refundable) and limited to five cords per permit, per household. Maps of the permit area off Funny River Road are provided with each permit.

Alaska State Forestry [262-4124] - The State does not have a designated area for wood-cutting, but you can cut personal use firewood on non-designated State land (not in parks, habitat areas, etc.). Dead-standing trees or dead and down wood can be cut and removed from these non-designated State lands, free of charge and without a permit. The Division of Forestry office in Soldotna has land status maps to assist you in locating areas that are State-owned and legally accessible.

Chugach National Forest / Seward Ranger District [224-3374] - Dead standing or dead and down trees may be cut and removed from the Chugach National Forest without a permit, for personal use only. Areas that are closed to the removal of wood products include campgrounds, trailheads and active timber sales. Motorized vehicles may not be taken off forest roads and highways without a permit. Contact the Seward Ranger District for more information.

Private lands - Search the local bulletin boards and the classifieds for private landowners who are selling firewood. Some are giving it away if you will fall the trees and pile the slash. A more ambitious plan would be to team-up with your neighbors and complete a FireWise Community Action Plan. Your neighborhood "team" could contact owners of vacant lots, organize work crews to cut trees and dispose of slash, or contract with a logger to cut and remove dead and

the natural world too. We depend on it for air, water, food, shelter, necessities, and recreation. Not only can we minimize impacts on the natural world in selecting and cutting a Christmas tree, but we can also give nature a gift by acting in ways that care for and protect our living planet year round.

For more information on Christmas tree cutting and other refuge topics, call 262-7021 or visit the refuge web site at http://kenai.fws.gov.

Candace Ward has been a Park Ranger at Kenai National Wildlife Refuge for over 15 years. She coordinates the refuge's information and education programs. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

Cutting that special Christmas tree

by Candace Ward

Each year Kenai National Wildlife Refuge opens refuge lands to individual household Christmas tree cutting from Thanksgiving to Christmas. Many local folks enjoy their annual holiday outing to find the perfect tree and consider the "tree hunt" to be one of their favorite holiday traditions. Others get into a hurried rush over finding their tree and find the experience a pressured ordeal. After fifteen years of answering visitor questions on the "how-to" of finding the perfect tree, here are a few insights to make the experience for your family smoother, more fun, and kinder to the natural world.

First plan on making the outing fun for the whole family. With the driving time from the central peninsula to a refuge location and time on the ground to find your tree, you will spend an average of four hours. So, bring snacks, juice, and a few well-chosen audio tapes for the car trip. Bring layered clothing to stay comfortable and warm inside and outside the car. Bring a few pillows to let the kids and your spouse nap on the trip home.

Tools for cutting the tree need to be prepared before loading the family into the car. A sharp ax or hand saw is a must. Rope to tie the tree securely to the vehicle for the trip back is also essential. A measuring tape is a great addition to the tool kit especially if you measure the area in the house you plan to put the tree in ahead of time. That way when you are ready to cut, you can double check the tree for size before you cut it. Depending on snow conditions be sure to take snowshoes and a sled if you are going out in deep snow. If icy, give us a call at the refuge visitor center so we can update you about hazardous road conditions.

Take only one tree per household. Cut in the right place. On refuge lands to cut a Christmas tree you must be 150 ft. from any road, trail, access area, or water body (lake, stream, river, pond, etc.). The reason for this requirement is to spread out the impact of taking trees. Cut the tree as near to the ground as possible. This measure reduces the safety hazard of sharp stumps sticking out of the ground.

A few other tips for tree cutting include walking around the tree and making sure it is the right shape. Often the tree doesn't have to be perfectly symmetrical since one side usually faces a wall. If it's snowy, shake the tree so you see the true shape. Remember once you cut the tree it's yours. Discarding a tree to cut a "better" one is a "sure fire" way to get a ticket and you don't want your family outing to end in costly frustration.

Know where it's legal to take a tree in the refuge. The area around refuge headquarters in Soldotna is closed to taking of Christmas trees. The next closest refuge area to Soldotna for tree cutting is out Funny River Rd. Go past the airport and note the refuge entrance sign. The refuge borders the south side of Funny River Rd. for six miles and a tree can be cut in this area.

Traveling north from Sterling on Swanson River Rd., look for the refuge entrance sign just before Mosquito Lake. From this sign you are now in the refuge for the rest of Swanson River Rd. and also for Swan Lake Rd. Refuge oil field roads in this area are closed to vehicles, but you may enter on foot to cut a tree. Traveling east from Sterling look for the refuge entrance sign. The Sterling Highway corridor inside the refuge from this point to Russian River and Skilak Lake Rd. are legal areas to cut your tree. Remember that 150 ft. distance. That equals 50-70 adult walking strides.

Each year I ponder the cumulative impact of cutting thousands of young trees on the refuge. In Alaska with our short growing season many of the four to six ft. evergreen trees can be 20 to 50 years old depending on the species and the location. So even though it is perfectly legal to take a Christmas tree if you follow the previous guidelines, take a moment to think about ways to reduce your impact. Are you in an area where young trees are crowded? Thinning out a crowded tree can be beneficial to the entire stand. Is a tree injured or uprooted? Choosing an injured tree that won't make it over the long term will reduce the long term impact of Christmas tree cutting.

Christmas is a season where we celebrate our religious, cultural, and family heritages. We examine our relationships with family and friends and find ways to show our appreciation for them. When we reach out to others in the spirit of generosity, let's not forget

in an avalanche and manage to get out your machine will most likely be buried and it's hard to help find your friends without your gear.

- Educate yourself: Take an avalanche awareness course. For more information contact the Alaska Mountain Safety Center, 9140 Brewster's Dr, Anchorage (907-345-3566).

There is a free Avalanche Hazard Recognition Workshop on Saturday December 2nd at the Soldotna High School Auditorium from 9:00am to 5:30pm, sponsored by Kenai Peninsula Office of Emergency Management. Pre-registration is requested. Contact Kay Steele or Bonnie Hanson at the Kenai Peninsula Borough Office of Emergency Management: 262-4910 or toll free 800-478-4441.

The Kenai National Wildlife Refuge is presently closed to snowmobiles until sufficient snow depth accumulates to protect underlying vegetation and terrain. There are certain areas of the Refuge that are never open to snowmobiles. These include all areas above tree line, except the Caribou Hills, and all maintained roads in the Refuge. Within the Skilak Loop Special Management Area, snowmobiles are prohibited except on Hidden, Kelly, Peterson and Engineer Lakes for ice fishing access only. The Swanson River Canoe Route and The Swan Lake Canoe Route and portages are closed to snowmobiles. If you plan on riding on the Refuge this winter, stop by the Refuge Office on Ski Hill road for a snowmobile map. It is the riders' responsibility to know where they can and cannot ride. The map is free, but the fine for snowmobiling in a closed area is $100. Ride smart and ride safe, and we'll see you out on the trails!

Bruce Bigelow is a law enforcement officer at the Kenai National Wildlife Refuge. Previous Refuge Notebooks can be viewed on the web at http://www.fws.gov/refuge/kenai/.

Snowmachine season is almost here

by Bruce Bigelow

Snowmobiling is a popular winter recreation activity enjoyed by millions of people across North America and especially on the Kenai Peninsula. It can also be a dangerous activity and each year hundreds of people are seriously injured and killed while snowmobiling. The main causes of snowmobile accidents are alcohol and excessive speed. To enjoy the sport of snowmobiling safely, each rider needs to accept responsibility for his or her own safety and survival.

Safety Tips

- Always wear a safety-certified helmet: Your helmet needs to be snug fitting and should include a face shield or goggles. The helmet provides protection from the cold and wind as well as from impact.

- Dress appropriately: Dress in layers so you can add or remove a layer to match changing conditions and activity level. Start with a layer of synthetic or wool long underwear; cotton looses its insulating properties when it gets wet and should be avoided. Add layers of wool, synthetic fleece or other heat retentive fabrics depending on the temperatures. The outside layer needs to be windproof because the windchill added by even slow travel on a snowmobile is significant. Avoid tight fitting boots and gloves that may restrict circulation.

- Don't drink and ride: Alcohol impairs judgment and increases the risk of hypothermia, a cooling of the body's temperature that can be fatal. ALCOHOL DOES NOT WARM A CHILLED PERSON. Instead it opens the body's blood vessels and removes the feeling of chill leaving the person more susceptible to the cold. DUI on a snowmobile is the same charge as DUI in a car; you will LOOSE YOUR DRIVERS LICENSE if you are caught riding under the influence.

- Keep your eyes open and the speed reasonable: Kenai Peninsula trails are used by skiers and dog mushers, as well as by other snowmachiners. Don't go into a limited visibility situation at a high speed—there may be somebody on the trail just over the hill or around the bend.

- Keep your machine in good working order: Have it checked over and serviced before the riding season. Follow the pre-ride checklist in your owner's manual. A 5-minute check at home or at the trailhead can help you avoid being stranded by a breakdown in the field. Always carry a tool kit with a spare drive belt, towrope, spark plugs

- Don't ride alone: Always ride with a friend and stay together in the field.

- Leave a trip plan: Let a responsible person know where you are going and when you expect to be back.

- Bring snowshoes: Strap them on the back of your machine; if you break down they may be your only way out.

- Stay physically fit: Riding a machine, especially in deep snow is a rigorous workout. Don't ride with anyone who couldn't make it back in the event of breakdown.

- Bring a winter survival kit: First aid kit, matches and fire starter (railroad flares work great, are water resistant and can double as a signal), map and compass, flashlight with extra batteries, sleeping bag, high calorie food, metal container to melt snow. A cell phone is a great addition to the survival kit but you still need to bring the basics (cell phones don't keep you very warm and are hard to eat). An extra cell phone battery can prove very useful, especially if warmed in an armpit.

- Carry avalanche gear in the mountains: Shovel, probe and avalanche transceiver. You need all three items together; one is not much help without the other. It is best to carry your avalanche gear on your person (in a backpack) instead of strapped to your machine. If you are involved

ing up to 100 feet from early 1990's shorelines.

All of these ecological changes and studies support the fact that the climate is warming, especially in recent decades, and that this warming is having an impact on the refuge and the rest of the Kenai Peninsula.

What do all these changes mean for fish and wildlife? The bottom line is that we often don't know, because of the complexity of ecosystems and our lack of knowledge of how northern landscapes will continue to respond to climatic warming. However, some earlier predictions have already come true. One was the prediction that a warming climate could trigger substantial insect outbreaks in the northern boreal forest. The present round of spruce bark beetle outbreaks on the central and northern Kenai Peninsula began in the early 1970's. Analysis of past Kenai Peninsula weather data by ecologist Ed Berg on the refuge staff has revealed warming temperatures with greater evaporation and water loss by plants (transpiration), beginning with the drought of 1968-69. This has meant about 35% less water available for plant growth, stream discharge and groundwater recharge. Less available water has meant more drought-stressed trees and spruce bark beetle infestation, as well as falling lake levels and dried up ponds.

Loss of mature white spruce forest could affect populations of spruce grouse, red squirrels, and neotropical migrant birds, such as Townsend warblers, which breed on the refuge. In our annual spring breeding bird surveys we have not in the past seven years recorded any of these specialized warblers, which favor mature white spruce forest. Declining water levels could influence numbers of breeding shorebirds, waterfowl and waterbirds on the Peninsula. Fewer favored places are available for breeding wood frogs and other species that rely on small ponds for survival.

What does the future hold for us and the many forms of life that share the Kenai Peninsula? We are entering an era never before witnessed by modern humans. At best, we will continue to document the changes, but only after they have already occurred and those changes that are most obvious. Sometimes we'll attempt to predict some outcomes, and maybe we'll be right or wrong. Many of these changes will eventually affect our lives and those of our children. We will have to adapt and perhaps change our lifestyles. Water tables, trees and other vegetation, and fish and wildlife distribution and populations will likely continue to change. More subtle changes may completely escape our notice until they are later pointed out by future researchers. Some of the researchers' predictions have already come true on a local as well as a global scale. But regardless of the confirmation, accuracy or timing of the predictions, significant changes are occurring and we are all along for the ride.

Ted Bailey is a supervisory wildlife biologist and has been responsible for the Kenai National Wildlife Refuge's biological programs for over 20 years. He and his staff monitor and conduct studies of ecological conditions and wildlife on the refuge. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

Ecological changes obvious on the Kenai Peninsula

by Ted Bailey

Many significant ecological changes are occurring on the Kenai Peninsula. Some have occurred so slowly or are so subtle that they escape notice of the casual observer confined to viewing the landscape from the ground. Those who have lived on the Kenai more than 20 years and have spent a lot of time flying over the Peninsula can readily relate to some of these changes because of their advantageous "bird's-eye" aerial view. Having met both of these criteria, I would like to share a few of the changes I have noticed since the 1970's. Most of the changes have become much more visible during the 1990's.

Some of the most obvious changes are the retreating glaciers and the shrinking Harding Icefield. These changes are most conspicuous to me because I can readily remember the different locations of the ice edges and adjacent rock or water. For example, in the late 1970's, the fronts of the two major glaciers—Skilak and Tustumena—were much farther down their valleys than they are today. An 1898 photograph of big-game hunter Dall DeWeese with the Tustumena Glacier in the background shows the front of the glacier well to the west of a prominent rocky point on the north side of the valley. No large lake can be seen at the glacier face. Aerial photographs taken 52 years (in 1950) and 78 years later (in 1976) show the face of Tustumena glacier still lying roughly one-half mile west of this point, but with a lake developing at the glacier face. That is where I remember seeing the Tustumena glacier on one of my first wildlife survey flights over the area in the late 1970's.

However, after a relatively brief period of twenty years, the face of Tustumena Glacier today has retreated well eastward of the rocky point, and a large glacial lake lies between the face and a prominent moraine formed about 1864. Detailed studies of glacial retreat on the Kenai Peninsula by Gregory Wiles from the Lamont-Doherty Earth Observatory at Columbia University confirm the retreat of Tustumena Glacier. According to Wiles, who dated the moraines with tree-rings and lichen diameters, the glacier started backing up at the end of the Little Ice Age in the mid-1850's, and its retreat appears to have been accelerated by the formation of the lake at its face.

Simultaneous with the pullback of Tustumena Glacier has been the periodic draining of a nearby meltwater lake. At least twice in the past five years, the large Arctic Lake has completely drained out underneath Tustumena Glacier, causing noticeable water level rises in Tustumena Lake and its outflowing Kasilof River.

The retreat of Skilak Glacier has been even more pronounced, especially during the last ten years. Skilak Glacier has now retreated well over one-half mile up valley, and a large glacial lake lies between the face of the glacier and its 1970's location.

Edges of the Harding Icefield have also retreated, exposing more rock and mountain slopes. This melting of ice was quantified in a recent study by Gudfinna Adalgeirsdottir from the University of Alaska-Fairbanks. Using aerial photographs she estimated the total volume of ice of the Harding Icefield has shrunk by about 8 cubic miles over a 43-year period; this translates into a loss of about 70 feet of icefield thickness since 1950. I found especially interesting her observation that the ice thickness on Skilak Glacier shrunk 10 feet between 1994 and 1996; this agrees with my "eyeball" observations that the rate of melting has accelerated over the last decade.

Significant changes have also occurred in the refuge lowlands over the past 20-30 years. Vast areas of spruce forest from Point Possession at the northern tip of the Peninsula to the Fox River Valley in the southern region of the refuge have been heavily thinned by the spruce bark beetle. In forested areas once dominated by mature white spruce trees, the canopy is now more open and the understory vegetation is changing.

Furthermore, the levels of numerous closed-basin lakes have dropped and many exposed lake shorelines are evident. The most evident shrinking lakes are in the Mystery Creek area and include Picnic, Browse, and Campsite Lakes, as well as nearby Dogteam and Upper Jean Lakes. In other shrinking lakes, new peninsulas and islands are appearing as lake levels drop. On a smaller scale, numerous small ponds once used by breeding wood frogs have dried up completely; other ponds have found their margins shrink-

From the Refuge to "The Abyss"

by Dianne MacLean

People come to Alaska for a variety of reasons. For some it's definitely a fling: the great fishing, abundant wildlife, every day a Kodak moment, then returning home to the security of routines and the conveniences of modern lifestyles. But for some, Alaska is true love, and it is not enough to be a spectator. There are many people like that on the Peninsula, and many who work on the Refuge. They live within the seasons, cycles, and challenges that are unique to life here, often exposed to unforgiving circumstances where routine decisions affect the well-being of everyone involved. The setting is beyond your average great place to be; the logistics are more complicated, the weather is more unpredictable, help is much further away. Alaska provides the yardstick of "bigness" against which other places are measured.

During the past fire season I was sent from the Kenai Refuge to a fire on the North Rim of the Grand Canyon. I thought that would be…'nice.' But compared to the grandness of the Chugach range, or Prince William Sound, or the Kenai Peninsula, just how "grand" could the Grand Canyon be?

My assignment was to manage the helicopter base, where I would address the needs of the aircraft and their crews, and respond to the priorities of the fire. In short, my job was to make things run better, rather than worse, regarding helicopter efficiency and safety. The Grand Canyon National Park has facilities on both the north rim of the canyon and the south rim. Flying between the south rim and north rim is known as "crossing the abyss."

Visitors to the rims can use picnic tables along the paved drives, or enjoy the massive stone and timber lodge, shops and restaurants. Step away from those conveniences and the visitor, or the firefighter, is engulfed in a hostile environment the scale of which I had not seen anywhere outside of Alaska. Outings rapidly escalate into life-or-death situations when people come ill-prepared, still accustomed to security and convenience. Even those of us whose jobs demand preparedness found sudden shock in any lapse: failure to carry enough water, to allow enough time, to anticipate the worst.

Late one afternoon, a call for help came in to our helibase. A rafting accident had just put 15 people into the Colorado River, and the Park needed a helicopter from the fire to help pull them out of the canyon, before it got too dark. As we flew from the North Rim, our pilot radioed that we were "crossing the abyss." Our ship might as well have been a mosquito transported to Mars. The scene was otherworldly—beautiful and vast on the scale of the Chugach Mountains turned upside down. Trying to take a photograph seemed pointless. A twisted car body lay nestled among rocky teeth several hundred feet below the south rim, where a despondent individual had driven off a month before.

The helicopter threaded downward through the narrow canyon walls. On the ground, the turning rotors generated a wind of superheated canyon air that was painful to breath, and we rescuers were made aware of our own vulnerability: the immediate need to drink, to have brought enough gear, to not lose communications with the rest of the world. The rescue proceeded in that tense, forced calm so necessary in emergency response. It brought a sense of accomplishment as a team, of appreciation for one another's abilities. As our pilot called in that we had just crossed back over the abyss and were returning to the helibase, I thought about Alaska and the Grand Canyon and of their similar, beautiful harshness. Without this harshness, many things would be easier, but there would be no test, less of a challenge to meet, and perhaps less of life to appreciate.

Dianne MacLean is a career firefighter, working in both prescribed fire and fire suppression. She came to the Kenai Refuge last year from the Forest Service, after working several summers on the Chugach National Forest, which followed twelve years of service on the Okanogen National Forest in Washington. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

sider the "Crown Jewel" of the Kenai National Wildlife Refuge.

Gary Titus is the Wilderness Ranger and Historian at the Kenai National Wildlife Refuge. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

The Alaska Guides took trophy hunters to Tustumena Lake in 1920-30's

by Gary Titus

Many people have lived on the Kenai Peninsula for years and have never seen one of its most striking features—Tustumena Lake. This huge lake (25 miles long and five miles wide) is almost as big as Kachemak Bay, but it is off the road system and is usually accessed by boat from the Kasilof River. Historical log cabins are found occasionally along on the shores of Tustumena Lake, and the moose, bear, sheep and other game that roam the hills have long attracted the interest of outdoorsmen. Herein lies the story of one such outdoorsman Gus Gelles and his trophy hunt guide business—the Alaska Guides, Inc.

In the fall of 1925 Gelles, a salesman and entrepreneur from Anchorage, flew with pioneer aviator Russell Merrill over the Kenai Peninsula, checking out good hunting and fishing areas. Gelles had the idea of organizing the peninsula's hunting guides into one organization. In 1926 he formed the Alaska Glacier Tours Association (AGTA), with headquarters in Anchorage, and a base camp called "Birchwood" on the northeast shore of Tustumena Lake near the mouth of Bear Creek (formerly known as Birch Creek). In 1927 Gelles changed the Association's name to the Alaska Guides, Inc., by which name the group is usually remembered today.

On August 13, 1926 the Association's first group of hunters arrived from Seattle. They made the trip from Anchorage to Kasilof on the Association's new boat AGTA, and continued up the Kasilof River by powerboat. The party was guided by Alex Liska, Fred Judd and Andrew Berg. After spending a month hunting in the Tustumena Lake area and taking many motion pictures of game, the hunters returned to Anchorage enthusiastic over the experiences they had enjoyed on their trip.

The hunting camps of the Alaska Guides were of the highest standards; at the Birchwood base camp, wall tents were equipped with chairs, dressing tables, rugs, spring beds, mattresses, sheets and pillow cases. Fires were laid each morning and evening. The hunters traveled from the base camp by horseback to moose camps and sheep camps. Packers were sent ahead to set up the camps with all the comforts, including a cook.

A sure sign of a good hunting camp is the quality of the food. For example, consider this dinner menu served at the Alaska Guides' base camp by chef Andy Leland: cream of oyster soup, cold slaw, sweet and sour pickles, brook trout, tenderloin of moose a la hamburg with onion dressing, served with wild cranberry sauce; boiled ham and cabbage, sweet potatoes, white potatoes, creamed peas, mushrooms fried in butter, Tustumena frijoles, white and raisin bread, hot baking powder biscuits, strawberries, coconut banana layer cake, sugar cookies, doughnuts, molasses drop cakes, creamed Swiss cheese, tea and coffee.

A typical hunt would cost about $1324, which included round trip from Seattle to Seward via steamer, round trip from Seward to Anchorage via railroad, and roundtrip by plane or boat to Tustumena Lake, complete with guides, food and lodging.

Well-known personalities hunted with the Alaska Guides: Coloman Jonas, the president of the Denver taxidermy firm Jonas Brothers; Captain Billy Fawcett, publisher of "Whiz Bang" magazine; and Van Campen Heilner, field representative of the American Museum of Natural History and associate editor of "Field and Stream" magazine, to name a few.

In 1930 the Alaska Guides was the largest organization of its kind in the world; they employed 45 men and had brought in $250,000 dollars over the previous five-year period. They had $25,000 invested in sixty head of horses, saddles and camp equipment.

The Alaska Guides operated in the Tustumena Lake region into the late 1930's, when the company was finally disbanded due to financial difficulties. Today all that remains of the Birchwood camp are a few logs and faded photographs of happy outdoorsmen.

Tustumena Lake still attracts hunters from all over the world for moose, caribou, Dall sheep and bears. Hikers and horsemen continue to explore the vast wilderness. Fishermen test their skills with the wide variety of fish, and all users enjoy the untrammeled beauty of Tustumena Lake, which many would con-

day, 24 in possession; sea ducks, 10 per day, 20 in possession; dark geese four per day, eight in possession; white geese three per day, six in possession; snipe eight per day, 16 in possession; and sandhill cranes two per day, four in possession. Lead shot may not be used or possessed while waterfowl hunting, so be sure to clean out your jacket from the grouse hunt. Successful hunters must leave a fully feathered wing or head attached to the bird for species identification. Shotguns must be capable of holding no more than three shells total. Motor boats cannot have their motor running; all forward progress must be stopped prior to shooting from a boat. Birds cannot be intentionally harassed for the benefit of the hunter. Finally, baiting is not allowed at any time for migratory birds. Additional regulations can be found in a pamphlet available at Refuge Headquarters, Alaska Department of Fish and Game Headquarters, and at local sporting goods stores.

Rob Barto is a law enforcement officer on the Kenai National Wildlife Refuge. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

Waterfowl hunting on the Kenai National Wildlife Refuge

by Rob Barto

As the snow starts to fly and the weather turns foul, it's time to dust off the over-under, mend the decoys, practice calling, start retraining the faithful Lab, and get out to enjoy some of the excellent waterfowl hunting opportunities on the Kenai National Wildlife Refuge. The Refuge is home to some of the finest duck hunting available by vehicle or short boat ride on the Peninsula. The Chickaloon River flats, Tustumena glacier flats, and the inlet and outlet of the Kenai River at Skilak Lake can all provide the diehard waterfowl hunter with ample places and opportunities to enjoy the last hunt of the year.

The toughest place to access is the Chickaloon River flats located on the northern edge of the Kenai Peninsula. Whether you take the three-hour drive out Mystery Creek Road, use four-wheelers along the beach from Captain Cook, or fly in with a friend, the Chickaloon flats can provide some excellent early and late season shooting. Mystery Creek Road is a long 36 miles, following the Enstar gas pipeline to Turnagain Arm. At best the road is marginally drivable; a four-wheel drive with good tires is a must, and a shovel, come-along, jack, cell phone, and overnight gear are highly recommended. If you have a four-wheeler, the best option is to start from Captain Cook State Recreation Area at low tide, follow the beach to the Refuge boundary, and hike from there. Hunters are reminded that the Refuge is closed to off-the-road vehicles; if not licensed through the State DMV, it's not allowed on the Refuge. Aircraft are a final option for reaching the Chickaloon flats. There are three landing strips on the flats, which are described in our aircraft brochure available at Refuge Headquarters.

Once you have made it to the Chickaloon flats, what kind of hunting can be expected? Both pass shooting and decoys can be successful on the flats. Decoy hunters typically set up on little ponds and sloughs near the Chickaloon River. Pass shooters tend to walk out onto the flats and hunt with the tide change. If you decide to try your hand at pass shooting, remember that the flats can be very tricky to navigate, and always keep your eye on the incoming tide. I speak from personal experience of having to swim across a slough that had been dry when I crossed it not 15 minutes earlier. During the fall hunting season all types of ducks use the flats, along with Canada geese, sandhill cranes, and occasional snow geese.

If your are looking for a spot somewhat easier to access but with limited hunting pressure, then try heading across Tustumena Lake to the glacier flats. These flats are located on the east side of Tustumena Lake, about an hour boat ride from the Kasilof River boat launch. The hunting on the flats can be excellent because hunters further south are pushing the birds out of the Fox River drainage. You can expect to find a variety of dabblers as well as divers using the flats. Most hunters that I have talked with in this area prefer to jump hunt rather than setting up decoys.

Folks hunting the Tustumena flats, as always, should be mindful of the presence of brown bears. Glacier Creek on the northern edge of the flats is home to a fairly large salmon run in the fall, as well as a good concentration of brown bears fattening up for the winter. As with all glacial lakes, the wind on Tustumena Lake can be fierce and unpredictable, so pack your survival gear and be prepared to spend an extra day if need be.

Two good spots for hunters that don't want to spend time boating across Tustumena Lake are the inlet and outlet of the Kenai River at Skilak Lake. You can reach the inlet by boating eastward around the corner from Upper Skilak Campground; the outlet is best reached by boating westward from Lower Skilak Campground. In either case you'll find a good variety of ducks. Waterfowl hunters are reminded that hunting is restricted to the south shore of the Kenai River.

Hunters who use the Kenai River below Skilak Lake will typically have a little better luck because fishermen moving up and down the river tend to keep the birds moving even on the calmest of days. Hunting both above and below Skilak Lake is best done with decoys placed in marshy areas. Many diving ducks use these areas, but mallards, teal, and widgeon will also fill the bag, if a hunter has patience.

Now that we know some of the places with good hunting, let's quickly review the basic regulations that govern waterfowl hunting. Bag/possession limits are as follows for the entire Peninsula: ducks eight per

found late that same afternoon. It was six inches long and made from ground slate. I was thrilled to hold it and I could tell by the brightness of the eyes around me, that I was not the only one feeling a connection with a long ago time. According to Corbett this artifact, very characteristic of Eskimo and Kachemak peoples, gives every indication that this was a 2000-year-old Kachemak single family home, not a potlatch or meeting house as originally thought.

Part of the learning process for the campers and archeologists is the time spent back at camp with discussions, questions, and making crafts with native tools and methods. Informal discussions with the kids lead to many questions about the Dena'ina and their way of life and beliefs. Trade and connections between the different peoples have sparked great interest, as have discussions about rivers and floods.

Not only were the kids digging up artifacts, they were also making some of their own. Using traditional native methods and hand tools the campers created jewelry and learned how to start fires with bow drills. I watched the kids sitting with stone tools hammering and chipping away, laughing and enjoying their chance at creativity in the ancient way. The kids were also required to contribute to the final yearly report on the dig. Some entries included drawings, stories and poems. Corbett enjoyed pointing out the quality of imagination and talent with which each camper had engineered his or her project.

Though I spent only a few hours with the campers and archeologists, I went home that night with a growing awareness of the Alaska I had come to enjoy during my summer's work. I have begun to learn the stories of the people that have made the Kenai Peninsula home. In spending time with the campers I realized that I had been watching some of them learning firsthand about their families and ancestors. It was as if they were opening up scrapbooks and picture albums for the first time. For those campers and archeologists with no family ties, they too found inspiration in the thrill of discovery and the adventure it provided. I remember well seeing the campers and waving good-by to them later in the summer, as they left on their last day, bound for Homer to bring their artifacts, cataloged and labeled, to the Pratt Museum for all of us to see and enjoy in the future.

Rachel Belouin is a senior at the University of Massachusetts majoring in outdoor recreation. She participated as a volunteer Student Conservation Association Resource Assistant on Kenai National Wildlife Refuge during the 2000 summer season. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

Future archeologists explore Kenai Peninsula's past

by Rachel Belouin

Within the Kenai National Wildlife Refuge, just a stone's throw away from combat fishing on the Russian River, a group of young campers aided by professional archeologists spent the summer learning the stories and history of the Dena'ina (Athabaskan) and Kachemak Tradition (Eskimo) peoples. This group of campers from the Kenaitze camp in Cooper Landing spent three weeks practicing the ways of archeologists as they uncovered artifacts and structures that belonged to early Russian River fishermen five hundred to two thousand years ago. This past summer I had a chance to spend a day with this group of campers and their counselors.

When I first arrived at the site, several hundred yards back from the bank overlooking the Kenai River, I found a hard working crew of campers and archeologists. Some were in the excavation pit, digging and scraping soil and rock with trowels into blue plastic buckets. The pit itself was not large, but separate rooms were distinguishable. Other campers were dumping the scraped earth into a large screen and sifting through the blackened soil looking for the smallest artifacts, while several campers and counselors worked on bagging and labeling their new finds. I was greeted with excited smiles and hellos as the campers came to tell stories of their different discoveries. Debbie Corbett, project leader and US Fish and Wildlife archeologist, patiently guided me through the project's history and accomplishments. This particular endeavor began three years ago when the Kenaitze camp for native children and the US Forest Service started a partnership to involve native children in activities within the Chugach Mountains and surrounding areas. Native Kenaitze children are given first preference to be camp participants, but Corbett assured me that no one has been turned down and that there has been a good mix of native and non-native kids attending the camp. Camper ages range from 12 to 18 years old, and sometimes a bit younger. For three weeks the campers are exposed to cultural experiences, learn about natural resources, and participate in an overall broad resource experience. Approximately half of the campers return each year.

As part of their work, the campers had to dig, record, sift, and ensure that all artifacts were accurately recorded. The campers also spent time working at the Kenaitze Tribe interpretive site where they made a catalog of artifacts with labels and full descriptions. The campers learned how to recognize artifacts and seemed very adept at finding and identifying fragments of bone. They also became skilled in recognizing changes in soil color and texture that indicated postholes and fire pits. As I watched the junior archeologists scurrying about the dig site, I was impressed by how assured the kids were of their tools and knowledge of how to properly dig and sort through the dark black soil. They often interrupting my conversation with Corbett to present a possible artifact, some smaller than their tiniest finger. Others were hollering to proudly point out where they had discovered the remains a fire pit and to show their knowledge that the dark black soil color was caused by charcoal. According to Corbett, three levels have been identified and dated within the pit, ranging from about 500 to 2000 years in age. The first level is 500 to 800 years old and has revealed copper, obsidian, and black slate beads, as well as old fireplaces and postholes that Corbett believes were part of a structure for smoking and drying fish.

The second level, 1000 years old, has yielded a lens of black charcoal soil, boulder spalls for processing fish, fire-cracked rock, scrapers, and worked slate. One boy in his second year on the dig explained that fire-cracked rock is rock which was heated up in fires and then put in baskets to heat food or to use for steam baths. Level two has also revealed bones, most of which were burnt. A lab in Vancouver has identified these bones and the kids reported excitedly that some of the bones were from two sizes of salmon, rockfish from salt water, various ducks, cormorants, and marmots. Corbett believes that level two may mark the Dena'ina's first arrival on the Peninsula.

The third level, where the campers were currently digging, has turned up numerous artifacts, including net sinkers which are characteristic of the Kachemak Tradition people. That evening, well after I had left the dig, Corbett and several of the campers excitedly sought me out to show me a spear point that they had

growth. On July 10th Refuge Biotech Doug Fisher, forest ecologist Andy DeVolder and I flew over to the Polly Creek beach, where we met John Swiss who homesteaded a setnet site here in 1949. John and his sons Tyler and Jack described their extensive efforts to clear fire-defensible space around their buildings, because the surrounding spruce forest was almost 100% beetle-killed. For the next three days we cored trees with increment borers to sample the tree-rings, collecting 120 cores, with the oldest dating back to 1696.

Back in our lab at Refuge Headquarters, Biotechs Candy Godin and Archer Larned set to work measuring the tree-ring widths in our core samples. When we analyzed all these measurements we could see a general period of accelerated growth from 1870 to 1890, especially in 1878-1880 when 24% of the trees initiated a growth release. With almost a quarter of the trees releasing in this three-year period, we can infer the occurrence of a major thinning of the forest canopy, i.e., substantial death of large overstory trees. When the Harriman Expedition in 1899 observed dead forests on the west side of Cook Inlet, they were presumably observing this mortality, which had peaked 20 years earlier, just as it had peaked earlier on the Kenai Peninsula side of the Inlet.

Polly Creek is the only site we have examined on the west side of the Cook Inlet, but it tends to confirm our view that the present bark beetle outbreak is basically a replay of the of the 1870-80's outbreak. Both outbreaks have affected hundreds of thousands of acres of spruce forest on both sides of the Inlet, and the outbreaks have lasted ten years or more in a given area. In both outbreaks, sites with sunny southern exposures have been hit the hardest, presumably due to drought-stressed trees. Conversely, sites on cool, steep north-facing slopes have experienced less beetle kill, or in the case of Neptune Bay, they escaped the 1870-80's outbreak altogether.

The comments, however brief, of the Harriman Expedition writers about the dead forests in Cook Inlet have added another valuable piece of information to the spruce bark beetle story of southcentral Alaska. I would be very interested in hearing from readers who might know of other such historical reports of dead forests. This might take the form of old letters, newspaper articles, maps, or photos. The spruce bark beetle puzzle is slowly coming together, but we need more pieces!

An excellent collection of photos from the 1899 Harriman Expedition can be viewed on the web at http://128.95.104.14/index.html (University of Washington archives).

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. He can be reached at Refuge Headquarters at 262-7021. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

Bark beetles hit west side of Cook Inlet in the 1870-80's

by Ed Berg

In late July 1899 the steamship Geo. W. Elder of the Harriman Alaska Expedition sailed into lower Cook Inlet, as far north as Iliamna volcano. The Expedition was financed by railroad magnate Edward H. Harriman and had recruited some of the top scientific and literary talent of the day. The goal of the Expedition was to collect as much data as possible on the natural history of Alaska and its native inhabitants. Nature writers John Burroughs from New York State and John Muir from California were the grand old men on board, as was William Dall (as in Dall Sheep) who was renowned as the first American naturalist to study in Alaska. Also on board was a young photographer Edward S. Curtis, later to become famous for his striking portraits of American Indians throughout the West. Mammalogist C. Hart Merriam, head of the U.S. Biological Survey, was chief of the 25 scientists recruited for the two month trip.

The Harriman Alaska Expedition collected great quantities of specimens, photos, artifacts, and interviews, and ultimately published 12 volumes of technical studies. Homer writer Nancy Lord has recently revisited the Expedition in her delightful book Green Alaska: Dreams from the Far Coast (1999, Counterpoint), when she and her fish tendering partner Ken Castner retraced the Expedition's route along the Alaska Peninsula and the Aleutians.

Nancy Lord points out that when the Expedition cruised through lower Cook Inlet extensive tracts of dead forest were noticed. John Muir wrote, "On the stratified deposits (Tertiary) on the west side of Kachemak Bay and Cook Inlet considerable areas were covered with dead forest, said to have been killed by showers of ashes and cinders…from Iliamna; some say by ordinary forest fires." Having survived the spruce bark beetle outbreak of the 1990's, as well as various eruptions of the Cook Inlet volcanoes, Nancy rightly balks at the suggestion that volcanic ashes and cinders, or fires in the damp coastal forests, might be the sources of mortality in these dead forests. She suggests that Expedition naturalists were observing the results of precisely the same kind of spruce bark beetle outbreak that we know so well today.

My curiosity was more than piqued when I read this observation and discussed it with Nancy Lord. At the Kenai Refuge we have spent several field seasons collecting tree-ring (dendrochronology) evidence of past spruce bark beetle outbreaks. We have looked at 16 sites from Seldovia to the Swanson River Oilfield, and east to the Mystery Hills and Cooper Landing. In the northern sites we can see regional beetle outbreaks in the 1810-20's, 1900-1910's, and 1970's. The southern sites were heavily hit in the 1870-80's, especially the north side of Kachemak Bay.

Several years ago we discovered William Langille's 1904 report on the forest conditions on the Kenai Peninsula. (Langille was the right-hand man in Alaska of Gifford Pinchot, Teddy Roosevelt's architect of the US Forest Service in 1905-06. Langille became supervisor in 1905 of what today is called the Tongass National Forest.) In his 1904 report Langille described the standing dead forest with 40-100% mortality between Coal Bay (Homer) and Anchor Point. In 1994 we studied a clearcut on the west side of Homer in great detail, cutting more than 500 slabs from stumps. Virtually every slab showed a major growth spurt (wider rings) in the early 1880's, due to a severe thinning of the forest canopy which "released" the survivors from competition. The fact that Langille described the dead trees as "standing" ruled out blowdown by wind as the mortality agent in this stand and left spruce bark beetles as the most plausible candidate.

The Harriman Expedition report of dead forest on the west side of Cook Inlet raised the possibility of a second historically confirmed dead forest. But could we find it? No specific location was reported, beyond being in the vicinity of Iliamna volcano. Nevertheless, if this was a beetle-kill event, it was probably a widespread regional event on the west side of the Inlet, just as it is today, and as it was on the southern Kenai Peninsula side in the 1870-80's and 1990's. Probably any forest from Kamishak Bay to Iliamna to Redoubt volcano should show evidence of this outbreak.

I decided to try Polly Creek, north of the Crescent River and Tuxedni Bay. Conversations with loggers and local setnetters indicated that this area possessed abundant mature spruce forest with trees old enough to have a good tree-ring record of 19th century

boxes, choked with brush and doghair stands of suppressed conifers. It is entirely possible that we have not yet seen the worst fire season—the potential remains. Nationally, we will have much to discuss in the months ahead. How can we prevent another Cerro Grande? What can we do to limit the potential of wildland fires in America? How can we supplement the national fire organization during extreme fire seasons? It's going to be an interesting winter…

Doug Newbould is the Fire Management Officer at the Kenai National Wildlife Refuge. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.