

Refuge Notebook

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New Administrative Officer at Kenai National Wildlife Refuge

by Becky Uta



Bird's eye view from the office of Becky Uta, the new Administrative Officer at the Kenai National Wildlife Refuge (credit: Becky Uta/KNWR).

Where did I come from? How did I get here? Why is it interesting to others? Being tasked with introducing myself, I realize it can be cumbersome. As I write and start over a few times, I laugh, as I look outside my window today, of all days, and I see three moose chomping on a tree, followed by conversations from the visitor center about delayed skiing because of them. I ponder this scene and know this is the reason I am here. Alaska is that place on everyone's bucket list to experience and those who have expressed with gusto their intent to come back.

I am Becky Uta, Administrative Officer for the Kenai National Wildlife Refuge. I track the Refuge budget and contracts, and supervise two employees who handle all things clerical: issue permits, triage incoming calls, and process Refuge employee personnel actions—the administration of administration. I started my career with the U.S. Army, later transferring to the Federal Aviation Administration, both out of Kansas City, Missouri, and earned many “admin” hats over my 10 years of service: Secretary, Records Manager, FOIA (Freedom of Information Act) Specialist, to name a few. As an enlisted Soldier, now Veteran, I was trained to be an Aircraft Structural Repairer.

Nothing in my past really gave me the direct heading to how I came to the Refuge, like some of my co-workers in technical fields. I have a knack for details and multitasking, and I love to fine tune processes for

time efficiencies. My life is my blended family, with a husband of 13+ years and four children, ranging from 10 to 19 years.

Word spread like wild fire at my former office concerning my move to Alaska, the number one comment received, “Wow that is quite a move, Why Alaska?” My response was always “Why NOT Alaska!” I am writing whilst the moose happily munch on the foliage outside my window. In the current winter state, covered in a foot of snow and sub-zero temperatures, I still proclaim, why not Alaska! It is that elusive place I only saw in pictures and heard about in the adventures of Alex, my brother, who has lived in Wasilla for more than a decade.

As my family prepared to leave the city I called home for 22 years, we were subjected to lots of advice and opinions about this hidden wonderland. Oh, we heard it all: Every advice about bears and moose, people shared songs about Alaska, and we heard every story about past trips to the state.

A personal experience was with my brother when I visited for the interview. He said that my “Lower 48” money wouldn't work here, indicating that I need not pay for dinner. But when I tried my bank card, it really didn't work! Unbeknownst to me, the card was only blocked as a security feature because it was outside of the U.S. Yes, read “Outside the U.S.”! He responded, “See Little Sis' Your Lower 48 money doesn't work here.”

Of course I began “collecting” these comments and tales. A few of my favorites: Do I like Snow? Am I ready for the cold? Am I prepared for the month of darkness? Do I have enough blankets? We need to brush up on dog sledding. The best joke was: If a bear charges, you only have to run faster than the person in front of you. Of course, I've since learned that is NOT what you should do if a bear charges! Check out our tips for outdoor safety: http://www.fws.gov/refuge/Kenai/visit/visitor_activities/safety.html.

Drawing in on final thoughts, since my arrival at the Refuge, I learned right away that this is a place full of life, community, and passion for nature. As a newly

transplanted resident of “The Last Frontier,” I am very fortunate to be a part of a place that my children and future generations will be able to enjoy. I have only seen the “tip of the iceberg” so far and, sorry, no penguins (another amusing comment received).

Living in the area for only three months, I sit at my office window and watch the passing moose, the occasional chickadees flit by, and experience the beautiful sunrises. Simply beautiful! So why Alaska? This is

why: Snow covered mountains that turn pink at sunset, the smell of crisp, cold, CLEAN air, and a skyline with colors that illuminate strange new places begging for me to explore, in time. But for now, it’s back to the budget system.

Rebecca Uta is the new Administrative Officer at Kenai National Wildlife Refuge. You can find more information about the refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Dena'ina names for birds of the Kenai Peninsula

by John Morton



Surf scoters (English) or the one with a light color on its nose (Dena'ina) flush from Bottenintnin Lake on the Kenai National Wildlife Refuge (credit: Mika Morton, Soldotna).

With a modest grant from the National Geographic Society, I spent a few months living with the Cofan Indians in the late 1980s studying white-lipped pecaries along the Rio Aguarico in Ecuador. I remember asking Randy Borman, the multilingual son of the first missionaries to work with the Cofan, what made Cofan different than other neighboring tribes like the Quechuans (formerly the Incans). His response, echoed by many professional anthropologists, was “if you speak Cofan, you are Cofan.”

Language, and more specifically what you name something, tells a lot about how you interact with the world around you. Joseph Robertia, a writer for our other local newspaper, once passed on an interesting tidbit that Native Americans tended to name wildlife after behavior rather than what the critter looked like. I filed this idea away until I recently ran into a book entitled “Bird Traditions of the Lime Village Area Dena'ina: Upper Stony River Ethno-Ornithology”. Here was a chance to test this idea.

I extracted 70 bird species from all taxa which the authors had been able to determine full Dena'ina names and were also found on the Kenai Peninsula. I classified their names, both Dena'ina and their common English equivalent (determined by the American Ornithologists' Union), into categories based on behavior, call or sound, habitat, physical attributes, and none-of-the-above.

Sure enough, 50 percent (35 species) of the English equivalents are based on physical attributes, birds like black-capped chickadee and spotted sandpiper. The next biggest English-based group is “none-of-the-above”, which includes 18 species with names that reflect a strong cultural bias (Lincoln's sparrow, American widgeon) or are simply not descriptive unless you know something about bird taxonomy (brant, whimbrel, northern harrier). There are only four species' names based on behavior (and only partly so) such as American dipper and olive-sided flycatcher, and only three based on sound (mew gull).

In contrast, 53 percent of Dena'ina names are based on behavior (22 species) and sound (15 species). So the cliff swallow is one that daubs mud, the olive-sided flycatcher is one that says “dry fish” (in Dena'ina), the ruffed grouse is the one that pounds, the osprey becomes one that watches the water, and the northern hawk owl is one that sits on branches whereas the boreal owl is one that stays under trees. The savannah sparrow is the “ground squirrel that goes ch'ich (scraping noise)”, an appellation that the authors speculated may have come about because this bird is found in open alpine areas where Lime Villagers harvested ground squirrels.

Only 26 of Dena'ina names are based on physical attributes. The three scoter species are great examples when translated: one with a light color on its nose (surf scoter), one with yellow-orange on its nose (black scoter), and one with light-colored eyes (white-winged scoter). There are also associations based on physical similarities – although red-necked phalaropes and red-necked grebes are not taxonomically related, the Dena'ina called the former the younger brother of the latter.

Some birds share the same habitat both in English and Dena'ina. The spruce grouse in English becomes one that eats spruce boughs in Dena'ina. The bank swallow becomes beneath the bank. But the harlequin duck becomes “resident of the passes”, a more precise label for a waterfowl species that breeds along mountain streams.

A couple of birds get unique recognition by the Lime Villagers. The fox sparrow literally translates to

“why does it scold me?” and the white-tailed ptarmigan to “you are dreaming”.

I don’t know exactly why Dena’ina may be more behaviorally attuned than those of European descent. Perhaps because binoculars and scopes are a great advantage for seeing, rather than hearing, birds in contemporary times. Perhaps because Dena’ina lived closer to the land in more recent times. Stephen Jay Gould, the great Harvard evolutionary biologist, wrote in an essay that while western and non-western cultures generally recognize species as similar organizational units, the increasing differences at higher levels (genus, family, order) involve their relative importance to humans rather than an evolutionary construct.

Many of the Old World names given to modern birds have etymological roots that may have been more meaningful prior to modern English. For instance, the harrier (or marsh hawk) likely derives from a mid-16th century use of “one that harries”, which describes behaviorally how the marsh hawk hunts for

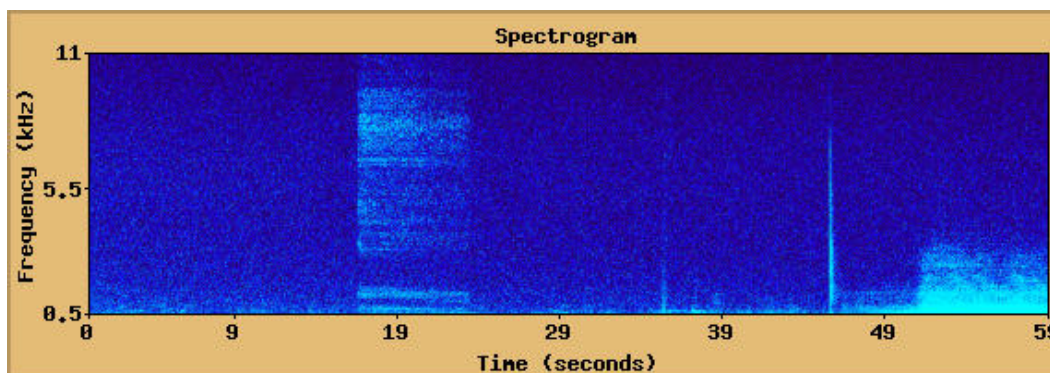
nesting birds and small mammals low over the landscape. Similarly, whimbrel may have also originated in the 16th century as an alteration of “whimper”, which is what its call sounds like.

Anyway, my point is that if you knew birds by their Dena’ina names, you might understand something of what it means to be truly native to the Kenai Peninsula. The calls of the olive-sided flycatcher (vava nihi) and golden-crowned sparrow (tsik’ezdlagh) told the Lime Villagers that the salmon were making their way through the upper Kuskokwim River. Peter Kalifornsky, the last native-speaking Kenaitze, told a similar story of how the tsik’ezdlagh heralded the first salmon run in the spring on the Kenai Peninsula. It’s a different way of relating to the natural world than looking at a sonar count online.

John Morton is the supervisory biologist at Kenai National Wildlife Refuge. You can find more information about the refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

A different way of “looking at” sound

by Mandy Salminen



Spectrogram of a 1-minute sound sample from the Kenai National Wildlife Refuge. Anthropogenic noise from an ice auger 50 seconds into the recording partially falls into the same bandwidth as biophonic chatter of a red squirrel at 19 seconds.

During my internship with Kenai National Wildlife Refuge, I have skied, hiked, and snowshoed. On these endeavors, I have had the opportunity to experience the almost surreal silence and uninterrupted natural sounds which I never heard in Ohio, my home state. My first experience with true silence was during a pause on a night hike. After the echo of my snowshoes crunching on the ice faded, all that was left was silence.

These experiences in Alaskan wilderness gave me a new perspective on my “wilderness” experiences back in Ohio. Hiking there, you accept that you are very unlikely to get away from the hustle and bustle of the human world.

Refuge biologists have been studying sounds within the landscape, or soundscape, to identify areas that are most and least affected by human-made noise. Sound recorders were placed at over 60 different locations on the refuge such as Caribou Hills, Mystery Creek, and Skilak Lake. These recorders captured a minute of sound or silence every half hour.

These recordings were uploaded to an online sound library called the Remote Environmental Assessment Laboratory (REAL). Anyone can check out the sound files on <http://www.real.msu.edu/> (click on projects). This library converts sound files into spectrograms and partitions them into 1 kHz frequency

bandwidths. An algorithm is then used to quantify the amount of sound energy within each bandwidth. This acoustic information provides soundscape ecologists a way to interpret sounds emanating from the landscape.

Soundscape ecologists categorize sounds into three general categories. Biophonic sounds are made by animals. Geophonic sounds are made by the earth such as rain and wind. Anthropogenic sounds are made by humans and their activities. Fortunately, the REAL sound library provides a means to search sound files based on frequency and sound energy. This tool can be useful for identifying sound files with specific attributes.

For the past six weeks, I have been working eight hours a day, five days a week listening to thousands of sound files that were recorded over the winter of 2011-2012. These data are being used to study the distribution of anthrophony on the Refuge and its potential effects on moose.

About 90% of the sound energy created by anthropogenic sources, such as automobiles, snowmachines and airplanes, lie within the 1–2 kHz band width. In contrast, most biophonic sources are typically above 2 kHz. What I have found interesting in my searches is that anthrophony and biophony overlap sometimes in the 1–2 kHz band width, so that the noise of snow-

machines and ice augers is mixed with the calls of ravens, eagles, goldeneyes, wolves, squirrels, coyotes, mallards, trumpeter swans and woodpeckers.

So why does this matter? Anthrophony can be very disrupting to an animal's communications. Soundscape ecologists believe that each species has its own acoustic niche. You may have heard of ecological niche, the ecological role (what a species eats, how and where it forages, and its interactions with other species) and space (habitat) that an organism fills in an ecosystem.

An acoustic niche is the frequency filled by the sound that a species creates within its habitat. These niches create something like an orchestra — initially all you hear is the “symphony” but, by focusing, you can pick out the “instruments”. This is how, in the middle of spring, different bird species can sing at the same time and still find a mate.

The problem is that certain anthrophonic sounds can fill those acoustic niches and mask biophonic sounds. This disturbance affects animals' ability to find mates, establish territories, announce a meal to share, and much more. These behavioral affects may be compounded with physiological stress responses to

human noise. There are multiple studies that show human noise, such as automobile or aircraft traffic, can increase stress levels and affect long-term health. Why would wildlife be any different?

Anthrophony can also take away from our wilderness experience. How many times have you heard an airplane overhead while hiking? Or casted a line out to catch that trophy king salmon and heard traffic whizzing by. The sounds of biophony, geophony and even silence have an intrinsic value to the natural landscape which many of us never stop to notice.

So even if our minds have categorized certain sounds as background noise, these still can have a huge effect on our mood, our health, and our wilderness experience. Silence is a beautiful “sound” that is rarely experienced in our busy world. I recommend a dose of this to everyone —allow yourself to slip into the silence only nature can offer you.

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A new clam on the beaches

by Matt Bowser



A bucket of soft-shell clams, an exotic species from the East Coast, harvested from an east-side Cook Inlet beach this past New Year's Day (credit: Matt Bowser/KNWR).

This last June while my family was out at the local beach, my son brought me a clam he had found in the mud flats, a clam of a kind unfamiliar to me. At home that evening, I identified it as a soft-shell clam (*Mya arenaria*), an exotic species.

I had no idea that there were non-native clams in our area, but I learned that this was not news. Soft-shell clams were first documented on the Kenai Peninsula in 1999. By 2006, soft-shells were already a dominant species in mud flats in the area. At least one clammer was targeting them in Kachemak Bay by 2011.

Soft-shell clams are native to the Atlantic coast of North America from North Carolina to Labrador and to the North Pacific from Korea to the coast of Alaska on the Bering Sea. In the 1870s, they were accidentally introduced to the San Francisco Bay area in a shipment of oysters transplanted from the Atlantic. Soft-shells had replaced native clams in the Bay area before the end of the 19th century. Through a combination of natural dispersal and intentional transplanting, soft-shells spread rapidly on the west coast, reaching southeast Alaska by the 1940s (<http://bit.ly/1fWWcdy>).

Alaska is not the only place that these clams are invading. Vikings brought soft-shell clams across the Atlantic around 1300 A.D. to Europe where they are

now widespread. There, soft-shells have continued to invade new areas in recent years, reaching high densities, decreasing abundance of native clams, and filtering enough algae to substantially reduce chlorophyll concentrations in seawater.

Given that soft-shell clams have made it to Cook Inlet and are already abundant here, I was now curious about the consequences of this invasion. Do they compete with native clams for space or food? What are the effects of this species on other wildlife? Will there be harvestable populations of soft-shell clams for me and others to exploit? Might a new clam fishery in Cook Inlet increase human use and pressures on Kenai Peninsula beaches?

Soft-shell clams do appear to be competing with native clams in some locations, at least for habitable space in mud flats where this species is often dominant. Measured densities of soft-shells in Cook Inlet reached 11 clams per square meter at Katmai National Park on the other side of Cook Inlet. For comparison, densities of harvestable razor clams vary from about 0.5 to 5 clams per square meter at Clam Gulch and Ninilchik beaches. Native Baltic macomas, false soft-shell clams, and other species had already occupied the mud flats in which soft-shells are now abundant and must be experiencing some level of competitive pressure from this new-comer.

Soft-shell clams are probably not competing for space very directly with other clam species commonly targeted by people in Cook Inlet. Razor clams, butter clams, and littleneck clams generally occupy more coarsely-grained substrates than soft-shells.

Other wildlife may benefit from this invasion. Many animals prey upon soft-shell clams, including crabs, flatfish, shorebirds, diving ducks, and sea otters. A study at Hallo Bay, Katmai National Park found that soft-shell clams were the primary species consumed by brown bears in mud flats, an important food source for bears in the spring until salmon start appearing in the streams.

As to usefulness by people, soft-shell clams have long been harvested on the east coast of North America. This species supports a 10 million pound per year commercial fishery in Maine alone. Called “steamers”

in New England, soft-shells are served as an integral part of the New England clambake.

As word gets out about this species' presence on the Kenai Peninsula, more clammers may target them. If you have visited Nilchik or Clam Gulch beaches during extremely low tides, you know that the razor clam fishery can be extremely popular (up to 1,367 clammers at Ninilchik beach on one low tide). I imagine that the soft-shells might attract at least some clammers to our mud flats, increasing human use on these beaches.

My next question was whether or not there was a harvestable population where my son had initially found the soft-shell. On the -5.1 ft. tide this New Year's Day, my brother-in-law and I slogged out onto the mud flats to find out.

We turned up nothing but worms for much of the tide, but eventually we found beds where the substrate was apparently more stable and obviously more productive than the surrounding mud, with many dimples from worms and clams. We had some success, eventually bringing home 24 eating-size soft-shells. While this small yield failed to justify the effort we expended to get them, I was more than satisfied to have learned more about soft-shell clams. To learn about local marine clams, download Dennis Lees' *Guide to Intertidal Bivalves in Southwest Alaska National Parks* (<http://bit.ly/1aHvoJQ>).

Matt Bowser serves as Entomologist at the Kenai National Wildlife Refuge. You can find more information about the refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Common gardens may reveal uncommon choice

by Elizabeth Bella



Spruce bark beetle followed by fire illustrates vegetation change in the Caribou Hills (credit: Kenai Refuge).

This unprecedented warm spell has us all thinking about climate, and the dramatic effects abnormal temperatures have on our seasonal expectations. Favorite winter activities have been curtailed by the warm, wet weather hunched over the region. On the plus side, heating bills are lower, runners are taking advantage of the balmy air and snow-free patches, and anyone who's driven to Anchorage lately appreciates the clear, dry roads.

Climate change is expected to have profound effect on regional and local ecosystems. Climate models are one way to visualize what future landscapes will look like. Climate-biomes, or cliomes, are large-scale assemblages of species and vegetation communities that we expect to occur based on prevailing climate conditions. Models illustrate that most regions across the state will have at least one big cliome shift in the coming century.

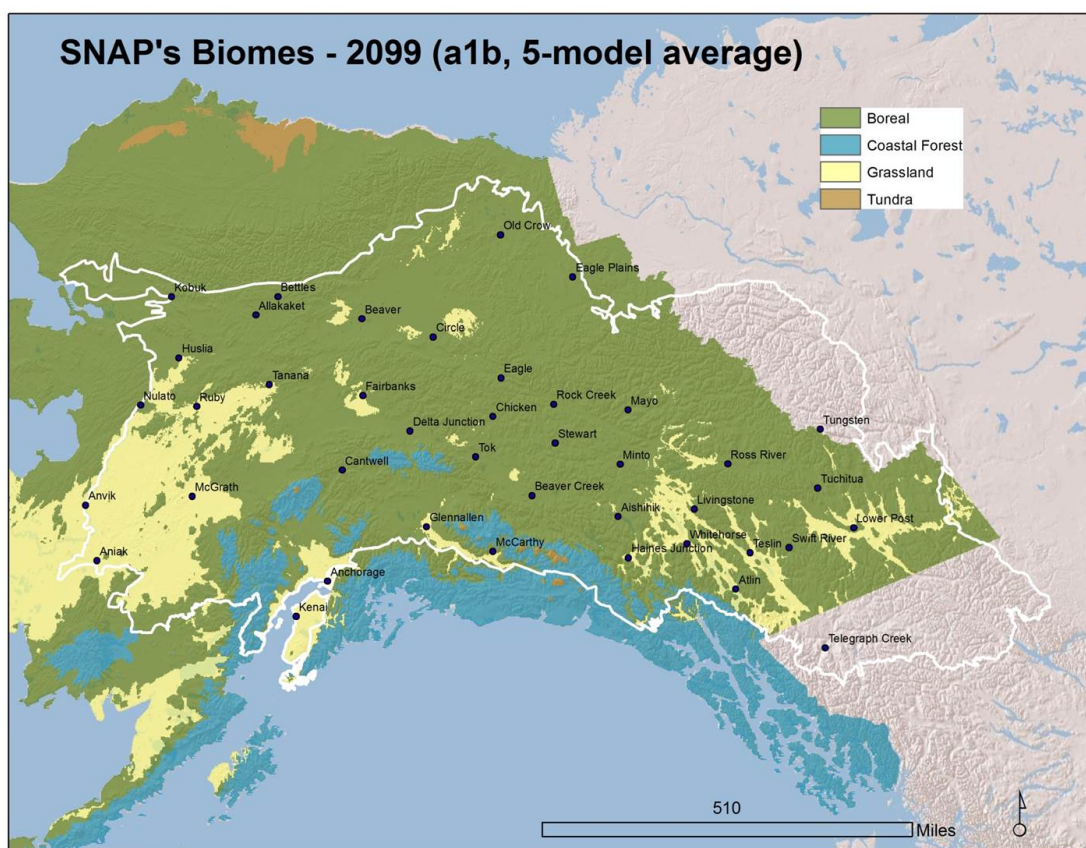
Several different climate models applied to Alaska show similar results – the future western Kenai Peninsula climate may be similar to that of the prairies of Saskatchewan. Bark beetle outbreaks, rising temperatures, and changing precipitation patterns may cause fire frequency or intensity increases, nudging the landscape towards grasslands. On the eastern Kenai, a future coastal forest climate prevails, which may resem-

ble the coastal rainforests of southern BC and Pacific Northwest rather than current Sitka spruce- mountain hemlock forests.

Adaptive capacity refers to the ability of a species, habitat, or ecosystem to accommodate or cope with climate change impacts with minimal disruption. The Kenai Peninsula has relatively high biological diversity, located between the coastal and boreal forest cliomes, but the distribution of tree species is curious. Glaciation and other major geographic features may have kept species from filling in their current potential range, such as mountain hemlock's absence from most of the south peninsula. Trees, as slow-growing, sedentary organisms, may have low adaptive capacity.

Climate and forest growth research in Canada suggests that many tree species are already lagging up to 80 miles in latitude outside their ideal climate range. Certain populations of trees, at higher elevations or at edges of their optimal climate range, may be more susceptible to climate change due to genetic isolation. Actual lag time depends on non-climate factors including seed dispersal ability, photoperiod requirements, or soil type compatibility. In the interior, seed dispersal capability is limiting tree species' ability to move northward, causing a serious lag at the front end of northward migration and subsequent decline at the southern range edge.

Adaptive management decisions may include planting or transporting species to cope with the lag. Assisted migration is one adaptive practice, involving the deliberate movement of species from their current climate niche to their projected climate niche. Understanding what species will grow, survive, and reproduce in new climates is essential to smart adaptive choices. To directly study tree growth, we aim to install a series of common garden sites at varying latitudes on the western Kenai. Also known as a transplant experiment, common gardens include a variety of species and genetic varieties (genotypes) planted under uniform conditions. We want to know if local genotypes will persist – and if locals aren't going to make it, we want to know what our best options are.



A five-model climate scenario depicts the western Kenai as having a grassland climate by the year 2099 (credit: SNAP, <http://www.snap.uaf.edu/>).

We plan to include various genotypes of local species including Sitka spruce, white spruce, and quaking aspen. Resident species may have particular genotypes that grow and survive better in changing climates. For example, white spruce that is stunted and slow-growing at high elevations in British Columbia may outstrip local white spruce growth rates when they are planted together, or may be able to resist new types of insects or disease that resident genotypes succumb to.

We will also plant forest species from nearby cliomes, such as Douglas-fir, Engelmann spruce, Pacific silver fir, western redcedar, yellow-cedar (suitable for moister forests of the projected future eastern Kenai), and ponderosa pine, Siberian and western larch, western hemlock, western white pine, and lodgepole pine (for drier cliomes like the western Kenai). Yellow-cedar is already in decline in Southeast Alaska, attributed to warmer winters, an example of a lagging species. Other species have already been planted up here, including lodgepole pine and various

larch species. Lodgepole pine is not native to the Kenai Peninsula, but is found just over in the Yukon Territory and near Haines, as well as throughout Southeast Alaska (the closely related shore pine).

The future landscape story is just starting to unfold as we work to understand the intersection of shifting cliomes and adaptive management choices. The idea of bison grazing in grassland patches between resilient pine forests, or elk frolicking in south coastal rainforest, may be far-fetched now – but maybe not in a century. We may be heading towards a decline in diversity due to range lags, so options for creating a novel landscape of the future are intriguing, especially considering our summer-like temperatures this January!

Dr. Elizabeth Bella is an ecologist at Kenai National Wildlife Refuge. You can find more information about the Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>. Biology news highlights can be found here: http://www.fws.gov/refuge/Kenai/what_we_do/science/biology-news.html.

Counting moose with drones? May be sooner than you think

by Nate Olson



Launching a Raven Unmanned Aircraft System (aka drone) at Haleakala National Park in Hawaii to survey invasive plants and animals (credit: USGS).

Imagine you are at the controls of a Piper Super Cub flying at tree-top level 150 feet above the ground. As you fly 10-mile long transects running north and south, and spaced $\frac{1}{4}$ mile apart, your head constantly swivels as you try to spot moose in the trees. Once sighted, you circle, mark a waypoint on your GPS, and record age, sex, group size, and number of calves.

Now imagine that instead of piloting a Super Cub you are sitting in your office peering at a computer monitor while drinking coffee and snacking on doughnuts. To me, this is a difficult concept to grasp but it may become reality sooner than I'd like to admit.

I am, of course, talking about Unmanned Aircraft Systems (UAS) or drones. The recent explosion in UAS development for non-military applications is rather daunting. Commercial demand has far surpassed the abilities of the Federal Aviation Administration (FAA) to develop regulations pertaining to their use. Corporate America is buzzing with grandiose ideas of how to use UAS. Companies like Amazon and FedEx plan to have UAS deliver packages right to your doorstep — how convenient.

When most people think of UAS, the image of a drone that looks like a winged beluga whale dropping

bombs on a nameless country comes to mind. But in the world of natural resource management, UAS are gaining a lot of interest and look to be promising. We currently rely heavily on manned aircraft, both fixed wing and helicopters, to execute a variety of aerial wildlife surveys, typically at low speeds and altitudes in a variety of challenging weather and terrain conditions. The adaptation of UAS technology to the world of aerial wildlife surveys and other resource applications could reduce the risk of human injury, casualty, and monetary costs.

The Department of the Interior has been testing the feasibility of using small UAS to survey wildlife since 2011. The first successful mission was to count roosting sandhill cranes at the Monte Vista National Wildlife Refuge in Colorado. The crew used an RQ-11(A) Raven UAS equipped to gather infrared thermal imagery of a roosting crane colony. The UAS proved beneficial as the Raven's small size and ability to fly low level at night using infrared thermal detection technology to detect individual bird heat signatures allowed for a successful roost survey. Typically, these surveys are conducted by fixed-wing aircraft with a high risk of mid-air collisions with birds.

Last year, ConocoPhillips successfully completed the first approved commercial use of an UAS in U.S.-controlled airspace with mixed results. They tested the feasibility of using UAS to monitor marine mammal population dynamics and ice conditions near proposed drilling sites in the Chukchi Sea. Typically these missions are executed by aircraft flying up to 200 miles offshore. This type of commercial testing is projected to ramp up this coming year as the FAA test sites come online.

There are exciting potential applications for UAS on the Kenai National Wildlife Refuge. As camera and image processing technology increases so does the potential for developing new methods for resource monitoring. Infrared thermal imaging technology may allow us to effectively count moose and bears in areas we currently cannot either because of dense forest canopy or because we can't do low-level flights over

urban areas.

We could survey sheep, goats and caribou in the Kenai Mountains safer and more cost effectively. We could reduce disturbance and increase precision for waterfowl surveys. The costs of monitoring fire activity could be substantially reduced while providing a greater safety and increase our abilities to monitor post-burn vegetation changes. Consider raptor nest surveys, wildlife habitat analysis, wildlife roadside interactions, lake shore mapping, and the spatial distribution of shrub defoliation by insects.

As of now the rules governing the commercial and government use of UAS are highly restrictive. The FAA requires a Certification of Authorization be issued for any project using UAS. This permitting process can take from 2 to 8 months for approval. Once approved, operators must have continuous visual contact with the UAS, are restricted to altitudes below 400 feet, must operate in uncontrolled airspace (class G), and must cease operations if another aircraft is spotted in the area. These restrictions make UAS resource operations at the scales needed on the Kenai Refuge and most other federal lands in Alaska impractical. However, Congress has mandated the FAA achieve full UAS integration into the current national airspace system

by 2015 and, with the huge interest and money being dumped into UAS development, that goal may well be met.

I don't need a palm reader to tell me that a large part of my flying duties may soon be replaced by UAS. Yet with any change there is a flip side. In this case, the downside is that we continue to distance ourselves from the natural resources we manage. Biologists learn a lot by experiencing the same environment as the animals and habitats we manage. We are constantly processing information related to wildlife resources whether it be habitat condition, water levels, phenology, animal condition, non-target species occurrence (or absence) and behavior. UAS technology cannot replace this experiential knowledge and data gathering.

The UAS can and likely will be very good at collecting specific information to be used for specific purposes but, hopefully, it will not replace first-hand observations of the world we love.

Nathan Olson is the wildlife biologist-pilot at Kenai National Wildlife Refuge. You can find more about the Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Genetic diversity of wildlife on the Kenai Peninsula is a mixed bag

by John Morton



Kenai moose have higher genetic diversity than other moose populations in Scandinavia and North America.

There are 1,786 plant and animal species known on the Kenai National Wildlife Refuge. That's extraordinary biodiversity for this latitude with perhaps another 3,000 species, by my estimation, yet to be found. George Shiras III, a famous National Geographic Society photographer, wasn't kidding when he wrote that "were all of Alaska erased from the map except the Kenai Peninsula and its immediately adjacent waters, there would yet remain in duplicate that which constitutes the more unique and that which typifies the whole of this wonderful country."

What makes the Kenai Peninsula so species rich is the intersection of the Sitka-spruce rainforest that colonized Prince William Sound with the drier white and black spruce boreal forest that extends from interior Alaska to the Cook Inlet. Combined with elevations ranging from sea level to 6,000 feet in the Harding Icefield, Mother Nature has created lots of ecological niches to be filled by species.

But because we live on a peninsula that is separated from the adjacent mainland by a narrow, 10-mile wide isthmus only recently de-glaciated, it's logical to assume that plant dispersal and wildlife movement have been minimal with restricted genetic mixing. So although species diversity is relatively high, we would expect low genetic diversity within populations of most species on the Kenai Peninsula.

On the other hand, a paper published in Science in 2003 showed that the diversity of chloroplast DNA

in European plant species was highest in areas where populations dispersing from northern and southern refugia collided in the aftermath of the last ice age. Such a place could be the Kenai Peninsula, an area in which at least some species may have been colonized by populations originating from both northern (Beringia) and southern refugia.

In fact, Caribou Hills, nunataks in the Harding Ice Field, and the northern part of the Kenai Mountains around Big Indian Creek were unglaciated during the last ice age, serving as local refugia for some flora and fauna. So genetic diversity might be low because it's an isolated peninsula or it might be high because of post-Pleistocene colonization patterns.

It only gets more confusing because there are different ways of measuring genetic diversity. Modern genetics considers variation in nuclear DNA versus mitochondrial DNA. Unlike nuclear DNA, which is inherited from both parents and in which genes are rearranged in the process of recombination, there is usually no change in mitochondrial DNA from parent (usually the mother) to offspring. As such, mitochondrial DNA is a powerful tool for tracking ancestry through females.

Consider Kenai brown bears. A study published in the Canadian Journal of Zoology shows they have lower levels of mitochondrial DNA diversity than most other brown bear populations in Alaska, including the Kodiak Archipelago, but relatively high nuclear diversity. The former could result from a few reproductive sows that are highly successfully. Conversely, the latter could be due to high gene flow from males that disperse widely coupled with a tendency of females to stay close to home. As the authors suggested, determining which mechanism is in play is important for effective management of the Kenai brown bear population — there's a danger of harvesting the wrong sows or too many boars.

In contrast, Kenai moose were found to have higher genetic diversity than populations elsewhere in North America and Scandinavia. Kris Hundertmark, originally at the Kenai Moose Research Center when

this study was published in 1992, and his colleagues found that genetic diversity, as measured by polymorphic loci in liver and muscle samples from moose killed by collisions with vehicles, was unusually high. They suggested that this was so because the Kenai population likely originated from moose that survived the last ice age in nearby climate refugia (Beringia).

Wolverines from the Kenai Peninsula were similarly found to harbor a disproportionate amount of the mitochondrial diversity in North American populations. Furthermore, the Kenai population was considered somewhat distinctive, with a single unique haplotype. While the authors of this study, published in the *Journal of Mammology*, suggested that the genetic structure of our wolverine is not enough to warrant designation as a subspecies (recognized as *Gulo gulo katschemakensis* in 1918), they also acknowledged that our local population deserves special conservation attention.

Similarly, Trumpeter swans on the Kenai Peninsula were found to have slightly higher genetic diversity based on nuclear DNA than other populations in the western U.S. However, the authors of this study,

from the University of Denver and U.S. Geological Survey, concluded that the diversity was not enough to warrant special management consideration.

At the end of the day, why should we care about genetic diversity? Genetic diversity plays an important role in the survival and adaptability of a species to environmental stressors such as rapid climate change, disease or contaminants, or how successful a native species might be in responding to competition from invasive exotic species. Variation in a population's gene pool provides variable traits among the individuals of that population. Like making the wise decision to not put all your eggs in one basket, having multiple baskets of varying sizes ensures that someone gets home with at least some of the eggs. More genetic diversity means greater resilience in a population or species to survive environmental change, exactly what is needed to sustain our diverse biota on the Kenai Peninsula.

John Morton is the supervisory biologist at Kenai National Wildlife Refuge. You can find more information about the refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Time to apply for summer jobs at Kenai National Wildlife Refuge

by Candace Ward



Seasonal Ranger Kendra Bush cleans a fire pit at one of dozens of camp and picnic grounds on the Kenai National Wildlife Refuge.



Seasonal employees repair the roof on one of the Refuge's public use cabins. Now's the time to apply through USAjobs for summer ranger and laborer jobs at Kenai National Wildlife Refuge.

Are you interested in working at one of the premier wildlife refuges in the nation this summer? The Kenai National Wildlife Refuge has a few challenging, yet rewarding, job opportunities for summer 2014.

The following job areas have positions available for summer 2014:

Park Ranger (Visitor Services Specialist) - Rangers work indoors and outdoors. They operate the Refuge Visitor Center in Soldotna orienting visitors to the Refuge and providing information on hiking, camping, fishing, and other recreation activities. Rangers prepare and present wildlife interpretive programs including nature walks, ranger talks, and discovery hikes.

Park Rangers also work outdoors in the Skilak Wildlife Recreation Area managing fee collections and caretaking the campgrounds. They do foot patrols in campgrounds assisting visitors, and hike nearby trails while doing light duty trail work.

Park Ranger positions begin May 19 and last until August 16. Pay per hour ranges from \$14.84 - \$16.60. (Hourly rate varies depending on number of college credits and prior job experience.)

Laborer (Cabin/Trail Crew) - Laborers in the cabin/trail crews work outdoors on cabin and trail projects in front country areas and in remote back-country sites. Projects include historic cabin restoration, cabin and trail maintenance, trail re-routes, construction of footbridges, boardwalks, and timber stairs, and installation of drainage and erosion control structures.

Crew members use a variety of hand and power tools including chain saws. Crew members must be prepared hike with heavy packs and to overnight in spike camps at trail project sites. Positions begin on May 19 and last until August 16. Pay is \$17.64 per hour.

How to Apply - You can apply through a convenient online website — USAjobs. These are the announcement numbers: Park Ranger (Visitor Services Specialist) #R7-14-1052733-AV and for Laborer (Cabin/Trail Crew) #R7-141051769-AV. The application period is Thursday, February 20 to Friday, March 7, 2014. For more information on Park Ranger positions, contact Park Ranger Leah Eskelin at (907) 260-2811 and for Laborer positions, contact Deputy Refuge Manager Steve Miller at (907) 262-7021.

Candace Ward works as a Park Ranger at Kenai National Wildlife Refuge leading the Refuge's Information & Education Program. She looks forward each summer

to working with new energetic seasonal staff. You can find more information at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

A demonstration of age and beauty

by Todd Eskelin



After 29 years, the leg band on a recently-deceased Bald Eagle was quite legible and in very good shape.

On a frosty morning in February 1985, biologists from the Kenai National Wildlife Refuge hunkered down in the bushes waiting for takers on their carefully laid trap. On a mostly unfrozen section of the Kenai River, a salmon carcass was strategically placed at the waterline and a padded foothold trap was submerged in the adjacent water. As the trap grabbed an adult Bald Eagle by the foot, the biologists sprinted into action. The eagle was secured, banded on one leg and fitted with a small backpack-mounted radio transmitter. After being released, the perturbed eagle flew to a nearby cottonwood and examined its newly installed bracelet.

For the record, this large adult female eagle would now be known only by its radio frequency #166.590. A total of 13 eagles were fitted with transmitters using this technique in 1985. For the remainder of the winter and throughout the summer they were periodically tracked to see where they went and if they nested on the Kenai Peninsula.

Eagle 166.590 was a bit elusive. After capture she immediately disappeared. In March, she relocated to a strip of woods in Halibut Cove on the south side of Kachemak Bay. She disappeared again and was discovered in May along the Swanson River. From that point on, she was never heard from again until just recently.

Biologists from Alaska Maritime National Wildlife Refuge responded to a report of an eagle that had been electrocuted in a collision with powerlines near Homer. Upon retrieving the dead eagle, they discovered an aluminum band on its leg. After reporting the band number to the Bird Banding Lab (www.reportband.gov) we were all notified that this eagle had been banded almost 29 years ago!

The backpack was long gone as they are designed to disintegrate after a couple of years. Other than the obvious damage from the collision with the powerline, the bird appeared to have been relatively healthy and in good body condition for its age.

If you factor in the age of the bird when it was banded, this eagle was a minimum of 33 years and 8 months old at the time it died, making it one of the oldest known wild Bald Eagles ever banded. We have to indicate wild, because there is a report of a captive eagle in New York that lived to 50 years old! It shows that even when you are at the top of the food chain, the stresses of the natural environment can be costly.



Volunteers Mike Kesterson and Carlos Paez prepare to release a radio-tagged Bald Eagle they captured on the Upper Kenai River during the winter of 1984-85.

While “our” 33 year old Bald Eagle from the Kenai Peninsula is impressive, nothing can rival the iconic star of the elderly bird world like Wisdom the Laysan Albatross. This impressive record setter just hatched what is believed to be her 35th chick at the ripe young

age of 63 years old. In her lifetime she has likely logged more than 3 million flying miles around the Pacific Ocean between Hawaii, Japan and Alaska.

After gallivanting around the Pacific, Wisdom periodically stops at Midway Atoll National Wildlife Refuge to nest and rear a single chick. This nesting process may take up to half a year. Surviving countless cyclones, typhoons and tsunamis, Wisdom is the oldest wild banded bird on record in the U.S. and she is still going strong.

One common attribute of long lived bird species is that they usually take a long time to mature before entering the breeding force. Laysan Albatrosses often fly around for 7 or 8 years before making their first breeding attempt. Bald Eagles will usually be in their 6th calendar year before first nesting and, in most cases, these early attempts are failures. Who would have guessed that Bald Eagles on the Kenai may take longer than a brown bear to mature and enter into the breeding population?

Longevity and delayed maturity are difficult factors in studying some birds and also pose problems when trying to assess population levels or recovery

efforts. At any point in time, there is the breeding or nesting portion of the population and the non-breeding portion that may not be coming back to nest for several years. Also, if an action is taken to help a struggling population, it may take several years before a response can be measured. If that effort was unsuccessful, it may take years before we actually know that a different approach is needed.

One thing is certain. In 1985 I was in high school. The last thing I was thinking about was banding Bald Eagles. I am thankful that biologists at the time were banding these birds as it gave me the unique opportunity to see one of the oldest banded Bald Eagles ever. It also revitalized me in knowing some of the work I do is for the here and now, but some will be fruit on someone else's tree long after I leave the Kenai National Wildlife Refuge.

Todd Eskelin is a biologist at the Kenai National Wildlife Refuge. He specializes in birds and has conducted research on songbirds in many areas of the state. You can find more information at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Kruger National Park and the Kenai National Wildlife Refuge share common conservation issues

by Ted Bailey



Ted Bailey (left) stands by a tranquilized white rhinoceros in Umfolozi-Hluhluwe Game Reserve in South Africa's KwaZulu-Natal Province in 1975.

Before we moved to Alaska, my family and I lived two years in South Africa's Kruger National Park (KNP), where I conducted research on African leopards. Later, while working on the Kenai National Wildlife Refuge (KNWR), I sometimes thought about the conservation issues these distant areas had in common despite their obvious differences. Unlike the KNWR, the KNP was situated in the subtropics, the southern hemisphere on the opposite side of the planet, and held numerous larger and potentially more dangerous animals.

However, fire plays an important role in both the KNP and KNWR ecosystems. In KNP natural fires help to keep brush from encroaching into grasslands, thus supporting many grass-eating species like the African buffalo, numerous antelopes and the zebra. KNP was divided into fire management blocks bounded by fire-break roads where natural lightning-caused fires were allowed to burn or where prescribed fires were set on a scheduled basis.

On the KNWR, fire consumes older forests, sets back succession and favors winter-browse-eating species such as moose and snowshoe hares and their predators like wolves and lynx. Natural lightning-caused fires are also allowed to burn in remote wilderness areas of the KNWR, and prescribed fire is similarly

used near developed areas to set back forest succession and to protect adjacent private property.

The reintroduction of extirpated native species was also a common conservation goal. Before it was established in 1926, KNP had already lost its populations of black and white rhinoceros, several antelope species and possibly the elephant. The KNP reintroduced white rhino in 1961, black rhino in 1971, and several species of antelope. The elephant came back on its own from either a small remnant population or perhaps from neighboring Mozambique. On the KNWR, extirpated caribou were reintroduced in the 1960s and 1980s but wolves, after a 50 year absence, had to return on their own.

Both the KNP and KNWR invest substantial time and resources on wildlife surveys and research in order to make science-based management decisions. The KNP routinely censuses elephant, African buffalo and most other large mammals. The KNWR, often with the Alaska Department of Fish and Game, periodically surveys moose and other ungulates and, with the U.S. Forest Service, recently used DNA to estimate the brown bear population.

I was fortunate, while in Africa, to help conduct an aerial wildlife survey in the Kalahari/Gemsbok National Park in South Africa and Botswana. There we counted widely scattered groups of gemsbok, springbuck, red hartebeest, ostrich and other wildlife while flying long aerial transects over the Kalahari Desert. I also took part in the live-capture of white rhinoceroses in the Umfolozi-Hluhluwe Game Reserve in South Africa's KwaZulu-Natal Province during a period when the reserve still had an abundance of white rhinos.

Both the KNP and KNWR cope with so called "problem" wildlife. The KNP's "problem" animals, among others, included elephants and lions which at times had to be destroyed if they caused damage outside the park. On the Kenai Peninsula the brown bear is sometimes considered a "problem" animal if its behavior conflicts with people. Moose are sometimes also considered to be "problem" animals if they become aggres-

sive toward people or when they are struck by vehicles on the highways.

But there are also major differences between the KNP and KNWR. Although poaching rhinoceros for their horns and elephants for their ivory were not major problems when we lived in KNP in the 1970s, it soon became significant throughout Africa. The number of black rhinoceros in Africa in the 1970s fell from 70,000 to less than 5,000 today because of poaching. In 2013 alone, 1,004 rhinos were killed by poachers in South Africa. Fortunately poaching is not a major issue on the KNWR.

KNP still struggles with the “elephant management dilemma”: too many elephants confined to a limited space that provides only a fraction of their long-life requirements. In the 1960s and 1970s park officials annually culled about 7,000 elephants to reduce their detrimental impact on the park’s vegetation and biodiversity. Although since discontinued, managing elephants in KNP still remains controversial.

Finally, unlike the KNWR, KNP officials in the 1970s had to deal with with hundreds of refugees fleeing into the park and encountering armed militia and

land mines along the park’s eastern boundary because of the war for independence in neighboring Mozambique.

I considered myself fortunate to have worked in one of Africa’s oldest, largest and most diverse national parks before coming to Alaska. I learned many of the planet’s conservation issues are similar. Consider reading *Shaping Kruger* by Mitch Reardon if you want to learn more about wildlife conservation in KNP.

It is said that conservation is a never-ending battle. As the rapidly increasing human population’s demand for the planet’s limited space and its natural resources intensifies, the conservation challenges for parks, refuges, and reserves, regardless of their location on the planet, will unfortunately become ever more challenging.

Dr. Ted Bailey, a retired Kenai National Wildlife Refuge wildlife biologist, has lived on the Kenai Peninsula for 37 years. His book The African Leopard: Ecology and Behavior of a Solitary Felid details his research in South Africa. You can find more information about the refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

New Visitor Center becoming reality

by Leah Eskelin



The Kenai National Wildlife Refuge Visitor Center is under construction on Ski Hill Road in Soldotna.

Up from the icy ground adjacent to the Kenai National Wildlife Refuge Headquarters in Soldotna, a building has grown. Through snow fall and rain, during negative temperature days and unseasonably warm meltdowns, the construction crew has been on site, dedicating long hours to what will be the hub of Refuge visitor services by the end of the year.

The new Refuge Visitor Center will house state-of-the-art exhibits that highlight the biodiversity of the Kenai, explore its ecosystems from the Harding Icefield, through the forests, rivers, wetlands and lakes to the Cook Inlet, and introduce visitors of all ages to what the residents of this great land already know: the Kenai is extraordinarily special. Beyond the exhibit hall, the new building will provide meeting space for public events, an inviting lobby and masonry fireplace set into a wall of windows that bring the beauty of the boreal forest inside. Natural light is celebrated, and its welcome dance across the polished concrete floors will reveal painstakingly installed sockeye salmon silhouettes that gather in imaginary eddies and pools all around the building's public floor space.

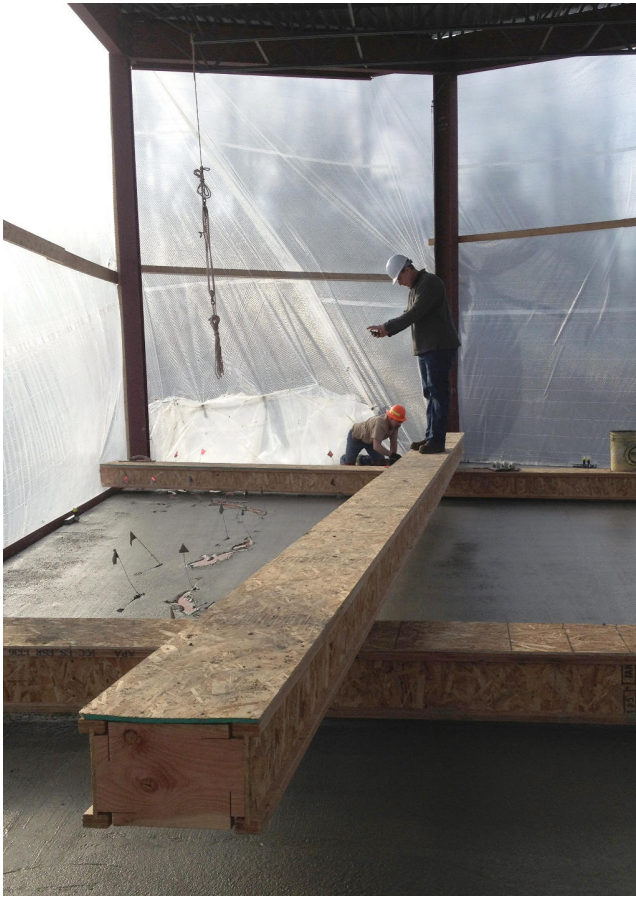
If you visit the Headquarters building now, it looks like the new Visitor Center is a concrete fortress, short on windows and heavy on steel. However, what appears a finished structure is still in a state of transformation. A third of the concrete walls will disappear below grade, covered by landscaping once the foun-

dation work is complete. The steel structure rising above the walls is the underpinning for a green roof, sown with grasses that will further dissolve the line between building and nature, where butterflies and dragonflies will flit and flutter in the summer sun, and where sod forms a natural insulation that advances the project's mission of becoming LEED-certified as a green, environmentally-responsible building. A south-exposure terrace will provide excellent visitor gathering space outdoors, while also letting the sun into the lobby, and connecting the indoors with outside through massive windows that are yet to be installed.

Adjacent to the new Visitor Center, a small pond sits tucked against the alders. This is a bioswale, where runoff from the parking lot collects and filters into the ground, protecting the land from flood and pollutants in an eco-friendly way. Hidden under the shallow water is a structure that feeds water away from the building through buried pipework. Not unlike other building features that will be hidden from view, considerable attention has been paid to systems and structures to improve the visitor's experience and environmental impact of the project.

What is yet to be revealed are the technological and artistic details that will make the building unique. A handsome bull moose statue will stand at the entrance, followed in line by migrating salmon as visitors make their way to the front door. Solar panels in the parking lot will follow the sun, providing 10% of anticipated annual energy needs.

It is exciting to watch these building features appear as construction progresses. The finishing touches are expected to be complete by fall, with a community opening in December. Between then and now, more than just the construction crew is hard at work preparing from the public opening of this new space. Refuge rangers and educators are busy planning new interactive events and programming. The building will come alive through these programs. It expands our ability to provide public talks and walks to larger groups, reintroduces hands-on visitor center-based field trip opportunities, and has initiated the redesign of our Junior Ranger program.



Contractors install salmon forms into the Refuge Visitor Center exhibit hall's concrete floor.

Like wildlife finding just the right fit in their environment, you, too, can find a niche at the Kenai National Wildlife Refuge. The Visitor Center project

opens the Refuge to a whole new group of residents and seasonal visitors through volunteerism. Volunteer opportunities abound, from staffing the front desk and helping during public programs to leading guided walks or hosting a summer campground. If you are interested in getting involved as a Refuge volunteer, we look forward to hearing from you! Contact me, Leah Eskelin, at 907-260-2811 to discuss visitor center volunteer opportunities starting this fall.

Don't want to wait for the visitor center to open to begin your volunteer experience? We are seeking summertime campground hosts at Hidden Lake Campground right now. This position is traditionally filled by a host couple with their own RV or travel trailer and runs from May 14th to September 1st, 2014. Contact Michelle Ostrowski at 907-260-2839 or email michelle_ostrowski@fws.gov for more information about the camp host program.

The Refuge Facebook page is the go-to source for all the Visitor Center sneak peeks from now through the end of construction. Updates, photos and announcements will be posted often. Now that the floors have been installed, walls, finishes, ceiling and windows will be next. Be sure to watch the progress both online on [Facebook](#) and the [Refuge website](#) and in person at the current Visitor Center as we prepare to welcome you, your family, friends and summer visitors to the new building this December.

Leah Eskelin is a Visitor Services Park Ranger at the Kenai National Wildlife Refuge. For more information about the Refuge and Visitor Center project, visit kenai.fws.gov or like [the Refuge on Facebook](#).

Two jays for two biomes

by Dawn Robin Magness



Steller's Jay by Glenn Bartley (credit: <http://birds.audubon.org>).

A couple weeks ago, a small flock of Steller's Jays flew across the Sterling Highway as I drove past the Welcome to Soldotna sign. Their dark bodies, crested heads, rounded wings, and long tails make them fairly easy to identify from a distance. On closer inspection, Steller's Jays have a black head and vibrant blue body. My appreciation of Steller's Jays began when I worked on the Tongass National Forest in southeast Alaska. I spent a summer playing a tape recording of Goshawk calls. The idea was that if Goshawks were nesting, they would fly in to investigate the sounds. I never saw a Goshawk during these surveys, but more times than I care to count, Steller's Jays flew in and tricked me by mimicking the recording. Many corvids, the family of birds to which jays belong, mimic sounds; cell phones, cat calls, and even human speech can be replicated by these birds.

Steller's Jays, named by German naturalist Georg

Wilhelm Steller, are very abundant in the coastal rainforest of Southeast Alaska. The Kenai Peninsula straddles the northwestern extent of the temperate coastal rainforest biome. Steller's Jays are likely to be found in the wetter coastal portions of the Kenai Peninsula and have been found most winters in Homer since the Christmas bird count began in 1960. In contrast, Steller's Jays only began to show up in Soldotna's Christmas Bird Count in 2005. Over the past decade, a few Steller's Jays are counted most years and their presence may be due to milder winters. However, they are still very uncommon in Soldotna.



Gray Jay photo by Garth McElroy (credit: <http://birds.audubon.org>).

Soldotna lies upon the Kenai Flats, the large flat area west of the Kenai Mountains, encompassing the southern extent of the boreal biome. The species historically found here are more typical of interior Alaska and the common jay species is the Gray Jay. Gray Jays, also known as camp robbers or whiskey jacks, are stocky birds colored light grey below and dark gray on the back with a partial black hood. Gray Jays are usually found in small flocks and even have the unusual habit of using nonbreeding adults to help with nesting.

Both types of jays are bold and curious. They like to investigate human activities to see what there is to eat - the nickname camp robber alludes to this behavior. Trappers can also attest to the curiosity of these

birds. I often caught Steller's Jays in the live traps that I used to trap and radio collar flying squirrels for a den study. Strangely, I had to release a Gray Jay "trapped" inside the grill of my Toyota Tacoma in the parking lot of Denali National Park. I can only guess that the jay was interested in an easy meal of smashed insects.

The range of both jays overlaps in a few areas including the Rocky Mountains and coastal Washington and Oregon. Not much is recorded about interactions between these species except that Steller's Jays have been known to steal the food caches of many animals including Gray Jays. Ten years ago, I witnessed a flock of three Gray and two Steller's Jays by the Kenai River. What appeared to be a juvenile Steller's Jay was beg-

ging to be fed by an adult Gray Jay. This strange mixed flock moved off before I could observe more. This was the only time I have seen these species together. I will likely never know what was going on much less why or how. But, I do know that I am grateful to live on the Kenai Peninsula where we are lucky enough to experience both coastal rainforest and boreal forest species.

Dr. Dawn Robin Magness is a landscape ecologist and Fish & Wildlife Biologist at the Kenai National Wildlife Refuge.

Previous Refuge Notebook articles can be viewed on our website <http://kenai.fws.gov/>. You can check on new bird arrivals or report your bird sighting on the Kenai National Wildlife Refuge Birding Hotline (907) 262-2300.

Defining wilderness in a climate changing world

by John Morton



The Andrew Simons unit, one of three units that comprise the 1.3-million acre Kenai Wilderness, includes parts of the Harding Icefield.

What is “wilderness”? It’s much easier to say what it isn’t than what it is. It certainly isn’t Central Park. Sometimes it’s tough to acknowledge that Kenai National Wildlife Refuge has wilderness with the lights of Anchorage glowing on the northern horizon during winter. It’s one of those intangible concepts that depends on the eye of the beholder.

Wilderness comes from the Old English “wildēornes” or “land inhabited only by wild animals (deer)”. The more recent Oxford Dictionary defines it as “an uncultivated, uninhabited, and inhospitable region” and sometimes “a neglected or abandoned area of a garden or town”. None of this really jives well with the Alaskan version of wilderness that is alive with wildlife that has sustained Native communities for thousands of years.

Wilderness advocates often distinguish between little “w” and big “W”. The uncapitalized version of wilderness is everything mentioned above. The capitalized version refers to Wilderness specifically designated by Congress under the Wilderness Act, legislation signed by President Lyndon Johnson on September 3, 1964.

Over 750 Big-W units now comprise the National Wilderness Preservation System, encompassing 110 million acres of Federally-managed lands in 44 states and Puerto Rico, and representing 5% of land in the U.S. Here on the Kenai National Wildlife Refuge,

1.3 million acres are designated as Kenai Wilderness in three units: Mystery Creek, Andrew Simons, and Dave Spencer.

The Wilderness Act defines Kenai Wilderness for us: “A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain.” The key word here is “untrammelled”, which the Oxford Dictionary defines as “not deprived of freedom of action or expression; not restricted or hampered”. Another way of saying this is that human actions and influence are “unintentional”.

This all makes sense when we consider that early pioneers might have left behind a now-decaying trapper’s log cabin, the remnants of a mining sluice, or even a new forest that regenerates in the aftermath of an escaped campfire. But how do we interpret what Wilderness is (or should be) in a world in which the climate itself is driven by carbon and methane emissions being pumped into the atmosphere by human engineering? The climate is what ultimately determines the distribution of plants and animals, fire return intervals, insect outbreaks, whether precipitation falls as snow or rain or at all, and the hydrologic regime that sustains returning salmon. Contemporary climate change is a game changer. Or is it?

I just returned from an engaging 3-day workshop in Missoula that was hosted by the Aldo Leopold Wilderness Institute and the University of Montana’s Wilderness Institute. Participants were invited staff from the U.S. Fish and Wildlife Service, Bureau of Land Management, U.S. Forest Service and the National Park Service — the agencies charged with managing Wilderness. The discussion centered on developing guidance for ecological restoration in Wilderness, including in response to contemporary climate change. To cut to the chase, the consensus was that climate change itself does not “trammel” Wilderness because it is NOT intentional despite being driven, at least in part, by humans.

However, a changing climate affects so many ecological processes that it will become increasingly more

difficult to describe any part of our world as “natural”. I suspect our collective perception of Kenai Wilderness is a boreal ecosystem dominated by landscape-scale wildfires every few decades or even centuries that sustain white and black spruce forests, coupled with the Harding Icefield that feeds our glacial lakes and streams, all inhabited by moose, bear, mountain goats, Dall sheep, wolves, salmon and waterfowl. In addition to non-motorized ways of getting around, we enjoy these resources by float-plane, snowmachines and motorboats in Kenai Wilderness, modes of transport that were allowed in Kenai Wilderness by the Alaska National Interest Lands Conservation Act in 1980.

But in my crystal ball, I don’t see that vision extending into the future. Without some deliberate human intervention, we are likely to see *Calamagrostis* grasslands in what was white and Lutz spruce forest sustained by human-caused fires that support ring-necked pheasants, kettle lakes unable to provide habitats for fish and waterfowl because they’ve been filled by elodea or have dried up, nonglacial streams too warm to sustain salmon, slow-moving streams clogged by reed canary grass and northern

pike, fewer moose co-existing with Sitka black-tailed deer, escaped lodgepole pine forests that support feral turkeys, diminishing alpine tundra unable to sustain harvestable populations of Dall sheep because of an encroaching treeline and invading orange hawkweed, and not enough persistent snow cover to allow travel by snowmachines.

Okay, that’s pretty much a downer. The future Kenai Wilderness will likely track somewhere between what we have now and what my cloudy crystal ball is telling me. But this scenario does highlight the need for Refuge biologists to think creatively about how to “restore” Wilderness in a climate-changing world within the bounds set by Congress. It’s a tall order but also reflects how management and policy evolve with new challenges.

This year, 2014, marks the 50th anniversary of the Wilderness Act. Watch for upcoming celebratory events both locally and nationally. See our website (kenai.fws.gov) for more on information on Kenai Wilderness and its management.

John Morton is the supervisory biologist at Kenai National Wildlife Refuge.

Hidden Lake Campground—a “hidden gem” on the Kenai Refuge

by Michelle Ostrowski



Looking to the right of the boat launch across glacially-carved Hidden Lake is 2,890 foot Hideout Hill (credit: KENWR).

I am often asked thought provoking questions while working in the Kenai Refuge Visitor Center. Recently, I was asked how Hidden Lake Campground received its name. It dawned on me that in the sixteen years I've worked here, I hadn't given it much thought despite the huge amount of time I spend in the campground both for work and play. In writing this article, I did a little digging to uncover some interesting facts about this “hidden gem” of the Kenai Peninsula.

The 18.8 mile-long Skilak Lake Road was part of the original Sterling Highway built back in the late 1940's. Hidden Lake, largely unseen or “hidden” from this road, leads me to believe this may be the origin of its name.

Hidden Lake Campground, located 3.5 miles from the East entrance of Skilak Lake Road, is a favorite camping spot for locals and visitors where pleasures range from enjoying a campfire to sighting a black bear. Leaving technology behind helps you make an unhindered connection with nature to recharge your mind and spirit. The awe inspiring beauty of the area may also provoke your curiosity about the topography and forest history of this area.

Carved by glaciers amidst the 2,000 to 3,000 feet

high Kenai Mountains, the Hidden Lake basin was deglaciated 14,000-16,000 years ago. Climbing on the exposed rocky outcrops within the campground, you can see the glacial striations – scratches in the rock caused by the tremendous weight and pressure of moving ice grinding and scarring the rocks.

From June - August 1947, a huge fire burned 300,000 acres of forest including areas around Hidden Lake. Sixty-seven years later, we see a mature boreal forest with primarily spruce and aspen trees. Within the campground, you can hike Burney's Trail, named after a wildlife researcher who studied lynx and snowshoe hares in the early 90's in the Skilak area. This trail travels through spruce forest to a rocky outcrop viewpoint overlooking Hidden and Skilak Lakes. This is a good hike for bird lovers of all ages to look and listen for boreal and black-capped chickadees as well as Swainson's and hermit thrushes.

Hidden Lake Campground received an overhaul in 1989 when the campground was paved, new camp loops were added (Ridge and Skyview) and sites were defined each with a parking space, hardened tent surface, fire grate, and picnic table. Now, as the largest Kenai Refuge campground with 44 camp sites, handicapped accessibility, picnic areas, and a boat launch, it receives the most camping use within the Refuge.

Throughout summer weekends, the boat trailer parking lot is full as visitors access the lake with canoes, kayaks, powerboats, and even a few sailboats. The depth of the lake varies from really shallow (less than 10 feet) to its maximum depth of 148 feet. The deepest portion of the lake is the first third of the lake from the boat launch to the start of the islands. According to Robert Begich with the Alaska Department of Fish and Game, “a feature that is attractive about Hidden Lake is that for a large lake it does not get too rough, and it is deep with relatively few boating hazards.” I know this for a fact as my family spends time fishing, exploring, boating and camping out along the islands.

A highlight of my summer is to catch a fresh “laker,” wrap it in aluminum foil, and cook it in a

hot-coal campfire with butter and lemon and fry some potatoes on a skillet. Ken Gates at the Kenai Fish and Wildlife Field Office shares that, “lake trout is likely the most popular fish people target in Hidden Lake followed by kokanee.” The lake supports the largest ice fishery on the peninsula. The lake also supports spawning and rearing sockeye, rearing coho salmon, rainbow trout and stickleback.”



Camp Hosts assist with basic upkeep at Hidden Lake Campground restrooms, once called “comfort stations” (credit: KENWR).

Hidden Lake Campground is just one of the “hidden gems” within the Kenai Refuge and would be an extraordinary place to experience during summer 2014. One way to experience this special place in depth is to become a campground host.

Kenai National Wildlife Refuge is currently recruiting campground hosts for Hidden Lake Campground for summer 2014 from mid-May to Labor Day. Camp Hosts have been present here since the early 1990’s and are appreciated by campers for their friendly service. Their efforts to care for campgrounds and help visitors are tremendously important.

Hosts need their own trailer or camper and receive a tax free reimbursement stipend of \$150 per person (\$300 per couple) per week for groceries, personal supplies, propane, and generator gas. If you are interested or know of someone who would like to host, contact Education Specialist Michelle Ostrowski at 907-260-2839 or by email at michelle_ostrowski@fws.gov for more details.

Michelle Ostrowski is the Educational Specialist at the Kenai Refuge and has enjoyed working with “kids” of all ages since 1998. Find the Refuge on Facebook, or check out our current events at <http://www.fws.gov/refuge/kenai/>.

Brown bears cannot be shot over black bear bait on the Refuge

by Rob Barto

With bear baiting season just around the corner, I thought I'd take this opportunity to review the rules and regulations for baiting black bears on the Kenai National Wildlife Refuge.

First and foremost, harvesting brown bears over bait is prohibited on the Refuge. However, black bear baiting is allowed on the northern half of the Refuge, specifically that area west of the Swanson River Road to the Refuge boundary, and north of Swan Lake Road to the section line approximately 6 miles north, by State and Refuge permit only.

The free, non-transferable State and Refuge permits are issued to those who provide their current contact information, a 2014 Alaska hunting license, and the Alaska Department Fish and Game (ADF&G) sponsored bear bait clinic number. This number is given to those hunters who have successfully completed a bear baiting clinic sometime during their hunting career. There are two upcoming clinics offered on April 15 at the Cook Inlet Aquaculture Association on K-Beach Road, and on May 2 at the Soldotna Sports Center during the Kenai Peninsula Sports Rec and Trade show. For those folks who prefer computers, ADF&G also offers the class online at <http://www.adfg.alaska.gov/index.cfm?adfg=huntered.bearbaitingsched>.

For the third year, Refuge permits will be issued on a lottery system. Individuals interested in black bear baiting on the Refuge will need to fill out a permit application at the Refuge Headquarters on Ski Hill Road. Hurry though – applications for the lottery will not be accepted after 4:30pm on April 11, 2014.

On April 12 at 10:00am, all applicants must return to our office for the lottery drawing. During the lottery, hunters will be able to choose from approximately 200 one-mile sections (cells) for their black bear baiting stand. Once a cell has been selected, it will be crossed-off so no other black bear bait stands will be allowed in their chosen cell. Individuals must be present during the drawing to receive a cell.

Any remaining unselected cells will be available on a first-come first-serve basis at Refuge Headquarters beginning Monday April 14, 2014. Finally, those

individuals with registered black bear bait stations and their additional permitted hunters will not be allowed to harvest brown bears in their assigned cell.

All black bear bait stations must be clearly marked with a warning sign on which the permittee's hunting license number, the hunting license number of those individuals authorized to hunt over that bait station, and State and Federal permit numbers. The signs should be placed within 25 feet of the bait station, and 6 to 10 feet off the ground. Some hunters choose to put more signs at the start of their trail in addition to required signs.

All black bear bait stations are prohibited within 1 mile of a residence, including your own home. Additional Federal regulations prohibit bear bait stations within ¼ mile of roads or trails, and within 1 mile of campgrounds and dwellings on the Refuge. The Refuge will provide a map with those boundaries marked to each person receiving a black bear baiting permit. The Refuge also prohibits the use of nails, wire, screws or bolts, or the building of permanent bait stations and tree stands, as well as cutting of green trees for shooting lanes.

Additionally, all bait (including contaminated soil), litter and equipment must be removed at the close of baiting season which is June 30, 2014. Finally, the Refuge requires all baiters to submit a harvest report by July 15 whether they set up a bait station or not.

Many of you may wonder why ADF&G and the Refuge allow black bear baiting at all. There are several reasons that come quickly to mind. Baiting allows a hunter to observe bears prior to shooting which prevents accidentally harvesting sows with cubs as well as juvenile bears. Youth hunters at a bait station are given a relatively safe opportunity to observe bears and learn subtle identification differences between sows and boars. Lastly, bait stations allow for clean kill shots in an area relatively free of branches and trees.

Some common violations that we see on a yearly basis include failing to submit harvest reports on time, building permanent structures, cutting green trees for

a shooting lane, and failing to remove all baiting equipment at the end of the season.

Baiting can be an enjoyable experience when done right. However, as with most hunting activities, it only takes the actions of a few to ruin it for everybody. So please report all violations and help us by recording license plates numbers or descriptions of those you

see violating the law. When in doubt, contact either the Refuge at 262-7021 or Alaska Wildlife Troopers at 262-4573.

Rob Barto is a law enforcement officer and K9 handler at the Kenai National Wildlife Refuge. Find more information about the Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Kenai Refuge celebrates Wilderness on Earth Day

by Candace Ward



Join in a special Earth Day Event on Kenai Refuge Wilderness, April 22, 7 PM, at the Kenai Peninsula College.

The first Earth Day began on April 22, 1970 and was the product of local grassroots action to increase environmental awareness and to garner support for national legislation to solve urgent environmental issues. Wisconsin Senator Gaylord Nelson proposed the first Earth Day's activities. He insisted this day was for people to act locally, not a day organized by Washington bureaucrats, but by individuals and groups in their own communities.

Nelson's decision to leave Earth Day to the grassroots exceeded all expectations. Nelson and his staff estimated 20 million Americans took part in the first Earth Day in 1970. Though students were the most numerous participants, a broad range of people including educators, workers, homemakers, farmers, scientists, and politicians - from Barry Goldwater to Edward Kennedy - made up the excited Earth Day crowds.

Senator Nelson acclaimed that "Earth Day worked because of the spontaneous response at the grassroots level. We had neither the time nor the resources to organize the 20 million who participated from thousands of schools and local communities. The remarkable thing about Earth Day was that it organized itself." In the 44 years following the first Earth Day, it has remained an important annual way to raise awareness

of local environmental issues throughout the country.

That tradition continues in our community as a host of community organizations take part in Earth Day 2014 at Kenai Peninsula College on Tuesday, April 22. As a partner in the event, Kenai National Wildlife Refuge will present a special program at 7 PM. Refuge Manager Andy Loranger will present the story of how Refuge wilderness was created and how it is vital to conserving habitat for wildlife and fish resources as well as for the quality of human life on the peninsula. After his presentation, the hour long award winning film, "Wild by Law," will be shown. This film shares the story of how the Wilderness Act was passed 50 years ago in 1964. This event is free to the public.

2014 also marks the 50th anniversary of the 1964 Wilderness Act, the landmark conservation bill that created a way for Americans to protect their most pristine wild lands for future generations. The 1964 Wilderness Act created the National Wilderness Preservation System, which protects nearly 110 million acres of wilderness areas across our nation.

Our own Kenai Conservation Society established in 1965 was instrumental in advocacy to create federally designated wilderness on Kenai National Wildlife Refuge. Dedicated members including Dr. Calvin and Jane Fair, Helen and Jim Fischer, Bill and Jean Schrier, George Pollard, and Marge Mullen exemplified the efforts of local "grass roots" citizens. Their advocacy was instrumental in the successful establishment of 1.35 million acres of Refuge wilderness which came to pass in 1980 as part of the Alaska National Interest Lands Conservation Act (ANILCA).

Joining in local Earth Day events is a wonderful chance to celebrate all that's been achieved for conservation in our local community and to inspire us to continue future efforts to protect our wildlife and conservation legacy on the Kenai Peninsula.

As the Information & Education Program Supervisor, Candace Ward celebrates her 30th anniversary working at Kenai National Wildlife Refuge this April. Visit <http://www.nelsonearthday.net> and <http://www.wilderness50th.org> for more information.

Kenai Refuge sponsors the first Game Warden Camp for Youth

by Kelly Modla



Kids who participate in the first-ever Youth Game Warden Camp will receive a t-shirt with this cool logo.

Have you ever wondered what a game warden does? How about boating on some of the Kenai Peninsula's largest lakes and popular rivers to check anglers or flying over portions of the vast Kenai National Wildlife Refuge and landing to check on one of the public use cabins? If you like to get out in the winter, how about taking a snow machine into the backcountry during trapping season? In the fall, a horse back patrol into the wilderness during hunting season might be more to your liking or perhaps a front country foot patrol along the Upper Kenai and Russian Rivers.

These are just a few of the many activities that game wardens do. More importantly, they help the public interpret and understand regulations. Resource stewardship, interacting with the public on a daily basis, and the variety that the outdoors offers is why folks sometimes say that we have a great job.

Maybe you know a young person who has shown an interest in wildlife law enforcement or perhaps

wildlife or fisheries management. The Kenai National Wildlife Refuge is hosting the first Youth Game Warden Camp for kids currently in the 4th and 5th grades.

This hands-on camp will foster an awareness and respect for Alaska's natural resources. Kids will discover the interesting side of a wildlife forensics crime scene while learning about antlers, skulls, duck identification, and our local fisheries. Meet our Canine Officer 'Rex', and participate in activities about boating safety, fitness, reading maps, using GPS and compass, and archery.

This camp is a chance to learn more about Alaska's natural resources and meet those responsible for protecting them. One of the goals of this camp is to give kids a meaningful experience that might spark career interests in fisheries and wildlife biology, conservation, and being a game warden. But most of all, it's about having fun.

Our junior game wardens will look for the clues in the wildlife crime scene and help solve a wildlife violation, work side by side with Canine Officer 'Rex' to look for evidence or find a missing hiker, take a duck challenge to see how well they know our local waterfowl, and determine how a moose is considered legal for harvest. Camp participants will also have fun using GPS units to locate gorp stations along trails, and learn what kind of gear is good to carry in the backcountry or on the boat.

Camp participants will be taught by Federal and State game wardens, management professionals and volunteers. Our partners for this worthwhile event include the Friends of the Kenai Refuge, Alaska Wildlife Troopers, U.S. Forest Service, Alaska Department of Fish & Game, Alaska State Parks, and the local 4-H chapter.

The camp is scheduled for May 3-4. For more information, please contact Kelly Modla at the Kenai National Wildlife Refuge at 262-7021 to obtain a registration packet. Registration closes May 1.

Kelly Modla is a law enforcement officer at Kenai National Wildlife Refuge. You can find more information about the Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Spring migration comes to the Kenai

by Toby Burke



Greater White-fronted, Lesser Snow and Canada Geese, and a few ducks (Northern Pintail, Mallard, Green-winged Teal) flock together on the Kenai Flats (photo credit: J. Morton)

Periodically, even through the cold of winter, I drive into Boat Launch Road at the Port of Kenai to use the wildlife viewing platform. It's a convenient vantage point from which to search the Kenai Flats for signs of bird life.

At noon on March 22, at the tail-end of an incredibly mild winter and a series of warm, sunny afternoons, I climbed the viewing platform and was rewarded by finding five Northern Pintail ducks among the 50 or so exceptional Mallards that had overwintered there. Those five migrant ducks marked the end of my personal winter as they were true harbingers of spring, the long-awaited vanguard of spring migration.

What begins as a trickle soon becomes a torrent. Only five days later 300 gulls spiraled high over Cook Inlet and descended toward the mouth of the Kenai River. The next day 2,000 gulls occupied the colony across from the Port. Their numbers will be steadily augmented until the end of April when no less than 35,000 raucous gulls occupy that crowded piece of real estate.

In sharp contrast to last year's record cold spring

and delayed migration, this spring migration has commenced unusually early. The central Kenai Peninsula's first spring migrants, Mallards, typically arrive the first week of April. Gulls are usually right behind, arriving about a week later. By mid-April, dabbling duck numbers are building rapidly and the first geese start to appear followed by Sandhill Cranes. At that time, Greater Yellowlegs are the first shorebirds to arrive with Black-bellied and Golden Plovers right behind them. In late April, raptors such as Osprey, Northern Harriers, Red-tailed and Rough-legged Hawks, Peregrine Falcons, and Golden Eagles typically appear in modest numbers.

By early May passerines, including most songbirds, begin to occupy area forests. The nuptial songs of American Robins, Varied Thrushes, Ruby-crowned Kinglets, and Dark-eyed Juncos are ubiquitous across our local landscape. Migrant diving ducks and Short-eared Owls also appear by this time as well as Trumpeter Swans awaiting ice-out on their nesting lakes.

By mid-May the floodgates of spring migration are wide open as loons, grebes, shorebirds, terns, and sparrows populate our area. In late May, warblers

and swallows descend en masse, Swainson's and Gray-cheeked Thrushes arrive, and our first flycatcher – the Western Wood-Pee-wee – lets us know that the last migrants are not far behind.

By the conclusion of the first week of June, all of our late arrivers such as Blackpoll and Yellow Warblers, and Olive-sided and Alder Flycatchers are finally here, on territory and in full song. Accordingly, by mid-June, area biologists are ready to begin their annual breeding bird surveys.

Spring migration in our area, from beginning to end, is approximately nine weeks in duration. Kenai National Wildlife Refuge trails provide some of the best venues to enjoy our area's songbirds. Though these birds are more frequently heard than seen in their preferred wooded habitats, an early morning walk in June at the height of their nuptial song will not disappoint and can yield upwards of two dozen singing species. The Refuge's Keen-Eye and Centennial Trails are not far from downtown Soldotna and are highly recommended for this purpose alone.

Tens of thousands of migrating ducks, geese, cranes, shorebirds, and gulls pass through the Kenai Flats from mid-April to mid-May. They can be viewed well from Sea Catch Drive, Bowpicker Lane, Bridge Access and Boat Launch Roads – each providing a front row seat. An unforgettable eagle's eye view can be obtained from the bluff at the public parking lot at end of Spur View Drive near the Kenai Senior Center. If you haven't yet witnessed the pandemonium of 50,000 birds vocalizing and flying in all directions when Bald Eagles disturb them from overhead, then you really need to get out more (to the Flats). It is a spectacle that must be experienced firsthand.

I encourage you to participate in the Kenai Birding Festival on May 15-18. Contact the Refuge, Kenai Watershed Forum, or the Keen Eye Birders for more information. Don't let spring migration pass you by!

Toby Burke is a Biological Technician at the Kenai National Wildlife Refuge. For more information on the Refuge visit <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Ice-age mammals on the Kenai Peninsula: an update

by Dick Reger

In her 2008 book, *Kachemak Bay communities, their histories, their mysteries*, Janet Klein first published information about the fossils of extinct woolly mammoths found along beaches between Homer and Anchor Point. She also suggested that lay people could help us understand the presence of these mammoth fossils by contacting trained individuals or museums when they find these rare objects.

Ted Bailey followed with two 2009 Refuge Notebook articles in which he initially provided general

information about extinct elephants and then discussed the climatic implications of elephant remains found along Kenai beaches. He speculated on when the extinct animals might have come onto the Kenai Peninsula but, at that time, none of the fossils had been dated. Since Ted's articles, 10 newspaper articles and numerous public presentations by Janet Klein and me have reported our progress during a 5-year community-based investigation of these interesting fossils.

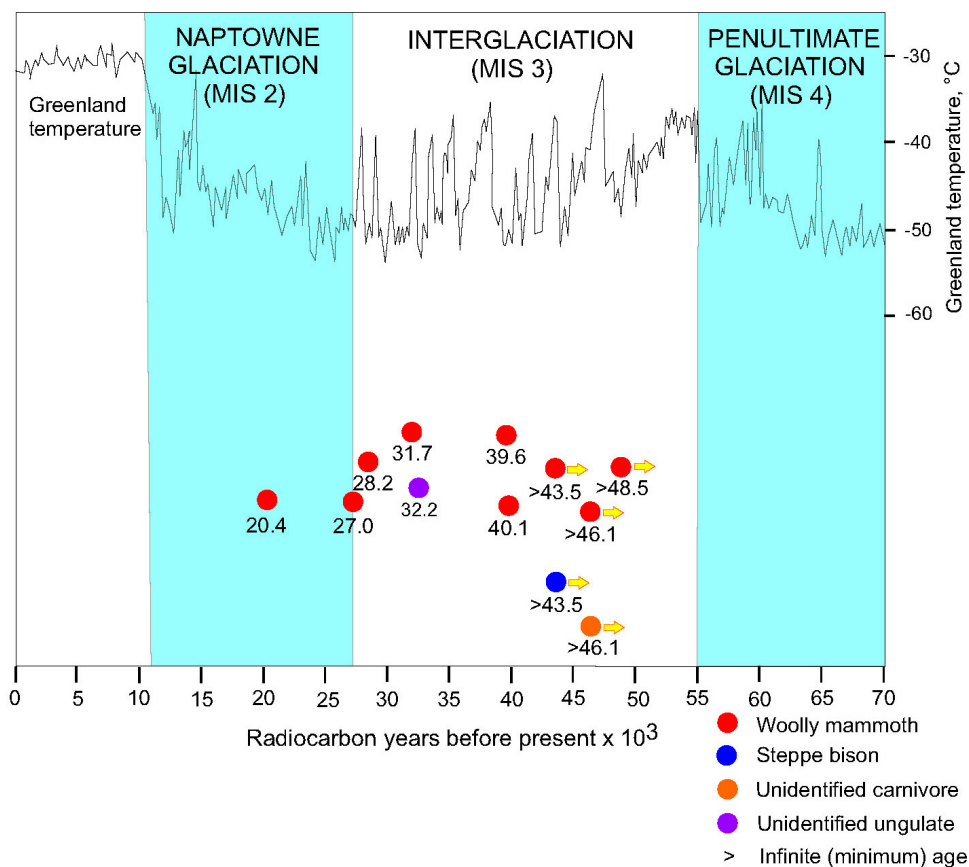


Figure 1. Radiocarbon ages for mammal fossils found on the Kenai Peninsula plotted against the late Pleistocene glacial chronology. Infinite ages represent the most recent times that the dated animals lived on the peninsula.

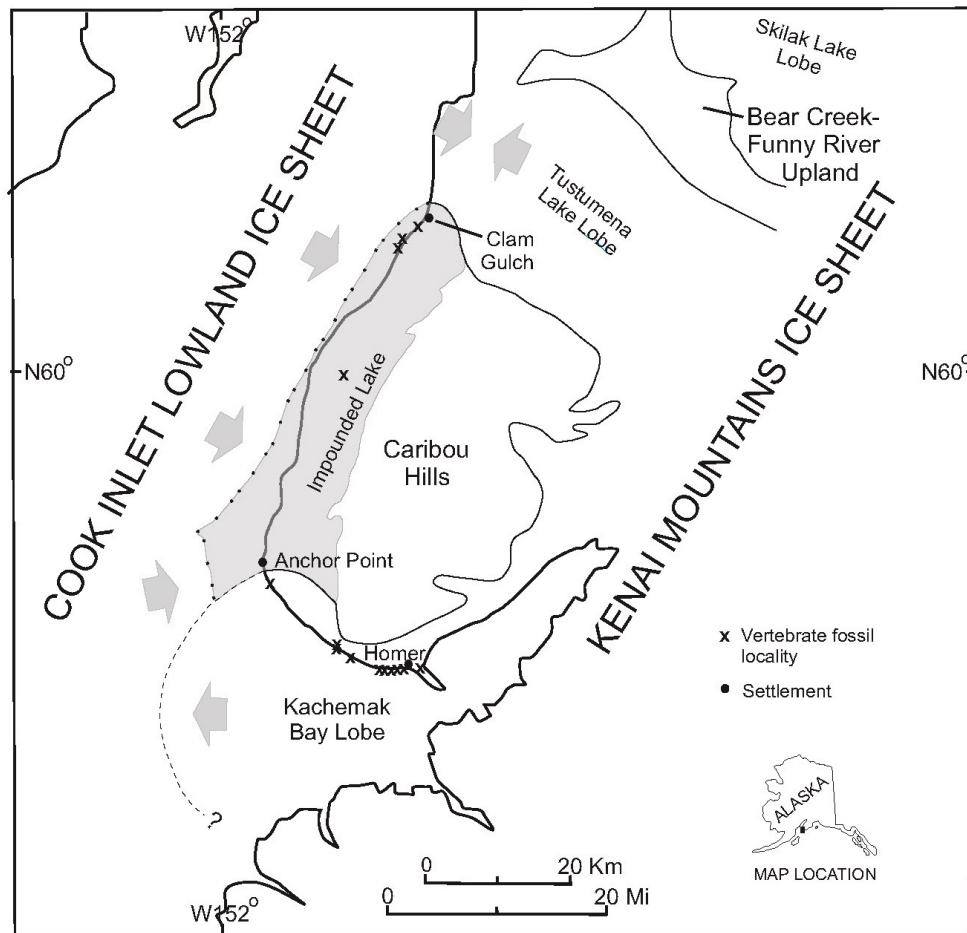


Figure 2. Maximum extent of the last major (Naptowne) glaciation compared to localities where fossils have been found.

Since 1958, 19 fossils of ice-age mammals have been found on the western Kenai Peninsula. A twentieth fossil bone was too small and indistinctive to be identified or dated. In the assemblage, 17 fossils were identified to species, but only 12 samples have been dated, using funds provided by interested individuals and the investigators. Nine mammoth fossils, one steppe bison horn core, and bones of an unspeciated herbivore and an unspeciated carnivore were dated.

Samples from a mammoth molar, the horn core of a steppe bison, and a horse tibia were contaminated, and so were not dated, although they were identified and photographed. We hope to resample the only horse bone found in hopes of obtaining an uncontaminated sample.

Through the years, only photographs were available for one woolly mammoth molar, two woolly mammoth molars were lost, and two finders of a woolly mammoth molar chose not to participate in the

program. Identifications were made or confirmed by Dr. Patrick Druckenmiller, an interested vertebrate paleontologist at the Museum of the North in Fairbanks.

A plot of radiocarbon ages against the glacial chronology here on the Kenai Peninsula (Figure 1) supports some of Ted Bailey's initial speculations about when the extinct fauna probably lived on the Kenai Peninsula. Of the seven finite ages, six range from about 27,000 to 40,100 radiocarbon years before present (B.P.), and five infinite radiocarbon ages range from at least 43,500 to more than 48,500 radiocarbon years B.P., demonstrating that the animals lived here on the peninsula for at least 21,500 radiocarbon years between the last two major glaciations.

At that time, conditions in this area were probably not too different from today, except that grasslands were probably more extensive – the assemblage is dominated by grazers. Evidence indicates that extinct mammals came to the peninsula from the Interior

through mountain passes after the penultimate (next to last) glaciation.

We question the significance of the finite age of 20,400 radiocarbon years for an extinct elephant tusk fragment, which plots close to the climax of the last major (Naptowne) glaciation. At that time, only about 510 square miles of the highest Caribou Hills were exposed above the surrounding lowland ice sheet and the large meltwater lake that was impounded in the lowland between the western base of the Caribou Hills and the ice sheet from the west side of Cook Inlet. Almost certainly, enough vegetation to support a viable population of large herbivores did not exist in that very windy, dry, frigid, upland environment.

Our speculations that the fossils were preserved outside the limits of the Naptowne glaciation are supported by the distribution of fossil finds (Figure 2), which are concentrated in the Clam Gulch and Homer areas. The Clam Gulch fossils were found inside the limits of the old meltwater lake basin. The single find near the middle of the old lake basin was actually located on a gravel bar deposited during the massive 2002 flood of Deep Creek, and confirms the Caribou Hills as the source of that 31,740-RC-year-old extinct elephant tusk fragment. The Homer samples, while technically in the glaciated area, were likely moved from the sites of their initial preservation to localities where the fossils were recovered during floods, by longshore currents along Cook Inlet beaches, or were

carried by debris flows.

Fossils recovered and identified on the Kenai Peninsula so far represent the three mammal fossils of this age typically found in interior Alaska: steppe bison (most common), mammoth, and horse (least common). Potentially, other mammals that could have provided bones in a very diverse assemblage include mastodon (another extinct elephant), muskoxen, caribou, sheep, elk, moose, a moose-elk, yak, saiga antelope, wolves, foxes, short-faced bear, brown bear, steppe lion, saber-tooth cat, giant ground sloth, wolverine, badger, and a host of smaller mammals, like ground squirrels, lemmings, voles, shrews, ferrets, and weasels. Many of these mammals are extinct, but some survived the monumental environmental changes that occurred in Alaska at the end of the last major glaciation.

I encourage you to report your suspected finds to Janet Klein in Homer (907-235-8925), who is the primary contact for folks finding mammal fossils in the southwestern Kenai Peninsula.

Dr. Dick Reger graduated from Kenai Territorial High School in 1957, and eventually earned a PhD in geology from Arizona State University. Over the last 38 years, he has intermittently studied the landscape evolution of the Kenai Peninsula. You can find more information about the Kenai National Wildlife Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Surviving an aircraft crash in water

by Jennifer Peura



Taylor Gregory, a US Fish & Wildlife Service technician, getting ready to be dunked in the “Home Depot 2000” at the Nikiski Pool.

“Mayday! The engine has failed! This is an emergency! Prepare for ditching!” These dreaded words hopefully no one hears. However, in the event of an emergency, having muscle memory on what actions are needed could very well be the difference between life and death.

As an itinerant wildlife biologist working this summer at the Kenai National Wildlife Refuge, I am required to take aviation safety training before stepping into a float plane to conduct aerial surveys or simply to be ferried to a remote part of the Refuge. And so here I was at the Nikiski Community Pool to learn what to do if your flight plan goes belly up in the water.

Rick Gividen and Dave Kreutzer, both trainers from Integrity Aviation Training, held a course this past Tuesday that included both a classroom compo-

nent as well as a hands-on training session in the pool (aka “dunker” training). They introduced three categories of actions that help ensure survival in case of an emergency: pre-takeoff actions, egress (exiting), and post-egress survival. “When the time to act comes, the time for preparation has passed,” stated Rick.

There are a few pre-takeoff actions that anyone flying, be it in a single engine up to a commercial airbus, could benefit from by simply taking a few moments to evaluate your environment. Rick advised to be aware of the location of the emergency exit. In smaller aircraft, you could even ask the pilot to practice opening the door. Rick spoke of a crash that ended in the worst possible way because the passenger was unable to exit the aircraft—he had never previously opened the door! Rick emphasized that the first time you open the door to the aircraft should not be in dire straits.

The same was true with simply unbuckling the safety belts. A quick practice run could really make a difference if something goes awry. Rick also stated that “all cargo can become a projectile or impediment if not properly secured.” Prior to takeoff make sure that everything is stowed away and take note of anyone or anything that is by the emergency exit. Thinking about details, such as the physical capabilities of the person responsible for opening the emergency exits to where the personal flotation device is located, could make a world of difference.

In the case of an emergency, Rick laid out 7 steps for a successful egression. For those of you who have completed the course, a quick refresher won’t hurt:

1. State “I’m a survivor” and set yourself in the right mindset to succeed.
2. Unplug flight helmet.
3. Open the door to the aircraft and brace for impact.
4. Slow count to 4 and sit up.
5. Locate, clear exit and grab a reference point.
6. Release seat belt and exit the aircraft.
7. Swim hand up, head up, investigate the surface and inflate your PFD.

The instructors emphasized that a positive mental attitude was a huge element of success. Practicing these 7 steps took me and other students to the Nikiski pool, where we were placed in the “Home Depot 2000”, a cage made of PVC pipes, straps, a harness and a helmet plug to simulate exiting an upside down aircraft underwater.

Post-egress survival is mainly dependent on not succumbing to hypothermia or fatigue. “It’s a tragedy to successfully egress...only to succumb to hypothermia” stated Rick. Dave reiterated this point that hypothermia is the biggest post-egression hazard.

To demonstrate survival techniques, my class practiced different floating and swimming formations in the pool. These formations were meant to utilize the warmest area of the water column, roughly the top foot of water just below the surface, as well as water that is warmed by our body heat. We got to really know each other after intertwining our limbs in formations such as “the carpet.” However, the best course of action – if the crew can make it to shore – is to start swimming. Keep an eye on every member of the crew, especially the slowest.

Survival tools and how to use them are also of extreme importance once the crew has successfully egressed. Some tools are intended for one-time use, such as dyes and flares, and should be conserved until the right moment when being spotted is most likely.

Basic preparations and survival techniques can make a huge difference for the crews that are flying into remote areas of the Refuge and other areas of the peninsula. Awareness and a refresher on training will not only give passengers on smaller aircraft peace of mind, but also the pilots who fly the helicopters and float planes that their passengers are prepared for an

emergency.

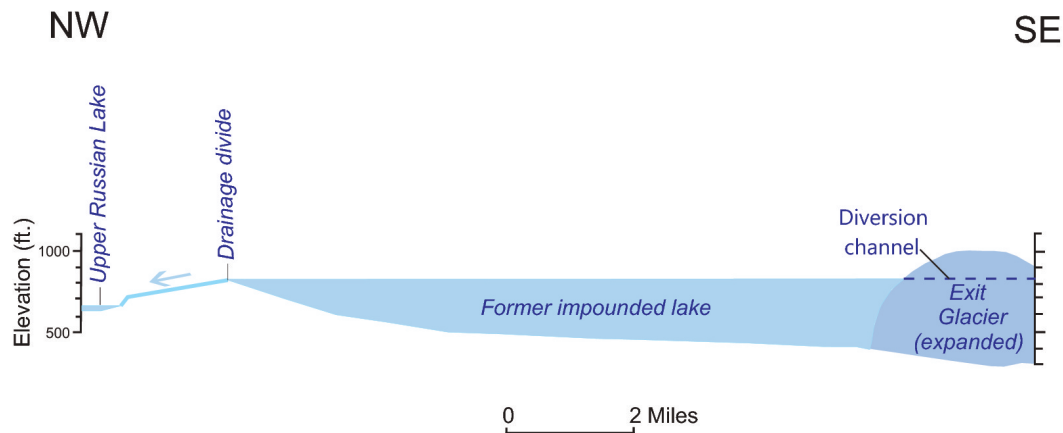


Trainers and course participants help simulate the disorienting nature of being turned upside down while underwater in a shaking aircraft.

Jennifer Peura is a new biological intern at the Kenai National Wildlife Refuge. You can find more information about the Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

A geologic explanation for two sockeye populations in the Russian River

by Dick Reger



Model based on the blockage of upper Resurrection River by a late-glacial advance of Exit Glacier, impoundment of the drainage in a former lake above the glacier dam, northwest overflow from the impounded lake into the upper Russian River, and southeastward drainage through a diversion channel around Exit Glacier into lower Resurrection River.

My interest in the Russian River fishery was suddenly piqued one day about four years ago, when a colleague, Paul Ruesch, asked me a very intriguing question: Could there be a geologic reason for the two genetically diverse sockeye salmon populations in the Russian River drainage?

My initial response was: What do you mean by genetically diverse sockeye stocks in Russian River? Paul, a retired Alaska Fish and Game fishery biologist, was ready with the answer—genetic studies demonstrate that the DNA is different in salmon spawning above and below the falls in Russian River.

A couple of days later, he showed me a complicated-looking diagram that illustrates genetic relations between red salmon that spawn in different Cook Inlet drainages, including Russian River. Simply put, closely related sockeye stocks plot close together in that diagram, and stocks that are not closely related plot far apart. At the top of the diagram, Paul pointed out a population of sockeyes that spawns above the Russian River falls during early and late runs, and the adults are small relative to adult reds that spawn below the falls. I later learned that those red salmon overwin-

ter in the Upper and Lower Russian lakes. In the lower third of the diagram, Paul then indicated a population of red salmon that spawns during the late run below the falls and clusters with other sockeyes spawning in the Upper Kenai River. Those reds overwinter in Skilak Lake.

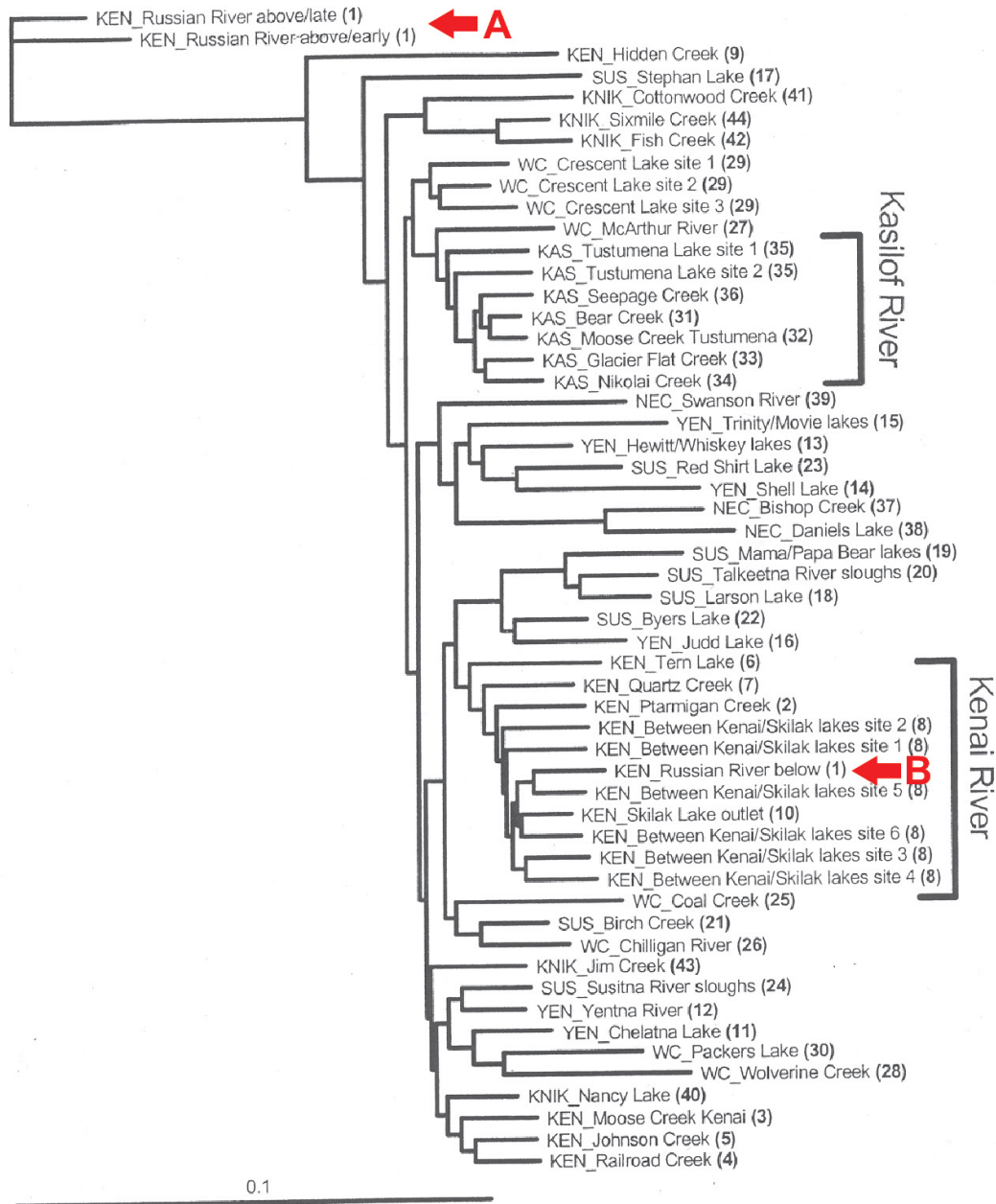
Actually, the relation of fish distribution to geologic factors has intrigued me since my graduate-school days, when I was assigned to read a classic 1948 paper by Carl Hubbs and Robert Miller on the zoological evidence relating fish distributions and drainage changes in the desert southwestern US. So, I was pre-programmed to try and answer Paul's initial question.

A guiding principle of my geologic studies is to understand the big picture first, so I initially studied the 1:250,000-scale topographic map of the Seward Quadrangle, where the Russian River, a north-flowing tributary of the Upper Kenai River, is confined in an intensely glaciated mountain valley. I located the Russian River falls, Lower Russian Lake, and Upper Russian Lake, and I noted that the uppermost Russian River is separated by a low drainage divide at 850 feet elevation from nearby Summit Creek, the uppermost

tributary of Resurrection River, which drains south-eastward into Resurrection Bay near Seward. Could red salmon somehow have crossed the divide from Resurrection River into Russian River?

Further examination of the topographic map revealed that Exit Glacier near Seward is positioned so that a significantly larger glacier would dam Resurrection River, impounding a large lake upstream of the

glacier barrier and potentially trapping sockeyes during a spawning run. If lake level reached 850 feet elevation, lake waters would decant across the drainage divide and enter the Russian River drainage, carrying along the red salmon trapped in the lake. Could I find evidence for the damming of the Resurrection River by Exit Glacier?



Genetic relations among sockeye salmon spawning in different drainages of the Upper Cook Inlet. Letters A and B represent genetically different sockeye populations in the Russian River (Source: Seeb et al. 2000).

I next looked at aerial photographs of the Exit Glacier area and examined the area stereoscopically, so that I got a good 3-dimensional impression of the topography there. Sure enough, on the northeastern side of the Resurrection River valley across from the modern terminus of Exit Glacier, there is an obvious bedrock channel at 850 feet elevation through which the river could have been diverted if the valley was blocked by an expanded Exit Glacier. Preparing a model (see graphic) showing the relations of the glacier/lake/drainage system was pretty straight forward.

Unfortunately, I lack the information to date the diversion of Resurrection River reds into the Kenai River drainage. An informed guess is that a larger Exit Glacier likely blocked the Resurrection River near the end of the last major glacial recession, perhaps 11,000 to 12,000 years ago.

I have not proven that such mixing of sockeye populations actually occurred in the manner I propose. Ideally, the model could be tested by comparing the DNA of the Russian River reds with sockeye salmon

that spawn today in Resurrection River. Unfortunately, I learned that the modern runs of red salmon in Resurrection River are not native to that drainage, but are composed of a mixture of fish from several different drainages that were initially reared in the Trail Lake hatchery near Moose Pass. So the DNA of those fish cannot be used to test my hypothesis.

Geologic investigations often reach an impasse like this, where the available data are inadequate to provide a definitive solution. Optimists, like me, anticipate that future geologists and geneticists will eventually find the information needed to verify or refute this particular drainage model.

Dr. Dick Reger graduated from Kenai Territorial High School in 1957, and eventually earned a PhD in geology from Arizona State University. He co-authored a 2007 guidebook on the late Quaternary history of the Kenai Peninsula (<http://www.dggs.alaska.gov/publications>). You can find more information about the Kenai National Wildlife Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Fire-adapted plants thrive after wildfire

by Elizabeth Bella



The iconic fireweed in a post-fire patch on the Kenai Peninsula (credit: Kenai Refuge).

The massive wildfire that recently engulfed a good chunk of the local landscape may look like a bleak, uninviting place for some time, but regenerative ecological forces are already at work. As we embrace the hard work, dedicated suppression efforts, and good fortune that resulted in a positive community outcome, many of our floral friends can rejoice in the opportunities of the fire-altered system.

Wildfire is nothing new to boreal spruce-birch forests, as these systems evolved with fire and are dependent on disturbance for regeneration. Many plant and wildlife species have adapted to fire disturbance, and their continued survival and success is dependent on it. Fire not only prompts regeneration of many plant species, it recycles mineral elements like nitrogen and phosphorus, and removes accumulated organic matter.

Wildfires are variable, with some areas burning so severely that only mineral soil is left, and other areas left with patchy vegetation or organic mat chunks. During a fire, vegetation either survives by chance or by adaptations like thick bark; by recolonizing from seed banks or seed transport by wind, flooding, or animals; or by sprouting new growth from underground roots or plant parts.

Reestablishment of ecological communities following a fire is variable in Alaska, but we understand

general patterns of succession, and know what to expect around the Kenai Peninsula. Post-fire ecological succession generally follows a process of soil building and early colonization by mosses and liverworts, then wildflowers and grasses, then deciduous shrubs and trees, and finally by conifers. Large fires in both 1947 (still the largest recorded wildfire on the peninsula at over 310,000 acres) and in 1969 left a legacy of patchy birch stands interspersed with spruce stands, structuring diverse wildlife habitat.

Plants that have fire-adapted traits are known as pyrophytes, and quite a few are found in our fire-evolved boreal forest system. Many species of moss and liverworts readily establish in patchy or severe fire areas, sprouting from wind-dispersed spores. These species help other species to establish by accumulating organic material like drifting leaves, twigs, and other organics, and holding moisture. Horsetails are common in post-fire areas that were not hot enough to burn the rhizome, or underground stem. Every gardener in the region knows the persistence of these plants that sprout and sprout again despite attempts to remove them.

The most celebrated early post-fire gem is the morel mushroom, which for somewhat mysterious reasons tends to abundantly fruit in the first or second year following a wildfire. The fungus may possibly seeking new food sources or substrates to colonize, prompting a big surge in fruiting bodies to produce spores. Morels can be easily distinguished from non-edible look-alikes as they have cap and stalk as one unit. False morels have brain-like lobes, with a detached cap. As with any wild edible, consult experts and guides before attempting to harvest them.

Bluejoint reedgrass mainly regenerates after a fire from thick root mats, and also through prolific seeding adjacent to burned areas. This common grass species can compete with tree regeneration, leading to a complex set of potential long-term changes in forest composition.

The iconic fireweed is probably the best-known post-fire plant, incorporating its affinity for burned areas into its very name. This species has prolific light seeds that can travel large distances in wind. Vast

patches of bright pink flowers are visible from considerable distances in the years following a fire. Unfortunately, many non-native flowers – such as the orange and yellow hawkweed and dandelions – display the same wind-dispersed prolific spread if there are seed sources following a fire. Monitoring for non-native species will take place to reduce invasions in recently burned areas.

Several shrub species, including dwarf birch, blueberry, lingonberry, and Labrador tea, will readily resprout in less severe burn areas from root crowns in partially burned or intact organic mat locations. Taller shrubs like willow, particularly Barclay's willow and Scouler's willow, sprout prolifically after fires. Alder can sprout, but tends to reseed in areas adjacent to fires to reestablish itself.

Deciduous tree species depend on fires for large-scale reestablishment. Paper (or Kenai) birch, an integral part of the forests here, readily grows on post-fire sites burned to mineral soil in vast patches from long-distance seed dispersal. Quaking aspen generally resprouts from root suckers which quickly grow in nutrient-rich post-fire soils. Cottonwoods, including both balsam poplar and black cottonwood, produce light tufted wind-dispersed seeds, and can resprout

from lateral roots and even stems or branch fragments.

Black spruce is entirely fire-dependent for regeneration, as its resin-sealed cones require the heat of fire to melt and release seeds. Black spruce's structure is very fire susceptible, with flammable low-growing short crowns that tend to burn completely in fires. Seeds are released between one to three years following a fire that kills the tree, and seedling growth can occur in both mineral and organic mat areas. White and Lutz spruce do not need fire to release seeds, but adjacent stands will produce large seed crops after a hot, dry summer to recolonize burned areas.

Post-fire landscapes can be eerie and solemn places, but within them is the pulse of new life and regeneration almost immediately following the destruction. As the landscape renews itself, creating fresh wildlife habitat for generations to come, we'll have the chance to directly observe the ecologically fascinating process – and perhaps even harvest some delicious morels along the way.

Dr. Elizabeth ("Libby") Bella is an ecologist at Kenai National Wildlife Refuge. You can find more information about the Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Ghosts of fires past

by John Morton



The perimeter of the 200,000-acre Funny River Fire includes large areas that were only partially burned including these mature stands that regenerated after a fire in 1871.

I flew over much of the Funny River Fire this past Monday. Almost three weeks after the fire was first detected on May 19, 60% of the perimeter has now been contained. On this particular day, there were two actively burning areas high on the Tustumena Bench, torching alpine tundra and subalpine shrub.

What struck me the most was how much forest had NOT burned within the perimeter outlining the almost 200,000-acre fire footprint. Sure, there were black spruce stands that had been completely incinerated down to black ash, particularly in the area close to the public eye along Funny River Road and across from the Kenai Keys. But there were other areas of mixed forest where the fire had skipped over the hardwood as it spotted from one white spruce to another. There were hardwood stands where the fire had burned through rapidly, consuming grass and other flash fuels on the ground while leaving the aspen canopy intact. As our plane approached the rugged hills above Tustumena Lake, we flew over extensive stands of white spruce and hardwood left unscathed within the fire perimeter.

What the fire folks will tell you is that oxygen, heat and fuel are needed to make a fire. Well, we had plenty of oxygen in the first few scary days of this fire with sustained winds of 20 mph and gusts exceeding 30 mph. We had heat provided in the form of human-caused ignition in extremely dry conditions.

It's the fuel that is a bit more difficult to describe. Of the almost 200,000 acres that the fire perimeter encompasses, 88% is (or was) forested. Analysis of Landsat satellite imagery tells us that the forest was composed of white spruce (68,300 acres), black spruce (54,200 acres), mixed hardwood-softwood (46,800 acres), mixed conifer (1,200 acres), hardwood (4,500 acres), and mountain hemlock (500 acres). Lakes, wetlands, shrub and alpine tundra constitute the remaining area.

Some think the fire raged because of the unsalvaged beetle-killed white spruce on the Kenai National Wildlife Refuge. Indeed, aerial surveys conducted by the Alaska Forest Health Protection Program indicate that about 50% of the area within the perimeter had been injured or killed by spruce bark beetle, mostly during the 1980s. This agrees well with satellite imagery that shows about the same acreage in white spruce and mixed forest.



Scorched areas of the Funny River Fire bump up against reduced fuel loads left by the 2005 King County Creek Fire.

But, again, this doesn't necessarily distinguish what burned or didn't burn in this fire. One of our refuge biologists, Matt Bowser, using an algorithm in MODIS, which is the same multispectral satellite imagery used to estimate the fire perimeter, estimated that only 65% of the 200,000 acres actually burned. Of the area that burned, only about 26,000 acres constituted "high severity" with the remaining 100,000 or so acres burned categorized as "low severity". And much of the area that burned hot was, in fact, mature black

spruce, not beetle-killed white spruce.



Alpine tundra was still burning on the eastern edge of the Funny River Horse Trail Fire as of June 9.

The fire footprint was better defined by the “ghosts of fires past.” Dr. Ed Berg and Andy DeVolder, both previously on our staff, used carbon-14 dating of charcoal and tree-ring dating of fire-scarred trees to map historic fires on the refuge. The current fire burned

over mature forest that was either not known to have burned in the last 200 years or regenerated in the aftermath of the 1871 fire that burned onto the Tustumena Bench. The 2009 Shanta Creek Fire burned 13,000 acres of the latter.

Much of the perimeter of the Funny River Fire was fated to be defined by previous burns including the 2005 King County Creek Fire and 2007 Swan Lake Fire that bump up against Skilak Lake, and the 2004 Glacier Creek Fire along the northeast corner of Tustumena Lake. Over in the west, the fire perimeter is as much defined by the 1981 Slikok Lake Fire as it is by the utility corridor along the Sterling Highway.

Just as previous fires helped define the current fire, the Funny River Fire will have an ecological and economic legacy that will extend into the future, past most of our lifetimes. Black spruce has a historic mean fire return interval of 80 years; white spruce has a return interval of several hundred years. The communities of Kasilof, Soldotna, Sterling and Funny River, so recently threatened by this fire, are now somewhat protected from future wildfire, at least from those originating between Skilak and Tustumena Lakes. And spruce stands that burned hot enough to reach mineral soil should convert to early successional hardwood, setting the stage for good moose hunting 15 or 20 years down the road.

The downside is that this fire is only a small section of the rapidly-developing urban interface that stretches for 175 miles along the refuge boundary between Point Possession in the north and the Fox River in the south. Refuge fire managers will continue working with landowners and other agencies to strategically reduce fuel loads along this wildland-urban interface to help ensure that future wildfires can renew wildlife habitats on the refuge without damaging our communities.

John Morton is the supervisory biologist at Kenai National Wildlife Refuge. You can find more information about the refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Aquatic habitat mapping “off-the-shelf”

by Mark Laker

Since I was a little boy, I’ve been interested in exploring the underwater world. My favorite TV show was *The Undersea World of Jacques Cousteau*. Though our lakes don’t offer quite the array of colors and charismatic species as a coral reef, they can be rich and interesting environments to explore. Just like on land, the richness of aquatic species is associated with habitat availability and quality.

For me, the ideal method to explore the underwater world is putting on my mask, fins, and snorkel or SCUBA gear and jumping in the water. On a small scale this works, but for large area, we need other methods. Our current project exploring aquatic habitat involves the elodea infestation in Stormy, Daniels, and Beck Lakes. Elodea is a nasty aquatic invasive plant that has the potential to displace native plant species and choke off waterways.

We have conducted numerous “rake surveys” to determine the presence of elodea on the Kenai Peninsula. This involved tethering a garden rake head to a rope and dragging it across the lake bottom to sample plants. From these surveys, we learned elodea prefers shallow soft bottom areas. Therefore, we wanted to map depth, bottom hardness, and presence of vegetation across entire lakes to understand where the best elodea habitat exists.

The first step in creating our lake habitat map to collect depth data for a bathymetric map. A bathymetric map is the underwater equivalent of a topographic map with contours for depth instead of elevation. All that is needed is location and depth, and lots of it. Not long ago it was an expensive and complicated task to record GPS location and depth, and then process it into depth contours.

Researchers are constantly looking to the consumer market for readily available equipment and solutions. These are called “off-the-shelf” solutions, and can save time and money. For this project, we used the Lowrance HDS Charter/Sonar with StructureScan to measure depths and locations. The recorded data was then processed by Contour Innovations (<http://www.contourinnovations.com/>). This off-the-shelf solution was recommended to me by ADF&G biologist Robert Massengill who was working on another eradication

project for invasive northern pike in Stormy Lake.

The Lowrance HDS sonar works by emitting an ultrasonic pulse directly below the boat and receiving the echo as it bounces off the lake bottom or vegetation. This is also referred to as a down-scanning sonar. The StructureScan operates at a higher frequency which is better for distinguishing vegetation and underwater structures. In addition to down-scanning, the StructureScan utilizes side-scanning technology. As opposed to the down-scan sonar which generates a profile or side view of the bottom, the side-scan sonar looks off to the sides to create an actual image of the bottom.

To collect the data we ran transects (spaced 100 feet apart) back and forth across the lake at a speed of about 6 mph. Typically when boating you try to avoid obstacles, but when mapping you almost intentionally run over them. On Daniels Lake we encountered some glacial erratics that were about 20 feet across – those are some big rocks! Needless to say, Daniels Lake made a few modifications to our prop.

Contour Innovations offers two services: LakeTrax for anglers, and ciBioBase for research. Before acquiring the research version, I experimented with the LakeTrax service by mapping the outlet of Tustumena Lake down to the boat launch. Anyone who has navigated that stretch of water knows there are some nice boulders covered with aluminum strips just upstream of the launch. With just a few hours of mapping, I was able to create a nice bathymetric map and identify hazards. You can save maps back on your Lowrance HDS unit, and in the future avoid leaving any trace of your boat on the rocks.

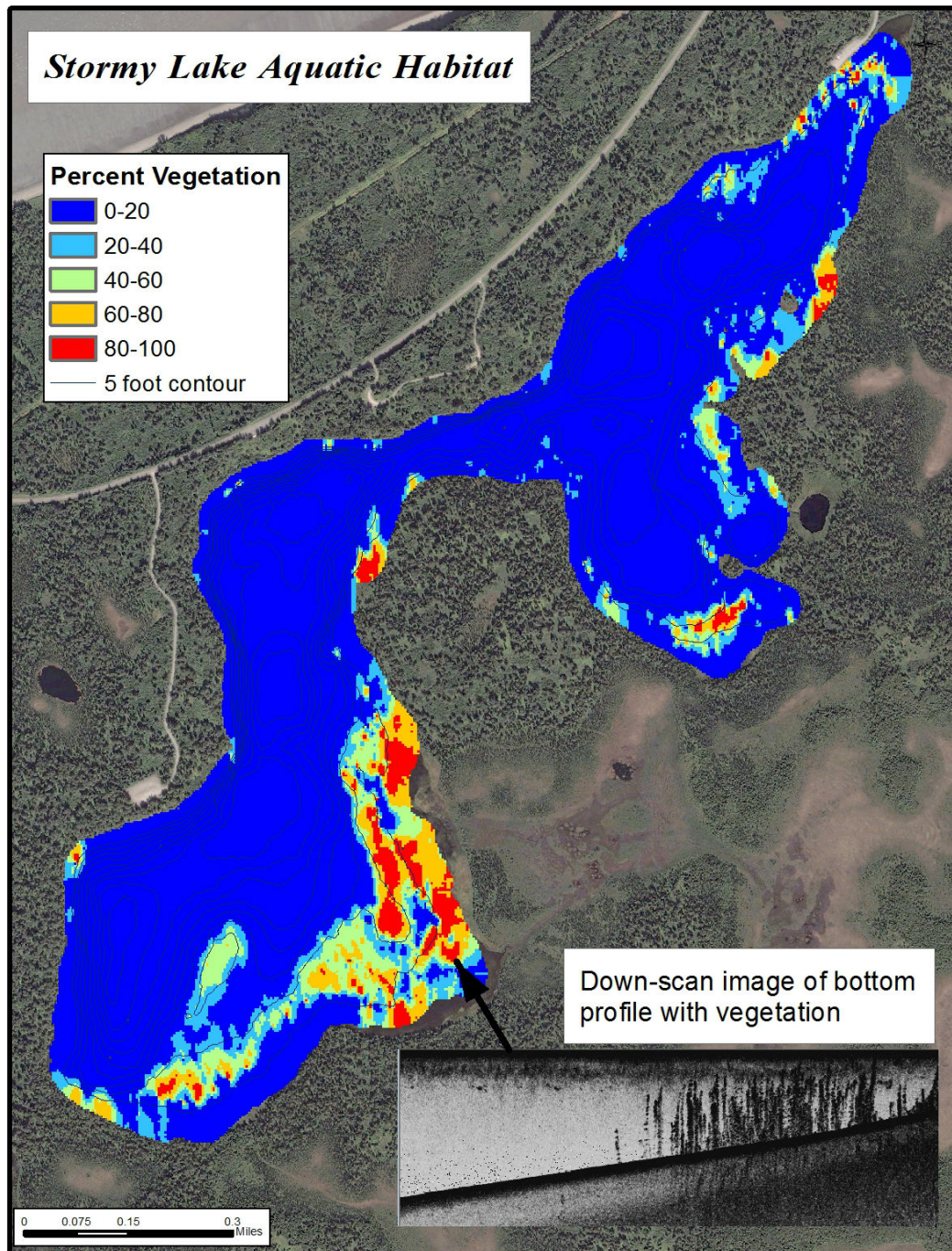
Beyond lake depth and obstacles, we also needed information about vegetation and the bottom substrate to understand elodea habitat. Therefore, our lake data (called sonar logs) were processed by the research service, ciBioBase, to produce three layers: depth, bottom hardness, and percent vegetation biomass. Bottom hardness is calculated by how well the sound signal is reflected off the lake bottom. Harder surfaces reflect well and soft surfaces tend to absorb sound. Percent vegetation biomass is simply the percent of the water column that is occupied by

vegetation (plant height divided by water depth).

From the new data layers we will produce a map identifying areas of the lake with suitable habitat for elodea. These will be important for both treatment and monitoring efforts. Though I'll still need to put on my

mask and fins to see for myself what's really under the water.

Mark Laker has been an Ecologist with the Kenai National Wildlife Refuge since 2003.



A Lowrance HDS sonar map showing underwater vegetation in Stormy Lake.

Breeding Bird Surveys—Quick! Three beers!

by Bri Kilbourne



An Olive-Sided Flycatcher, characterized by a call resembling "Quick! Three beers!" (credit: Alan Murphy Photography).

I saw the moon for the first time this summer. Waking up at 2AM brings a new perspective to the seemingly perpetual daylight of Alaskan summers. However, this darkness didn't last long, and after a blurry-eyed car ride, I found myself at the turnoff to Skilak Lake Road. Here, Toby Burke and I prepared for the 50 stops to come this morning as we waited for 4AM. It was time, once again, to collect data for the National Breeding Bird Survey on one of the many designated routes within the Kenai National Wildlife Refuge.

The Breeding Bird Survey is a North American survey beginning in 1966, and is designed to get a wide-spread idea of bird population numbers. These numbers are then compared to prior years to track the changes in bird distribution. The surveys are performed in the US, Canada, and Mexico. The Kenai National Wildlife Refuge began doing the surveys annually in 1982, and now have the largest continuously run routes in Alaska. Currently, the refuge monitors four routes—two on the refuge and two off of the refuge.

When species numbers are shown to have dramatic changes across the years, this is not a reason to panic and assume endangerment. One common explanation for this phenomenon is some species are timed to spruce cone crops, and when the crops are not abun-

dant, the birds will travel to a new location to breed. As the birds on the Kenai Peninsula migrate back to breed, they do not return to the exact location each year. Naturally, the birds will breed in the areas giving the highest success for their offspring.

So why start as early as 4AM to survey, you may ask? The birds do most of their singing to attract a mate between the hours of 4 and 9AM, and even then there are very specific restrictions on survey conditions. In order to have the highest amount of detectability (meaning hearing the song of the birds present in the area), the prevailing winds cannot be above 10mph and there cannot be rain or fog. These weather trends tend to put the birds, shall I say, under the weather. The refuge performs the survey after June, which allows enough time for the birds to migrate into the area and begin singing. By mid-July the singing is done and the birds are now rearing their young.

Today, our first 39 destination points were along Skilak Lake Road, with the remaining 11 being on Mystery Creek Road. The survey is conducted by stopping every half mile and listening to the songs for 3 minutes. Simultaneously the number and species present is written. Studies have determined three minutes to be the optimum time to hear the majority of the species present in the area while still allowing 50 stops to be completed before 9AM. In addition, the start and end time is recorded, weather conditions are noted, and a new temperature reading is made every three stops.

Some of the species the Kenai National Wildlife Refuge observes include Swainson's Thrush, American Robin, Varied Thrush, Yellow Rumped Warbler, and my personal favorite, the Olive-Sided Flycatcher.

Some other interesting non-bird species Toby has seen along his routes are multiple moose, and the occasional bear, wolf, and lynx crossing his path. These enthralling sights make his surveys even more enjoyable.

Because almost all of the bird species are detected with auditory senses, the surveyor must be proficient at detecting the location of each bird while keeping a mental map of what species are singing at which site. Avid birders on the refuge work very hard to protect

their ears.

Toby has been acquiring a vast amount of knowledge and familiarity with bird calls and vocalizations for over 30 years now, and is extremely proficient. His passion for birds is contagious and it is hard for one not to be entranced by the mystery of the bird calls when doing field work with him. The variety of song combined with the beauty of the refuge is the most peaceful way to spend my morning - besides sleeping that is. Some birds have mnemonics used to identify the call such as the Olive-Sided Flycatcher's distinct "Quick! Three Beers!" song.

Do you have experience in bird calls and are interested in being a part of the Breeding Bird Survey? There are opportunities to join the citizen science project and volunteer to perform the survey on abandoned routes. I encourage you to jump in and contribute your knowledge to a nationwide project!

Are you interested in hearing the breeding songs of birds present locally? The best time to hear the songs is one half hour before sunrise through 10AM. Do you want to learn different calls and songs of birds? There are many resources ranging from CD's to internet sites to phone apps.

Bri Kilbourne is a biological intern at the Kenai National Wildlife Refuge. For more information regarding Breeding Bird Surveys please visit <https://www.pwrc.usgs.gov/bbs/about/>.



Bri Kilbourne, Kenai National Wildlife biology intern from Colorado (credit: Bo Reilly).

Our sockeye red, ptarmigan white, & forget-me-not blue

by Jennifer Peura



Red salmon swim in a Kenai Peninsula stream.

In an effort to commemorate and celebrate our nation's birthday, it is with deep honor that I may present an Alaskan patriotic take on 'Ole Glory. Independence Day may not have high contrast firework displays here in the Last Frontier, but we do have unbelievably stunning examples of Red, White & Blue.

July means the Sockeye season is in full swing, and the coloration of our red salmon is awe-inspiring. The salmon's coloring is due to the consumption of krill, an oceanic crustacean with a high concentration of carotenoids. Carotenoids are pigments that give rise to a myriad of different colors ranging from soft yellows to brilliant oranges to vibrant reds. Carotenoids are found throughout nature: in leaves (for example, when the green chlorophyll pigment degrades in the fall, the carotenoid pigments are especially apparent in the changing color of the leaves) to even our own skin. These carotenoid pigments are found in the body of the crustaceans, which the salmon then consume and accumulate in their muscles.

This trait is also shared with members of four other genera of salmonid fish. However, what sets apart our Sockeye is that as the salmon approach the spawning ground, they absorb many of their scales, and those scales that do remain are translucent. The underlying red color of the skin is now what is visible. Sexual selection over a generational time frame may have further impacted the extent in which the Sockeye's red

coloration has become what it is today: truly a breathtaking beauty of our Kenai Peninsula waters.

Currently in July, Alaska's state bird, the Willow Ptarmigan, has a plumage of light brown. This non-migratory bird in winter molts its feathers to an almost pure white display, save for their black tail feathers. The seasonal molt is triggered because of thyroxin, a hormone produced by the bird's thyroid gland. These hormonal changes within the ptarmigans are stimulated by end of breeding season, which coincides with the beginning of snow cover. As with all species of birds that molt, when the ptarmigan changes its feathers it does so in a symmetrical pattern which will keep its body balanced and does not encumber flight. The quills of the ptarmigan's summer brown feathers, which may be thought of as its breeding plumage, will begin to loosen with hormonal changes, and then the winter white plumage starts to grow. The now camouflaged ptarmigan has a greater chance for survival by evading predators in the snow.



A ptarmigan in full winter white color.

This Independence Day weekend bursts of color can be seen not just in the sky, but also in the flora that is around us for many wildflowers are in bloom. Alaska's most beloved flower, the Alpine Forget-Me-Not, blooms with a graceful and elegant sky blue. The blue pigmentation helps attract animals that will pollinate the flowers. In addition to this brilliant blue color, the scent, which is present in the evening, helps at-

tract pollinators. Forget-me-not is found in various places around the refuge, and can be seen up around the Swanson River area, as well as along trails off Skilak Lake Road.



Alaska's state flower, the bright blue alpine forget-me-not.

I hope you enjoy the holiday weekend, and in particular, that you may get to enjoy Alaska's red, white and blue - whether it's flipping a sockeye, admiring our ptarmigan, or stumbling upon one of our Alpine Forget-Me-Nots, which Thoreau wrote it most eloquently of a sister species to our forget-me-not: "The mouse-ear forget-me-not, *Myosotis laxa*, has now extended its racemes very much, and hangs over the edge of the brook. It is one of the most interesting minute flowers. It is the more beautiful for being small and unpretending; even flowers must be modest."

Jennifer Peura is a biological intern at the Kenai National Wildlife Refuge. For more information about the Kenai Refuge, visit our webpage at <http://www.fws.gov/refuge/kenai/>.

Tracking time in the New and Old Worlds

by John Morton



The library at Ephesus, a Greco-Roman city in Turkey that persisted for 2,500 years while contemporary Aleuts and Dena'ina were settling the Kenai Peninsula.

I had the good fortune to take a cruise through the Mediterranean this summer, focusing on ports with archaeological sites. My family marveled at Greco-Roman ruins that once hosted the Temples of Zeus and Artemis, and the Colossus of Rhodes — three of the seven wonders of the ancient world — and Venice, an ancient yet modern city that offers one solution for other coastal cities responding to rising sea levels.

Our visit was a snapshot of history that spanned thousands of years. It got me thinking about how time in the Mediterranean, one of the longest settled areas of the Old World, is tracked by human manipulation of the environment. In contrast, time on the Kenai Peninsula, a sliver of the Last Frontier in the New World, is tracked by natural history sometimes captured by science and sometimes by oral histories of indigenous cultures.

To make my case, I've drawn some information from a 2006 article coauthored by retired refuge ecologist Ed Berg and colleagues. Entitled "Holocene development of boreal forests and fire regimes on the Kenai

Lowlands of Alaska", this study analyzed pollen and plant macrofossils found in sediment cores from three lakes on the Kenai National Wildlife Refuge.

Although humans have been in the Mediterranean for the past 100,000 years, North America was colonized by Paleolithic hunter-gatherers crossing the Bering land bridge less than 20,000 years ago, coinciding with glaciers receding at the end of the Wisconsin Ice Age. Carbon-14 dating shows the first Sphagnum peatlands were indeed being laid down in the Kenai Lowlands 18,000 years ago.

As white spruce colonized woodlands composed of alder, willow and birch on the Kenai Lowlands 8500 years ago, Neolithic humans in the Mediterranean were transitioning to early agriculture. Evidence of early settlements show up at this time around what is to become Ephesus in the 10th century BC, a city that ebbed and flowed for 2,500 years in the hands of Hittites, Greeks, Romans and Byzantines before being abandoned by the Ottomans in modern-day Turkey. This is the same city that Paul the Apostle supposedly

had in mind when he penned his Letter to the Ephesians.

By the time black spruce shows up in the pollen record from the Kenai Lowlands in 2600 BC, the Sumerians had invented writing and the Greeks were making bronze.

Shortly after the Parthenon was built on the Athenian acropolis in 440 BC, Paleo-Aleuts began settling on the western Kenai Peninsula. By the time Dena'ina arrived 1000-1500 years ago, the Roman Empire had already come and gone from the Mediterranean.

Tree coring of mature mountain hemlock in the Kenai Lowlands indicate that some may have been seedlings when Suleiman the Magnificent laid siege to the fortress of the Knights of St. John on Rhodes, a Greek island off the coast of Turkey. The Colossus of Rhodes, destroyed by an earthquake well before the Turks arrived, was a 100-foot statue of Helios originally erected in the harbor to celebrate a Greek win over a much earlier siege by a Cypriot army in 305 BC.

There's a point to all of this. Ancient Greeks and Romans were around for centuries, at a time when technological and environmental changes were slow compared to today's frantic rates. They adapted to the environment by moving and shaping rock into Doric and Corinthian columns that supported the likes of the Parthenon, transporting water to arid places with aqueducts, and living in houses with indoor plumbing, through-the-floor heating and marble facades.

Alaskan Natives have also been around for centuries, adapting to post-Pleistocene warming by learning the seasonal movements of wildlife and phenology of plants, and developing the technology to harvest and store wild foods. Although early humans in the

New World likely contributed to the extinction of large mammals like woolly mammoths, their collective impact on the natural world was comparatively minimal.

In contrast, American society hasn't been around all that long. We haven't had to think much about land stewardship as we expanded ever westward over the last two centuries in pursuit of natural resources that added states and territories to the original thirteen colonies.

But we've run out of new space to colonize even as the remaining landscape is changing rapidly in response to increasing human populations and a warming climate. These are directional drivers, pushing us towards an outcome that is still uncertain but doesn't appear particularly rosy to me. Consider that the total area of gray infrastructure (buildings, roads, parking lots) that has been laid down since the founding of the U.S. is expected to double in the next forty years! Locally, 1.5 housing units are built on the Kenai Peninsula every day.

The bad news is that we don't have the time that previous cultures had to address the consequences of our actions because the world is changing faster than societal norms. The good news is that humans are adaptable. But we may have to explore sustainable lifestyles and innovative natural resource management on the fly, without the luxury of transitioning slowly or the benefit of careful experimentation, regardless of how we choose to track time.

John Morton is the supervisory biologist at Kenai National Wildlife Refuge. You can find more information about the refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Herding geese—with airplanes?

by Bri Kilbourne



Greater White Fronted Geese pack into the “pot,” part of the trap into which flightless geese are herded by floatplanes on Innoko National Wildlife Refuge (credit: B. Kilbourne).

That’s right! National Wildlife Refuges like to do things in style. And by style I mean using float planes to herd geese in order to place bands on them.

The banding of Greater White Fronted Geese has been an annual effort at Innoko National Wildlife Refuge in interior Alaska since 1985, with the exception of three years in the 1990s. As a biological intern at the Kenai National Wildlife Refuge, I was loaned out to be part of this efficient and experienced field crew.

The operation focuses on failed or nonbreeding geese that become flightless as they molt on the Innoko River. This river attracts molt migrants (geese from other breeding areas) because of the abundance of vital foraging habitat, and it is here the geese initiate their molt early. Successful breeders, on the other hand, remain with their broods and molt later in the season.

Greater White Fronted Geese typically live up to

20 years in the wild and have the potential to mate every year. As with all waterfowl, there is always a proportion of the population that doesn’t breed. Geese cannot successfully breed if they are less than three years old or if their nutrition is inadequate. Predation of eggs or young by coyotes, fox, wolves, eagles, and even great horned owls is also a problem for obvious reasons.

Goose banding entails capturing them and placing an aluminum ring around their leg with a unique number engraved into it. Looking somewhat like a really flashy ankle bracelet, bands are used to document proportional harvest, breeding areas, and annual survival of adults. Annual survival is determined from harvest reports by subsistence and sport hunters, as well as from recaptured individuals during subsequent banding efforts.

Lead by Julian Fischer from the USFWS Division of

Migratory Birds in Anchorage, this operation begins with a scout plane. A pilot flies out and picks a group of geese to band. Ideally, it'll be a flock of no more than 350 geese, and one that can be reached by plane and is well positioned for herding.



Biological intern Bri Kilbourne inverts a cloaca to determine sex of a Greater White Fronted Goose while banding it (credit: Janel Mayo).

Once a flock is chosen, the crew is transported in five floatplanes (two Cessna 206s, Super Cub, Top Cub, and Cessna 185) to the designated trapping spot. The 11 of us create a V-shaped trap with mist nets. One end of the “V” is longer and is called the “long lead” because this is the direction the geese will be entering; the short end is the “short lead.” Where the two leads meet at the base of the “V” is a circle called “the pot.”

The pot is where the geese are temporarily held while a few individuals are banded and released.

After the nets are set, the planes herd the flock towards the trap. With one plane coordinating high overhead from a bird’s-eye-view, the other four planes can be directed either in the air or on the water.

The whole operation becomes a well-executed kidnapping mission. Two crew members remain to take position on the short and long lead ends of the net. I was on the long lead end where I hid behind bushes, ready to hop out in case the geese sought to run around the nets. I carried five essentials with me: a hand-held radio, shotgun, bear spray, bug jacket and, of course, beef jerky.

While waiting in the shrubbery, I sat and listened to the operation over the radio. My excitement grew with the increasing roar of the planes’ engines and honking of geese. Final commands were given and I watched as the confused flock of geese walked smoothly from water to shore and into the pot.

The banding itself is an assembly line. Geese are captured in the pot and handed over the ropes to a carrier. The carrier transports them to people kneeling on a tarp with pliers and bands. The sex of the goose is determined by inverting the cloaca. Substantial black coloration on the lower chest indicates that the goose is older than two years. These observations, along with the band number, are verbalized to the recorder. Lastly, the geese are released back into the water.

This year, the U.S. Fish and Wildlife Service crew banded more geese than during any of the previous 29 years of this program—1,200 geese after two days! The yearly goal is 1,000 and the pot sizes are kept small to reduce stress on the geese. Fortunately, no geese fatalities occurred.

A successful operation with more geese banded. These efforts are essential for monitoring and protecting another one of Alaska’s magnificent creatures.

Brianna Kilbourne is a biological intern at the Kenai National Wildlife Refuge. You can find more information about the refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Fish need trees too

by Isabela Vilella



A rehabilitated bank at Jim's Landing on the Kenai River provides a resting place for a tired sockeye salmon.

It's that magical time of year once again when the salmon are flooding through the Kenai River and its tributaries. People and wildlife alike flock to the shores in hopes of catching their fill of the riches that the waters provide. It's wonderful to see so many people uniquely enjoying what nature has to offer.

What's equally important are the efforts we can put forward to ensure that the emerald waters of the Kenai River remain healthy. Littering and polluting

are both common problems that come to mind, but what about those weird rules about river banks? All of the public fishing facilities—whether city, state or federal—have signs telling you to stay off the river bank and its vegetation.

Why is this necessary? Seems a little over the top for one pair of boots. But we're talking the salmon season—hundreds, upon hundreds of boots each year trampling along the shore, aching to hook a red. What will be left at the end of August when everything is said and done?

Well, typically what's left is a huge case of bank erosion. Erosion is the natural process of wearing away the earth, in this case, bank sediment. Wind and water are two common agents for erosion in the wild, usually at glacially slow rates. People, however, can speed up erosion where normally it would take decades to change, devastating habitats and salmon alike.

As an intern at the Kenai National Wildlife who hails from Mississippi, riverbank erosion is not an unfamiliar issue to me. Boat wakes and river bank trampling are both destructive acts that increase erosion on the East and West coasts. However, unlike the Kenai River, the muddy Mississippi doesn't support salmon that require pristine, flowing waters.

Trees, shrubs and grasses that make up riparian vegetation depend on the land beside the river. Water quality, fish and invertebrate habitats, flood control, and bank stabilization are only a few of the important roles that riparian vegetation plays.

With the vegetation removed, the natural buffer zone that trapped sediment and created new bank buildup is gone and erosion rates increase. Without cover, young fish are left without habitat to safely avoid predation. Lack of riparian vegetation and the receding of banks can drastically change water quality, as well as increase or decrease water velocity to dangerous levels. Increased velocity of water flow straightens and channelizes streams. The quickened waters can carry away salmon eggs from their gravel nests (called redds) and prematurely rush young salmon downstream into waters they aren't prepared for.

Conversely, widened banks from erosion can decrease stream velocity and trap sediment on redds, decreasing oxygen flow to the eggs. This event in particular is a huge killer of salmon eggs. The growth and spawning of salmon are sensitive to changes in temperature and oxygen levels that erosion influences as well.

So what can we do? Avoid bank trampling by using board walks and designated ladders that provide access for fishing. If you're unfamiliar with an area that you intend to fish, always come prepared with the right equipment. Trampling on the banks just because the water was too deep, and hip waders were mistakenly brought instead of chest waders, is no excuse for the banks (and fish) to suffer. Minimizing your boat wakes within shallow waters is a great help as well.

While it may seem like an inconvenience at times to abide by these rules, it's important to remember that it is not about the seemingly insignificant impacts that we make as individuals, but the sum of those impacts as a community. Very simple choices determine whether our pursuit of salmon is benign or has negative consequences on fish populations. Help keep the rivers clear and beautiful for our beloved chrome jewels as they return home.

Isabela Vilella currently participates in the Career Discovery Internship Program. She is a junior at Mississippi State University, majoring in Wildlife, Fisheries and Aquaculture Sciences. You can find more information about the Kenai National Wildlife Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

When is a dandelion not a dandelion?

by John Morton



The yellow flowers growing along the Unity Trail in Soldotna are fall dandelions, not common dandelions, but both are nonnative invasive plants that spread by wind.

Roses are red, violets are blue, but what are all the yellow flowers along Kalifornsky Beach Road?! Along almost the entire length of Unity Trail that parallels the road, there's a plant blooming that at first glance looks an awful lot like the common dandelion. But stop and take a closer look—there are multiple flowers per stem (as opposed to one), and the leaves of its basal rosette are “spikier” with the flower having fewer yellow ray florets (petals) than a typical common dandelion (*Taraxacum officinale*).

This perennial plant in the Aster family is aptly called fall dandelion (*Leontodon autumnalis*). Unlike common dandelion which reaches peak bloom in June, fall dandelions probably hit their zenith last week. Although both species produce the characteristic “achene-pappus unit”, which is the technical term

for the feathery white puff balls that carry seeds in the wind, they're actually in different genera.

The fall dandelion is an Old World species, and grows well in northern places like arctic Russia and Norway. It's not clear how or when it was first introduced to North America, but in Alaska it is spread in straw, contaminated fill, and by wind. Fall dandelions are prolific, producing 779 seeds per plant on average. In parts of Germany, seed density in the soil is known to reach more than 5,000 seeds per square meter! From what I can see locally, it forms a mono-culture mat of basal rosettes, much like orange hawkweed, and so will likely demand your attention when it finally arrives in your backyard.

What's so incredible about this week's display of fall dandelion is that it was uncommon in our local area as recently as last summer. It has been fairly abundant around Homer for the past few years and really started to spread along the southern Seward Highway about 2 years ago, but only a few records occur around Kenai-Soldotna in the statewide database maintained by the Alaska Natural Heritage Program.

And this is precisely why this rapid spread and establishment of fall dandelion is so alarming. It underscores how insidious exotic plants with wind-dispersed seeds can be—literally here today, everywhere tomorrow.

I found an article published in 1973 that explored the dispersal effectiveness of achene-pappus units, and it wasn't quite as impressive as the evidence around us suggests. In this particular experiment under lab-controlled conditions, the maximum dispersal distances for fall dandelion was 64 inches and for common dandelion was 89 inches in a 10 mph wind. But a more recent study I found used statistical simulations to show that if only one in every 1,000 seeds was caught by a strong convection current, some wind-dispersed plants could easily spread 8 miles per year, a migration rate that has been documented in real life in other species.

I often bike the Unity Trail, enjoying the exercise while musing about the waterfowl on Kenai Flats or the RV traffic or whatever happens to be blooming. Over the past few years, the chronology of in-

vasion by exotic plants along the trail mirrors what has taken place over the larger Kenai Peninsula landscape. It wasn't so long ago—2006?—that the first ox-eye daisy appeared on the north side of Bridge Access Road, mixed in with common dandelions, nonnative bigleaf lupines, and clovers. These ruderal species (meaning the first to colonize disturbed soils) were followed in rapid succession by narrowleaf hawksbeard, narrowleaf hawkweed, orange hawkweed and, now, fall dandelion.

These latter wind-dispersed plants are poised to spread rapidly and indiscriminately from our major thoroughfares to residential neighborhoods, remote sections of the Kenai National Wildlife Refuge, and areas that burned in this spring's Funny River Fire. Wind knows no boundaries and, so, neither do these yellow- and orange-flowered invasives.

Frankly, there's not much we can do about it once these plants get established. This is a lesson that every community and every landowner learns and relearns—you can't give an inch to wind-dispersed plants or they'll take a mile.

Among the weed warrior community (professionals who make a living fighting invasives), we of-

ten talk about applying EDRR—Early Detection, Rapid Response—as the most effective approach for eliminating infestations. Detect them when they first appear and stomp them out by the most appropriate means before they begin to spread.

But the time between initial detection and treatment often ends up being somewhat gray, particularly if funds for treatments are scarce or permits are difficult to acquire. The message here, for both weed warriors and landowners, is don't dither when it comes to plants that have the reproductive capacity to spread by wind.

Having trouble identifying a suspected invasive species? Wondering about the most appropriate means to treat something? Want to know about certified weed-free forage or gravel? Contact the UAF Cooperative Extension Service at 262-5824 or the Kenai Peninsula Cooperative Weed Management Area (<http://www.kenaiweeds.org/>).

John Morton is the supervisory biologist at Kenai National Wildlife Refuge. You can find more information about the refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Spruce mast events: feast or famine

by Matt Bowser



White spruce bearing heavy cone crop at the Kenai National Wildlife Refuge's Visitor Center, August 12, 2014 (credit: Matt Bowser/USFWS).

Peer out the window or take a walk around the neighborhood asking yourself if the spruce trees bear an unusually large load of cones this summer. I do not know of anyone who keeps track of spruce cone crops locally, but this appears to be a mast year.

When a population of trees produces a larger than average seed crop, this is termed a mast year or mast-ing event. Many tree species—including our white, black, and Sitka spruces—yield variable crops of seeds from year to year. This variability in seed production has very real consequences for seed-eating animals that cascade through the food chain and can affect their predators.

What I find most striking is how coordinated the present mast-ing event is across the Kenai Peninsula and perhaps further on to the mainland. Spruce trees

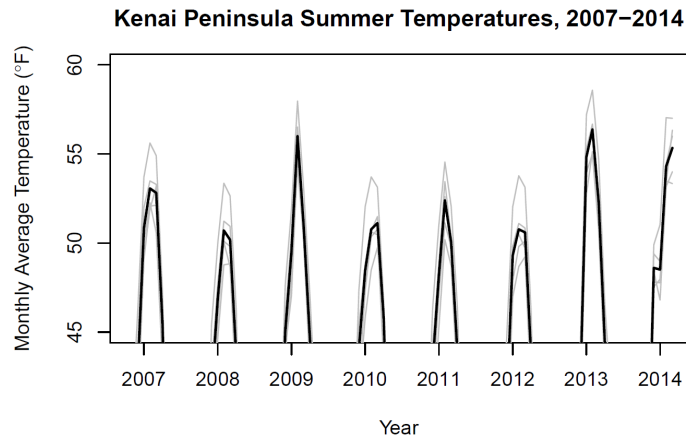
across the Kenai National Wildlife Refuge from Kasilof to the Kenai Mountains bear especially heavy loads of cones right now. I also obtained reports of heavy cone loads in Interior Alaska and the Yukon this summer. In fact, mast-ing events can extend over the spatial scale of subcontinents, with seed production in phase across 1,500 miles! Multiple tree species can be in synch including paper birch and other conifers like mountain hemlock.

It turns out that year-to-year climate variation synchronizes cone production cycles in white spruce, at least in part. We see the largest cone crops following optimal conditions: a cool growing season two years before a cone crop, allowing trees to grow and build reserves; a hot spring in the year preceding a cone crop, stimulating trees to initiate cone development; and cool growing conditions the year of a cone crop, enabling maximum development of the cones. The trees' reserves are exhausted during a mast-ing event, resulting in very few cones the following year. The cycle repeats every two to six years.

Our trees are responding to temperatures over the last several summers: cool growing seasons from 2010 to 2012, then a warm summer in 2013, leading to a mast crop this year (see graph). We should see meager cone production next year.

Similar to predator satiation strategies of pink salmon and periodical cicadas, spruce trees' synchrony of mast-ing is advantageous to the trees by overwhelming seed predators. During a boom year, so many seeds are produced that seed predators can only eat a small portion of seeds, increasing the chances of survival for each seed. Population sizes of seed predators are then limited by the intervening years of low seed production.

Red squirrels, our most important seed predators of spruce, depend on spruce seeds for roughly half of their diet. They mitigate the trees' predator satiation strategy by doing what squirrels are famous for: hoarding. The tiny squirrels can only eat so much before the seeds are dropped and have little capacity for fat reserves, but each squirrel can store away about 9,000 cones in a good year.



Western Kenai Peninsula monthly average summer temperatures from the following USDA NRCS SNOTEL sites: Summit Creek, Cooper Lake, Swanson River Road, McNeil Canyon, and Anchor River Divide. Grey lines represent individual stations and the bold black line represents monthly averages over all sites.

Even so, the trees' cone production in mast years (500-1000 cones per tree) vastly outstrips the squirrels' abilities to hoard them, so most seeds escape the squirrels. During years of low cone production, red squirrels switch to hoarding more mushrooms.

White-winged crossbills, specialists on conifer seeds, consume up to 3,000 seeds per bird per day. They deal with cyclical cone production by wandering great distances in search of good cone crops. I have heard that this is a good year for seeing white-winged crossbills on the Kenai. Expect many fewer next year, when cone production should be quite low.

Spruce cone maggots can be major pests of spruce cones, causing up to 100% loss of spruce seed crops. Adult flies emerge in the spring. Females lay eggs on scales near the bases of young cones. The larvae bore into the cone, mining out a spiral around the cone axis, destroying scales and seeds. Mature maggots emerge, drop to the soil, and pupate there.

These flies employ a different strategy to deal with the ups and downs of spruce cone production. Some of the pupae emerge their first spring, while others wait in the soil for an additional year, spreading out their risk of emerging during a crop failure.

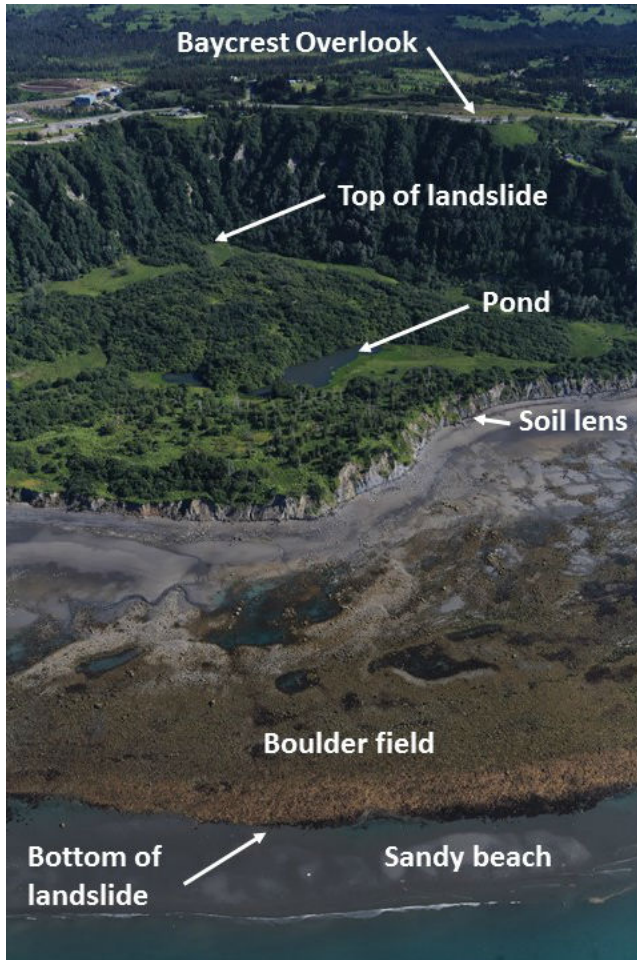
Populations of red squirrels, crossbills, and cone maggots do respond to the spruce mast cycle, increasing with mast years and declining between masting events. Their predators (lynx, coyotes, marten, and sharp-shinned hawks, for example) are affected by this cycling of their prey, but none rely solely on red squirrels or crossbills for food, dampening the effects of the spruce mast cycle as they ripple up the food chain.

While landscape change agents including introductions of exotic species, urbanization, and climate change are expected to alter where white spruce and other tree species occur on the Kenai Peninsula, the cycle of mast seeding should persist. Local year-to-year temperatures vary together over the scale of the Peninsula, providing synchronizing cues to the trees. This means that squirrels and other seed eaters will be dealing with alternating and synchronized feasts and famines of the spruce mast cycle for the foreseeable future.

Matt Bowser serves as Entomologist at the Kenai National Wildlife Refuge. You can find more information about the refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Geologists determine age of Bluff Point Landslide

by Ed Berg, Dick Reger and Bretwood Higman



Aerial view of the Bluff Point Landslide taken at a recent -5.3' low tide. The slide originally extended to the edge of the boulder field, but has eroded back 400-600 yards to the present beach bluff (credit: Ian Reid, Eagle Eye Gallery).

Many Homerites remember when they first came down the Sterling Highway and stopped at the Baycrest Overlook. The view of Kachemak Bay, the mountains and Cook Inlet is totally commanding and can reset a humble traveler's life priorities in a heartbeat.

Also to be seen, looking west from the Overlook, is an enormous gap in the bluff, now carpeted with grassy meadows, dense alders and spruce, and four

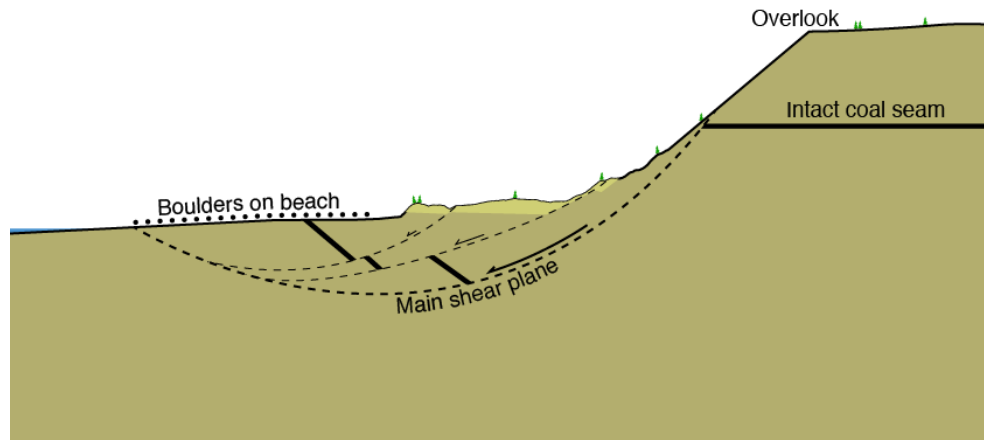
small ponds. This mile-wide chasm was made by a massive collapse of the bluff, called the Bluff Point Landslide.

As geologists we try to put a date on everything, even if just to the nearest million years or so. One of us (DR) published a geological report in 1979 with radiocarbon dates of 1100 and 1500 years ago on pieces of trees in the deposits overlying the landslide deposits, but those trees could have lived thousands of years after the original slide and then been exposed during more recent, secondary slumping due to beach erosion.

Last summer we had the good fortune to find an intact lens of soil that somehow was transported downhill within the slide without being turned into random debris. The soil lens was exposed for 50' along the bluff base by strong wave action during the 2012-13 winter. It showed a crusty black organic layer on top, underlain by several feet of silty-sandy soil that graded downward from dark reddish purple to gray. Several small tree roots stuck out of the soil; a volcanic ash layer was also present. The intact soil-bearing sliver was surrounded by highly deformed slide material. The soil was quite mature, having formed over several thousand years.

Three root samples we sent to the University of California-Irvine were estimated to be about 2250 years based on radiocarbon dating. We think that is a very good age estimate for the slide because the roots were in growth position and would have died when they were deeply buried by the slide mass.

The full extent of the landslide can only be seen during an extreme -5' or lower tide, when a sandy beach is exposed beyond the slide boulder field. Many of the boulders exposed at low tide were transported to Bluff Point by a glacial advance that partially filled Kachemak Bay 17,000 years ago. This glacial expansion is known as the Killey Advance (after the Killey River). Its moraine rested in the Bluff Point area for about 15,000 years, and then was instantly ferried out into Kachemak Bay by the landslide event.



Schematic cross-section of Bluff Point Landslide, showing rotation of the coal layers in the slide mass. This cross-section near the Baycrest Overlook is drawn to scale with no vertical exaggeration. The green trees are about 50 feet tall. The light brown color depicts soil that has accumulated on the slide deposit from up-slope erosion since the slide occurred. The tide is shown at -5' level. Underground shear planes (dashed lines) are probably more complex than shown (Diagram by Bretwood Higman).

During the past 2250 years, wave erosion has whittled the slide mass back 400-600 yards, leaving a thick lag of boulders only exposed during low tides. The soil was probably originally deposited as sandy silt in seawater beside the Killey ice lobe because we saw small rocks called “drop stones” in the soil that had been dropped from floating ice.

When the bluff collapsed, it probably did not simply drop straight down. Typically in such collapses, a large block rotates downward along a curving failure plane, which is steeply dipping at the top but flattens out below to form a spoon-shaped surface. During failure the outer edge of the sliding block rotates upward, leaving a depression behind it. The four ponds on the Bluff Point Landslide formed in this low area.

Along the beach you can see coal beds tipped up and dipping steeply to the northwest. Farther out during very low tides you can see coal beds dipping in other directions, with some beds overturned where the slide mass was more chaotically deformed. The coal beds are undisturbed in the bluff above the slide, and remain more or less horizontal.

Mapping indicates several landslides around Bluff Point. Looking at GoogleEarth you can see a 2.7-mile strip extending on both sides of the main slide with collapse deposits at the bluff base. In July 2009, between Bluff Point and Diamond Creek, the high bluff face collapsed like a hammer onto the upper end of an

old slide block, rotating the block like a teeter-totter and pushing up a very strange 15' high mound in the intertidal zone for a distance of 1200' along the beach. Rotated shale layers in the mound's center were nearly vertical. Over the following winter the mound was completely removed by wave erosion.

People were living in Kachemak Bay when the Bluff Point Landslide occurred 2250 years ago. The Marine Kachemak Tradition culture had already been here for 800 years and would be here for another 1000 years. The dumping of so much sediment into the Bay must have disrupted fish and sea mammal populations. It would be interesting to examine the rich legacy of artifacts left by those people to see if there is any cultural expression of this event.

The Bluff Point Landslide was likely triggered by a large 1964-style subduction zone earthquake. Ian Sheenan of Durham University (UK) and his colleagues dated five major pre-1964 earthquakes over the last 3000 years, two of which occurred 2140 and 2415 years ago. There are typically errors of 100-200 years with radiocarbon dates, so either earthquake could have been culpable.

Dr. Berg retired as the ecologist at the Kenai National Wildlife Refuge in 2010. Dr. Reger is a consulting geologist who retired from the Alaska Division of Geological & Geophysical Surveys. Dr. Higman is a geologist with Ground Truth Trekking.

Scottish kids help restore cabins on the Kenai National Wildlife Refuge

by Graham McDonald



Scottish kids and their chaperones pose in front of a historical 4-ton steam boiler (once used in a lumber mill) that they moved from the shores of Tustumena Lake to higher ground with levers, pulleys and sweat this past summer.

In the summer of 2006 I was fortunate enough to meet Gary Titus and so began the story of this trans-Atlantic partnership between the Kenai National Wildlife Refuge in Alaska and Banchory Academy in Scotland.

Back in 2006 I was Depute Rector (vice principal) of Banchory Academy and I had travelled to Alaska with a group of 12 senior students to climb on the Harding Ice Field and to undertake some volunteer work with the U.S. Fish and Wildlife Service.

Gary, the Refuge historian and cabin restorer, was our main contact and I think he sized us up pretty

quickly. One of his first questions of us was, “are you guys up for a full-on experience?” My reply was an immediate “of course” and we were off...off to Tustumena Lake and some of the most amazing volunteer conservation work in some of the most stunning country I’ve known or heard of. That first visit was such a success that it spawned two more in 2010 and 2014. Each trip built on the successes of the last and the projects become ever more demanding, with friendships cemented over the period.

During that first summer in 2006, we worked on two projects at Moose Creek on Tustumena Lake.

The first involved restoring the historical sauna at the creek's mouth. We lifted the cabin to remove and then replace the bottom three tiers of logs. The replacement logs were fashioned with hand tools from freshly-felled trees using the same techniques as the original settlers. This was a hugely-challenging but amazingly-rewarding project that was overseen by Gary in such a way that we all felt we had done it! We also repaired and "upgraded" the Moose Creek trail that leads to the Tustumena Bench.

We returned in 2010, again travelling to Tustumena Lake to work on the cabin of Andrew Berg, a famous local trapper. We reroofed the cabin with the same tin shingles that Andrew used when he built the cabin at the beginning of the last century. Some hard work, great fun and developing friendships saw the project through to a satisfactory conclusion. We also cleared the Emma Lake Trail, from its mouth on Tustumena to the Emma Lake cabin on the Bench.

This past summer followed a similar pattern, with Gary as our contact, our mentor and our field manager. As we travelled to Anchorage in late June we had an inkling of what was in store for us. We were headed back to the Home Cabin and Gary told us we were raising it up onto block...was Gary having some fun at our expense? We knew from before that he likes to have fun, but we knew also that Gary was serious and professional in all things associated with the history of the Refuge!

After setting up camp at the nearby cabin owned and graciously shared by Jim Taylor, Gary briefed us. We were indeed going to raise the Home Cabin up onto "stilts" so as to protect it from high water. We were going to move an old steam boiler, used in a now-gone lumber mill early last century, away from the shoreline before it was lost to one of the many storms on

Tustumena. We would do some further work on both the Emma Lake and Tustumena Glacier trails. With the help of a retired U.S. Fish and Wildlife Service archaeologist, Debbie Corbett, we would also do some archaeological digging on the site of the old lumber mill to help establish its history.

Gary had tools and a plan for the cabin (he's done this type of project many times before), he had Scott Slavik and the Refuge trails crew, and he had Debbie for the archaeology. For the boiler project he had some tools but he left the plan up to us. Those first words of Gary's in 2006 resonated in my head..."are you guys up for a full-on project?" We were then and we were again—anything the 2006 team could do so too could the 2014 team. A plan was hatched to move the 4-ton boiler with levers, pulleys and people power—all used to great effect as it was successfully transported to the safety of dry land away from the dangers of winter storms and rising water.

Three visits over eight years, involving 36 youngsters and five adults from Scotland. Hopefully we have made a small contribution to the Refuge and their staff. Their trust has allowed students (and staff) from Banchory Academy to have some amazing experiences with some wonderful people in a truly amazing part of the world—we feel immensely privileged.

I don't want to believe that this is the end. Gary talked about a new scheme where companies, schools and organisations adopt areas of the Refuge so as to look after them. We'll need to discuss this next phase in our partnership with Gary before he retires!

Graham McDonald retired from Banchory Academy in Scotland and is now co-owner of Venture Force Ltd. You can find more about the Kenai National Wildlife Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

A journey through botanical time

by Elizabeth Bella



The old ranchhouse on Simeonof Island, part of the Alaska Maritime National Wildlife Refuge, with introduced Sitka spruce that is now reproducing (credit: E. Bella/KNWR).

While understanding the ecological system of the place where you work and inhabit is an invaluable, lengthy process, the chance to occasionally visit new places for collaborative research and data collection is an exciting opportunity for a vegetation ecologist. My recent trip to a number of Aleutian Islands within the Alaska Maritime National Wildlife Refuge, on board their research vessel the R/V *Tiglax*, was reminiscent of the early adventurous days of botanical exploration in far-flung places of the earth.

Scientists from the refuge and other agencies on board included wildlife, bird, range, and vegetation experts. The diverse group illustrated the merits of collaborative work, inspiring discussion and resources and offering changes to learn from each other. The pace of the journey allows time to process specimens and data, plan the next island visit, and discuss what you saw – as well as time to read a book, catch a movie, and rest a bit – as long as the waves aren't too big.

On the two week voyage, we visited several different islands. The trip had multiple purposes, but I was there primarily to look for invasive plant species and assist with vegetation work. Islands are fascinating habitats for vegetation ecologists in that each island is a self-contained laboratory, challenging us to

understand why each island has a bit different plant composition – luck? History? Deliberate planting? Incidental introductions?

We first stopped at East Amatuli Island, one of the Barren Islands, to drop off a bird survey field crew, with all their supplies for two months. Long field stints in isolated, magical locations are the norm in the summer around this refuge. I had my first immersion in the typical treeless Aleutian island vegetation.

Our next stop was Chirikof Island, where cattle have been present since the late 1890s. We first went ashore in the southwestern part of the island, encountering low beach bluffs and bleached piles of gigantic spruce driftwood, interspersed with colorful buoys, large tangles of boat line, and bits of plastic. The healthy looking cattle, numbering over 700, run unfenced on the beaches and hills.

The first day passed without incident, although several large sentinel bulls made us nervous. The second day, on the north side of the island, we found ourselves in the center of a cow stampede in a meadow with nothing but an old fence post for shelter. Luckily the cows turned, the bulls ran off, and we didn't have to explain the ignominy of demise by cow trampling after many years of working in bear country in remote Alaska.

Prior vegetation surveys had recorded a number of non-native plants, and I found some species mixed in with native vegetation throughout the island, including mouseear chickweed and Kentucky bluegrass. More obvious aspects of cattle presence was massive erosion of beach ryegrass (their preferred forage) habitat, and shifts from typical Aleutian diverse plant communities to new assemblages with high proportions of lupine (a non-palatable species) and deschampsia grass (another non-preferred plant that increases with grazing).

Our next stop was to the lush, dramatic wedge of Chowiot Island, with its imposing seabird-filled cliffs. Shed construction and camp resupply took some time, and I had the chance to hike around and observe a relatively pristine vegetation environment for contrast – and a rare place where absolutely no non-native plants are found.



The Tiglax and Chowiot Island field camp, on a spectacular Aleutian afternoon (credit: E. Bella/KNWR).

The next stop, Simeonoff, was equally fascinating in that cattle had been removed around 1984, giving insight as to what may happen if cattle are managed more closely on cattle-present islands. In the intervening 30 years since removal, beach ryegrass has completely recovered in severe erosion areas and recolonized bare sand spits, and other impacted vegetation types are recovering.

Settlement on the island brought several non-native plant species in, some of which have survived and spread. The old ranchhouse still stands, with a number of species nearby like rhubarb and strawberry originally planted in the garden. Also planted was ox-eye daisy, which now invades over five acres of crow-

berry tundra and old field habitat near the house. Several non-native grasses, likely introduced by hay, were found near the old corrals and fencelines. Another invasion was evident in the spread of Sitka spruce, which had been planted near the house in this treeless landscape – and was now reproducing on its own.

Traveling on to Wosnesenski Island, where the cattle only number around 130, effects on vegetation were more subtle. I still found some non-native plants scattered throughout the island, but erosion was lower.

At first glance, comparing vegetation across islands reveals that most have the same common species, but some have more wetlands, higher elevation, and varying drainage patterns – making each island essentially unique to the variation-seeking eye of the vegetation ecologist. What was evident was that each island's history crossed with its unique geography had effects on the current vegetation.

Many questions remain – will the spruce continue to thrive and spread on Simeonof? What if a spruce had gotten there by itself – how long would that take naturally? Will changes in cattle management cope with the erosion on Chirikof? Are strawberries the new blueberries in Alaska with a changing climate? Over a Simeonof- grown rhubarb crisp on board the ship that night, we contemplated these questions as we cruised to Dutch Harbor to head back to our regular lives.

Elizabeth Bella is ecologist at the Kenai National Wildlife Refuge. Visit <http://www.fws.gov/refuge/kenai/> for more information about the Refuge.

Bird checklist of the Kenai Flats: It's about time

by Toby Burke



Aerial view of the Kenai Flats, where 187 bird species have been documented over the past five decades.

My favorite place to birdwatch, or “bird”, on the Kenai Peninsula is the Kenai Flats. “The Flats” are not merely the wetlands you see from Bridge Access Road or from the bluff near the Kenai Senior Center. In its entirety, it encompasses 7,500 acres of intertidal mudflats, sand and gravel bars, dunes, tidal sloughs, creeks, river, grasslands, riparian shrub and forest. As the estuary of the Kenai River, the Flats extend a mile beyond its mouth into Cook Inlet and upstream to River Mile 12 near the Pillars.

By definition an estuary is the tidally influenced, broad lower course of a large river and embayment at its terminus where salt and fresh waters meet and mix. Here, nutrient-laden river waters combine with shallow coastal waters and the upwelling of nutrient-rich deeper ocean waters, generating exceptional primary productivity that supports vigorous marine food chains. They are areas of concentrated productivity, measured as abundance of individual organisms and

species, as well as biomass and energy. The wealth of plant life and invertebrates directly or indirectly provide nourishment for resident and migratory fish, marine mammals, and birds. Estuaries are renowned for their prodigious biological productivity and, along with tropical rainforests and coral reefs, rank as the world’s most productive ecosystems.

Accordingly, a few local biologists and a handful of dedicated birders from the Keen Eye Bird Club decided it was finally time to formally assess the avian productivity of the Kenai River estuary. Combing through thousands of records of bird sightings over the last 50 years, a checklist of species and their relative abundances through the four seasons was compiled. The effort delineated 187 bird species that have been seen on the Flats, of which a remarkable 81 species are known to breed there annually or at least occasionally.

The “Checklist of the Birds of the Kenai Flats” serves as the most current and complete inventory of

bird species for this area. It is long overdue considering the Flats is one of the foremost bird watching destinations on the Kenai Peninsula. Two other local birding “Meccas”, Kachemak and Resurrection Bays, have had formal bird checklists for decades. The new checklist proves that the Flats deserve its weighty reputation — though considerably smaller in size than the other two areas, the number of bird species documented on the Flats rivals them.

While the checklist is a compilation of all species recorded over five decades, the relative abundance is essentially a snapshot in time (2014). This latter attribute is invaluable to biologists. Bird populations are dynamic, so periodic snapshots allow biologists to track changes in abundance (and occasionally species) over time.

For example, Rusty Blackbirds and Red-necked Phalaropes were once common breeders and migrants on the Kenai Flats but have become increasingly scarce, reflecting not merely local but continent-wide declines. Conversely, Northern Saw-whet Owls, Red-breasted Nuthatches, and Brown Creepers, now common in the Flat’s riparian forests, were not known to occur there prior to 1970 before these species experienced dramatic continental expansions northward and westward.

Aleutian Terns commonly bred on the Flats decades ago but now only occasionally feed there in modest numbers. In contrast, Northwestern Crows and Steller’s Jays first appeared on the Flats little more than a decade ago but now breed along its wooded margins. The colony of hybrid Herring Gull-Glaucous-winged Gulls has grown substantially, their status changing from common to (super) abundant, likely

due to increasing local food sources (especially from human waste). Bald Eagles are also far more numerous on the Flats, benefiting from the same waste sources, opportunity to prey on the colossal gull colony, and the end of the Bald Eagle bounty in 1952.

I would be remiss if I did not discuss the dramatic decline of Snow Geese on the Kenai Flats. In years past, 10,000 Snow Geese could be seen during peak staging in late April. But over the past ten years you’d be fortunate to see even 300 at their peak. This does not reflect a continental or flyway-wide decline as their populations are robust, but rather their abandonment of the Flats for estuaries on the west side of Cook Inlet.

Species that typically garner disproportionate attention on checklists are the one-time rarities such as the Ruff in 2003, Ivory Gull in 2006, and Lesser Black-backed Gull and Willet in 2012. Notably, the Willet sighting was the first and only substantiated record of this species in Alaska. Avid birders from all over the state converged on the Flats to view this mega-rarity.

“Checklist of the Birds of the Kenai Flats” should be available soon at the Kenai and Soldotna visitor centers, as well as the Kenai Refuge headquarters. Also, contact the Kenai Refuge (262-7021) or the Keen Eye Bird Club (262-7767) if you’re interested in counting birds during the 5th annual BIG SIT on Saturday, October 11 from 8am to 6pm at the Lower Skilak Lake Boat Launch Campground.

Toby Burke is a Biological Technician at the Kenai National Wildlife Refuge. You can find more information about the Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Silence in Kenai's soundscape

by Tim Mullet



A sound recorder stationed at Glacier Lake, a remote glacial lake in the Kenai Mountains. This site is among the quietest locations in Kenai National Wildlife Refuge with 97% of recordings consisting of natural silence.

Winter is coming. That is probably one of my favorite phrases from the Game of Thrones' character, Eddard Stark, Lord of Winterfell. As Alaskans, I am sure that the same phrase reverberates from our lips every September. Most of us look forward to winter.

I grew up in Ohio so snow is nothing new for me. But as I got older and less inclined to build snowmen and battle it out with friends in snowball fights, winter became less tolerable.

So what am I doing here? Well, life takes many turns and I chose to pursue a Ph.D. in wildlife biology at the University of Alaska Fairbanks. My doctoral research addresses concerns over the possible effects of snowmobile activity, and the noise it generates, have on wildlife, plants and wilderness on the Kenai National Wildlife Refuge. It seems ironic that for all these years I tried getting away from snow and cold, I ended up in the snowiest and coldest state.

I spent many hours collecting data in both near and remote regions of the Refuge, definitely on some of the coldest days of the year. Field work in such conditions isn't easy but one focal piece of my research, namely sound, gave me an entirely new perspective on winter and, indeed, on nature.

Winter is a season of low biological activity. Most

birds migrate south and many resident animals become dormant or hibernate. Human activity also declines in winter and contrasts sharply with the hustle and bustle of mid-summer. There are also changes in geophysical events - rain becomes snow and rivers become frozen.

These environmental changes greatly alter the soundscape. Soundscape ecologists use the terms biophony, anthrophony, and geophony to describe the biological, anthropogenic (human), and geophysical sounds of the landscape.

Winter's soundscape is seasonally unique. As a musician you could describe the spring and summer soundscape as the forte of the seasons while winter would be the piano. During winter 2011-2012, I recorded and subsequently listened to (with the help of some very patient interns) 60,000 sound recordings from 62 locations throughout the Refuge.

While I did identify many sounds, I also recorded long time periods and many areas of the Refuge that had no sound, not even wind - the complete absence of biophony, anthrophony, and geophony. In other words, silence. But not true silence; not the silence created in a sound chamber. It was the silence of nature.

This was a very interesting discovery! Among my fellow soundscape ecologists, who study and record soundscapes during spring, summer and fall, or in tropical areas where sound is so prevalent species have developed acoustic niches to hear one another, my findings were the first to be documented.

Natural silence is likely unique to northern latitudes and winter especially. The ecological significance of silence is not yet known. I like to think of natural silence as the canvas upon which other sounds are painted. Silence could mean many things. It could indicate the absence of habitat qualities conducive to life. This seems partially the case considering I found that Tustumena and Skilak Lakes were large hotspots for natural silence.

Natural silence could also indicate dormant niches. After all, many of the vocal species that occur during summer do not stay over winter. This leaves vacancies in the ecosystem that remain dormant throughout

winter when resources are no longer present or inaccessible. But as spring returns, so do vocalizing birds, insects, or wood frogs that fill the acoustic space.

Natural silence could also represent a time period when risks to wildlife are reduced. Silence is in the ear of the beholder. We already know that some species communicate on subsonic and supersonic frequencies beyond the threshold of human hearing, but animals also have hearing thresholds. Not every species hears at the same frequency (pitch) and, like humans, the ability of one species to experience silence is not the same as another. It seems probable that the spectrum of sound perceived by an organism as silence may provide acoustic information that says “All is calm; there is nothing to worry about.”

Natural silence also plays a special role in human perception and experience. In a spiritual sense, silence can be a means of respecting religious settings, meditation, and prayer. Silence is known to physiologically initiate a relaxed state of mind. Silence is often associated with respect for the dead and is gen-

erally expected during funerals. Silence is also known to psychologically activate certain human behaviors in public buildings such as libraries, churches, and temples. The human experience alone may be significant enough to qualify the importance of silence in nature.

All these likelihoods could be considered mere speculation, but scientists like to call them new hypotheses to test. The best thing about science is that one discovery always leads to new questions and new discoveries.

If you’re fortunate enough to travel in the Kenai backcountry this winter, stop for a moment and listen. Perhaps you’ll hear nothing – yet another unique Alaskan experience you may not have fully appreciated.

Tim Mullet is in the Pathways program at the Kenai National Wildlife Refuge. He is also adjunct faculty at the Kenai Peninsula College. You can find more information about the Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Celebrating 50 years of wilderness

by Andy Loranger



The Funny River Fire burns high in the Andrew Simons Wilderness Unit on the Kenai National Wildlife Refuge this past summer. This unit is the largest of three that make up the 1.3 million-acre Kenai Wilderness.

Just a few weeks ago, the Wilderness Act celebrated its 50th anniversary. Signed into law by President Lyndon Baines Johnson on September 3, 1964, the Wilderness Act established the National Wilderness Preservation System by designating 54 U.S. Forest Service-administered wilderness areas, totaling 9.1 million acres on National Forests in 13 states. Included were some of the nation's most iconic wilderness areas like the Bob Marshall Wilderness in Montana and the Gila Wilderness in New Mexico.

The Act also established the process for designating Wilderness areas and required the Forest Service, the National Park Service and the U.S. Fish and Wildlife Service to evaluate lands for possible future Wilderness designation by Congress.

It was not an easy push. The author and architect of the Wilderness Act, Howard Zahniser, wrote 66 drafts of the Wilderness Act between 1956 and 1964

and navigated the bill through 18 Congressional hearings. A tireless crusader, Zahniser was influenced by the poets William Blake and Henry Thoreau and inspired by some of the nation's most revered conservationists – Aldo Leopold, Olaus and Mardy Murie, and Bob Marshall.

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

What makes the Wilderness Act unique and powerful was Zahniser's capturing of the inherent but intangible value of wild places for their "wildness." He carefully chose the word "untrammelled" for his definition, against the advice of many who thought it too obscure, which in essence means "free of manipulation" by man. In doing so, he was emphasizing his belief that allowing the natural processes at work in our nation's wildest places to continue without interference was critically important in the face of a rapidly developing and mechanizing nation.

Through the Act, Zahniser also recognized the need to protect wilderness for its more tangible benefits to us and our physical, mental and spiritual well-being by providing opportunities for primitive recreation and solitude and through its educational, historical and scientific values.

Today, on the Act's 50th anniversary, there are 758 Wilderness areas in 44 states, totaling nearly 110 million acres, including our own Kenai Wilderness within the Kenai National Wildlife Refuge. Not unlike passage of the Wilderness Act, designation of additional wilderness areas by Congress has almost always depended upon strong grassroots advocacy on the part of citizens. This certainly was the case in Alaska and here on the Kenai.

Well before the passage of the Wilderness Act, the Kenai National Moose Range's first manager Dave Spencer advocated for protection of its wilderness values. His ideas came to fruition in 1957 when an 800,000-acre area between Skilak and Tustumena lakes was formally designated as the Andy Simons Research Natural Area. Through this designation, the area was to be managed so as to allow "natural processes to predominate." Mr. Simons, the area's namesake, was a 55-year resident of the Kenai Peninsula, a member of the territorial Alaska Game Commission for 28 years, a master guide, and had strongly supported the establishment of the Moose Range in 1941.

In the 1960s, succeeding managers Will Troyer and John Hakala continued to push for protection of wilderness values. It was at this time that the idea for a canoe trails system encompassing many lakes in the Moose Range's northern lowlands was born, which became the now famous Swanson River and Swan Lake Canoe Trails, and regulations were promulgated to

restrict motorized use and promote wilderness recreation within the area.

In the early 1970s, wilderness reviews and recommendations for formal designation of Wilderness areas on the Moose Range were completed, as called for in the Wilderness Act. As in so many other cases, local grassroots advocacy played a pivotal role.

The Kenai Conservation Society was formed in 1965, a group of local residents including Dr. Calvin and Jean Fair, Helen and Jim Fischer, George Pollard, Bill and Jean Schrier and Marge Mullen. They worked tirelessly on conservation issues affecting the entire Kenai Peninsula, including furthering wilderness protection on the Moose Range, highlighted by Ms. Mullen's eloquent testimony in June 1971 at very contentious public hearings on wilderness designations in Alaska.

The group recommended a substantially larger proposal for wilderness designation on the Moose Range than the proposal forwarded by the Fish and Wildlife Service. Their efforts culminated in the designation of the 1.34 million-acre Kenai Wilderness under the Alaska National Interest Lands Conservation Act in 1980, which encompasses almost two-thirds of the Refuge.

Next Friday, October 3rd from 6 to 8 pm, the Refuge and the Kenai Visitors and Cultural Center will be hosting a "Wilderness Jam" and the opening of the "Voices in the Wilderness" traveling art show to celebrate the Wilderness Act's 50th anniversary. The Voices exhibit, which will be open to the public through October 25, features a showcase of artists from around the world – poets, sculptors, painters, photographers, fiber artists, and musicians – who lived as artists-in-residence in some of America's most remote and beautiful wilderness areas. Friday evening's festivities will include drawings and poetry by local students, a special photographic exhibit on the Kenai Wilderness, and live music and refreshments.

Please join us at the Kenai Visitors and Cultural Center for this free event!

Andy Loranger is the Refuge Manager of the Kenai National Wildlife Refuge. You can find more information about the Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Research links the forests of the Kenai Peninsula and Amazon

by Juan Camilo Villegas Palacio



Researchers from the University of Arizona, Michigan State University, University of Washington, and the Kenai National Wildlife Refuge establish a monitoring site in the Caribou Hills off Oil Well Road (photo credit: Nathaniel Chambers).

Recently, I and other researchers from the University of Arizona, Michigan State University, and the University of Washington visited the Kenai Peninsula to collaborate with biologists at the Kenai National Wildlife Refuge to investigate tree mortality and how it affects microclimate conditions near the ground, such as shading and temperature. Funded by the National Science Foundation, our team is interested not only in the changes locally, but if these changes could influence other areas as far away as the Amazon Basin in South America.

Our team lugged a lot of equipment to measure how the forest structure and the microclimate changed after tree mortality. We compared two plots: one where most trees had died and another where only a few had died.

At each plot, we hoisted up a mast that allowed us to measure solar radiation above the trees as well as temperature, relative humidity and wind conditions from there all the way down to the ground. To measure the forest structure, we took photographs with a fish-eye camera lens facing the sky that will be used to calculate how much shading occurs at a certain place and time. Additionally, we brought a laser-based instrument called LiDAR (Light detection and Ranging) that scans the vegetation structure and provides a detailed picture of the complicated branch and leaf structure of the plots. These can be related to all the other measurements of microclimate.

Together, these measurements let us characterize near-ground conditions such as albedo and air turbulence in the atmosphere. Albedo is the amount of so-

lar radiation reflected by the land surface and is related to surface properties like its color. When trees such as the dark spruce of the Kenai are replaced by other types of vegetation, for example lighter-colored grasses, the change in energy absorbed near the earth's surface due to change in albedo alters the transfer of moisture and energy to the atmosphere and influences the amounts of evaporation and tree transpiration.

Also, when tree structure is replaced by a different type of vegetation, such as grasses, wind patterns near the ground change. Near-ground wind currents are responsible for transferring moisture in the form of water vapor to the atmosphere. This moisture eventually produces rainfall either locally or elsewhere when transported by high atmospheric currents.

In a changing climate, droughts accompanied by higher temperatures are becoming more frequent. Associated with these droughts are large-scale tree die-off events that can be amplified by the presence of pests such as bark beetles, as well as by the potential occurrence of fire. Tree die-off events are widespread in temperate regions around the world. Locally, the Kenai Peninsula has experienced such large-scale tree mortality in response to bark beetle infestations and, more recently, forest fire.

Even the tropics are not exempt. In the Amazon, tree mortality has occurred when there are particularly dry seasons produced by strong El Niño events. Vegetation changes resulting from tree mortality, such as those observed on the Kenai Peninsula, can have many effects. When trees die, this changes the microclimate near the ground in terms of shading, temperature and other variables. This microclimate influences many other environmental factors such as what plants will grow in there, will new seedlings reestablish the

trees that were lost or will new species come in, and how quickly will water in the soil evaporate back into the air.

The changes in microclimate after many trees die is important not only locally, but can also have effects on the climate at larger scales. The microclimate near the ground surface interacts with the atmosphere above it. If the microclimate of a large enough area changes substantially, it can influence how the atmosphere circulates, thereby affecting other areas as well. Because tree die-off has been occurring over such large areas, scientists have begun to ask if large scale tree die-off, as has occurred on the Kenai Peninsula and in many other large areas in North America, could affect all the way down to the Amazon Basin in South America.

Scientists call this type of effect “atmospheric teleconnections”. The reason we think this might be possible is because a recent study calculated that if trees were added to grasslands—something being discussed as a way to reduce some of the carbon in the atmosphere that is contributing to warming—there is a potential teleconnection with the Amazon. Now we are asking if losing trees from forests could also have a similar effect. By understanding the structural and functional effects of forest die-off, and through the use of climate models, researchers expect to better understand the atmospheric feedbacks and interactions that can potentially develop.

So the next time you tromp through a once-forested area on the Kenai that is now an open grassland, consider that this change may influence happenings in the Amazon. It is indeed a very small world.

Professor Palacio is at the Universidad de Antioquia in Medellín-Colombia. For more information on the Kenai National Wildlife Refuge visit <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Special regulations for furbearer trapping on the Refuge

by Joe Williams

As the days get shorter, morning temperatures dip below freezing and termination dust starts to appear on the mountains, it's evident that fall is in full swing. This is an exciting time of year for many of us, as the furbearer trapping season is soon approaching on the Kenai Peninsula. While the Kenai National Wildlife Refuge presents trappers with unique opportunities, it also requires an understanding of some special guidelines and regulations.

For those folks planning to trap on Refuge lands this season, I would like to take the opportunity to address a few topics. Individuals 16 years of age or older are required to have a valid state trapping license as well as a special use trapping permit, issued by the Refuge. The Refuge requires that a one-time trapping and snaring orientation class be taken prior to receiving a permit.

This year, the lynx trapping season will be closed on the Kenai Peninsula. Because of this closure, the use of cubby and/or flag sets will not be allowed on the Refuge (However, the use of small cubbies and flag sets with an opening of 7 inches by 7 inches or less, leg hold traps No. 1 ½ or smaller, or No. 120 or smaller Conibear-style traps, are allowed). The Refuge considers a cubby any enclosure, whether natural or constructed, with an opening at one or both ends that is used in conjunction with a trap or snare. A flag set is a visual attractant, such as a CD, foil or flagging, used to attract animals to a trap. The prohibition of flag sets will help reduce the number of lynx accidentally caught in traps.

All trap lines must be at least one mile from public roads, campgrounds, and trailheads. However, trapping for mink and muskrat using small leg-hold traps No. 1 ½ or smaller, and No. 110 or 120 Conibear style traps, is allowed in these areas. The Skilak Lake Recre-

ation Area is closed to all trapping. All traps and snares are required to be identified by the owner with an approved tag or marking that is clearly visible.

Traps and snares are required to be checked regularly. Depending on the type of trap and the Game Management Unit the trap is located in, trap checks are required every four or seven days. Frequent trap checks allows targeted furbearers to be humanely harvested, while ensuring a timely release of uninjured non-targeted species. It also enables trappers to check and inspect their traps to make sure they are working correctly. This is especially important during the "freeze and thaw" cycles, common during Kenai Peninsula winters. It is also a good practice, but not required, to post your trap line with a sign so other outdoor users (and their dogs) can avoid entering areas with active traps.

Another unique requirement for trapping on the Refuge is the prohibited use of "sight exposed bait" within 30 feet of a trap or snare. Bait that is visible from 360 degrees at a height of 3 feet or greater must be at least 30 feet away from a trap or snare. This regulation is aimed at reducing the take of non-targeted species in traps, such as eagles, hawks and other protected birds of prey that hunt by sight.

A trapping and snaring class is scheduled for Saturday, October 25, 2014, from 9:00 a.m. to 5:00 p.m. at the Kenai National Wildlife Refuge office on Ski Hill Road. This class will cover the topics addressed above as well as trapping techniques, fur care and more. The class is free to the public and no pre-registration is required.

Joe Williams is a law enforcement officer at the Kenai National Wildlife Refuge. You can find more information about the Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

A day on Tustumena Lake

by Donna Handley



The Kenai National Wildlife Refuge trail crew poses after working on the Tustumena Glacier Trail.

As I traverse through my daily mountains of permits, paper work, and visitor requests, there is never doubt in my mind that my days in the office at the Kenai National Wildlife Refuge will always be an adventure. This is one of the reasons I truly enjoy my administrative position here at the Refuge—there is seldom time for boredom.

Still, every now and then, I start to think maybe the grass is greener on the other side. I feel this especially on those beautiful Alaskan summer days when I'm stuck inside and the trail crew stops by the office with sun and dirt on their faces. So, when the opportunity arose for me to get out on the 73,000-acre Tustumena Lake with the trail crew, I jumped at it.

After hitting most of the popular Refuge trails all summer long, our trail crew had a little time for a

special project resurrecting the old Tustumena Glacier Trail at the far eastern end of the lake. The trail gets grown over from time to time, so we were there to make it more passable for hikers and hunters. Overall, the mile-long hike was relatively flat which makes for easy walking, although hip boots are needed for about 100 yards due to overflow from glacial melt.

Except for a few inholdings, this enormous 23-mile long lake is entirely within Congressionally-designated Kenai Wilderness. Did you know that Tustumena Lake has a maximum depth of almost 1,000 feet? That's deeper than the Cook Inlet!

I can't deny the excitement wore off a little when I'm told I have to put the camera down and actually use the pulaski I carried in! At one point I remember thinking to myself—as I'm covered in sweat, dirt, no-

see-ums, and confused about which end of the tool I should be using—that I’m happy spending most of my days at the Refuge Visitor Center. It was a real eye opener for me to see how hard trail and cabin crews work.

When on Tustumena Lake you have a sense of being somewhere very remote. As we hike to the glacier, someone mentions that they feel as if they aren’t on the Kenai Peninsula anymore. I feel the same way, because having never seen it before (despite growing up here), it was uncharted land to me. It was a great feeling, and some might say selfish too, as I knew I was seeing something that most people will never see in their lives. Tustumena seems to be a perfect balance of accessibility and wilderness that makes it this way for visitors such as myself.

In order to get to Tustumena, one must either take a boat that’s big enough to handle a lake of that size, a floatplane, a horse, or take a long hike. Obviously, not everybody has these methods of transportation available to them or the ambition to hike the seven miles of the Pollard Horse trail to just get to the western shore line.

That late September day on Tustumena Lake was about as perfect as a day on the eighth largest lake in

Alaska could be. The combination of the fall colors, a hike to Tustumena Glacier, and the glass-like water conditions made for an unforgettable day. I’ve heard many stories of how unpredictable the conditions of that lake can be, so I know I was lucky to have a day in which my biggest challenge was staying awake on the smooth boat ride back. The physical labor on the trail really wore me out.

We also checked in on a few of our historic public use cabins on Caribou Island and at Big Bay. Both cabins are in great locations, and feel like a true wilderness getaway. Big Bay Cabin, built in the 1890s, is now one of the oldest standing structures on the Kenai Peninsula.

I recall from an end-of-the-summer Refuge staff meeting that almost all of Youth Conservation Corps kids (all local residents) said that visiting Tustumena Lake was the best part of their experience on the Refuge. Many of them also realized that chances are they would have never seen it if they hadn’t applied for their job. What a great thing to be able to say...

Donna Handley is an administrative assistant at the Kenai National Wildlife Refuge. You can find more information about the refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Thousands of feet on the ground are a challenge in Changbai Mountain, China

by Leah Eskelin



The North Approach to Lake Tianchi sees over 10,000 visitors on weekend days (credit: Matt Conner/USFWS).

I had the honor of serving as one of six delegates representing the U.S. Fish and Wildlife Service, Alaska Region, at the 2nd Annual Changbai Mountain International Ecological Forum last month in Jilin Province, northeast China. Professionals from around the world gathered to discuss the importance of protected areas (such as national parks, preserves and refuges) and how environmentally-conscious development can co-exist with these protected lands.

In short, China is attempting to make development decisions that take into consideration their impacts on the natural world and the benefit of green spaces to human health. Our delegation was also present to continue a cooperative partnership between Arctic National Wildlife Refuge and Changbai Mountain Na-

tional Nature Reserve, with a focus on wildland fire management and visitor services in protected areas.

Changbai Mountain straddles the China-North Korea border and has been held in almost sacred esteem by both nations for centuries. It is this adulation that has protected the landscape from development over the years, until it became officially protected within a 200,000 hectare reserve in 1960. However, now, with a growing middle class and increasingly easy tourist travel to the region (the Changbaisan airport opened in 2008), human pressures on the area's natural resources are mounting. Illegal hunting, plant and mushroom gathering, and the simple recreational activities of law-abiding visitors are all taking their toll on the land.

Lake Tianchi, the awe-inspiring crater lake atop Mount Baekdu, can be viewed from two vantage points. We visited the North Approach on a Saturday, along with 10,000 other visitors. The experience is intense. First, in a vehicle driven by Changbai Mountain staff, you travel up the mountain from the forest of yew, Korean pine and birch at the base through 30 hairpin turns onto the tundra, and finally to the summit of gray rock. At an elevation of 6,257 feet, there is a chill to the air that solicits rental parkas in the gift store at the top. The weather is very changeable here year-round, and not unlike the experience of visitors to Alaska's Mt. McKinley, many visits end with no view of the "Heaven Lake" at all.

The day of our visit was bright for us, and we not only found ourselves with a bit of sunburn on our faces but with over 600 photos in each of our cameras! Many of our photos were a result of our translators' eagerness to capture us at what is to them a once-in-a-lifetime visit to a very special place. A colleague who works for China's State Forestry Administration became a pro at getting me into nearly every photo op, and would take 5-10 pictures at each one.

I felt like I really saw the cultural importance of this protected place through one of our Chinese colleague's response. She was so eager to share, so determined to immortalize our visit, that, unlike other field

trips of the week, I was shepherded across the crater rim trail with very careful attention. She showed me a hospitality that I will not soon forget. It echoed the significance of Lake Tianchi to the Chinese people, and I felt honored to have seen it.



Considered sacred to both Chinese and Korean cultures, the lake atop Mt. Baekdu is a popular tourist stop within Changbai National Nature Reserve (credit: Leah Eskelin/USFWS).



Crouching on a rocky outcropping suspended over the crater lip, visitors to Lake Tianchi in northeast China are encouraged to pose for photographs, especially on clear viewing days (credit: Leah Eskelin/USFWS).

Once we made our way back down the trail to the Tourist Service Station, I was able to take in the rest of the infrastructure that made this high level of visitation possible, including new construction of another Visitor Center across the parking lot from the small

gift shop and bathrooms. Managing the steady flow of people coming to this viewing area is an immense task.

Protecting visitors from accidents, protecting the land from the people by using boardwalks and shuttle buses and still trying to maintain an ecologically sound landscape at Changbai Mountain has proven hard over the years. Illegal activities including poaching, plant and mushroom gathering, and logging have taken a toll on the biodiversity of the Changbai region. Only 20 Amur (Siberian) tigers remain in the wild here, non-native wild boars are damaging the forest and unwise pest management practices from a decade ago have left parts of the forest devoid of insects, and thus also missing the birds and mammals that once fed on these insects. Walking for miles over several days before seeing or hearing a bird is more alarming than walking along a Kenai National Wildlife Refuge trail and seeing fresh bear sign.

Changbai Mountain welcomes visitors to share the beauty that is found within the Reserve's borders. This beauty, however impressive, is but a melancholy fragment of its former self. What today's visitors see are principally geologic features with remnants of native vegetation and even fewer wildlife.



Boardwalks protect sensitive hot spring pools from foot traffic damage at Changbai Mountain's Julong Hot Springs (credit: Leah Eskelin/USFWS).

In contrast, we are able to visit protected lands in Alaska like National Wildlife Refuges, National Parks and Alaska State Sanctuaries that are protecting whole ecosystems, with intact assemblages of native plants, animals, fish and people. I value the diversity of wildlife one short visit to the Kenai Refuge can reveal

even more now that I have spent time in a protected area where the spectrum of sounds, flitting movement of birds, and muddy animal tracks along the trail are all missing.

The Kenai Refuge's purpose to "conserve fish and wildlife populations and habitats in their natural diversity" has new meaning for me after seeing what can happen when the ecosystem is taken out of balance in an otherwise protected forest. I am glad my children will know Alaska with its beautiful species in their native homes but am sorry to have lost that opportunity in some protected areas of the world.

Leah Eskelin is a Visitor Services Park Ranger at the Kenai National Wildlife Refuge. You can find more information about the Kenai Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.



The forest surrounding Changbai Mountain has been impacted by logging, pesticide treatment and poaching (credit: Leah Eskelin/USFWS).

Kenai Refuge has new Visitor Services Manager

by Matt Conner



Matt Conner, the new Visitor Services Manager at the Kenai National Wildlife Refuge, kneels next to the entrance sign being completed for the opening of the new visitor center in early 2015.

The other day I was in the garage unpacking boxes from our recent move from Fergus Falls, Minnesota, to work as the Visitor Services Manager for Kenai National Wildlife Refuge. I have heard people say, "It is like Christmas when you open your moving boxes." This might be true if what I got for Christmas was a bunch of stuff that I already own, plugs and wires to computers that have since been disposed, keys with no known source, and used and dried paint rollers that I don't remember ever using.

One of the more interesting finds was a fireplace tool set. It had been owned by the previous occupants of our home in MN but, as we converted the fireplace to gas after moving in, the tools were left under the stairs and forgotten about. I had never really looked at them until now and I was shocked to see that they had been hand forged from beautiful twisted iron. As

I was admiring the tools, my 10-year-old son Wyatt walked into the garage and said, "Whoa, cool!" Wyatt was presently tending a fire in the backyard so I handed him the poker and told him he could use it.

Perhaps there were still fumes emitting from the crusty paint roller and this is what lapsed my judgment to hand a 10-year-old boy a giant iron spear. Several hours later I was inside the house when I heard what sounded like a ruffed grouse beating its chest with its wings. I walked out to discover the sound was Wyatt beating something on the ground with the iron poker that I had handed him hours ago. I told Wyatt to bring me the poker and asked why he thought it was okay to treat something like this with such disregard for its care. He gave me his typical shrug and muttered something that sounded like "Idaho" (I don't know).

As the sun began to set I walked down the hill to-

wards the creek and made a startling discovery. I saw that Wyatt had not been beating the ground with the poker; rather, he had been mutilating his sister Bailey's pumpkin. I went back in the house and after more "Idaho" mumblings, Wyatt went outside and picked up the remains of the pumpkin left in the yard.

Later that night, a small figure stood in our doorway to say, "I threw up in my bed." It was Wyatt and when the mess was assessed, it was found to be bright orange. I asked Wyatt if he had eaten the raw pumpkin that he had smashed with the fireplace poker. He smirked and said, "We eat what we kill!" He went back to bed and as I was falling asleep, I heard the dog hacking up in her kennel. She too had produced lovely orange slur containing pulp and seeds.

I appreciated my son's response, "we eat what we kill" for a couple of reasons. First it proved he had a sense of humor and knew it would illicit a positive response at 3:00 a.m. It also indicated that he remembered some of the ethics we have discussed on several occasions while exploring national wildlife refuges. He has obviously heard me state this several times when hunting together at my previous position at the Fergus Falls Wetland Management District, as well as the many hours the family spent bird watching and on canoeing trips when we were stationed at White River NWR in St. Charles, Arkansas.

As a father, I feel that my children have a wonderful privilege to grow up around National Wildlife Refuges. We have spent many hours as a family fishing, hunting, watching wildlife, learning about nature and spending time outdoors because of the opportunities offered by refuges. My hope is that my work at Kenai NWR will help offer similar experiences to all visitors of the refuge. Simply put, my job at Kenai NWR is to share the story and significance of the

refuge as well as assist in managing the recreational opportunities of this amazing place.

This is no small feat to accomplish, however, the new Kenai NWR visitor center will help us better inform our visitors. For 35 years, visitors to the Kenai Refuge have walked into the small lobby of the headquarters building to ask questions, obtain maps and maybe watch a video in the quaint exhibit hall. Soon, our visitors will have an entirely new experience!

The new visitor center is being constructed next to the existing headquarters building. Once completed in early 2015, the facility will be host to thousands of visitors looking to learn and understand more about the refuge. The visitor center will have multi-purpose rooms, a cozy fireplace to sit by while a ranger shares information about the refuge, and an exhibit hall that is best described as a manifestation of the majestic Kenai National Wildlife Refuge.

I was thinking about the opportunities for our family to explore and learn on the Kenai later the next morning at breakfast with my wife Stacey and our two children Wyatt (10) and Bailey (8). As I sat daydreaming of future hikes, back country cabins, and wildlife of the refuge, Wyatt asked if he was in trouble for the pumpkin crime. I told him no, but I did have to ask one question. "Did you have a partner in crime in the pumpkin murder?" Wyatt smiled and said, "yes, our dog Lucy ate it too. How did you know?"

"Oh," I said, "I'm just smart like that. Now hurry up and finish breakfast because it's your turn to clean out Lucy's kennel before school today!"

Matt Conner is the new Visitor Services Manager at Kenai National Wildlife Refuge. You can find more information about the Kenai Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Elusive, inconspicuous brown creepers favor old growth forests

by Ted Bailey



A brown creeper probes for insects behind the bark of a birch tree (credit: T. Bailey)

I have seen more brown creepers on the Kenai Peninsula this year than in the past two years when I saw none. Brown creepers are tiny, brownish-gray, woodpecker-like birds that are cryptically colored, perfectly blending into the brownish-gray patterns of tree bark. They are not only visually inconspicuous, but their short, high frequency calls are easily missed. A typical call consists of 4-9 faint, very high pitched notes that last only about a second each.

Here on the Kenai, they often fly to the bottom of large, old white or black spruces trees and begin creeping upward, like woodpeckers, probing for insects and spiders hidden in the furrowed bark and plucking them out with their thin, delicate, slightly curved bills. They also find prey behind amongst the loose bark of birch trees. It's rare to see brown creep-

ers feeding on smooth-barked trees such as aspen.

Your chances of seeing brown creepers are the greatest in old growth forests. In the 1970s, Sue Quinlan, working on the Peninsula's Chugach National Forest, reported that brown creepers were most abundant in old growth forest stands over 100 years old. But, in the 1990s, other studies indicated a decline in the abundance of brown creepers throughout south-central Alaska probably because many large dead and dying white spruce trees (from the spruce bark beetle infestation) were removed by logging. The decline is understandable since brown creepers frequently build their well hidden nests behind loose bark on dead and dying trees.

Apparently only the female incubates the eggs, but she is regularly fed on the nest by the male. They likely compete for food with red-breasted nuthatches, woodpeckers, chickadees and kinglets but whether this competition affects their reproduction or populations is unknown.

Brown creepers are the only member of the creeper family of birds (Certhidae) in North America. Creepers are believed to have originated in the Old World (known there as treecreepers) and later spread to North America. Because brown creepers are not as winter-adapted as chickadees and nuthatches, they sometimes withdraw from the coldest part of their range in harsh winters and become short distance migrants. However, little is known about their migratory habits in Alaska. I have seen them on the Kenai during winters but unfortunately for winter bird watchers, they seldom visit bird feeders.

My closest encounter with a brown creeper and one of my most memorable wildlife experiences happened years ago. I was standing motionless watching a family of brown creepers fly from tree to tree. One of the young ones flew up to me, landed on my brown plaid flannel shirt and began "creeping" up my chest. But it soon realized that I was not the trunk of a tree and flew off to rejoin its family. I felt lucky to have experienced such a unique encounter.

I don't know why I have seen brown creepers more

often this year than I have in the past several years. I walked the same routes and trails. Has the resident population increased? Have habitat conditions improved? Did last year's relatively mild winter increase their survival? Were previous winters too harsh on the birds? Are the creepers seen here on the Kenai Peninsula in the fall actually short-distance migrants fleeing colder parts of Alaska?

I've always been interested in elusive species like brown creepers because many aspects of the lives of

such species are still unknown. And the brown creeper is a prime example.

Dr. Ted Bailey retired from the Kenai National Wildlife Refuge where he was the supervisory wildlife biologist for many years. He has lived on the Kenai Peninsula for over 38 years and still maintains a keen interest in its wildlife and natural history. Find more information about the Kenai National Wildlife Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Progress on eradicating elodea from the Kenai Peninsula

by John Morton



Is it working? On the left, a typical rake sample of elodea from Beck Lake during surveys in 2013 (credit: C. Anderson) and, on the right, a rake sample 13 weeks after Beck Lake was treated with fluridone in 2014 (credit: KENWR).

I am fascinated by how plants and animals are named. Elodea, the first submersed freshwater invasive plant to infest Alaska, was named by the famous French botanist André Michaux. Michaux was first sent to the U.S. in 1785 by Louis XVI. After the misguided French king was beheaded, Thomas Jefferson asked Michaux to lead another American expedition in 1793. Michaux collected several specimens in the Midwest that he later assigned to the new genus *Elodea*, meaning “marshy” in Greek.

Elodea does indeed grow in marshy habitat. But where introduced outside its native range, elodea can also turn otherwise clear lakes into marshy habitat due to several unusual traits. It’s incredibly facile at dispersing, reproducing asexually from just a plant fragment. It’s marvelously prolific, continuing to photosynthesize under the ice after native plants have senesced.

And, unlike most native plant species that have evolved to occupy specific depths or one stratum in the water column, the perennial elodea can root into the bottom substrate as deep as 30 feet and send con-

tinuous strands to the top of the water column where it spreads across the water’s surface. Its growth can be so hyper-abundant that boat traffic is impeded and lakeshore property values drop, and the biological oxygen demand so great that salmon and other fish are deprived of oxygen. Elodea represents an enormous economic and ecological threat to aquatic and fisheries resources of the peninsula, particularly in the 4,000 or so lakes and ponds of the Kenai Lowlands.

For these reasons, partners in the Kenai Peninsula Cooperative Weed Management Area decided that elodea had to be eradicated from the peninsula after it was first detected in Stormy Lake in September 2012. During summer 2013, surveys of 69 high-risk lakes confirmed that the current elodea distribution on the peninsula is constrained to just three lakes north of Nikiski. Stormy Lake is co-managed by Alaska State Parks and the Kenai National Wildlife Refuge. Beck and Daniels Lakes, with many private landowners, drain into Bishop Creek, which wanders in and out of the Refuge enroute to the Cook Inlet.



Biologists from Kenai National Wildlife Refuge, Homer Soil & Water Conservation District (SWCD), Alaska Department of Natural Resources and SePRO stage 20-lb pails of pelleted fluridone for the second treatment of Stormy Lake in September 2014. The Fairbanks SWCD also participated to learn more about how to eradicate elodea from Chena Slough and Lake.

This past winter, the U.S. Fish and Wildlife Service, Alaska Department of Natural Resources, Homer Soil & Water Conservation District, Alaska Department of Fish & Game, Alaska State Parks, Cook Inlet Aquaculture Association, UAF Cooperative Extension Service, Kenai Peninsula Borough, Kenai Watershed Forum and a few dedicated Daniels Lake residents developed a plan that detailed how this eradication was to come about.

We chose to work primarily with fluridone—a selective, systemic herbicide that inhibits carotene formation, a plant pigment needed for photosynthesis, thereby preventing the formation of sugars necessary to sustain elodea. Working closely with SePRO, the manufacturer of fluridone products sold under the trade name Sonar, we developed a prescription that calls for four treatments over a 3-year period (2014–16).

We applied the first two treatments to each of the three infested lakes this summer. Beck and Daniels Lakes were first treated in early June. We applied both liquid and slow-releasing pelleted fluridone in Beck Lake. In Daniels, because elodea has not yet spread throughout the lake, we applied both pelleted fluridone and diquat, a nonselective contact herbicide, to five treatment areas that total less than 100 acres of the 640-acre lake.

Stormy Lake was also treated with both fluridone

formulations, but not until late July due to delayed funding. We then applied a second round of pellets to all three lakes in mid-September, with the expectation that very low concentrations (< 8 ppb) of fluridone under the ice would continue to have herbicidal effects on elodea all winter.

To monitor treatment efficacy, we established 50 sites in each of the three lakes (150 sites total). Pre- and post-treatment elodea populations were measured in late May and early September, respectively.

So how are we doing? For two lakes, the results were spectacular. Thirteen weeks after the first treatment, elodea occurrence in Beck Lake (the most infested of the 3 lakes) decreased from 70% to 12% of sites, with average abundance declining by 87%. In Daniels Lake, elodea occurrence decreased from 22% to ZERO—not a fragment was found! But this dramatic outcome is likely due (at least in part) to diquat, which kills exposed plants on contact but not roots beneath the sediment.

In Stormy Lake, where elodea grew unhindered most of the summer before being treated on July 23, the population had not yet been significantly affected by herbicidal action when surveyed in mid-September. Although many strands were showing pink tips (a sign of necrosis), elodea fragments were everywhere in Stormy, even washed up on yellow pond-lily pads. The good news is that with fluridone uptake occurring

under the ice, we expect elodea to continue dying over the winter.

Sometime in February, we'll auger through the ice to take water samples for assaying fluridone concentrations. After the ice goes out in May, we'll resample our 150 sites for elodea. No promises, but I anticipate that elodea will be all but gone in Beck and Daniels Lakes, and very sparse in Stormy Lake, by next spring. Scheduling of the third herbicide treatment in 2015 depends on what we find about fluridone concentrations and elodea populations after ice-out, but it will likely

be in late June.

Despite great progress, it ain't over 'til the fat lady sings or, in this case, until elodea is gone, gone, gone. Even after elodea is no longer detected on our 150 sites, we will survey extensively elsewhere to ensure it no longer occurs on the Kenai Peninsula.

Dr. John Morton is the supervisory biologist at Kenai National Wildlife Refuge. Find more information about the Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Birders flock after “fowl” weather events

by Todd Eskelin



Luke DeCicco photographed the first Kenai Peninsula record of this Cape May Warbler in Seward on November 2, 2014.

It was like a scene out of the movie “The Big Year” starring Steve Martin, Owen Wilson, and Jack Black. Several hotshot birding friends decided to make a run to Seward after a recent storm to see what interesting birds might have been deposited.

At their second stop they popped into Benny Benson Lagoon and 3 of the 4 birders jumped out and began scanning the collection of gulls that assemble at the outlet of the lagoon. The congregation was feeding on dying Coho salmon. If there was going to be a rare gull blown in during the recent foul weather, this would be the ideal spot to find it. The fourth birder in the group decided three sets of eyes on the lagoon were likely enough, so he decided to scan the alder patch behind them that was unlikely to hold much of anything with no leaves and only a few insects coming off the trickle of water in the ditch.

A flash of yellow appeared and he was in business. He alerted the rest of the group to his find. Flitting in the grey wet branches was the first record of a Cape May Warbler for the Kenai Peninsula!

The Cape May Warbler is a fairly hardy little bird that breeds throughout the boreal zone in Canada and

winters on islands in the Caribbean. I say it is hardy because there are many winter records of stray birds being found in the central and eastern U.S. into mid-January. These strays appear to be assisted by feeding on suet feeders which may allow them to “hang-on” a little longer.

The Kenai Peninsula is experiencing unseasonably mild temperatures this winter and this does have a benefit for birders, but probably not in the way you would think. Intuition would tell you that the warm weather might attract migrants to stay here. Maybe the warm weather is even attractive enough for birds that don’t normally live here to come and visit.

The reality is that birds are either blown astray by huge storms or they are pre-programmed to go the wrong way. The warmer weather just helps stray birds survive long enough that bird watchers have an opportunity to find them. Most of these strays are unlikely to actually survive the entire winter period, but that is part of the system built into their biology to allow each species to adapt to changing environmental conditions.



This White-throated Sparrow was found in Seward this November, far north of their wintering grounds in the Lower 48 (credit: Luke DeCicco).

You can think of these vagrants as the pioneers. A very small portion of each population decides to go against what every other member is doing. Instead of heading south to the balmy climates of the Cayman Islands, these adventurers seek out untested areas. Like most early adventurers they meet their demise by encountering conditions unfit for survival.

OK, it may not be quite as glamorous as that—they may just be wired wrong and flew the wrong direction in trying to find Cuba. But as the climate or habitat changes, these birds find spots that are inhabitable and they become the wanderers that are able to make it and establish a new range for the species. Personally, I would pick the Bahamas over Seward in November, but that is just me.

The rest of the trip for our hotshot birding crew from Anchorage was quite fruitful. They found what appeared to be a first year “Kumlien’s” Gull which breeds in the Canadian arctic.

Then, in a residential area, they photographed a White-throated Sparrow. White-throated Sparrows breed throughout the Great Lakes Region and across Canada to within about 600 miles of Seward. Interestingly, individual birds have been found during winter in Homer, Seward and Kenai for about seven years in a row. It may be a matter of time before someone discovers the first breeding pair of White-throated Sparrows and extends the breeding colored portion of the range

map to the Kenai Peninsula.

It is this constant ebb and flood of bird ranges and occurrences that makes studying and watching birds so fun and frustrating at the same time. When you look at a range map in a book, it is just a snap shot at the time of printing. Then when you think about our changing climate and the things that are happening here on the Kenai Peninsula, it is an exciting time for bird watchers to find something new. It may be the excitement of finding a common species like a Violet-green Swallow in September which has never been documented before.

If you are lucky and put your time in, you may find a new species for the Kenai like a Canada Warbler or a Rose-breasted Grosbeak. My guess is that vagrants of both species have landed on the Kenai in the past, but were never discovered.

If you see or photograph a bird you don’t recognize, call Todd Eskelin or Toby Burke at the Kenai National Wildlife Refuge for help with identification (907 262-7021). If you know what the bird is, enter it in eBird (www.ebird.org) to share your sightings with other birders.

Todd Eskelin is a Wildlife Biologist at the Kenai National Wildlife Refuge who has conducted research on songbirds in many areas of Alaska. Find more information about the Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Thanksgiving: Remembering those who trusted, encouraged and inspired us

by Ted Bailey

This Thanksgiving I recalled and was thankful that so many helped me on my way to become a (now-retired) professional wildlife biologist. These are folks who helped me build confidence to pursue a career I never dreamed was possible when I was young. Perhaps it is a sign of growing older that this holiday is now (for me) a good time for reflection.

I think of those in the military who trusted that I knew what I was doing when I worked on aircraft costing millions of dollars, and of the lives of the aircrews that depended on my mechanical skills and knowledge. I think of two roommates in the military who in the evenings took out their slide rules and opened their textbooks on differential and integral calculus so that they could eventually obtain their degrees in electrical engineering. It was they who encouraged me to think of college and led me to earn a year's worth of college credits while in the military that worked to my advantage later.

I think of my late parents who could not financially help me in college when I returned from the military, but who offered me words of encouragement that my efforts would somehow be financially rewarded. I am thankful for a wife who delayed her higher education goals so that I could obtain mine.

I am thankful that a U.S. Fish and Wildlife Service Cooperative Wildlife Research Unit leader encouraged me to continue on to graduate school with the promise that "I will find you a fellowship so that you won't have to worry about the cost." I am thankful that yet another Cooperative Wildlife Research Unit leader obtained other fellowships for me, allowed me to choose a research project of my interest (bobcat ecology and

social behavior) in Idaho, and then found funding and trusted me to complete research projects on wolverines in Montana and African leopards in the Republic of South Africa.

I think of a colleague who was influential in my coming to Alaska and later a refuge manager who, unknown to me, went beyond the call of normal duty to hire me in a new position that opened up numerous opportunities for wildlife research and management.

I am also thankful for those who inspired me by their writings—"Walden" by Henry David Thoreau, "A Sand County Almanac" by Aldo Leopold, and "Of Men and Marshes" by Paul Errington. And those who inspired me by their efforts, some of whom I was fortunate to eventually meet—Durwood Allen's research on wolves on Isle Royale, George Schaller's studies on mountain gorillas, tigers, lions, and Himalayan and Tibetan wildlife, and my advisor and mentor Maurice Hornocker's studies on grizzly bears and cougars and later on wolverines, river otters and Siberian tigers.

Some of these people, including my parents and wife, have already passed on. But they all helped me in ways they probably never knew, and for that I am most thankful.

Dr. Ted Bailey retired from the Kenai National Wildlife Refuge where he was the supervisory wildlife biologist for many years. He has lived on the Kenai Peninsula for over 38 years and still maintains a keen interest in its wildlife and natural history. Find more information about the Kenai National Wildlife Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Are we winning the war on invasives?

by Elizabeth Bella



Finding a needle in a haystack: one of the permanent monuments put in place eight years ago to mark the location of 74 plots used to monitor invasive species populations on the Kenai National Wildlife Refuge (credit: E. Bella/KEWNR)

Invasive plants are now well known as a threat to ecosystem integrity across the Kenai Peninsula. We've watched the not-so-slow march of invasive species down the road system, dispersing seemingly faster each year. Wind-dispersed plants are of particular concern as their dispersal can be exponentially higher than for other nonnative plants. Hawkweeds, hawksbeard, dandelions, and now fall dandelion have become so common along our roadsides as to be virtually part of the "natural" landscape.

This trend of accepting potentially huge ecosystem changers as commonplace makes those of us involved in invasive species management ask a difficult but essential question—are we winning the war against invasive plants or merely holding the line? There is also the possibility—if we look at big picture trends—that we are failing miserably in our aim to contain, control or eradicate infestations.

Fortunately, on the Kenai National Wildlife Refuge, we have the means to get at this question. A large-scale systematic plot survey initiated in 2004, the LTEMP (Long Term Ecological Monitoring Program), revealed that only four percent of 256 plots had nonnative plant species. By observing what proportion

of the Refuge remains composed of completely native flora over time, we can address our question at the landscape scale.

However, we also know that the nonnative plant community is mostly constrained (at least for now) to areas of the Refuge that have been disturbed by humans. So, working with Colorado State University in 2006, we inventoried native and nonnative flora on 74 plots that were established for the purpose of monitoring invasive plants on the Refuge's human footprint. With the exception of a few remote public use cabins, the human footprint is mostly in the Skilak Lake area, the Swanson River and Swan Lake canoe systems, commercial oil and gas leases, the Refuge headquarters and Funny River Road area, and seismic lines spreading north of the Sterling Highway.

These plots were distributed in what is known as a stratified-random design where at least seven plots were randomly chosen for sampling within several disturbance types or strata: roads, campgrounds, seismic lines, right-of-ways, oil and gas well pads, and trails. These categories were further separated into fine-scale disturbances, such as developed versus undeveloped campgrounds.

We resurveyed these plots this summer, 8 years after their initial measurements. We battled swarms of mosquitos, slogged through bogs in the rain, and experienced a remarkable day of two flat tires. Once we even took an unplanned swim through a wetland to get to a plot. Finding the monument—metal discs affixed to rebar, often buried, moved or missing—was also a challenge. Throughout it all, even during the physically hard parts, we were buoyed by the new and unique vistas experienced each day, and the initial thrill of seeing what had changed since 2006.

The good news is that the distribution of invasive species hasn't changed much within the human footprint. Nonnative plants occurred on more than 50 percent of the plots (38) in 2014, similar to 39 plots in 2006. The highest numbers of species were found on the oil and gas pads, followed by campgrounds and paved roadsides. The most common nonnative species were dandelion, clovers, Kentucky bluegrass, pineapple weed, bigleaf lupine and plantain.



Kenai Refuge biological intern Jen Peura collects vegetation data on one of the plots (credit: E. Bella/KENWR)

Twenty invasive species were identified in 2014, down from 25 in 2006. Shepherd's purse, narrowleaf hawkweed, oxeye daisy and red clover were found in 2006 but not in 2014. In contrast, lambsquarters and reed canarygrass were found in 2014 but not in 2006.

Some areas within the human footprint are intrinsically more susceptible to invasion due to frequent vehicle or pedestrian traffic. The oil and gas infrastructure has been disturbed a lot recently with renewed interest in drilling and new ownership of leases. Roadsides are disturbed frequently by grading and by simply the annual passage of more than a million vehicles down the Sterling Highway. Visitors to trail heads and campgrounds inadvertently bring seeds with them. Nonetheless, we've been able to keep the spread in check due to a comprehensive herbicide treatment program that targets oil and gas well pads, campgrounds, trailheads and roadsides—gateways to the Refuge's more pristine interior.

In contrast, plots on seismic lines showed little disturbance and virtually no invasion; some of the oldest

lines from the 1950s and 1960s were barely discernable from surrounding vegetation. Most of these sites are rarely visited for any reason, and many were in wetlands. Future invasion is unlikely in these areas.

So are we winning the war? We appear to have mostly held the line on the Refuge over the past 8 years. The problem, however, is that by most counts we're losing badly outside the Refuge with many invasives becoming well established in towns and rural subdivisions, and on the highway system outside the Refuge. Eight years from now, our resurvey of these plots will likely paint a very different picture. Although our surveys will continue to contribute to our understanding of patterns and chronology of invasions on the Refuge, smart strategies for combating invasives are necessary across land ownership boundaries if we are to really succeed on the Kenai Peninsula.

Dr. Elizabeth "Libby" Bella is the plant ecologist at the Kenai National Wildlife Refuge. Visit <http://www.fws.gov/refuge/kenai/> for more information about the Refuge.

Camouflage depends on the background

by Dawn Robin Magness



Snowshoe hares in winter coat are camouflaged in snow but stand out in an otherwise brown landscape if the snow melts prematurely (credit: D. Gorden/E. Robertson).

Throughout fall and early winter, a short-tailed weasel has been making my afternoon schedule more interesting. As I wait for my son to finish his day at elementary school, I have lucky days where I see the weasel working the edges of the parking lot.

Short-tailed weasels, also known as ermine, are small mammals with thin, long bodies. They are fierce hunters that prey mainly on voles. Before this recent snowfall, the weasel was easy to spot because it was stark white against the background of brown grass and black pavement.

Short-tailed weasels molt from a sandy brown back with a white belly to a white coat with a black tipped tail. Several animal species on the Kenai Peninsula undergo seasonal color changes to blend into snowy conditions. Three species of ptarmigan, the least weasel, and snowshoe hare also switch to white for the winter months. White fur or feathers provide camouflage in the winter, which should help these animals hide from predators and possibly be more effective hunters. However, as all hunters know, camouflage only works when it matches the environmental conditions.

Phenology is a branch of science that focuses on how climate affects the timing and seasonality of biological events such as migration, hibernation, and molting. Plant and animals that are not in sync with the climate, a phenomenon called phenological mismatch, may not be as healthy or successful. Animals turning white before snow can provide cover is an example of a phenological mismatch. Over the past 100 years, the average duration and extent of snow cover has decreased in North America. Snow cover can come later and leave earlier than it has in the past.

Animals have some capacity to adapt to changing snow conditions. Marketa Zimova recently received her master's degree from the University of Montana for a graduate study that explored the ways snowshoe hares might respond to changing snow conditions. Individual animals may be able to change the timing of molt or change their behaviors, for example hiding in thicker cover, when their fur color is out of sync with the snow conditions.

Zimova, and her advising professor Dr. Scott Mills, recently published a paper in which they did not find evidence that snowshoe hares changed the timing or rate of their molt in years with very different snow conditions. Zimova also did not find evidence that snowshoe hares changed their behavior when their white coats made them more conspicuous and vulnerable to predation. Hares freeze in their tracks when threatened to enhance the likelihood that they will not be detected by a predator. Zimova found that hares neither flushed sooner nor chose places with better cover for resting sites when their coats were out of sync with snow conditions.

In contrast, ptarmigan do change their behavior in different snow conditions. Male rock ptarmigan, which molt later than females, will soil their feathers to become more cryptic when snow melts in the spring.

Another way a local population could sync molt phenology to changing snow conditions is natural selection. In this scenario, the genetic make-up of individual hares would cause them to molt at different times and at different rates. Individuals with bad timing or who molt quickly would be more likely to be

eaten. Over time, the molt timing of the population would shift.

There is evidence that snowshoe hare populations do become adapted to local conditions. Across their range, different populations exhibit variability in the timing of the molt and in the resulting color. For example, snowshoe hares that live in the milder climate of the Washington and Oregon coast remain brown all year. Zimova did find that hare with fur color that was mismatched to snow conditions were less likely to survive and this suggests there would be strong selection.

For populations to adapt to new conditions through natural selection, differences must exist between individuals. These differences in individuals depend on genetic diversity. Sometimes, unique individuals show up on the landscape. In 2004, an abnormal moose with patchy white fur was photographed in Sol-

dotna and the picture was run in a Peninsula Clarion story. The moose's coat was likely due to her unique genetic makeup, but not related to phenology.

Seasonal color changes in hares and weasels are caused by hormonal changes induced by the amount of daylight. However, the amount of daylight needed to start the change differs between individuals because of their unique genetic makeup. As climate and other habitat conditions change, maintaining genetic diversity becomes an evolutionary bet-hedging strategy. Unique individuals that are not successful today may become the most successful in novel, future conditions.

Dr. Magness is a landscape ecologist at the Kenai National Wildlife Refuge. Visit <http://www.fws.gov/refuge/kenai/> for more information about the Refuge.

Eradicating an invasive predator from the Kenai Peninsula

by Kristine Dunker and Robert Massengill



Northern pike are voracious predators of juvenile salmon and trout. This pike was from Alexander Creek, a tributary of the Susitna River (credit: Dave Rutz).

Loons calling through the morning mist...The cry of an eagle perched overhead...Rainbow trout leaping from the water, and your children's smiles as they reel one in. This tranquil image illustrates what once was commonplace for many lake residents in the Soldotna Creek drainage.

Clyde Mullican, a homesteader on Sevena Lake, recalls trout fishing from his property as "outrageous." "You couldn't throw a hook in without having a rainbow on it. Big ones too!" Unfortunately, today, those hooks go largely untouched.

In the 1970's, northern pike were introduced to the Soldotna Creek drainage through illegal stockings. Later more illegal introductions occurred in other area lakes from Kasilof to Nikiski. In most cases, native fish populations collapsed within a decade of pike establishment taking away fishing opportunities for prized native fish. For example, the quality rainbow trout fisheries in East and West Mackey Lakes and Derks Lake, which are in the Soldotna Creek drainage, were severely impacted by the introduction of northern pike. The stocked coho salmon fishery on Union Lake was also eliminated.

Northern pike are an invasive species in South-central Alaska, and they are the likely suspect in the

decline of salmon populations in formerly productive drainages like Alexander Creek in the pike-plagued Susitna River basin. This infestation prompted concern by the Alaska Department of Fish and Game (ADF&G) that similar scenarios affecting local native fish populations would eventually play out on the Kenai Peninsula.

Stormy Lake and Soldotna Creek were of particular concern because of proximity to critical coho salmon and rainbow trout rearing areas that contain the densely vegetated calm water habitat pike prefer. For Stormy Lake, the fear was that pike would spread to the Swanson River drainage. For Soldotna Creek, the concern is primarily for Kenai River tributaries like the Moose River.

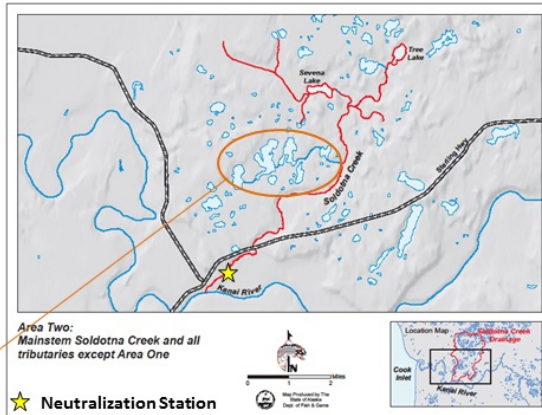
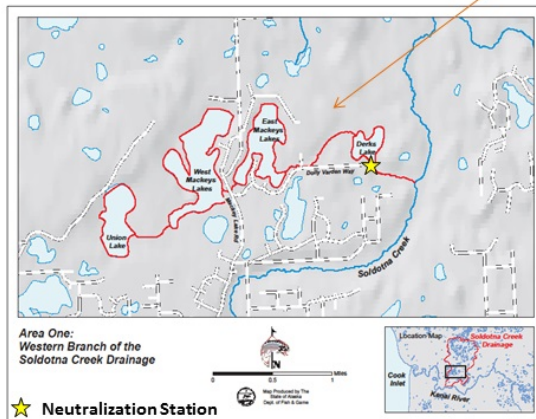
Although the fast-flowing glacial Kenai River is not optimal habitat for northern pike, the river can serve as a travel corridor for them. Up to 40% of the Kenai River's coho salmon production occurs in the Moose River. If a reproducing population of northern pike ever establishes there, it could have devastating consequences for native fish and the fisheries that depend upon them. The good news is that this hasn't happened yet and can still be prevented.

Soldotna Creek Treatment Areas

Area 1

Union Lake, West Mackeys Lake,
East Mackeys Lake, Derks Lake

Treatment Timing: 2014



Area 2

Sevena Lake, Tree Lake,
Mainstem of Soldotna Creek

Treatment Timing: 2016 and 2017

Native Fish Relocation effort from Area 2 → Area 1 in 2015

Soldotna Creek Project Plan

Phased application of rotenone to two treatment areas is part of a multi-year project to eradicate northern pike from the Soldotna Creek drainage.

ADF&G is taking a very proactive approach in dealing with northern pike on the Kenai Peninsula with the goals of preventing their spread and protecting the area's native fish populations and fishing opportunities. Along the way, native fish populations are being restored, but the primary goal is to eradicate northern pike from the Kenai Peninsula.

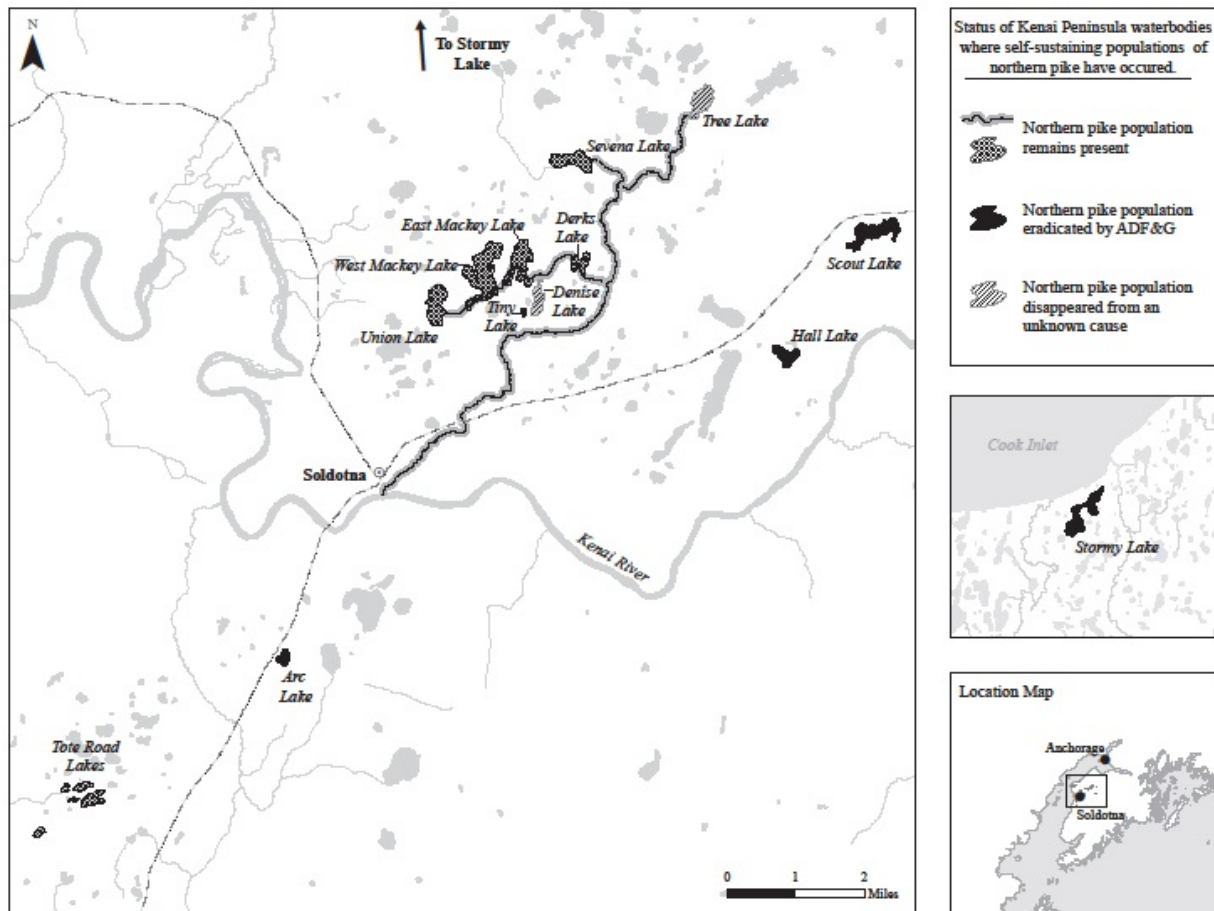
To eradicate invasive fish, there are few options. One is to drain an entire waterbody, which isn't usually feasible. In rare cases intensive gillnetting can be effective, but only if the waterbody and pike population are both very small. The best option is to use a fish pesticide, an approach used on the Kenai Peninsula since 2008.

We typically use a plant-based product called 'rotenone.' Rotenone kills fish because it is easily absorbed into the bloodstream via the thin tissue of the gills. Once in the blood, rotenone disrupts cellular respiration, and fish can't metabolize oxygen. All organ-

isms with gills can be affected by rotenone.



Clyde Mullican's rainbow trout catch from Sevena Lake circa 1970 before introduced northern pike began to affect native fish populations (credit: Clyde Mullican).



Northern pike distribution on the Kenai Peninsula.

Fortunately, at the extremely low concentration needed for pike control of less than 50 parts per billion, rotenone-treated water is safe for birds and mammals (including humans) to contact because rotenone is poorly absorbed through the skin and is broken down by digestive enzymes if ingested. Regardless, in order to eliminate all risk of exposure, we advise the public to not contact rotenone-treated water until the rotenone has fully degraded. To that end, treatments usually occur just prior to ice up, when recreational use is at a minimum.

In preparation for rotenone treatments, ADF&G staff spend years planning the projects, collecting field data, coordinating with area residents, and acquiring permits. Many local residents have attended meetings or provided comments on projects. Tackling the problem of a northern pike infestation as a community is vital to the success of these efforts. ADF&G seriously

reviews and considers all comments and feedback received before starting rotenone treatments.

Local pike eradication efforts began in 2008 and 2009 with rotenone treatments of Arc and Scout Lakes. In 2011, two very small pike populations of less than 30 individuals per lake were removed from Tiny Lake and Hall Lake following many months of intensive gillnetting.

In 2012, the department treated Stormy Lake with rotenone. This was the first project where native game fish still occurred in the lake. Prior to the treatment, native fish were relocated from Stormy Lake into holding pens in Wik Lake until the rotenone in Stormy Lake degraded. This project was also the first treatment of an open system as Stormy Lake drains directly into the Swanson River. Today the pike are gone, and the native fish are increasing their abundance in Stormy Lake. Catch rates of trout, char, and coho

salmon during a single day-long survey in 2014 surpassed the total catch of these species following two months of intensive survey effort before the treatment.

This past October, ADF&G initiated a multi-year effort to rid the entire Soldotna Creek drainage of northern pike. This is the most extensive pike removal project to date. The drainage was divided into two areas by a series of fish barriers. The western branch (Area 1) only contained northern pike and was treated with rotenone in October. Area 2 (comprising the remainder of the drainage) still harbors native fish species and has not been treated with rotenone.

Next year, ADF&G will evaluate the success of the Area 1 rotenone treatments to ensure the pike are gone. If the evaluation indicates success, we will spend the summer relocating native fish from Area 2 to Area 1. This effort will provide a sanctuary for native fish that would otherwise perish after treatment of Area 2 in 2016 and 2017 and help restore native fish pop-

ulations in Area 1. Once we can verify that the entire drainage is pike-free, fish barriers will be removed to allow unrestricted movement and recolonization of native fish.

This will be a milestone for pike eradication efforts on the Kenai Peninsula because the Tote Road lakes near Kasilof will be the only remaining water bodies containing northern pike. These efforts will restore wild fisheries on the Kenai Peninsula so that hooks cast out into Soldotna Creek lakes will again see the action they once did.

Contact Kenai Area Research Fishery Biologist Robert Massengill at 907-262-9368 or Southcentral Alaska Invasive Species Coordinator Krissy Dunker at 907-267-2889 for more information on northern pike eradication from the Kenai Peninsula . You can find more information about the Kenai National Wildlife Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Rutting moose and the social significance of antlers

by Ted Bailey



A rutting bull moose tests the air for the scent of a cow moose standing just a couple of feet in front of him to determine her reproductive status (credit: Ted Bailey).

On a hike on the Kenai National Wildlife Refuge in early October, I came upon a group of rutting moose. There were at least two bulls and four cows, one with a calf. I was captivated watching them interact.

Much of what we know about the reproductive biology of moose in Alaska is from studies by Chuck Schwartz, the late Al Franzmann and others who worked with captive moose at the Alaska Department of Fish and Game's Moose Research Center at the end of Swan Lake Road. We know about the behavior of rutting moose in Alaska from biologists Dale Miquelle and Vic Van Ballenberghe and others who studied a naturally-regulated population of moose in Denali National Park. And much of what we know about the evolution and social significance of moose antlers is based on studies by the late Anthony "Tony" Bubenik, a Canadian research scientist and once a world renowned authority on horns and antlers. He once studied rutting moose on the Kenai Peninsula and I was fortunate to meet and converse with him in the 1970s.

In most cow moose, the typical estrous cycle—the hormonal and physiological changes—starts in the late summer and usually lasts 24-25 days. However, most cows are receptive to bulls for only a brief 15-26 hour period during their cycle. The average date of first breeding for most cow moose in Alaska is October 5 with a mean calving date of May 26, but it can vary from September 28 to October 12.

Although the majority of cows conceive during their first estrus, studies have shown that if a cow is not bred during her first estrus cycle, she can recycle up to six more times which means she could potentially be bred as late as March. The average calving date for second-estrus-bred cows is June 15 and third-estrus-bred cows' average calving date is July 3. Delayed breeding may thus explain the difference in the sizes of moose calves we sometimes see in the spring and summer.

In contrast to cow moose, bulls must be ready to mate on short notice if the cow accepts them, but bulls pay a price—physiologically—for growing antlers

whose size often determines who will breed. The main mineral in antlers is hydroxyapatite or crystalline calcium phosphate. Before the rut, in order to harden or mineralize their antlers, calcium is often withdrawn (decalcification) from the bulls' skeletal bones. Because prime bulls do not feed for about two weeks during the rut and thus cannot rapidly replace this lost calcium, the bones in their bodies—mainly the shoulder blades and ribs—become soft and fragile, a temporary condition (osteoporosis) which subjects the bulls to injury and is the reason why some bulls have broken shoulder blades and ribs. Prime bulls may also lose 12-19 percent of their pre-rut body weight from not eating during the rut.

The cessation of feeding by prime bulls before and during the rut coincides with scent-urination marking. Prior to, during and after the main rutting period, bulls scent mark by rubbing trees, digging rutting pits in which they urinate and splash urine-soaked soil on their antlers and bodies, salivate copiously, and saturate the bells hanging from their necks with saliva and splashed urine to attract cows. Scent urination by bulls attracts cows and is believed to induce cows to ovulate. Cow moose also scent mark in pits, but are more likely to do so during peak rut by rubbing trees, perhaps to advertise their estrus condition. Bull moose also scent mark trees later in the rut perhaps to attract females that were not bred earlier.

The urine, saliva and other body excretions contain pheromones that presumably advertise the sexual status of the moose. Bull moose assess the breeding status of cows by smelling the cow's urine or genital area. Sometimes they deeply inhale the cow's scent into their vomero-nasal (Jacobson's) organ in the roof of their mouth by extending their neck and curling their upper lip, a behavior known as flehman. And as we moose hunters know, bulls also vocally advertise their readiness to mate by their "grunting" calls.

Fossil evidence suggests that antlers first evolved millions of years ago to protect the head and eyes of ancestral ungulates from thorny vegetation and during sparring with other males. Antlers were too fragile and sensitive to evolve as weapons against predators. Later, antlers slightly changed their position on the head to become primary structures of social significance and indicators of dominance.

While moose antlers are growing from ½ to ¾ inch

per day, they are covered with a very sensitive and vascularized skin (velvet) which lasts about 140 days. The loss of velvet is likely controlled by photoperiod and shedding begins in late August to early September. Antlers are usually cast in December by mature bulls but younger bulls may retain their antlers through March. It takes 4-5 years for the final antler shape to develop in a bull, prime antlers are carried by bulls 5-12 years old, and the optimal antler size and form is reached around 10 years old.

Antler size and configuration are important in determining dominance among bulls because they compete with each other for the opportunity to breed. Smaller-antlered bulls usually give way to larger-antler bulls without a contest. But bulls with similar-sized antlers may spar each other to determine dominance, sometimes fighting vigorously and becoming injured.

However, they may also merely display the size and form of their antlers in a ritualized manner with the sub-dominant bull conceding to the bull with the larger antlers without a fight. Because larger and heavier bulls usually have the largest antlers, it is easier and less dangerous for competing bulls to determine dominance by antler size by ritualized displays rather than by trying to estimate body size and mass by physical combat.

In a naturally-regulated moose population in Denali National Park, large bulls accounted for 88 percent of all copulations with cows during the rut. However, the ultimate decision to accept or reject a bull regardless of its rank is decided by the cow. In moose populations where the natural sex and age structure have been altered, breeding may be prolonged and conducted by younger, immature, or inexperienced bulls regardless of antler size. Tony Bubenik maintained that the rutting period of moose should be as short as possible to avoid a prolonged rut with recurrent estrus cycles and extended or delayed calving periods.

Dr. Ted Bailey retired from the Kenai National Wildlife Refuge where he was the supervisory wildlife biologist for many years. He has lived on the Kenai Peninsula for over 38 years and still maintains a keen interest in its wildlife and natural history. Find more information about the Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.