

agroborealis

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SUSTAINABILITY, THE FOOD SYSTEM, AND **ALASKANS**

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School of Natural Resources and Agricultural Sciences
Agricultural and Forestry Experiment Station

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A TAXONOMIC KEY AND NOTES ON *BOMBUS* SPECIES

Bumblebees are important pollinators, and can even be more efficient than honeybees at crop pollination. Their tongues are longer, they can buzz pollinate, and there are lots of them in Alaska. With the recent die-offs of honeybees due to Colony Collapse Disorder, scientists are looking at native bees and other pollinators....*By Rehanon Pampell, Alberto Pantoja, Derek S. Sikes, Patricia Holloway, and Charles Knight*

NOTE TO READERS:

This is a special, themed issue of *Agroborealis* that focuses on Alaska's food security. Articles in this edition all relate to policy, resources, people, and institutions in Alaska that pertain to food and agriculture, and on the people, businesses, and nonprofits that help make Alaska a growing state—literally.

ABOUT THE COVER:

Clair Lammers sitting in his apple orchard, summer 2011. Lammers is one of more than forty farmers interviewed in the last year and a half for the newspaper column Homegrown Alaska, which has shown the variety and extent of farming across Alaska. The column has so far concentrated on farmers of the Interior—agriculture in the 49th state is far broader and provides more livelihoods and products than many Alaskans may realize. See story on p. 13.

—PHOTO BY NANCY TARNAI

Dean and Director Carol Lewis and the entire SNRAS faculty and staff express their deepest appreciation to our financial donors, from those who donate to the Reindeer Research Program, Georgeon Botanical Garden, scholarships, and graduate fellowships. You are helping us fulfill our mission in Alaska. Thank you.

The SNRAS Food Day organizers express their gratitude to all the local farmers who donated food for the 2011 Food Day event. Because of your generosity and the excellent food preparation by NANA Management Services we were able to provide a veritable bounty of Alaska Grown foods on very short notice. Thank you.

THE ALASKA FOOD POLICY COUNCIL

Deirdre Helfferich

4

IN THE LAST TWO OR THREE YEARS, Alaskans have become more acutely aware of the importance of the food system in their lives. Of course, everyone knows food is important: everybody eats. But the issue of food security and the vulnerability of Alaska to disruptions in the food supply chain have recently gained more attention than they have in a long time. There's nothing quite like seeing the produce aisles at the supermarket three-quarters-empty a few days after a snowstorm in Seattle to bring home just how dependent one is on transportation connections running smoothly and on time. In the winter, produce is flown up, and if the airports Alaskans depend on to get that fresh cargo north are closed due to inclement weather, shoppers quickly see the results on the grocery store shelves.

For those of us who live or grew up in areas of the state far from a handy grocery store, having a good six weeks' to six months' supply of basic foodstuffs on hand is not unusual or new. It is simply part of the normal stock on hand that one expects to keep to supply the family through the winter—when trips to town might be far and few between, it is normal to buy in bulk. Alaska, however, has become far more urban than it used to be, and most of the state's population lives in areas where it is not unreasonable to go to the store every few days—after all, there are supermarkets right near by. Those supermarkets, however, are part of a vast system of food distribution that the average shopper is not directly involved with, yet is deeply dependent upon—and that system is far more vulnerable than can be comfortable, or safe.

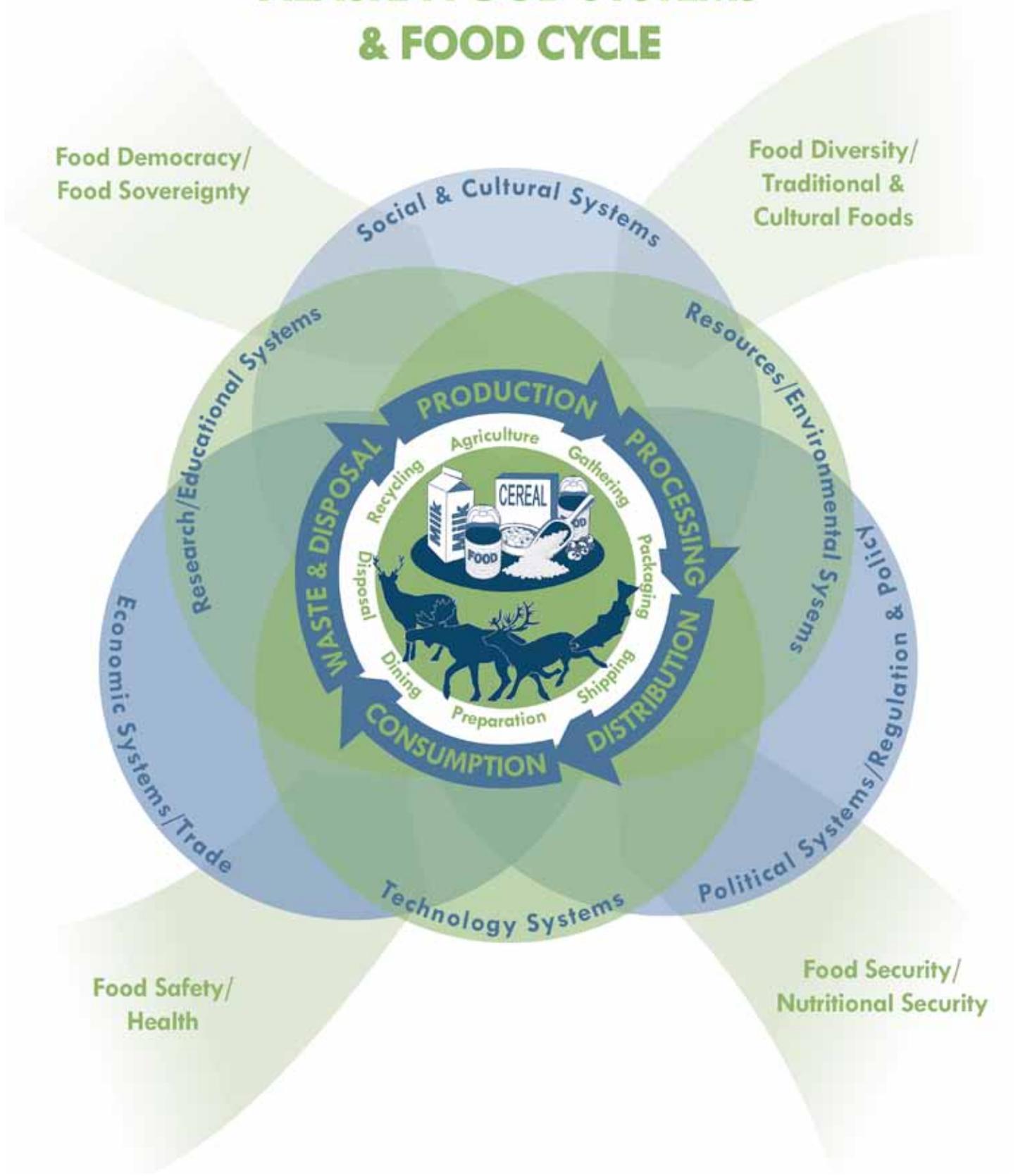
Even in rural areas, where people are used to the idea of stocking up for the winter, Alaskans' vulnerability to the weather and the supply chain can be problematic. Regional hunger is not just a shade from the Bad Old Days: In autumn 2008, the early freeze-up of the rivers and ocean prevented barges from getting to Emmonak and other villages, resulting in a serious shortage of food and fuel later that winter and a public furor that created international embarrassment for then-Governor Sarah Palin—making our state's food policy and emergency supplies, or rather, lack thereof, a matter of day-to-day conversation in ordinary Alaskans' homes. A few years ago, snowstorms temporarily closed the Parks Highway, trapping postal vans in Cantwell and preventing the train and trucks from bringing needed supplies to Fairbanks—and Fairbanksans became aware of just how few days' worth of food was available from local retailers in the state's second-largest city. Food security wasn't just a rural issue.

Alaska's farmers and food buyers paid attention. Between 2000 and 2010, the number of farms with Community Supported Agriculture operations went from fewer than five to twenty-six. In February 2009, a meeting of local CSA farmers was hosted at the University of Alaska Fairbanks by SNRAS, and resulted in the formation of the Alaska Community Agriculture Association, which now boasts members from across Alaska. The state's politicians began to pay more attention to issues surrounding food and agriculture, and in 2010 the Alaska Farm-to-School Program was enacted. In August 2011, the burgeoning interest in local food was documented by a report from the USDA,* which showed a growth of 46 percent in the number of farmers' markets in Alaska just between 2010 and 2011—the fastest growth in the nation.¹

*See the USDA's press release at www.usda.gov/wps/portal/usda/usdahome?contentidonly=true&contentid=2011/08/0338.xml.

1. The absolute *number* of markets in Alaska was very small, of course: the total went up to thirty-five in 2011, compared to the second-fastest growing state, Texas, which had 166 markets (up 38 percent). Average national growth in farmers' markets was 17 percent overall.

ALASKA FOOD SYSTEMS & FOOD CYCLE



Alaska Food Systems & Food Cycle graph, showing the interactions among different aspects of society, the environment, and human health in the food system.

GRAPHIC COURTESY THE ALASKA FOOD POLICY COUNCIL, REPRINTED FROM *FOOD IN ALASKA: FOOD SYSTEMS, SECURITY, AND POLICY IN THE 49TH STATE*, PUBLISHED 2012 BY THE ALASKA FOOD POLICY COUNCIL

About food policy councils

Food policy councils convene citizens and government officials for the purpose of providing a comprehensive examination of a state or local food system. This unique, non-partisan form of civic engagement brings together a diverse array of food system stakeholders to develop food and agriculture policy recommendations.

—DRAKE UNIVERSITY AGRICULTURAL LAW CENTER

Food Policy Councils (FPCs) bring together stakeholders from diverse food-related sectors to examine how the food system is operating and to develop recommendations on how to improve it. FPCs may take many forms, but are typically either commissioned by state or local government, or predominately a grassroots effort. Food policy councils have been successful at educating officials and the public, shaping public policy, improving coordination between existing programs, and starting new programs. Examples include mapping and publicizing local food resources; creating new transit routes to connect underserved areas with full-service grocery stores; persuading government agencies to purchase from local farmers; and organizing community gardens and farmers' markets.

—COMMUNITY FOOD SECURITY COALITION

Community supported agriculture also increased, growing from twenty-six CSAs in June 2010 to thirty-nine as of January 2012, representing an increase of two-thirds in just a year and a half.² In December 2011, Governor Sean Parnell announced his proposed 2012 budget, highlighting a \$4.9 million appropriation for emergency food supplies to be distributed and securely stored in several locations throughout the state. This is significant because the State of Alaska has had *no* food supplies set aside before—relying on individuals, businesses, and the federal government to provide in the event of an emergency, with mixed results, as the crisis in 2008–2009 showed.

It was from these facts, events, and discussions that the Alaska Food Policy Council came into being, with an initial organizing meeting held in Anchorage in May 2010. The mission of the AFPC is:

[T]o strengthen Alaska's food systems to spur local economic development, increase food security, and improve nutrition and health. The Council serves as a resource for information on local and state food systems, and works to identify and propose policy and environmental changes that can improve the production, processing, distribution, health, security, and safety of our food. The long-term goals of the Council are to identify barriers to building a viable Alaska food system, create a strategic plan to address these barriers, and make the necessary recommendations to decision makers to implement this plan.

The San Francisco Department of Public Health provides a succinct description of a food system as “the cycle of growing, distributing, eating, and recycling our food, and all the factors that affect it.”³ Alaska's food systems are, like the state itself, unique in many ways. From *Food in Alaska: food systems, security, and policy in the 49th state*.⁴

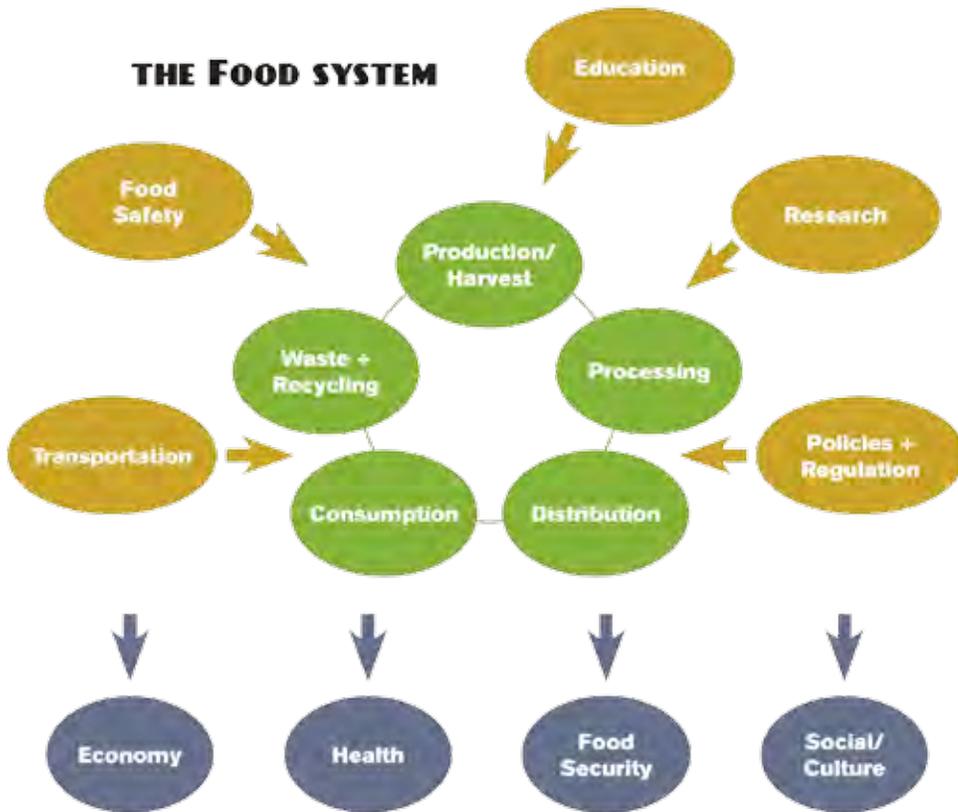
For example, Alaska is one of the country's greatest food-producing locations with over half of the nation's seafood production. Also, its vast land area provides an opportunity for significant agricultural development. With a rich, healthy ecosystem, Alaska provides an amazing bounty of wild and natural foods that residents may harvest, gather, and hunt.

2. This figure is from a CSA database kept current at the SNRAS publications office, and includes a community supported fishery but does not include school CSAs. There are at least nine school gardens in the Fairbanks area, and others elsewhere in the state. Most of these offer CSAs and/or farmstands.

3. From “About Food Systems,” www.sfgov3.org/index.aspx?page=755.

4. Published 2012 by the Alaska Food Policy Council.

THE FOOD SYSTEM



The components of the food system.

DIAGRAM COURTESY DIANE PECK, FROM ALASKA FOOD POLICY COUNCIL STRATEGIC PLAN 2012–2015

Yet there remain significant human, economic, and community development challenges in Alaska's food system. Most Alaskans are almost completely dependent on external sources of food, shipping, and distribution services. Most of Alaska's seafood is harvested and processed by non-local firms with little market concentration in Alaska. The agriculture industry struggles in Alaska's high cost and rugged environment, and faces a lack of basic infrastructure and support industries common elsewhere.

However tightly linked and related one part of the system is to another, the food system is the result of a complex interaction between many participants, drivers, and factors, and so it is therefore difficult if not impossible to make comprehensive changes with a sure result: changes can result in unforeseen consequences. Nevertheless, tremendous improvements in all phases of

the food system are achievable with better communication, education, facilities, and program development, both public and private, and with policies that encourage the development of a healthy regional or local food system.

Alaska's policy makers also must contend with a wide range of biomes and subclimes: tundra, taiga, temperate rainforest, boreal forest, our extensive ocean coastline, a continental Interior, high mountains, floodplains, glacial moraines, and so on. Our food system's foodsheds⁵ reflect a

5. A foodshed is similar to a watershed, describing the flow of foodstuffs through a community: it is the farm-to-fork movement of food. Unlike watersheds, however, in Alaska, foodsheds here do not typically spring entirely from local ground. Ironically, most Alaska foodsheds start in places like Iowa, Oregon, or even Chile, because we import almost all of our food. See also "Fisheries and Food Security in Alaska," by Philip A Loring and Hannah L. Harrison, on p. 45.

wide variety of climates, cultures, and available foodstuffs. (pp 3-4)

Jack Kloppenburg, Jr., in his seminal article on foodsheds,⁶ gets to the heart of the problem of our current food system: "Ultimately," he and his fellow authors write, "distancing disempowers." Alaskans are indeed disempowered by the great distances from our food supply source, and we are placed at risk with every storm, every economic decision made by the executives and boards of businesses located far away from us. Despite the bounty that Alaska provides to its people, the state can be thought of as a giant food desert, a region without ready access to fresh, healthy, and affordable food. A healthy food system is one that serves more than the USDA's basic concern for physically accessible food, however. It is one that is also culturally appropriate and which protects and promotes the dignity of the people within that system.

Food sovereignty and *food democracy* are vital to the health of a food system. In Alaska, these are connected to both the traditional Native cultures of the state's indigenous peoples as well as to the communities and cultures of later immigrant groups. Food sovereignty may be defined as the right of a people "to define their own food and agriculture; to protect and regulate domestic agricultural production and trade in order to achieve sustainable development objectives; to determine the extent to which they want to be self reliant; to restrict the dumping of products in their markets, and; to provide local fisheries-based communities the priority in managing the use of and the rights to aquatic resources. Food sovereignty does not negate trade, but rather, it promotes the formulation of trade policies and practices that serve the rights of peoples to safe, healthy and

6. "Coming in to the Foodshed," by Jack Kloppenburg, Jr., John Hendrickson, and G.W. Stevenson, *Agriculture and Human Values*, Summer 1996, 13(3): 33–42.

ecologically sustainable production.”⁷ Food democracy, on the other hand, “is based on the principle that citizens or ‘food citizens’ have the power to determine food policies and practices locally, regionally, nationally and globally. Food democracy asserts it is a right and responsibility of citizens to participate in decisions concerning their food system....The goal of food democracy is to ensure all citizens have access to affordable, healthy and culturally appropriate foods. Food democracy emphasizes social justice in the food system, and food is viewed as the center of the democratic process.”⁸ As the Alaska Food Policy Council states, “Food nourishes more than the body.”⁹

The AFPC recently completed a three-year strategic plan,¹⁰ in which it outlined five major goals and strategies in specific focus areas: access; economic development; safety, security and protection; sustainability; and public engagement.

Goals:

- All Alaskans have access to affordable, healthy (preferably local) foods.
- Alaska’s food-related industries have a strong workforce and operate in a supportive business environment.
- Food is safe, protected and supplies are secure throughout Alaska.
- Alaska’s food system is more sustainable.
- Alaskans are engaged in our food system.

Strategies:

1. Develop, strengthen and expand the school-based programs and policies that educate about and provide healthy, local foods to schools (e.g., Farm to School Program, Agriculture in the Classroom, traditional foods in schools, school gardens).

2. Strengthen enforcement language in the Local Agricultural and Fisheries Products Preference Statute (AS 36.15.050), also known as the “Seven Percent” statute and Procurement Preference for State Agricultural and Fisheries Products (Sec. 29.71.040).
3. Advocate and participate in the development of community level and comprehensive statewide emergency food preparedness plan(s).
4. Develop AFPC’s role as research aggregator and resource.
5. Identify and support existing local food system leaders, projects, events, and activities that support Alaska’s food system.

While the Council has a clear direction in which to aim its efforts, the order is a tall one. Across the country and the world, food policy councils have formed at local, state, regional, national, and even international level (the Food and Agriculture Organization of the United Nations, for example, is the inheritor of the World Food Council, originally formed in December 1974). There are at least seventeen state-level food policy councils in the United States, and many more addressing food policy at the local, usually municipal, level. Alaska faces many unique challenges when compared to these organizations, not least of which is the perception that Alaska is an “ice box” in which nothing can grow—or even should be grown. As the state’s many gardeners and farmers know, however, this perception is errant nonsense—yet it persists, perhaps as a subconscious prejudice, influencing policymakers in ways they may not even be aware of. Still, as *Mother Earth News* points out:

The uniting feature among the various forms of food policy councils is the connection they establish between food producers and consumers, working to create relationships for a strong, local food web.¹¹

It is that connection that the AFPC is working to develop, and that is its strongest asset.



7. From “People’s Food Sovereignty is a Right,” posted at *Toward an Eco-Economy*, “Food Sovereignty -- by Via Campesina and other NGOs,” Sunday, January 23, 2011, at <http://mecteam.blogspot.com/2011/01/food-sovereignty-by-via-campesina-and.html>. For more background, go to La Via Campesina, the International Peasant Movement, <http://viacampesina.org/en/> (also available in Spanish and French).

8. Food First: Institute for Food & Development Policy, “What is Food Democracy?” by Alexandria Fisher, based on Tim Lang’s work on food democracy. Article available at www.foodfirst.org/en/node/2868.

9. “Food in Alaska,” p. 19.

10. “Alaska Food Policy Council Strategic Plan 2012–2015,” published January 12, 2012. Available at <http://alaskafoodpolicy.blogspot.com>.

11. “Food Policy Councils Advocate for Community Food Security,” by Jennifer Kongs, 9/15/2010, at www.motherearthnews.com/healthy-people-healthy-planet/food-policy-councils-zb0z10zkon.aspx.

SUPERMARKETS IN FAIRBANKS

Alison Meadow

Supermarkets per person in the FNSB 1965-2007

Year	Supermarkets	Population	Persons/Supermarket
1965	7 ¹		2,220 ¹
1975	10	56,700 ²	5,670
1985	9	72,474 ²	8,053
1995	11	84,380 ³	7,671
2005	8	87,555 ³	10,944
2007	9 ⁴	97,484 ³	10,832

1. Burgett (1967); 2. Alaska Department of Labor (1975a,1987); 3. U.S. Census Bureau (2000a, 2008); 4. Meadow (2009)

WITH GROWING INTEREST IN THE REDESIGN OF OUR FOOD SYSTEMS, we have become far more aware of how our food is produced, where it comes from, and how far it has to travel to reach our plates. But another important question is how accessible food is within our communities. Food must be affordable as well as physically accessible for a community to achieve food security. Ensuring equitable access to healthful foods is a critical component in building a functional food system.

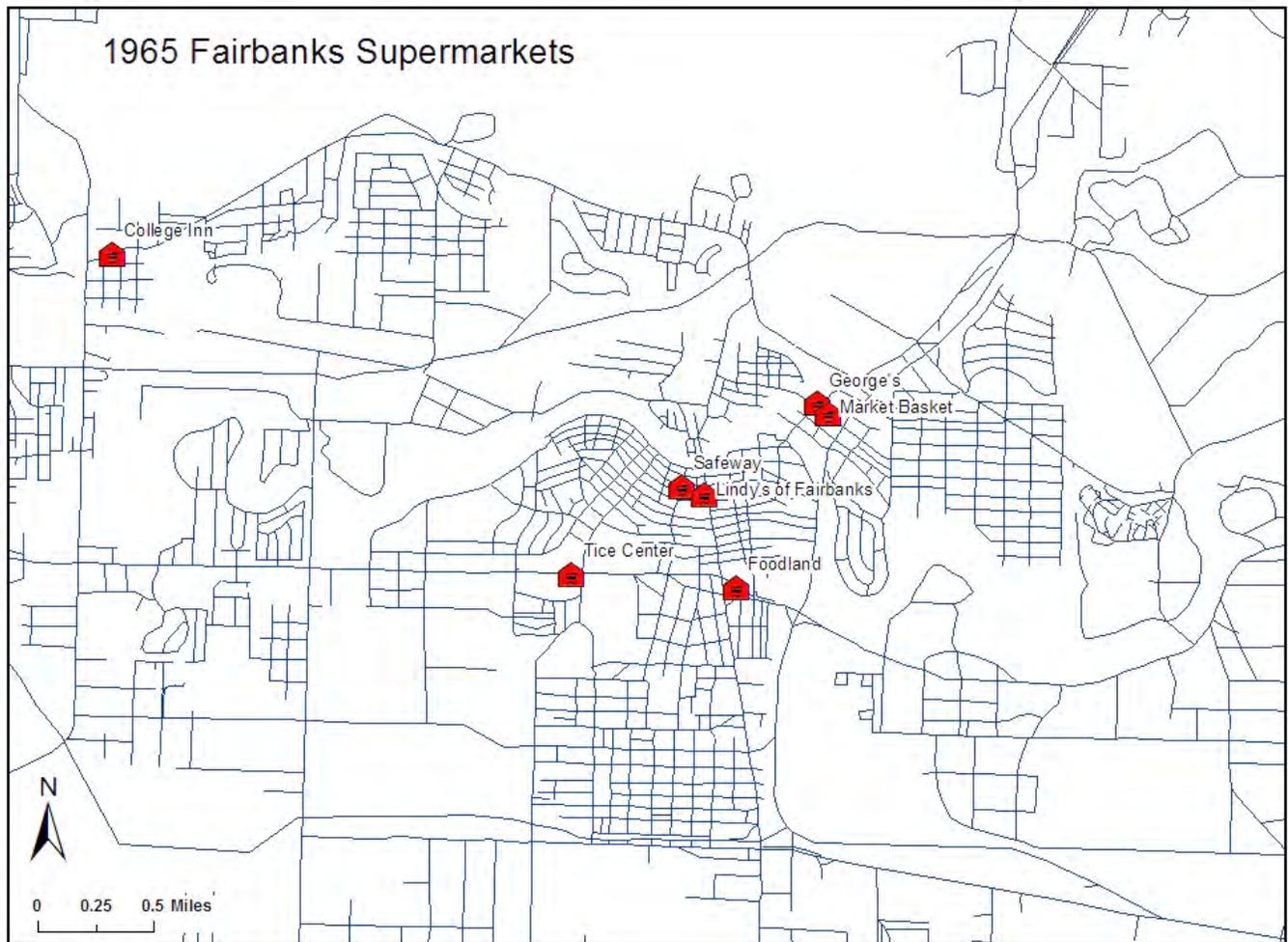
Two trends in food retailing may affect food access and food security within our communities, and both are evident in Fairbanks, Alaska: fewer supermarkets per resident, which means that fewer neighborhoods in general have a supermarket nearby, and supermarket migration toward suburban neighborhoods, a trend that tends to leave lower-income neighborhoods in the urban core with reduced access to a range of healthful foods. While a nearby supermarket is not a guarantee of a healthful diet, lack of access to healthful foods has been linked to poor nutrition and health outcomes.

In 1965, Gary Burgett estimated that there was one supermarket for every 2,200 people in Fairbanks. By 2007, there were nine supermarkets in the Fairbanks North Star Borough, but only one for every 10,832 people (see table). While national statistics are not directly comparable, stores classified as “Supermarkets or Grocery Stores” have declined from 73,357 in 1992 to 66,150 in 2002. During the same time, the US population grew from approximately 249 million to 281 million people.

Farmstands and markets can be used to help address gaps in food access in particular neighborhoods, but they probably cannot offer a wide enough selection or low enough prices to address all food equity issues. Larger-scale changes may also be required. For example, municipalities can support food system planning by consciously considering food access, and by taking actions to create incentives for supermarkets to open in urban core neighborhoods. As we work to change the way our food is grown and where it is grown, we must be mindful of keeping it in reach of all members of our communities.

The location of the stores in Fairbanks has changed over the years, too. There are no longer any full-service supermarkets in the downtown core,* which places them farther from low-income neighborhoods. Only three of the nine supermarkets in Fairbanks in 2007 were in census tracts with below-median household incomes.

*Editor’s note: Over the last several years, the Fairbanks Co-op Market has been working to create a cooperative, member-owned grocery store in downtown Fairbanks at the site of the old Foodland grocery store on Gaffney Road. The Co-op’s mission is: “Fairbanks Community Cooperative Market works for health and sustainability by providing natural foods and products, promoting local suppliers, and offering consumer education in an open community center environment.” The store is expected to open its doors in 2012. For more information on this market, go to <http://fairbankscoop.org>.



Map of Fairbanks area in 1965, showing locations of Fairbanks grocery stores and supermarkets. See following pages for maps from later years.

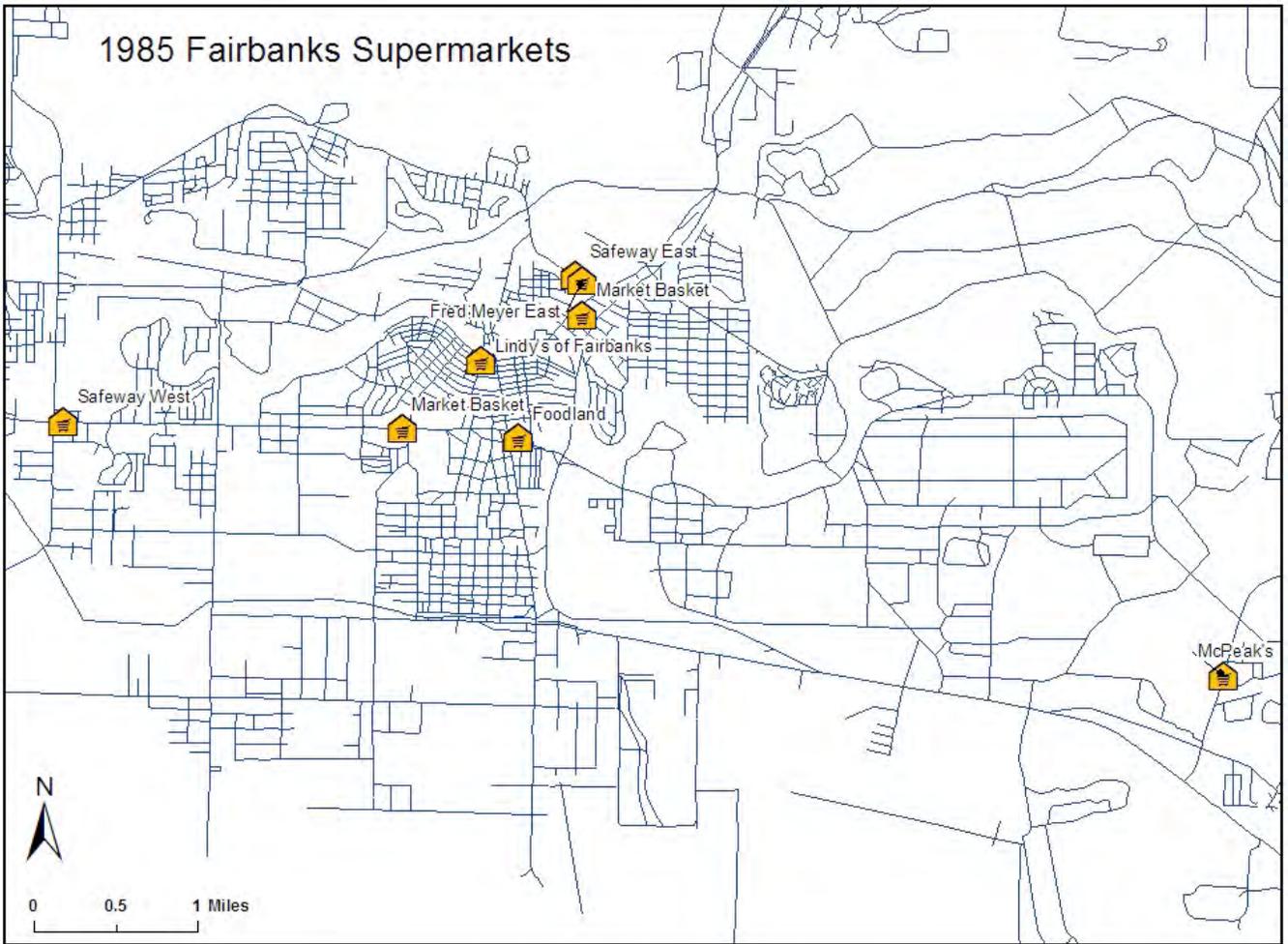
The maps illustrate the migration of supermarkets away from the urban core of Fairbanks toward the city's fringes and newer suburban neighborhoods.



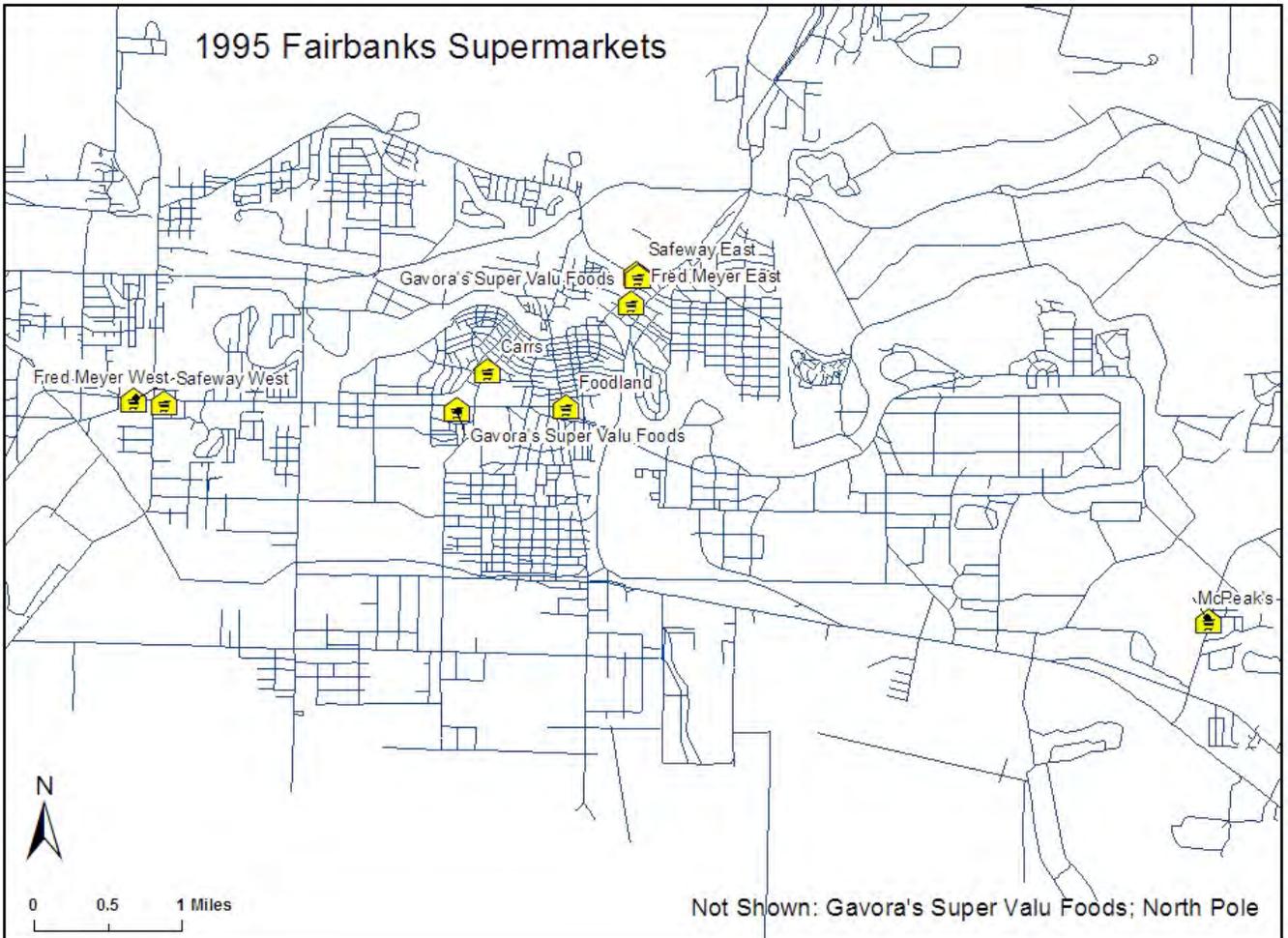
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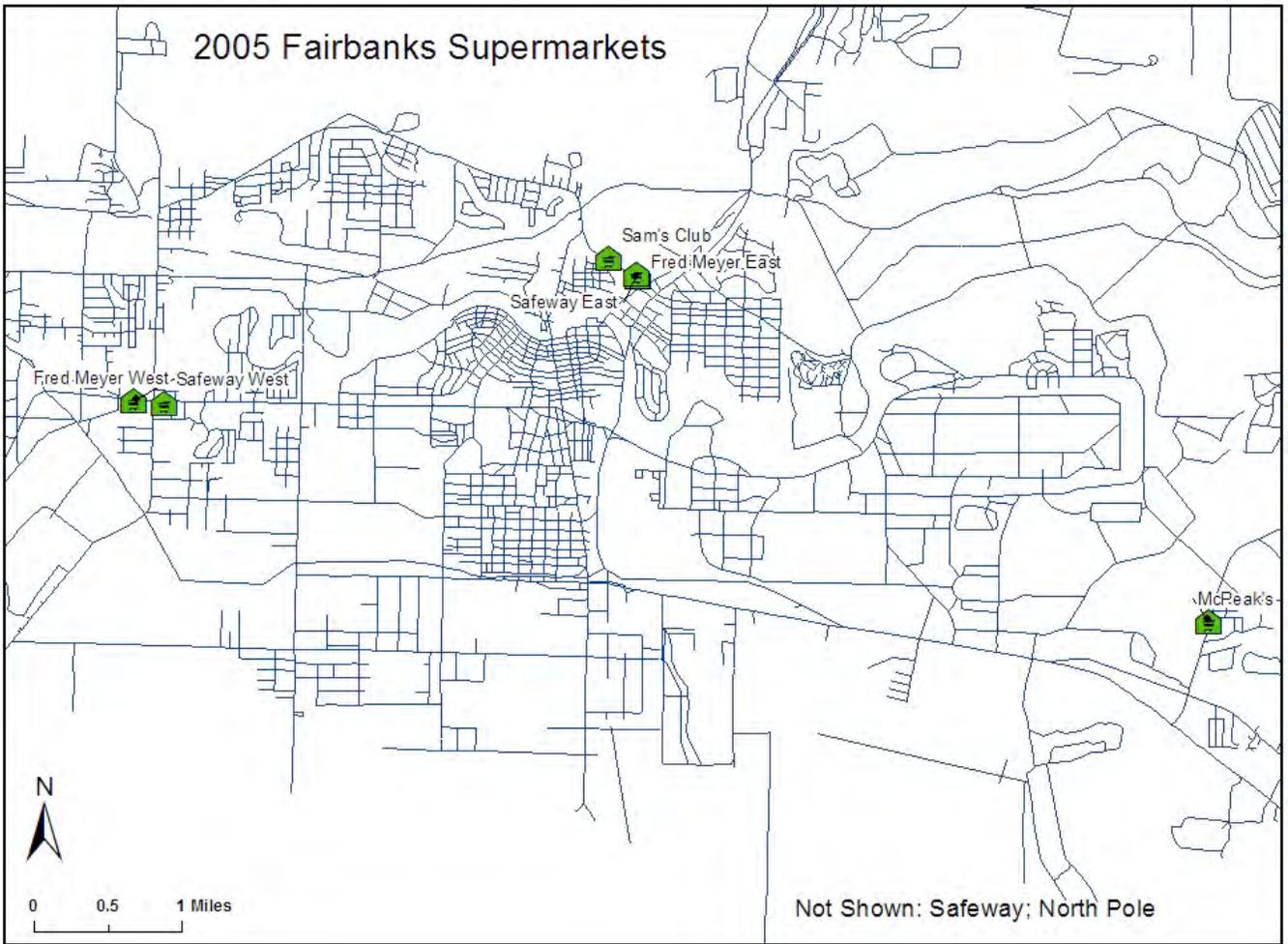
1985 Fairbanks Supermarkets



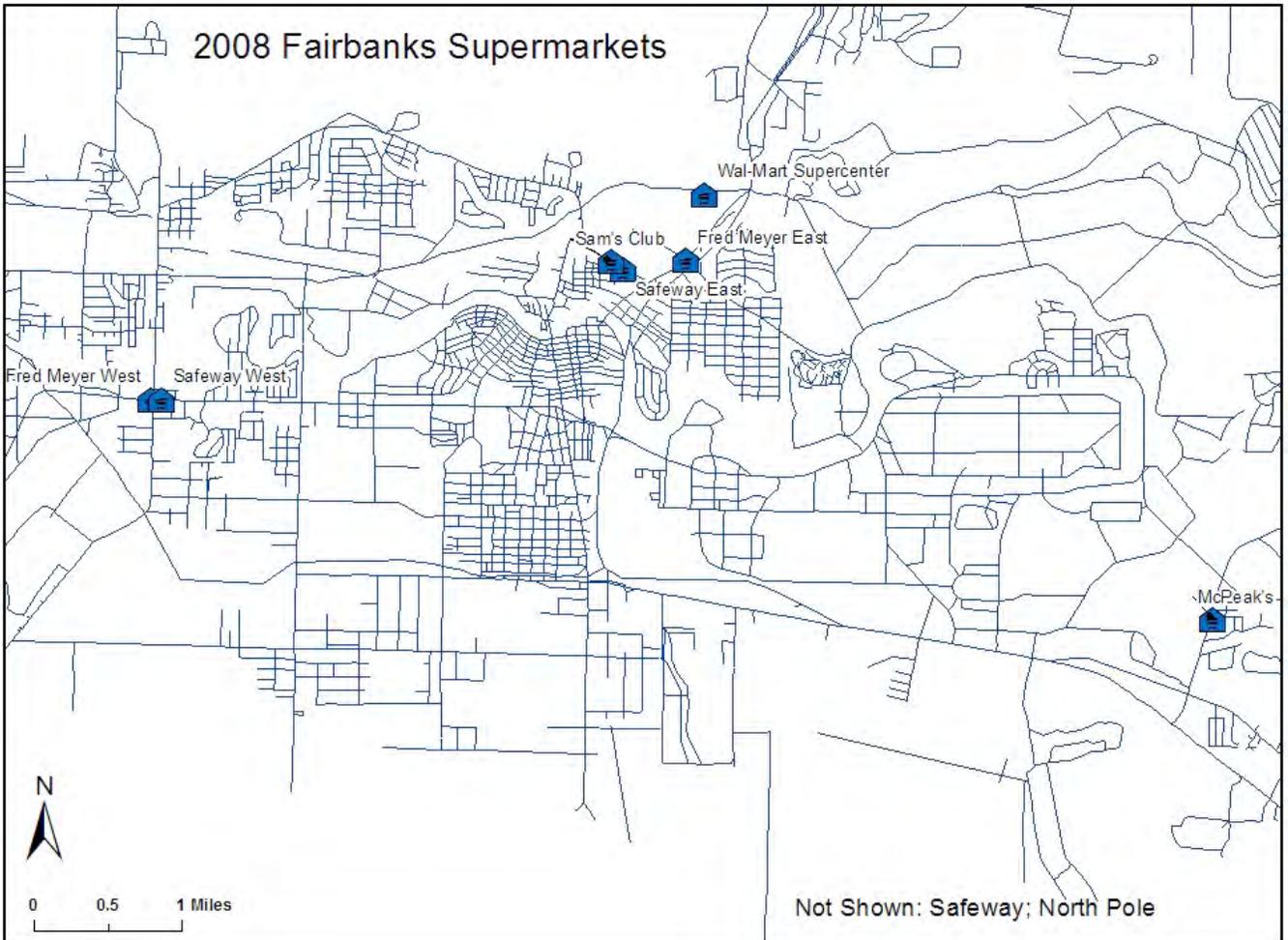
1995 Fairbanks Supermarkets



2005 Fairbanks Supermarkets



2008 Fairbanks Supermarkets



HOMEGROWN ALASKA

FARMER PROFILES OPEN THE EYES
OF THE INTERIOR TO THE SCOPE OF
LOCAL AGRICULTURE
Nancy Tarnai

IN JUNE 2010 I was at an Association for Communication Excellence conference in St. Louis and had just listened to a Canadian speaker give a presentation about his experiences writing an agricultural column for his local newspaper. During the next break I ran to the hotel's business center and e-mailed the features editor of the *Fairbanks Daily News-Miner*. I proposed starting a column profiling farmers. The editor's reply was disheartening: "That sounds good but there isn't much agriculture to write about here. You'll only get a couple of columns out of it and I need more of a long-term commitment."

After presenting the doubting editor with a list of farmers I knew off the top of my head he agreed to let me try, and thus Homegrown Alaska was on its way. When I arrived back in Fairbanks I called the farmer I knew best, Mike Emers at Rosie Creek Farm. He got what I was trying to do and so I went to his farm for an interview and photos. Once that first column ran I had something to show other farmers so they could envision what I was proposing.

Since then, the *News-Miner* has featured forty Homegrown Alaska columns; all were reprinted at the UAF news site and the SNRAS blog and many were picked up by *Alaska Farm and Ranch News* and a variety of websites and Facebook groups.

Upon starting Homegrown I had a niggling fear that the columns would be too homogenous, that the farmers would all have the same story to tell, but I couldn't have been more wrong. Other than the facts that farmers like working for themselves and being outdoors the variables proved to be many.

Homegrown has covered farmers from Bethel, Nenana, Delta Junction, Two Rivers, Salcha, Manley Hot Springs, Fairbanks, and North Pole. They are men,

Bill Johnson of Johnson Family Farms.
PHOTOS BY NANCY TARNAI



A Large Black Hog piglet butts up to the fence at Triple McLean Farms just north of Delta Junction.

PHOTO COURTESY OF TRIPLE MCLEAN FARMS

women, couples, brothers. They are old and young. They are Alaskans or imports. Many are college educated; some were educated in the school of life. They are single gals who are tenant farmers, people who joined the WWOOF program,¹ men who are teaching their sons the farming skills. They grow organically or traditionally or somewhere in between. They have community supported agriculture plans, sell wholesale, have farmstands, run booths at farmers' markets. Their farms are big and small and in between, but one thing in common is that they are dedicated to the land and to producing good food for Alaskans. I found them to be innovative, hard working, and smart.

As for what the farmers grow, it would be easier to state what they don't. Homegrown has featured farms with goats, ducks, chickens, donkeys, reindeer, turkeys, hogs, cattle, yaks, bison, and farms that are renowned for their carrots or potatoes or apples or microgreens or berries or pumpkins. There are farms with expansive, rolling fields overlooking the mountains and there is a farm located indoors at an office park in South Fairbanks.

Some farmers claim their secret to success is the soil or the water or the location. They are a humble lot, claiming no particular right to what they've achieved, acting bemused if they are successful and willing to work even harder if they are struggling.

They have welcomed me into their homes and fields, introduced me to their families, made me run after them with pad and pen as they conducted their chores. They have been friendly and inspirational, openly sharing their hopes, dreams, and rarely their complaints about lack of support. A column about the CSA I joined made the owner cry. "I just wanted to write and thank you for writing such a beautiful article about our CSA and your experiences," Susan Kerndt of Wild Rose Farm said. "It was so beautifully thoughtful that it brought tears to my eyes. Thank you so much for being a part of our farm."

1. World Wide Opportunities on Organic Farms is an international network of organizations that connect organic farmers with volunteer farm workers. Farmers (hosts) grow organically, are in conversion, or use ecologically sound methods on their land. Hosts provide hands-on experience of organic growing and other learning opportunities where possible. They are required to provide clean dry accommodation and adequate food for their volunteers. The WWOOFers (volunteers) are people who have a genuine interest in learning about organic growing, country living, or ecologically sound lifestyles. WWOOFers help their hosts with daily tasks for an agreed-upon number of hours. For more information about the program and member organizations, see the website, www.woof.org.

Bites from Homegrown columns

Jeff Johnson/Homegrown Market

When Jeff Johnson decided to open a local food market in Fairbanks he was told repeatedly it could not be done. With his can-do attitude and commitment to hard work, Johnson proved the naysayers wrong with his wildly popular Homegrown Market.

Darren Demattio/Copper Kettle Farm

For Two Rivers farmer Darren Demattio, building proper infrastructure is imperative for a successful agricultural venture.

Six years ago, he started clearing the virgin forest on his 319-acre farm. The progress he and his wife Cristina have made since then is amazing. The couple's Copper Kettle Farm, 25 mile Chena Hot Springs Road, features fields and fencing, two greenhouses and shelter for rabbits and chickens.

"We're trying to get things running smoothly and get the bumps and wiggles figured out," Demattio said. "Things are going well; God has blessed us."

Gary and Barb McLean

Getting to the Tanana Valley Farmers' Market twice a week all summer is no picnic for Gary and Barb McLean. First they load their vegetables in a boat and make a 20-minute ride on the Tanana River, then they have to re-package everything into a truck and drive for over an hour to get to town. But seeing their regular customers and providing them with fresh produce makes it worthwhile.

The McLeans have been vendors at the market for eleven years and have resided on a homestead north of Delta Junction since the 1980s.

Claire Lammers/Clair's Cultivations

The rumors of Clair Lammers' retirement have been greatly exaggerated. Lammers, a fixture in the local agricultural community for decades, is still going strong in his apple orchard, despite chatter that he has an eye on his rocking chair.

"It's a lot of work but it keeps a guy out of the bars," Lammers said.

To prove he is still active, Lammers explains that he harvested 6,000 pounds of apples last year, selling all he could at the Tanana Valley Farmers Market and donating the surplus to the Food Bank.

His Chena Hot Springs Road orchard is home to 200 varieties of apples, several he grows for the University of Saskatchewan, testing to see what are the coldest temperatures the trees can survive.

Phil and Mary Kaspari

Passersby at the Kaspari farm outside Delta Junction inevitably slow down for a second, or third, look. The unusual



Barb and Gary McLean at the booth at the Tanana Valley Farmers Market in 2010.

PHOTO BY NANCY TARNAL

creatures dotting the fields are yaks, and although they may look out of place in the Alaska countryside, they are perfectly suited to the environment.

“They fare very well here,” Phil Kaspari said. “They are hardy animals and they are efficient as far as feed consumption. They are easy keepers.”

Raising the critters for food and fiber, Phil and his wife Mary also intend to market them as pack animals.

Pete and Lynn Mayo/Spinach Creek Farm

Pete Mayo didn’t set out to become the Tanana Valley’s “carrot king” but he has achieved that distinction through hard work and the ability to grow a crop that is apparently in great demand.

Pete, 48, and his wife Lynn, 46, own and operate Spinach Creek Farm and when interviewed in late September were up to their elbows in carrots—beautiful, bright orange, straight-as-arrows carrots—their favorite cash crop.

Pete grew up in the Fairbanks area with parents who gardened and raised animals. Lynn hails from Massachusetts,

bringing with her a degree in natural resources from the University of Massachusetts. When they decided the farming lifestyle was for them they spent a couple of years working for Gordon Herreid, a well-known local farmer who passed away several years ago. He served as their mentor and they learned a lot about growing strawberries and carrots from him. They also worked for Happy Creek Greenhouses and took odd jobs such as shoveling barns, peeling logs, and caring for plants.

Tim Meyers

When Tim Meyers tired of his career as a commercial pilot and decided to become a farmer, his neighbors in Bethel just shook their heads, assuming he had lost his marbles.

Heads are still shaking, but now it’s due to what Meyers has done with his farm. He is producing so much that he has gone beyond the local market and is selling crops in Anchorage.

At first Meyers only intended to grow good food for his family, but that quickly changed. Last year he grew 8,000 pounds of potatoes, 10,000 pounds of onions and leeks,

along with peppers, cabbage, cucumbers, garlic, zucchini, artichokes, and turkeys.

“I haven’t mastered the tomato yet,” he said.

Susan Willsrud/Calypso Farm and Ecology Center

Susan Willsrud, Fairbanks’ own “Pied Piper of local foods,” is just as happy hoeing weeds or sorting seeds as she is extolling the benefits of fresh veggies.

As the farm director at Calypso Farm and Ecology Center, Willsrud helps hundreds of people put homegrown vegetables on their plates and makes sure children gain practical gardening experience in their own school yards.

Growing up in Ventura, California, Willsrud earned pocket money by selling avocados from a wagon; in her teen years she marketed the fruit to restaurants. She studied botany and zoology at the University of California Davis, before doing graduate work at the University of Alaska Fairbanks, where she earned a master’s degree in natural resources management with an emphasis on plant ecology.

Even as a student Willsrud was already thinking about founding an educational farm. To help prepare, she and husband Tom Zimmer worked on farms in California and the Matanuska-Susitna Valley. “We decided to give it a go here,” she said.

Virgil Severns/Range View Farm

Although massive pumpkins garnered a lot of attention (and set new records) at the Alaska State Fair in Palmer this month, it’s the tasty gourds that deserve respect.

This time of year Virgil Severns is harvesting colorful, beautiful, and appropriately sized pumpkins and squash at his Range View Farm, 6 mile Chena Hot Springs Road. His booth at the Tanana Valley Farmers Market throughout August and September fairly screams “autumn.”

Severns grew up on a farm in Kansas. He earned an agriculture education degree at Kansas State University and taught in Kansas for two years before returning to KSU for a master’s in livestock production.

Mike and Scott Schultz

For Delta Junction farmer Mike Schultz it’s the combination of hands-on field work and business tasks that makes his career choice an enjoyable one. As Schultz well knows, there is more to successful farming than putting seeds in the ground and watching them grow or feeding livestock until they are ready for slaughter. Predicting the markets and keeping abreast of consumer demands are integral to a farm’s success, and these aspects can be particularly challenging in Alaska.

Schultz, 60, and his business partner and brother Scott grew up on a farm in Iowa. Scott went into the construction business and Mike continued to farm. They were lured to Alaska in 1982 by the Delta farm sale, in which the state

auctioned off land. Their parcel is 28 miles from Delta Junction in the Sawmill Creek Road area. “We thought we would get into something that looked financially feasible,” Schultz said.

Fritz Wozniak

When Fritz Wozniak retired after thirty years as a heavy equipment mechanic he was determined to stay active, so he immediately leaped into farming.

“I went from 10-hour days to 14 to 18-hour days,” Wozniak said, shaking his head. He loves the turn his life has taken and at 58, he hopes to live to be 100 without spending much time in a recliner.

Farming was already in his blood, as he comes from a third-generation farm family in Nebraska. Until the eighth grade he helped raise cattle, but when his father got a job as postmaster the family moved to town. Wozniak and his brother worked as hired hands on nearby farms all through high school. “We never took a summer off,” Wozniak said.

Ila Shoen

Growing food is more fun when it’s a group activity. At least that is the philosophy of Ila Shoen of Two Rivers.

When Shoen retired from her thirty-one-year career as a school secretary four years ago, the first thing she did was travel to Romania with Habitat for Humanity. She was duly impressed with the way everyone worked so well together. “The camaraderie was incredible,” Shoen said.

Knowing she would have free time in retirement, Shoen decided then and there to grow a garden the next summer. She did, but she had so much excess produce she gave most of it away to friends and neighbors. After that, people were naturally drawn to her garden, with the activities surrounding it soon dubbed, “the Shoen Family Garden Club.”

Chris DuBois and Nancy Davidian/ Arctic Roots Farm

If slow and steady truly does win the race, Nancy Davidian and Chris DuBois are on the right track at Arctic Roots Farm.

When the couple bought their seventy-four acres four years ago they weren’t even seeking to purchase that much land. “You can’t buy five acres,” DuBois said. “They’re either zoned inappropriately or priced for prime real estate.”

Davidian considers the property to be a heavenly place so they went ahead and settled on the old homestead. It took the first year to clean everything up, and because it came with three residences, they focused on getting the houses up to par to provide income for the farm.

Slowly, the couple has been working to get the farm operating. Every corner of Arctic Roots is ship-shape and the animals are fat and happy. In addition to twenty-five acres of hay, Davidian and DuBois raise geese, ducks, turkeys, and chickens and they have bee hives. They are also steadily working to create a perennial garden in a one-acre moose-



Chris DuBois and Nancy Davidian with their turkeys at Arctic Roots Farm.
PHOTO BY NANCY TARNAI

proof fenced area with gooseberries, cranberries, raspberries, currants, asparagus, horseradish, and a variety of fruit trees.

Brandy McLean/Triple McLean Farms

When Brandy McLean first read about the breed Large Black Hogs in *Countryside Magazine* she knew she had to add some of the animals to her farm, but first she did her homework. This heritage breed is an old-word hog known for its flavorful meat.

McLean thoroughly researched ideas for her business, Triple McLean Farms. What she discovered about the Large Black Hogs led her to purchase some of the creatures from a farm in Ohio.

On the day of the animals' arrival, McLean and her sons waited anxiously at Fairbanks International Airport. She

worried about how the animals would fare while traveling. At the scheduled time McLean asked the cargo agents where her hogs were and was told, "Hogs? We have dogs but we don't have any hogs."

McLean was on the verge of panic but after a couple of hours more, the critters finally got to Fairbanks.

"They traveled well," McLean said.

She ensconced them at her Delta Junction farm, where they have adjusted remarkably well. "They are rugged; there is no need for a heated barn," McLean said. "You don't need a lot of money to raise them." She is believed to be the first producer of this breed in Alaska.

Pam Laker/Quackmire Farm

Throughout her childhood near Detroit, Pam Laker wanted one thing—to live and work on a farm. Now she is living that dream at Quackmire Farm.

"When I played, I played farm," Laker recalled. "I didn't factor in scooping up poop. I just wanted to live in the woods with animals."

Laker earned a degree in psychology at the University of Wisconsin Madison before heading to Alaska in 1993. Her intention was to visit friends for two weeks but now she can't imagine living anywhere else. At first she worked as a laborer and electrician and later did odd jobs.

She and her husband Brad Morris were vegetarians for years, and when they began to consider consuming meat again, Laker wanted to be involved in the process. Committed to the idea of knowing exactly where her meat comes from, Laker was determined to experience the life of the animals and be connected to what she was going to eat.

"It was either raise our meat or learn to hunt," she said.



Pam Laker and her children in their hatchery at Quackmire Farm.

PHOTO BY NANCY TARNAI

Ruby Hollembaek/Alaska Interior Game Ranch

If there's one thing Ruby Hollembaek gets more inspired about than rhubarb it's stumping for Alaska agriculture. Hollembaek, who along with her husband Scott owns Alaska Interior Game Ranch near Delta Junction, is one of the state's most enthusiastic agricultural supporters.

She cheerfully gives tours of her ranch, hosts several blogs, helps run rhubarb cookoffs and gets involved in campaigns to improve the state of farming in Alaska.

But she really loves rhubarb, the stalky vegetable that graces pies, cakes, muffins and breads so tartly. If Hollembaek had her way, there would be acres and acres of rhubarb in Alaska.

Born in Seward and raised in Palmer, Hollembaek grew up surrounded by agriculture. She became a teacher but never left her farming ways behind. When the couple moved to Delta Junction they faced the overwhelming task of converting 1,000 acres of forest to farmland. After seven years of backbreaking work they had beautiful grass fields where their Angus and Chianina cattle could graze.

Mike Emers/Rosie Creek Farm

"This happened by accident," Mike Emers tried to explain.

As a young person growing up in Rhode Island in a family interested in gardening, Emers always expected there would be a garden in his future, but he never imagined he'd one day become a farmer and own Fairbanks' largest community supported agriculture business.

His parents appreciated good food, so they always had a garden and Emers was expected to help out. The rest of his free time was spent collecting baseball cards. In his late teens and early 20s, Emers found mentors in "back to the land" folks.

"They were self-reliant and that really appealed to me," he said.

Today he is living that unpredictable dream alongside his wife, Joan Hornig, and their two young children at Rosie Creek Farm.



Truly, the newspaper editor who said there wouldn't be enough agricultural activity to write about in interior Alaska must have had his eyes opened. (He now lives in Arizona.) How long it will be until Homegrown Alaska has covered the scope of agriculture remains to be seen, but in the meantime it's been a fun ride.

ASSESSING FOOD SECURITY IN FAIRBANKS, ALASKA

Charles Caster

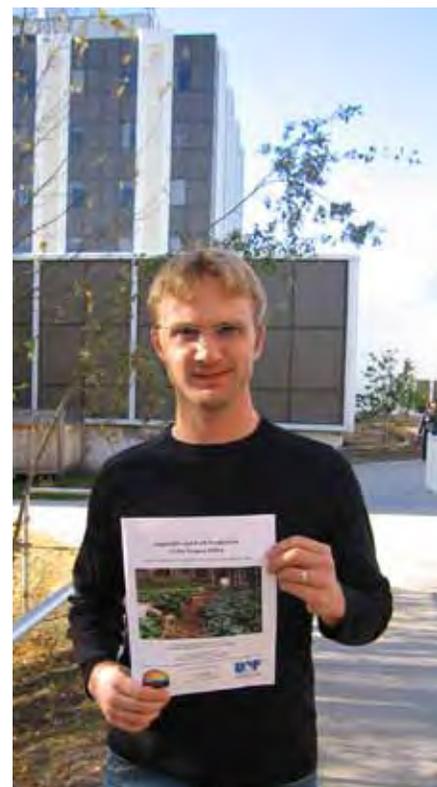
All seniors at SNRAS majoring in Resources Management are required to take NRM 405-406, the senior thesis course. Students identify a research project and develop and defend a thesis based on research that they conduct during their junior or senior year. Outstanding undergraduate research projects are recognized and published in the Senior Thesis Series. Charles Caster, who graduated 2011, is among these seniors who have made a significant contribution to the body of scientific research produced by SNRAS. Below is a condensed version of his thesis, adapted for Agroborealis. To view the complete thesis, see ST 2011-01, available at www.uaf.edu/files/snras/ST_2011_01.pdf.

FOR MORE THAN A CENTURY, since the arrival of non-Native peoples to Alaska, most Alaskans have relied on imported foods. With more of the state's population moving from rural to urban centers, the statewide reliance on imported food is expected to grow. The state's population has grown over the past several decades from activities such as resettling of farming families during the Great Depression of the 1930s, World War II, and the Alaska oil pipeline project of the 1970s. With population growth, the increased demand for food has resulted in an increase in imported foods. There have been various estimates of how much food Alaska imports. According to data compiled by the US Department of Agriculture (USDA), National Agricultural Statistics Services (NASS), Alaska currently imports 98 percent of its food, which raises the question of how food secure Alaska is or can be. The World Health Organization defines being food secure as "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life." An increased reliance on imported food sources weakens Alaska's food security.

In Alaska, the definition of food security can be extended to include availability of food that is both affordable and nutritious. One concern in Alaska with respect to food security is the possibility of a disruption (e.g., volcanic eruption) in the food supply. Another concern relates to the costs associated with increases in transportation and fuel costs that make importing food expensive. These additional dimensions of food security, coupled with the concerns of a disruption in the food supply chain and the rising cost of importing food to Alaska, speak to the current food system in the state.

A food system that is integrated in nature, one where a significant part of the local food system is derived from locally grown foods for the benefit of the producers, consumers, and local economy, is not prominent in Alaska. The current food system in Alaska is, by and large, unintegrated. That is, food is imported into Alaska, payment for food flows from consumers to food outlet to Outside. In an integrated food system, not only is food grown locally, but money used to purchase the food remains in the state. A more integrated food system would help support local economies and control costs associated with transportation. An integrated food system could promote a small and mid-scale agricultural production system that builds local farm economies and is linked to local markets. In addition, an integrated food system would provide education to individuals on about how they can grow nutritious food for themselves and their families.

A transition to an integrated food system would reduce the concerns over disruptions in the food supply chain and in the high costs of importing food to Alaska—today and in the future. Ultimately, Alaska's food vulnerabilities and food



Charles Caster and his survey, on the West Ridge of the UAF campus.

PHOTO BY NANCY TARNAI

security concerns may be reduced if an integrated food system is developed. In order to move toward a more integrated food system, however, an understanding of current food production in Alaska is needed.

The current method to measure the production of food in Alaska is through a bi-annual survey conducted by the USDA's NASS called the Alaska Acreage & Production Survey (OMB No. 0535-0002). This survey does capture gross levels of statewide production, although the instrument does not adequately capture what is being produced locally for local consumption. Therefore, a method for determining local food production is needed. Acknowledging the fact that measuring production at a local level is a more involved process, I chose to develop a pilot study designed to generate a snapshot of local production of vegetables and fruits in the Tanana Valley of Alaska's interior region. My goal for this study is to establish a baseline for future studies of various aspects of agricultural production statewide that can be measured annually.

Background/History

During the latter part of the eighteenth century, as the first European settlers were establishing agriculture in the eastern region of North America, Russian settlers were, it is believed, the first non-Native inhabitants to grow crops in what we now know as Alaska. There are accounts from southeast and interior Alaska from as early as 1765 of small-scale agricultural activities in the form of gardens. However, before the turn of the twentieth century, little is known about the agricultural activities among native communities in Alaska's Interior.

As arable lands were quickly claimed in the continental United States during the latter part of the nineteenth century, people travelled north to a territory of the United States that would one day become the state of Alaska. Alaska's path to statehood originated with US Secretary of State William Henry Seward. Secretary Seward (1861–1869) negotiated the purchase of Alaska for the United States from Russia for \$7.2 million—or two cents per acre. After first becoming a US district on October 18, 1867 and then an official US territory on August 24, 1912, Alaska joined the other lower 48 states to become the 49th state on January 3, 1959.

Agriculture in Alaska has not developed in a manner similar to areas throughout the lower states. The climate and isolated nature of Alaska challenges agricultural production in the state. As with the gold rush and other mineral extraction activities, Alaskan agriculture as an industry has consisted of brief cycles of growth and success, followed by waning interest and failed endeavors over the past century.

In 1897 while Alaska was still a US district, the federal government, through the Office of Experiment Stations, determined that 15 million acres had the potential to support agriculture in Alaska. In 1898, Charles Georgeson, a high-latitude farming expert and head of the US Agricultural Experiment Stations at the time, was sent to Alaska to establish and oversee seven experimental stations and to test the viability

of agriculture in the northernmost region of the United States. Within five years, Georgeson reported to the federal government that agriculture was indeed possible in Alaska. Georgeson and Sheldon Jackson, a minister turned educator, were successful at convincing many families from the contiguous United States of the agricultural potential in Alaska. By 1929, well before the New Deal program brought American families to settle in the Matanuska Valley, there were already 500 farms in the state. By the height of the Great Depression, however, all but two of the original Alaska experiment stations were closed due to a lack of federal support.

Throughout the twentieth century, the low cost of fuel and the development of new technologies made it more affordable to import food to Alaska. In-state agricultural production increasingly struggled to compete with imported foods, adding to the woes of Alaska agriculture as many farming operations closed. The relatively small state population, in combination with urbanization and a general lack of interest in farming, has further contributed to difficulties with the viability of the Alaskan agricultural production, marketing, and distribution system.

At the turn of the twentieth century, only about 63,000 people lived in Alaska. The Alaska market was small because of a small resident population, the area great, and the transportation infrastructure to move agricultural goods to market efficiently did not exist. By the mid-1980s, the state's population had grown to a little over a half-million people. Although the market was larger and a few transportation routes existed—the rail-belt and the Alaska Highway system, for example—interest in farming remained low, as most of the existing population moved to Alaska from urban areas in the lower 48 states and elsewhere with no farming background.

In 2007, there were about 680 farms in Alaska (USDA 2009). There are less than 900,000 acres of land in farms today, which is far less than the early federal government estimates of 15 million acres identified as having agricultural potential. On the Seward Peninsula, reindeer herding has yet to become a successful industry,¹ although a market

1. Editor's Note: Greg Finstad, manager of the Reindeer Research Program, disagrees with this assessment: "[M]any would argue that reindeer herding has been a success. One herder from Nome used to generate annual gross income over \$500,000 and many others would gross close to \$100,000 a year from combined field slaughter meat sales and velvet antler sales. There were many more animals at the time so there was money to be made through volume sales. Now with numbers way down, to promote profitability we need to add value to a much smaller volume of product hence produce an inspected product and sell at a higher price." As previously explored in *Agroborealis* 34.1 ("Reindeer Research: Intensive Management May Be Key"), 38.1 ("Reindeer meat—is it always tender, tasty, and healthy?") and "The expert tastebud: a sensory panelist's training experience"), 38.2 ("Reindeer in Alaska: Under New Management"), and 41.1 ("Reindeer market project makes history!"), the change in migration patterns of caribou on the Seward Peninsula has had a strong impact on the reindeer industry there and required that

study by researchers at UAF’s Reindeer Research Program is underway to see if there is demand for reindeer products. Of the many dairies that once operated in the state, only two private facilities remain. Also, several large-scale grain projects over the years have struggled to remain viable. Many farms still grow vegetables and some fruits—sold primarily during the summer months at popular farmers’ markets, through community supported agriculture² (CSA) organizations, local retail stores and restaurants, and directly from the farm to consumer. Agriculture is alive in Alaska, but many challenges from the past are ever-present.

Few studies have investigated the issue of food security in Alaska. In Alison Meadow’s dissertation “Evaluating and designing urban food systems: The role of local initiatives” (2009), she asserts that if we are to close the gap on “food insecurity,” referring to people not having access to sufficient amounts of nutritious foods as part of a healthy lifestyle, more research in the area of local food systems is needed. In the contiguous United States, the average distance that food is transported from field to market is 1,500 miles, although this distance is greater in places such as Alaska, where the majority of food is flown, trucked, or barged in. If any event occurred to disrupt the supply of food imports to Alaska, it has been estimated there might be about a three-day supply of food on store shelves as a result of “limited in-state warehousing”.³ Also, Alaska has the smallest state agricultural industry despite being the largest state by area. In the past several years, 2003–2008, Alaska has produced just over \$30 million in agricultural products annually. Based on cash receipts of all fifty states, the USDA ranks Alaska last. These numbers are a reality that many Alaskans, who rely on imported foods, have become accustomed to. Yet, with the rising costs of importing foods as a result of current political, economic, and environmental challenges, food security is gaining importance.

In recent years, a movement toward eating locally produced foods has been developing throughout the United States, with an emerging movement here in Alaska as well. Currently, among state and federal agricultural agencies, agricultural producers, and the general public, a consensus on the definition of “locally” produced food does not exist. The disagreement appears to be regarding the distance between the grower and consumer. In essence, people disagree on how far an agricultural product can be grown from the consumer and

herders come up with innovative approaches to management and marketing of their reindeer herds and products.

2. Community Supported Agriculture: Defined as a food production and distribution system that directly connects farmers and consumers. Consumers buy “shares” in a farm’s harvest in advance. Source: http://localfoods.about.com/od/localfoodsglossary/g/csa_glossary.htm

3. Dissertation presentation on March 2, 2010 by Philip A. Loring, PhD candidate. (Loring was presented his doctoral degree in May 2010. —*Editor*)

still be considered to be locally produced. However, based on geographical proximity, the Food, Conservation, and Energy Act of 2008 (2008 Farm Act) defines locally produced food to be “any agricultural food product that is raised, produced and distributed in ... the locality of region in which the final product is marketed, so that the total distance that the product is transported is less than 400 miles from the origin of the product; or ... the state in which the product is produced.” Concerns over the distance that most food travels, relating in part to the carbon footprint, as well as to issues of food security, illustrates only a couple of reasons for the growing interest in local foods. A 2009 study performed by the Food Marketing Institute, designed to uncover consumer motives for preferring locally produced food, found that consumer preferences have been found to be linked to many perceptions: the freshness of local food, a desire to support the local economy, the taste of locally produced food, and concern about the environmental impact of transporting foods across great distances.

Locally produced foods (e.g., produce) are generally sold at a higher price than imported foods that can be found at local grocery stores. Consumers who are willing to pay more for locally grown foods tend to “place importance on product quality, nutritional value, methods of raising a product and those methods’ effects on the environment, and support for local farmers.” The local food movement across the US represents a fundamental shift away from national and global food systems. The support for local farms and food systems and consumers wanting to know where their food comes from reflect this growing movement.

Today, locally produced foods in the Tanana Valley are generally sold either directly to the consumer, or through local retailer/foodservice organizations. Farmers’ markets are one of the most popular and growing sectors of local food marketing. According to the USDA’s Agricultural Marketing Service, the number of farmers’ markets nationwide rose from 2,756 in 1998 to 5,274 in 2009. CSA operations are another important and rapidly increasing form of “direct-to-consumer” marketing of locally produced foods, with the number of CSAs climbing from 400 nationwide in 2001 to estimates of over 1,400 in 2010. Other forms of “direct-to-consumer” marketing include roadside farm stands, direct from farm (e.g., pick your own), and community gardens. The 2007 Census of Agriculture stated the total US sales in 2007 for “direct-to-consumer” marketing totaled \$1.2 billion dollars, up from \$551 million in 1997.

Farm to school programs, where farms supply food to local school meal programs, are estimated to have doubled since the 2005–2006 school year, with an estimated 2,051 farm to school programs in 2009. Although the most common forms of “direct-to-consumer” marketing represents but a small proportion of the total sales of agriculture in the United States, they are rapidly growing—as more people choose to eat locally produced foods. The growth of the local food movement requires growth in the number of small and

Table 1. Reported number of selling weeks

How Many Weeks Is Your Selling Season?	
	14
	12
	0
	18
	8
	18
	7
	18
	8
	22
	13
	12
	12
	15
	12
	8
	12
	22
	18
Average	13
Median	12
Mode	12

Table 2. Most significant pest problems

Pests:	
	Aphids
	Cut Worms
	Flea Beetle
	Grey Mold Fungus
	Moose
	Potato Scab
	Rabbits
	Root Maggots
	Voles
	Weeds

mid-size farms, although such farms are faced with multiple policy, production, and economic obstacles as they attempt to expand production.

The USDA defines a farm as “any place from which \$1,000 or more of agricultural products were produced and sold, or normally would have been sold” over the course of a year. This definition is likely to exclude some small local farms that are important contributors to local food production. A small farm is considered a farm with total sales of less than \$50,000. These small farms that support the local food markets are faced with many limitations in meeting the growing demand for local food. These limitations include capital for farm investment, “capacity

constraints ... and lack of distribution systems for moving local food into mainstream markets; limited research, formal and informal education, and training programs for marketing local food. In addition, there are multiple uncertainties related to regulations that may affect local food production, such as food safety requirements, land use and zoning changes, and changes in government programs designed to support local food production.”⁴ Local,

4. Martinez, S., M. Hand, M.D. Pra, S. Pollack, K. Ralston, T. Smith, S. Vogel, S. Clark, L. Lohr, S. Low, and C. Newman. 2010. *Local food systems: concepts, impacts, and issues*. United States Department of Agriculture, Economic Research Service. *Economic Research Report*, 97.

This page: Tables 1, 2, and 4 from the survey results, as published in Caster’s senior thesis, ST 2011-01. Opposite: Table 5 from the thesis.

Table 4. Crops grown in the Tanana Valley (2010)

Crop	
Asian greens	Cucumbers
Chard/Swiss Chard	Onions, leeks, scallions
Herbs (basil, parsley, etc.)	Peas
Kale	Peppers
Head Lettuce	Rhubarb
Leaf lettuce (Salad mix)	Summer squash (e.g., zucchini, crook neck)
Other greens (Spinach, collards, mustard, etc.)	Strawberries
Broccoli	Other berries (e.g., raspberries and currants)
Cabbage	Tomatoes
Cauliflower	Winter squash and pumpkins
Kohlrabi	Sweet corn
Other (brussels sprouts, savoy cabbage, etc.)	Wild mushrooms
Carrots	Mixed produce (bagged)
Potatoes	Parsnips
Turnips	Tomatillos
Other root crops (radish, beets, rutabaga, etc.)	Eggplant
Beans	Garlic
Celery	Apples

small-scale farmers have reason to be optimistic as an increasing number of local, state, and federal government programs have committed resources to help overcome the challenges they currently face in establishing or expanding their farms for the benefit of local food systems.

The objective of this project was to generate a snapshot of local vegetable and fruit production in the Tanana Valley. The end goal was to get input from as many producers as possible.

In consultation with agricultural and other professionals, I developed the initial questions for a survey. The survey questions included eighteen production-related questions and a few demographic questions. Along with the draft of the survey, I sent a letter wherein I introduced myself, the project, its purpose, and objectives of the project.

In an attempt to muster support from the producer community, a similar version of the introduction letter was posted on the Alaska Community Agriculture (ACA) blog site (www.alaskacommunityag.org). Although the ACA did not formally endorse the project, a few members expressed their support for it, and encouraged participation on the organization's blog site and in member e-mails.

To compile an accurate mailing list for vegetable and fruit producers in the Tanana Valley, I contacted representatives of the Tanana Valley Farmers' Market (TVFM) in Fairbanks, DNR in Fairbanks, SNRAS at UAF, and also sellers at the TVFM, the Highway's End Farmers' Market in Delta Junction, and at the Ester Community Market in Ester.

To encourage survey completion, I offered respondents a chance to win one of three different prizes of beef: A 20lb, 15lb, or 10lb package of beef—raised at the University of Alaska Matanuska Experiment Farm in Palmer. Information about prizes was included on the introductory letter and the two post cards. The survey formally closed in late January.

Discussion

This project is designed as a pilot study of the current production of vegetables and fruits grown in the Tanana Valley. While the broader goal of the project was to determine how much produce and fruit is being grown in the Tanana Valley for local consumption, the development of a survey instrument that can be implemented annually to measure Tanana Valley production of locally grown vegetables and fruits became the focus. Promising attributes of the survey results, challenges of the study, and survey questions to be addressed for future studies have all resulted from this project.

The results highlight many successes of the production of vegetables and fruits in the Tanana Valley. The vast variety of crops that were reported grown in 2010 profile the capability and resourcefulness of individuals under challenging climatic circumstances. Producers have successfully grown numerous crops and extended their growing season, and ultimately their selling season, through innovation and hard work. In general, the producers in the Tanana Valley have seen an increase in revenues from the previous year. Producers reported greater sales and greater interest from area residents in purchasing their vegetables and fruits. Many of the growers reported the desire to expand their farms in the coming year, which would serve to fill the growing demand for locally produced foods. Most CSA producers have also reported expansion in both their farms and CSA shares.

Although the level of production for each farm and CSA producer varies (i.e., 13–40 shares per acre), the potential to feed an increasing number of people on the existing farms in the Tanana Valley appears possible. Based on CSA producers' farm size and the number of CSA shares they reported during the development of the survey, on a per acre basis, currently there is a potential for producers to supply approximately 40 subscriptions per acre of land in production. A CSA share in the Tanana

Table 5. Constraints on expanding farm/business

Constraints
I do not wish to expand my farm/business
Crop storage availability
Labor costs
On-farm infrastructure availability (e.g., hoop houses, greenhouses, low tunnels, chillers)
Access to capital/financing terms
Water availability
Fuel costs
Transportation/shipping costs
Electricity costs
Land availability

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Table 6. Constraints on expanding production in the Tanana Valley

Constraints
Affordable land
Local processing facilities
Unreliable market and affordable market outlets to sell produce
Outside competition selling organic produce in Tanana Valley
Availability of labor and labor costs
Production costs
Lack of farmers who want to work hard
Climate/length of growing season
Crop storage
Marketing
Financing for infrastructure development

Valley, assuming it provides a portion of vegetables and fruits to an average of four people during the selling season, has the potential to provide vegetables and fruits to 160 people per acre of land in production. What this calculation does not take into consideration is that the CSA producers are also selling a portion of their production through other outlets such as farmers' markets and roadside stands.

Regardless of the outlet or market, producers in the Tanana Valley have the potential to feed a significantly greater number of people than the current number of households that take advantage of locally grown vegetables and fruits. For example, using the mean farm size (calculated from the survey results) in the Tanana Valley of 2.91 acres, and multiplying it by 54, the number of identified farms in the Tanana Valley during 2010 (identified during the development of the project) should result in 157.14 acres of production. Assuming that each farm is capable of growing enough to feed 160 people per acre (based on 40 CSA shares per acre and four people per share), the producers in the Tanana Valley could supply locally grown vegetables and fruits to 25,142 people. A study of fresh market vegetable farms in the upper Midwest with similar results found that farms that operate a CSA were able to provide 25-35 shares per acre.⁵ Another study of CSA producers, also in the upper Midwest, found that growers were able to provide as many as 27.8 shares per acre.⁶ In the Tanana Valley, 25 shares per acre would provide food for 15,714 people. As a reminder, CSA producers do not generally sell all of their vegetables and fruits as shares, therefore, the remaining food would significantly increase these previous estimates. Also, it is important to note this survey does not capture the production of non-commercial growers, those who grow crops in home, community, and school gardens throughout the Tanana Valley. While the possibility of increasing the production of vegetables and fruits in the Tanana Valley is great, there are many challenges in using a survey instrument to measure current and future production levels.

The first challenge I faced when developing the project was to create an accurate and inclusive list of current producers in the Tanana Valley. While a few organizations were willing to share their producer contact lists openly, others were not. The list of producers I created was as accurate as it could be without being able to cross reference them with the databases of other organizations (i.e., local, federal, and non-governmental organizations). To minimize the possibility of missing an important segment of the grower population in the Tanana Valley, it would therefore be

prudent for organizations and agencies alike to work together on an annually maintained grower contact list that can be used for future surveys and studies.

Another challenge of measuring vegetable and fruit production in the Tanana Valley that this project did not pursue was that of measuring the contribution of vegetables and fruits grown by community and home gardeners. During the development of the survey, local publicity surrounding the project resulted in e-mails from home gardeners who were concerned about being excluded from the survey. It is understood that home gardeners and community gardens contribute greatly to the production of vegetables and fruits in the Tanana Valley, but measuring that production was beyond the scope of this project. Furthermore, based on our experience with commercial growers, obtaining accurate and complete measurements would be a challenge in and of itself. Therefore, I only targeted growers who sold commercially so that I would have a way to track increased production over time through gross sales.

Conclusion

Through innovation, creativity, and hard work, Tanana Valley producers are successfully growing a remarkable variety of crops and expanding overall production—all under challenging circumstances. Producers have also been successful at extending the selling season through the use of important season extension techniques. The potential to expand production and to feed more families in the Tanana Valley is great, but continued research is needed on enclosed environments and other season extending methods to support longer growing seasons in the Tanana Valley and elsewhere. Furthermore, with an aging producer population, more young farmers may need to be attracted to the Tanana Valley. Current marketing outlets are cost, time, and labor intensive. A central marketing outlet like a cooperative market currently being proposed in Fairbanks or other ways of decreasing the transaction costs between producers and consumers could serve as an important outlet for growers. Measuring the production of vegetables and fruits in the Tanana Valley is another challenge that will require further research and a greater collaborative effort among growers and researchers. Greater grower participation is essential to develop a system to accurately measure production. If producers wish to have current and potential consumers informed about the benefits of buying locally grown vegetables and fruits, a better understanding of local production is needed.

While this study was successful at highlighting many promising aspects of local vegetable and fruit production in the Tanana Valley, it also shed some light on a few of the many challenges Alaska faces if it is to transition from a linear food system to a more complete food system that generates value to local communities.

5. Hendrickson, J. 2005. *Grower to grower: creating a livelihood on a fresh market vegetable farm*. Center for Integrated Agricultural Systems, College of Agricultural and Life Sciences, University of Wisconsin – Madison.

6. Tegtmeier, E. and M. Duffy. 2005. *Community supported agriculture (CSA) in the Midwest United States: a regional characterization*. Leopold Center for Sustainable Agriculture, Iowa State University, Ames, Iowa.



Sample question page from the survey:

8. What vegetables and fruits did you grow for commercial sale (excluding personal use) in 2010? For each crop grown, list weight and its percentage of your total sales revenue (approximate when necessary).

Crop	This year, 2010	
	Weight (lbs)	% of Sales
Leafy greens		
Asian greens		
Chard/Swiss chard		
Herbs (basil, parsley, etc.)		
Kale		
Head lettuce		
Leaf lettuce (salad mix)		
Sprouts		
Other greens (spinach, collards, mustard greens, etc.)		
Cole crops		
Broccoli		
Cabbage		
Cauliflower		
Kohlrabi		
Other (brussels sprouts, savoy cabbage, etc.)		
Root crops		
Carrots		
Potatoes		
Turnips		
Other root crops (radish, beets, rutabaga, etc.)		

Crop	This year, 2010	
	Weight (lbs)	% of Sales
Other		
Beans		
Celery		
Cucumbers		
Onions, leeks, scallions		
Peas		
Peppers		
Rhubarb		
Summer squash (e.g., zucchini, crook neck)		
Strawberries		
Other berries (raspberries, currants, etc.)		
Tomatoes		
Winter squash and pumpkins		
Others (please list)		

RECOVERING FROM AN ABERRATION

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THE FUTURE OF ALASKA'S LIVESTOCK

Deirdre Helfferich
photos by Nancy Tarnai

David Poppe, Nenana Urban Farms, with Dexter cow Clara and her four-hour-old bull calf on Sept. 28, 2011.

LIVESTOCK ARE AN INTEGRAL PART OF AGRICULTURE, and this is true in Alaska as anywhere else: animals are raised for meat, milk, fiber, transportation, labor, and companionship. Or is there a difference in the Last Frontier? The species raised here range from dogs to horses to goats to cattle to reindeer to muskoxen to yaks to llamas. In Alaska livestock production may have perhaps a recognizably different twist.

Agriculture in Alaska has followed a different path than in the rest of the United States. Alaska's northern latitude, remote geography, and distinctive ecological characteristics precluded an agricultural boom as experienced in the Lower 48. Instead, agricultural practices developed a uniquely Alaska character due to the ecological limitations of a short growing season and our limited infrastructure. Today, agricultural production is possible, productive, and active in many parts of the state, especially with respect to smaller-scale production in the Interior, the Matanuska-Susitna valleys, and southeast Alaska.

In the face of rising fuel costs and changing climate, Alaska agriculture cannot simply import practices and technology from southern regions. Alaska needs to adopt best practices that accurately and realistically reflect the opportunities and constraints that define high-latitude agriculture.

Lean red meat has been a prominent component of the Alaska diet throughout history, and remains an important part of the culture and human ecology in the state. Live animals also afford a greater flexibility in processing when compared with high-latitude crops that must be harvested

in a short and climatically challenging growing season. Lean red meats are an excellent source of protein, minerals, vitamins, and antioxidants, and are justifiably considered part of a healthy diet. In addition to meat, a healthy and vibrant livestock production system contributes to the maintenance of soil productivity, especially in the context of organic production.

—2011 Sustainable Livestock Production Conference
organizing committee

The phrases *food sustainability* and *food security* seem to crop up everywhere these days, and are particularly relevant in a state like Alaska where approximately 85 percent of our red meat is imported—where, in fact, we still do not know exactly how much food we produce and how much we import, although we can make an educated guess.

Can Alaska develop a sustainable red meat system? Can Alaska produce enough red meat to weather a major disruption in transportation or combat soaring fuel costs?

The Sustainable Livestock Production Conference was held in Anchorage on October 13 and 14, 2011, to help answer these questions. It featured keynote speaker Dr. John Ikerd, professor emeritus of agricultural and applied economics of the University of Missouri at Columbia. The conference was organized by SNRAS professors Jan Rowell, Milan Shipka, and Joshua Greenberg, Cross-Cultural Studies professor S. Craig Gerlach, and Alaska Department of Fish & Game wildlife biologist Tom Paragi. The workshop brought together Alaska producers, researchers, retailers, policymakers, and students, who worked to identify:

- practices that work, from the production of healthy meat to environmental compatibility;
- barriers to sustainable red meat production, from animal production to market issues and consumer attitudes;
- how the university can support the development of sustainable agriculture through research, education, and extension.

This intensive two-day workshop narrowed the broad issue of food security in Alaska down to a single food system (sustainable red meat production). “We know we have the potential to produce enough red meat to feed the people of Alaska—but we don’t do it. Why not?” asked assistant professor and conference coordinator Jan Rowell. “What would it take to develop this industry?”

“Alaska is positioned to design and develop a sustainable agricultural system unique to our situation, incorporating practices and attitudes different than those used elsewhere in the US,” Rowell said. “Developing sustainable food systems is the first step on the path to food security and demonstrates a significant investment in Alaskans.”

SNRAS Dean Carol E. Lewis gave the opening remarks, making a powerful statement at the beginning of her comments: “I’m frightened,” she said. “Our food system is threatened.” And not simply, she explained, because of the problems associated with being at the end of a long food chain or the costs to our environment of the energy-intensive means to produce, market, and distribute food in our modern global food system. These are formidable in themselves

but this threat is not because producers and supporters of agriculture are not trying, but through either lack of understanding or neglect, those who could be involved, from government officials through the private sector, have chosen not to pay attention to what is happening....

Dr. Lewis went on to explain that the conference was meant to tackle the following questions:

- What is the knowledge bank on livestock production in Alaska?
- What are the challenges to creating a sustainable food system in Alaska? What are the constraints that affect what we can do?
- What are our needs?



Conference attendees look over the brainstorming sheets prepared by each subject-focus table.

Dr. John Ikerd

John Ikerd was raised on a small dairy farm in southwest Missouri and received his BS, MS, and PhD degrees in agricultural economics from the University of Missouri. He worked in private industry for a time and spent thirty years in various professorial positions at North Carolina State University, Oklahoma State University, the University of Georgia, and the University of Missouri before retiring in early 2000. Since retiring, he spends most of his time writing and speaking on issues related to sustainability with an emphasis on economics and agriculture. He is the author of several books on these topics, including *Sustainable Capitalism: A Matter of Common Sense*, *A Return to Common Sense*, *Small Farms are Real Farms: Sustaining People Through Agriculture*, and *Crisis and Opportunity: Sustainability in American Agriculture*. He is both one of the characters in and member of the board of advisors for the movie *Fresh*.



FOR MORE ON DR. IKERD AND LINKS TO HIS WRITINGS AND OTHER WORKS, SEE [HTTP://WEB.MISSOURI.EDU/~IKERDJ/](http://web.missouri.edu/~ikerdj/)



“This conference,” she emphasized, “is designed to be participatory.” Solutions will come from it, she said, and from the people actively involved in producing meat in Alaska. The conference was important because change is coming to us, and she warned the audience, “if we do not manage change, change will manage us. We are here to effect that change.”

Dr. Ikerd likewise emphasized the current of change in modern agriculture in his keynote address:

“I’m convinced that we’re at a point in time where we’re at a fundamental change, a change at least as great as the Industrial Revolution. Different thinking is what it’s going to take to get us through the change that’s coming.”

“I think the Industrial Age is coming to an end in agriculture. The benefits of this industrial paradigm have been fewer and the costs greater than probably any other sector of our economy. Because of my age I’ve seen most of the changes of the industrial era in agriculture. In the late 1950s agriculture in the US was still mostly the diversified family farm, but was beginning to change. The factories that made tanks for World War II started turning out tractors. Gas was cheap and plentiful.... Agriculture was about to change from a way of life to a bottom-line business.”

“Industrialization is a reflection of a way of thinking that is seen most clearly in specialization, standardization, mechanization, and simplification, leading to consolidation. Food security is the main purpose of government involvement in agriculture. We continued to use the language of the family farm, but the assistance from experts supports consolidation and increased efficiency so that farmers can sell more at less cost of production, so that the consumer can buy more. But this does not support the family farm.”

Ikerd described how the supports provided during the latter half of the twentieth century and through today were aimed at increasing efficiency and reducing risk. However, he cautioned, the reduction of risk also increased the vulnerability of the agricultural system. Increase the efficiency of production, and the price of goods fall, the margin to the farmer is reduced, so farms become larger and more efficient so they can produce more—and the small farms are gradually forced out. Farm bankruptcies became common. Farmers began leaving rural areas and changing careers, moving to urban centers. This, he said, is a natural effect of the increase in efficiency.

He explained to the audience how over the years he realized that the farmers he was trying to help succeed did not do well:

The [farmers] we were trying to help who had focused most narrowly on the bottom line were the ones that were failing. The ones who’d been following the so-called experts’ advice were the ones that were doing



Above: Participants in one discussion group at the Sustainable Livestock Conference. SNRAS professor Milan Shipka (with long beard), one of the conference organizers, is at center back. Below right: Alaska Farm Service Agency Director Danny Consenstein acting as notetaker for another breakout group.

the worst, while the “laggards” as we called them, were doing a little better.”

The industrial model, focusing as it did on economic efficiency, was bad for the farmers, bad for their communities, and bad for the land and its productivity. Life is about more than making a living, Ikerd said. It’s about the desirability of your life, and having purpose and meaning in your life.

Then came the sustainable agriculture movement in the late 1980s. Sustainable agriculture balanced the quality of life, stewardship of the land, and created ecological and social and economic integrity. Industrial agriculture had failed every test: ecological, social, even economic. And it wasn’t even meeting the needs of the consumer, which it had been designed to serve.

Farms and feedlots had turned into biological assembly lines.

Despite the promise of the increases in efficiency and production, the consolidation of small farms into large ones, “industrial agriculture was an absolute failure,” he said, that has not created food security. “There is a larger percentage of the population hungry now than in the 1960s,” he said, adding that our modern food system is making us sick, causing diabetes, cancer, heart disease, high blood pressure, and more ills, and that not only in our diet, but in the effects of how we grow, store, process, and transport it and its temporary success based on the easy availability of cheap energy. “Abundant, cheap energy made the surge possible, but it’s not true now.” Ikerd said: “The economic growth of the industrial era is unsustainable, and not ever likely to be repeated. It was an aberration.”

Approximately ninety people attended the conference. Participants were given a program that included the following questions:



Production

1. What elements, resources, and/or strategies are needed to develop a sustainable red meat system capable of feeding more Alaskans?
2. What kind of information and strategies would help livestock growers plan for and remain adaptable to social, economic, and/or ecological change?
3. What should we be doing to help recruit new farmers?

Processing and Distribution

1. What kinds of processing infrastructures can cope most effectively in Alaska, considering the huge distances between farms and markets and the rising costs of fuel? (a) on the road system (b) seacoast or river communities (c) in isolated communities.



Discussion at Table 3, with SNRAS Dean Carol Lewis as notetaker.

2. Given the highly seasonal nature of farming in Alaska, how can we avoid swamping limited processing resources while minimizing risks to the farmers?

Marketing, Retail, & the Consumer

1. What kinds of organizations or programs are best suited to help connect the farm to the consumer, institution, and/or the restaurant?

2. What are some marketing strategies to increase the consumption of locally produced meat and decrease our dependence on imported meat?

3. What are some advantages of locally produced meat that can be used for marketing?

Dr. Phil Rasmussen, the Regional Coordinator for the Western Region SARE Program, served as the moderator for the conference work sessions. The participants brainstormed answers to the questions on day one, then moved to different tables on the second day and evaluated and rated the proffered solutions, determining if something important was missing, or if the ideas could be combined or restated more clearly. Then each table voted on the solutions as determined.

Among the issues brought to light were the question of a farmer mentoring program. Mike Emers, of Rosie Creek Farm and the co-chair of the Alaska Community Agriculture

Association, described a program he knew of at the University of California Santa Cruz, in which there is a farming class where students are hired out to three different farms for a month each, providing on-the-job farm training and farmer mentoring. “In Alaska this kind of thing is technically illegal,” he said—there is no provision for it in the labor laws. “Some states have a farmer training apprentice labor guideline which makes it legal. There’s nothing like that in Alaska.” The cost of farm labor is a significant problem for Alaska farmers also.

Tom Zimmer of Calypso Farm and Ecology Center described the importance of cooperation among producers, saying: “This is one of our strengths in Fairbanks. The farmers get together and talk with each other.”

There was general agreement that one or more agricultural economists were needed to advise farmers. Other ideas included creating a farming manual to be handed to new farmers. This would be a compilation of all the how-to publications and bulletins produced by the university (something that the Cooperative Extension Service used to provide). Marketing wasn’t generally seen as an impediment; as one person said, “We can sell what we produce.” Educating the consumer, however, was seen as worthwhile. One suggestion was to create a food mileage chart for different foods—both those produced in and out of the state. On the other hand, the lack of facilities and obstacles to processing

meat were seen as problems. The possibility of opportunities for processing to create value-added items and jobs in Alaska communities was also mentioned: “Alaska is different: we can’t follow the model of the Lower 48. We won’t have a big processing center. [Our food system] has to be regional here, look to smaller, appropriate scale models for our communities. The more local and regional [the scale], the more job creation possible.” Added another participant, “Mt. McKinley Meats didn’t work because it was large scale. It was not appropriate for here.”

The organizers of the conference are preparing a white paper that will go into full detail on the suggestions the participants made. Dr. Rowell explained:

A major objective for us—the organizers—was to get some feedback from producers. We wanted the people who are vested in Alaska’s red meat food system to share their ideas with us. What works, what doesn’t, and what can we, as a university community, do to help make this food system better? As we summarize and digest the information generated at the meeting, one idea remains dominant. We need to create a livestock advisory committee made up of representatives of Alaska’s livestock food system. We need this group to continue to offer their ideas and perspectives—and sustain the energy generated at this meeting.

In his closing comments, Dr. Ikerd said,

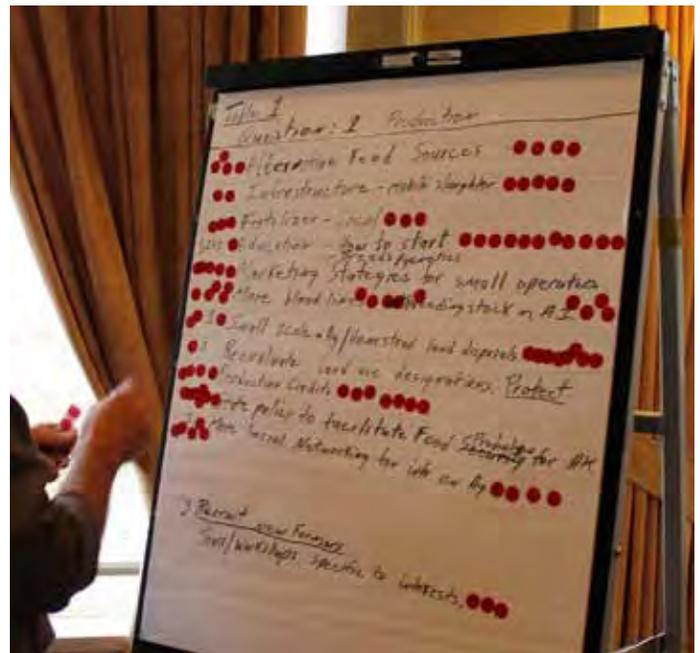
I’ve kind of come to the conclusion that people don’t make major changes until there’s three basic changes in place.

You have to come to the conclusion that what you’re doing and where you’re at aren’t working. So if marketing isn’t your problem, then what isn’t working? Because that’s where you need to make the change. How’s that working for you?

You don’t make changes until you know there’s something else better that can work instead. You have to have a vision of something fundamentally different and better than what you have. With me, that vision is of sustainable agriculture. But what’s this for you? What’s the compelling vision that drives you? Unless you have a good reason to change and something to change to, you’ll just keep doing what you’ve been doing.

You have to have hope. You have to know that it’s possible, that it makes sense, that it’s worth working toward. Even if you ultimately fail, you know that it was possible, that it was worth the effort to work toward it. Focus on things that need to be changed and work on doing it.

I believe that in this new era that we’re working through, it’s going to be up to the grassroots. It’s



Rating options on Question 1 at Table 1.

going to be up to the people who are actually doing it. It’s up to you decide what you’re actually wanting to do.

[You need a s]tatewide organization that would bring people together on regular basis—the people who don’t fit with the regular organizations, the folks who don’t fit. If it doesn’t come from the people, it’s not worth doing.

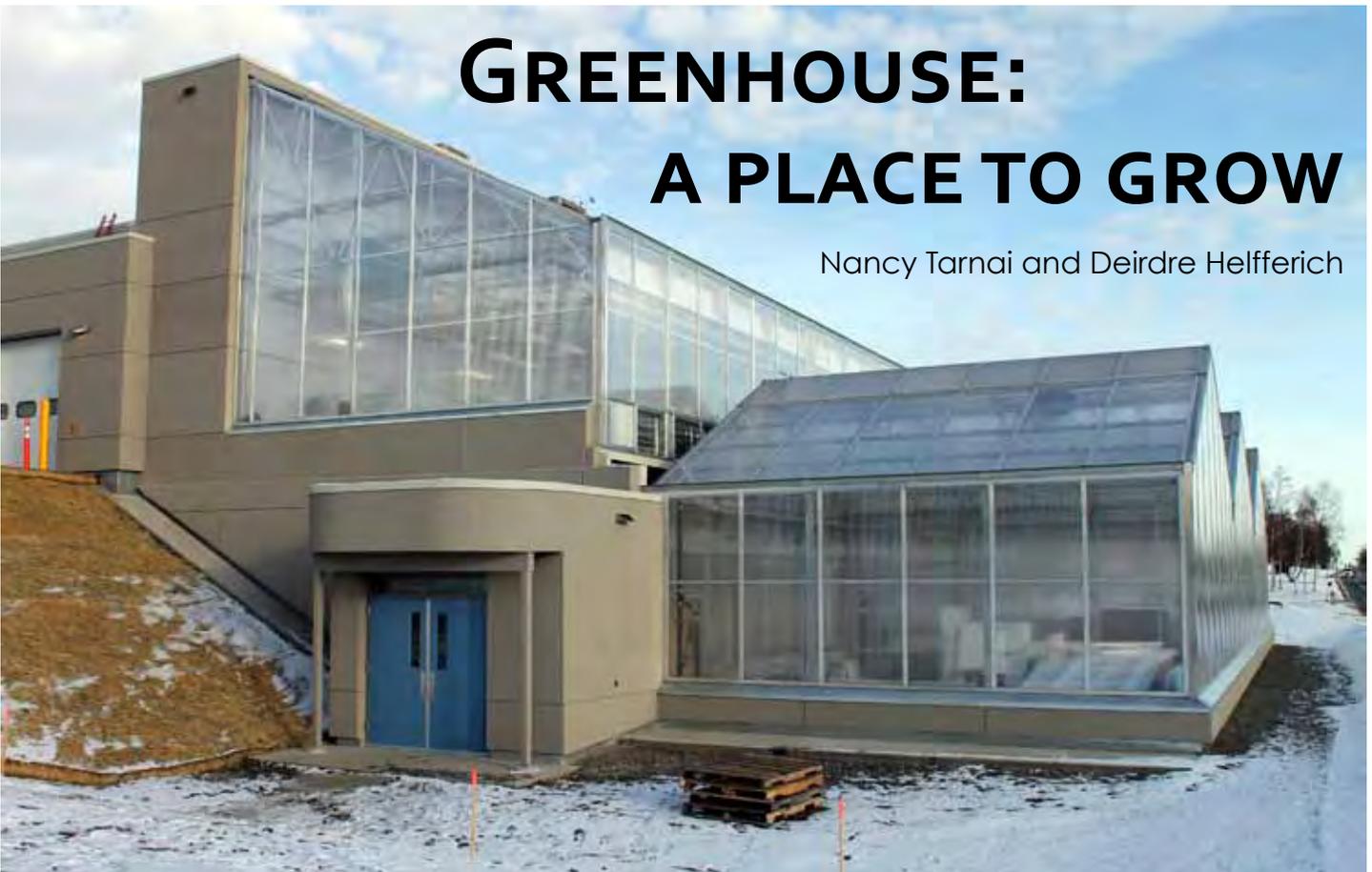
What you’re talking about is life. It’s not just enterprise or business or farming, those are all parts of life. ...Being a good farmer is about a calling to be a farmer. It’s not just a profession. It’s about purpose, a life that’s worth living. That gives us purpose and meaning and gives us a level of economic security.



The organizers of the Sustainable Livestock Conference are working on a paper detailing the results of the conference, and will also present a summary of their findings at the 2012 Sustainable Agriculture Conference & Organic Growers School, held in Fairbanks March 13-15, 2012.

GREENHOUSE: A PLACE TO GROW

Nancy Tarnai and Deirdre Helfferich



The new AFES greenhouse, still under construction, October 2011.

PHOTOS BY NANCY TARNAI

WHEN THE FORTY-YEAR-OLD Agricultural and Forestry Experiment Station greenhouse on the West Ridge of the UAF campus was dismantled in the spring of 2011 to make way for the new Life Sciences Facility, it was only a matter of months before a new \$5 million teaching and research greenhouse was constructed.

The new greenhouse, attached to Arctic Health Research Building, is already in use. The 4,500-square-foot facility includes space-efficient teaching and research areas equipped with state-of-the-art environmental control and innovative plant production systems. The finished upper level has two greenhouse sections of 750 square feet and two sections of 375 square feet. The lower level has three sections of 750 square feet each and houses a 900-square-foot growth chamber area.

“We are very excited about the research, teaching, and outreach opportunities the greenhouse will provide for our faculty and students,” said Carol Lewis, dean of the UAF School of Natural Resources and Agricultural Sciences and director of the Agricultural and Forestry Experiment Station.

A computerized control system monitors and regulates environmental variables such as temperature, humidity, and light intensity in each greenhouse compartment, providing optimal conditions for plant growth. “This will provide excellent opportunities for students to prepare for careers in the modern greenhouse industry,” Lewis said.

Dr. Patricia Holloway, professor of horticulture and director of the Georgeson Botanical Garden, echoed this sentiment:

The computer controls will allow more precision control and manipulation of the greenhouse environment. We will be able to set up better experiments because we can manipulate more factors such as humidity and light so we can learn best practices for greenhouse crop production.

We can also more effectively train our students in standard greenhouse systems used around the world. In the old house we were unable to upgrade

or explore new technologies because of old heating and lighting systems. [We've been] bumped into the twenty-first century.

The greenhouse currently features a finished upper level and a built-out lower level that is not yet fully automated or ventilated. At the dedication ceremony Nov. 22, 2011, Chancellor Brian Rogers promised to secure the funding to finish the project. The greenhouse complex also includes 1,100 square feet of classroom space, a laboratory, two offices, a clean room, storage, and an area for handling plant materials, fertilizers, and potting media. This portion of the complex was completed in an earlier renovation of the west wing of Arctic Health Research Building.

"This is an exciting day for the School of Natural Resources and Agricultural Sciences and for UAF," Rogers said during the dedication event. "This has been a fast-track project."

Calling the greenhouse a critical component of SNRAS's horticulture program, Chancellor Rogers said the new facility increases the teaching and research space from what was available in the old greenhouse. While some people questioned the cost of the facility, Rogers assured the doubters that this is not just a simple greenhouse. Its state-of-the-art climate control system will enable researchers to examine a wide range of conditions experienced by growers throughout the state. "We'll be able to reach out to communities, help in the drive for food security, extend the growing season and create new economic opportunities," Rogers said.

He recognized the school's partners, Pike's Landing and Chena Hot Springs Resort, and thanked Ghemm Co. and Design Alaska. "They put the work into this to make it succeed."

Chena Hot Springs Resort owner Bernie Karl praised local hire for getting the job done so efficiently. "The difference between good and excellent is 5 percent," Karl said. "The extra 5 percent has been put into this job. Take



UAF Chancellor Brian Rogers, left, and SNRAS Dean Carol Lewis cutting the ribbon on the new greenhouse at the dedication ceremony November 22, 2011.

a look at the mechanical work; it is a work of art."

Dr. Meriam Karlsson, professor of horticulture and program manager for the Controlled Environment Agriculture Laboratory, later elaborated on how the new greenhouse will enable researchers to do many things that could not be done in the old greenhouse, and with better energy efficiency:

We can control and maintain more precisely temperature and light conditions. Even during hot summer temperatures, we will be able to maintain moderate greenhouse temperatures thanks to a fogging system that will function both to increase and maintain humidity levels, as well as a cooling system.

With the environmental computer, we can program temperature set points throughout the day. The same can be done for the lights. Lights can be turned on or off based on light

levels or other variables during the day, or daily clock times. We will have continuous records of actual temperatures, light levels, humidities throughout the day and over the year in the various greenhouse sections and outside conditions. This allows us to calculate hourly, daily, or weekly averages that are essential in understanding greenhouse crop responses. We can then develop greenhouse protocols where environmental set points are used to produce crops of desired quality, morphology and development. (Even if specific temperatures cannot be maintained in a facility, we can predict what impact that will have on a crop.)

I am looking forward to using a nice clean greenhouse with an acrylic covering material (Deglas) that has considerably higher light transmission properties than the covering on



Cameron Willingham, SNRAS research technician, cares for plants inside the new greenhouse.

PHOTO BY NANCY TARNAI

the old greenhouse. At the same time, it has a higher insulation value to maintain proper temperatures even during cold -40°F periods. The energy curtain evens out the night and day temperatures and saves on the amount of energy needed for heating the greenhouse. The energy curtain will also work as a shading material during the summer months to protect plants from high light levels as well as keeping the greenhouse at the desired temperatures.

The location of the greenhouse also has some advantages over the old West Ridge Greenhouse. It has a headhouse that is well lit and designed for seeding, transplanting, and taking data—and that is directly connected to the greenhouse. This makes it easy to move plants to and from the greenhouse sections. Researchers can move plants easily among the greenhouse sections, growth chambers, and other laboratory facilities within the Arctic Health Research Building. Karlsson said, “The growth chambers are located on the ground floor and they give us opportunities to more precisely study temperature, light effects, and types of light sources. This arrangement allows us to use the greenhouse sections for propagating and preparing plant materials. We can return plants after limited or more extensive time

periods as needed in the growth chambers, to a greenhouse environment for final observations.”

Karlsson added, “We have a well lit and warm receiving area that will make bringing plants and supplies into the greenhouse much easier even during the winter half of the year. The greenhouse sections are accessed from a hallway with separate entrance doors. In the old greenhouse, we had to walk through one section to reach another greenhouse section.” This isn’t simply a matter of convenience or comfort for the researchers, she pointed out: “Climatic conditions can be maintained more accurately and experiments requiring special considerations or conditions can be separated.”

When the bottom three greenhouse sections are fully operational, researchers will be able to work even more effectively on finding solutions to northern agriculturalists’ needs. Karlsson explained, “We can maintain several experimental environments and be able to run experiments simultaneously. In the past, we often have had to complete the various treatments of an experiment one after the other. This is difficult as the natural light and temperature conditions vary over the year and plants from different treatments cannot be compared side by side.”

At the dedication ceremony, student regent Mari Freitag said, “This facility is a model of connectivity. A research

greenhouse is critical to provide producers with information. This will enable students to move into modern greenhouse jobs.”

Murray Richmond, legislative aide for Sen. Joe Thomas, read remarks sent by the senator. “Alaska agriculture sounds like an oxymoron to some people,” he said. “But they don’t know Alaska. We are the only people who would dedicate a greenhouse when it is 18 below zero.

“The work you do here is important. You are coming up with solutions. This project is true to the spirit of Alaska. We will find a way.”

Fred Schlutt, director of the UAF Cooperative Extension Service, extolled the eighty-year history CES and SNRAS have of working together and said, “Controlled environments are an area that will help expand agriculture in this state. It will bring information to help the state become more self-sufficient in agriculture.”

Karlsson later reflected on why greenhouses are important in Alaska: “If anything is going to be grown at this time of the year [midwinter], it has to be in greenhouses or some other form of controlled environment. For research purposes, Alaska is the only place in the US with extreme day lengths and extended periods of daily twilight. Understanding plant responses and development under these natural conditions will add to our basic knowledge of plant physiology and crop production. (Simulating twilight in a research facility is still a challenge.)” Karlsson added that Alaska’s climate can test the facilities themselves: “Greenhouse manufacturers should test greenhouse structures and equipment under our conditions (just like cold weather testing for cars and airplanes). If the structure, covering materials, ventilation systems, etc. work here with temperatures from -40 to +80, they probably will perform well in most climates.”

Dean Lewis summed up at the dedication ceremony, saying that controlled environments are the future of agriculture in Alaska. The new greenhouse will present many wonderful opportunities, she said. “It’s going to be innovative and great fun.”



SNRAS/AFES Horticultural Research

CONTROLLED ENVIRONMENT AGRICULTURE LABORATORY

35

Meriam Karlsson, professor of horticulture

- High tunnel work in a variety of different types of hoop houses
 - Testing apples for growing in the Interior, comparing high tunnel and field production
 - Greenhouse best management practices
 - Controlled environment technology in greenhouses
 - Vegetable and floral production protocols
 - Light sources for greenhouse production
 - Plant/light interactions at high altitudes
 - Use of Light Emitting Diodes (LEDs) in plant production
 - Use of hydroponics in plant production
-

GEORGESON BOTANICAL GARDEN

Patricia Holloway, professor of horticulture

- Protocols for propagation and cultivation of more than 100 Alaska native plants
 - Protocols for commercial field cultivation of lingonberry
 - Reproductive biology of Alaska's only endangered plant species, the Aleutian shield fern
 - Aleutian shield fern recovery
 - Databases for long-term horticultural plant research, evaluation, and conservation at the GBG
 - New crop opportunities for Alaska in field cut flower production
 - Establishment of the Alaska Peony Growers Association
 - Antioxidant levels in Alaska wild berries
 - Fate of antioxidants in frozen and processed wild berries
 - Protocols for field cultivation of Alaska wild berries
 - Effects of domestication on antioxidants and other nutraceuticals
-

ARS SHUTS THE DOOR ON ALASKA RESEARCH

Nancy Tarnai

WHEN THE USDA AGRICULTURAL RESEARCH SERVICE closes in Alaska (predicted for April 2012) the door will shut on a long history of research that won't be easily picked up by anyone else. From utilizing seafood waste to grasshoppers to controlling weeds and invasive plants, the work of ARS in Alaska is unmatched.

Due to the federal government cutting nearly \$40 million from the ARS national budget, twelve ARS stations were chosen for closure, Alaska among them. An ARS scientist housed at the University of Alaska Fairbanks recently pointed out his whiteboard filled with lists of unfinished projects. "There was so much I wanted to do," he said, shaking his head sadly. "So many things were still a work in progress."

The decision to close was made at the highest levels by the Department of Agriculture and approved by Congress. The scientists have accepted their fate. Some will retire; some will accept positions at other stations, but all are flummoxed by the edict. As of Nov. 18, 2011, the scientists were told to stop any new research and to concentrate on writing up current projects. In January Alaska's twelve ARS employees were given their new assignments, ranging from Louisiana to Idaho to Iowa to California. If they accept their new posts they are given ninety days to relocate.

Since ARS began operating in Alaska in 1948 (with a shutdown in the mid-1990s), it has developed more than forty cultivars of potatoes, barley, raspberries, and grasses. The scientists have endeavored to enhance the productivity, profitability, and environmental quality of Alaska's farming and fishing industries and natural resource areas.

A look at the ARS website reveals long-term research projects in aquaculture, particularly in fish processing byproducts, crop protection (pest management), prevention and control of invasive plants, plant diseases, plant genetics, and utilizing agricultural products.

"We tried to find out what the problems of the growers were and solve their problems through research," an ARS scientist explained. What are the minimum temperatures invasive plants will grow at? How can a land manager control white sweetclover? How can a Delta Junction grower deal with chickweed, foxtail barley, and shrubs encroaching on his crops?

How long does a certain herbicide last in the soil? "Without research on controlling invasive weeds, people will just try different herbicides and not know if they will harm subsequent crops," the scientist said.

ARS has had an important role advising the US Forest Service and the Bureau of Land Management on how to control invasive plants. They conducted research on controlling invasive bird vetch, white sweetclover, and orange hawkweed and studied their effects on native ecosystems. "We showed last year that snowmachines carry seeds of white sweetclover," a source said.

Another scientist said from the beginning ARS was concerned about feeding the state's residents. "Alaska was perceived to be pretty vulnerable in terms of food security," he said. In the early years research was devoted to developing grain and forage varieties, discovering potatoes that would work well in Alaska soil, figuring out which tomatoes and strawberries were best and what fertilizers to recommend. "It's been really important for developing crop varieties adapted to Alaska," he said. "A lot of farm practices for Alaska have been developed here."

Bebral rye field study conducted with ARS scientists at the Fairbanks Experiment Farm, 2009.



More research would have been conducted in a new greenhouse ARS recently constructed in Fairbanks. The \$1.2 million greenhouse and research complex on Geist Road, which opened less than a year ago, will be closed along with the rest of ARS facilities in Alaska. No decision has been made about the future of the greenhouse but options are being considered, including its use by UAF. Because it was built on leased ground it cannot easily be sold.

Especially important to grain farmers in Delta Junction was the work on no-till and reduced tillage systems, which helped prevent soil erosion. And in Palmer, the state's only gene bank exists under the ARS umbrella. Varieties of critical plants have been maintained, with seeds and cuttings from blackberries, raspberries, and rhubarb shared with growers. In 2010 alone 100 new peony clones were collected and the gene bank researchers identified a novel vitivirus in red and black currants, which led to screening hops, mint, currants, gooseberry, rhubarb, and honeysuckle accessions. Blueberry cultivar evaluation trials were conducted on the Kenai Peninsula.

Recently there has been renewed interest in food security throughout Alaska. "I had hoped that the USDA would see the importance of sustainable agriculture systems in all parts of the country, including Alaska, but it didn't happen," the scientist said. "The ARS administration was never convinced Alaska was an important place to do work even though we were the only site in the Sub-Arctic."

Now that the gene bank is being closed, along with the rest of ARS facilities, the plant and seed collections are being shipped to other stations around the country. For example, most of the accessions from the rhubarb collection will be dug up and shipped to Dr. Barbara Heller at the Pullman, Washington, location; she is now the curator of that collection. Ruby Peck-Hollembaek, a livestock rancher and rhubarb grower living in Delta Junction, commented on the impact that the closure of ARS will have:

Well, it is devastating for us Alaskans in the business of growing crops and produce like rhubarb for our own use as well as possible export. Losing that link between the agricultural industry and ARS leaves us having to communicate with a state that does not share the same climate or challenges as we do. The Alaskan rhubarb production is increasing. Folks were turning to the ARS [for] their expertise to assist us with cultivating a crop that we in Alaska have used for generations. It's a sad day in our Alaskan agricultural history to lose this link. Once again, Alaska is separated from the remainder of the Lower 48 states by another country with the best scientists heading out and away from a state that is beginning to know again how important growing local is, as was [true] years before during the homesteaders' and colonists' time. It's a sad day in Alaska's history.

Where will the Arctic and Subarctic Plant Gene Bank's germplasm go?

Although the Sub-Arctic Research Service unit of the Agricultural Research Service is closing and much of the collections and equipment shipping south, the materials from the unit's gene bank in Palmer will not all be leaving the state. Researchers around the state have obtained some of these plant species from the collections:

PALMER CENTER FOR SUSTAINABLE LIVING

Norm Harris: *Rubus* (raspberries and related plants), rhubarb, *Ribes* (currants, gooseberries, and related species), peonies, mint (about 500 plants, both mentha and mountain mint or pycnanthemum species), blue honeysuckle, blueberries

FAIRBANKS EXPERIMENT FARM

Pat Holloway: Strawberries, *Ribes*, rhubarb, peonies, apples

ALASKA DIVISION OF AGRICULTURE (PLANT MATERIALS CENTER)

Strawberries, *Rubus*, *Ribes*, peonies, *Juncus* (rushes), hops (*Humulus*), blue honeysuckle, blueberries, agronomic (grain) crops



Wasp, butterfly, and bee collections held at ARS, part of the insect collections that will now go to other institutions.

Fortunately, some plant accessions, including some of the rhubarb, will be transferred to the University of Alaska Fairbanks to the Matanuska Experiment Farm in Palmer and the Georgeson Botanical Garden at the Fairbanks Experiment Farm.

Another area of research was collecting wasps, flies, ladybugs and bees, studied for their pollination effect on plants, and pests such as aphids and leafhoppers to see what damage they did to crops. The extensive collection will be parceled out to museums, including the UA Museum of the North and the Smithsonian in Washington, DC.

Even cold climate construction has benefited from ARS research. From the early 1950s to 1960s, Dr. Ivan Branton, an ARS agricultural engineer who later worked for the University of Alaska, investigated the best ways to build in the north and discovered how to construct a vapor barrier to prevent moisture accumulation in building insulation.

In the past decade, Peter Bechtel's work in Kodiak in conjunction with the Fishery Industrial Technology Center brought an economic and educational boost to that area. Bechtel's research on fish processing byproducts brought in USDA funding for one-fourth of the FITC faculty funding and paid stipends for graduate students. Learning how to use fish byproducts for fertilizer cuts back on seafood waste

dumping and provides useful and available organic matter for agriculture. Losing the graduate students means a cut in research labor and a lack of well-trained people to enter the fishing industry workforce.

While the end of the research is painful, the economic impact may hurt too. According to ARS spokeswoman Sandy Miller-Hays in Washington, DC, for every dollar spent on agricultural research the country sees a return on investment of \$10. UAF graduate students will feel the pinch, as many have worked their way through school interning and researching for ARS.

"It has been a really rich history with a lot of benefit to Alaska," one of the scientists said. "If you eat Alaska-grown food, have a garden, have a lawn, have ornamental shrubs, flowers, or own a home (vapor barrier) you have benefited from USDA research."



(Editor's note: The scientists interviewed for this article requested anonymity as they are federal employees who believe that being named could be detrimental to their careers.)

FOOD DAY BEGINS WITH A BANG

story and photos by Nancy Tarnai

WHEN THE CENTER FOR SCIENCE IN THE PUBLIC INTEREST launched the idea for Food Day in 2011, officials there had no idea what kind of response they would get. Now they know that this will be an annual occurrence all over the country, comparable to Earth Day in scope and impact.

On Oct. 24, 2011, all fifty states hosted multiple Food Day events, including Alaska. At the University of Alaska Fairbanks, the School of Natural Resources and Agricultural Sciences Dean Carol Lewis spotted advance publicity about Food Day in late summer and announced, "Let's do something." That turned out to be an understatement, as UAF hosted a large community gathering featuring twenty exhibits, a Taste of Alaska, an Iron Chef cookoff, a film festival, lectures, and a Food Jeopardy game.

The goal of the CSPI in starting Food Day was to build a broad "real food" movement of Americans who want healthy, affordable, and delicious food produced in a sustainable and humane way. The Food Day website proclaims, "Food Day's goal is nothing less than to transform the American diet. In other words, we want America to eat real."

Lilia Smelkova, Food Day's national campaign manager in Washington, DC, had this to say about the event:

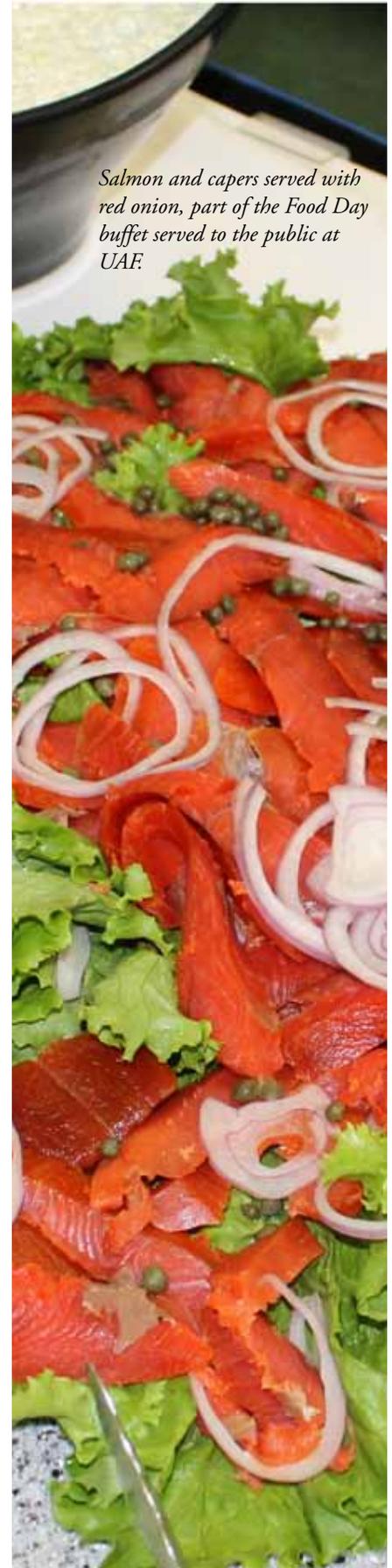
Food Day owes its success in large part to the unprecedented mobilization of national organizations around one campaign. Groups ranging from the American Public Health Association, to the Earth Day Network, to the National Education Association used their networks built by years of work and activism to publicize Food Day and encourage participation. More than 120 national and state partners dedicated resources and staff time to publicize Food Day. Food Day inspired new partnerships among diverse organizations involved in hunger, nutrition, sustainability, and farm worker justice.

As an annual event, Food Day will make the food movement more formidable, more united, and better positioned to fix the problems that plague our food system.

The six principles of Food Day are:

1. Reduce diet-related disease by promoting safe, healthy foods
2. Support sustainable farms and limit subsidies to big agribusiness
3. Expand access to food and alleviate hunger
4. Protect the environment and animals by reforming factory farms
5. Promote health by curbing junk food marketing to children
6. Support fair conditions for food and farm workers

Across the country from New York City's Times Square to Sitka, Alaska, more than 2,000 celebrations marked Food Day in as many variations as there were locations. Educational fairs, film fests, potlucks, and special restaurant menus marked the occasion. Schools used a special Food Day curriculum emphasizing the importance of



Salmon and capers served with red onion, part of the Food Day buffet served to the public at UAF.

eating real, fresh food; cutting back on processed foods; and advocating for a healthier community. In Detroit, Food Day menus were served to all public school students.

Closer to home, Alaska hosted events in Anchorage, Sitka, Homer, and Fairbanks. Anchorage restaurants served locally grown food, St. Elias Specialty Hospital held a celebration, and the Alaska Farm to School and Obesity Prevention Program hosted a carrot taste test at Rabbit Creek Elementary. Homer Flex High School had a “Root Roast,” a roasted root vegetable lunch supplied by local farmers. In Sitka, the Food Co-op held a benefit organic dinner and showed the film *Fresh* and the Slow Food Sitka group had a potluck dinner and slide show.

“It was all about healthy eating and supporting local, sustainable agriculture,” said Carol Lewis. “We were very pleased with the interest and excitement.” The events garnered the media spotlight from local television and radio stations, the UAF student newspaper the *Sun-Star*, and even the national website *about.com*. Fairbanks North Star Borough Mayor Luke Hopkins and Anchorage Mayor Dan Sullivan signed official proclamations declaring Oct. 24 as Food Day.

The celebration of National Food Day on the University of Alaska Fairbanks campus was a kaleidoscope of events co-sponsored by SNRAS, the Cooperative Extension Service, and the UAF Dining Services/NANA Management Services. Attendance was excellent.

After much collaboration between UAF’s Dining Services department and the campus food contractor, NANA Management Services, the morning of Oct. 24 kicked off with the “Iron Chef” Surf vs. Turf Cookoff Challenge, highlighting the culinary talents of Carol Lewis and Michael Castellini, dean of the School of Fisheries and Ocean Sciences. Naturally, the ag school dean prepared reindeer and the fisheries dean, shrimp. Both were assisted by professional chefs, Lewis with Michael Roddey of the Community and



Left to right: Iron Chef judges Sarah McConnell, LCSW, Program Manager/Faculty for the Troth Yeddha’ Nutrition Project of the UAF Rural Nutrition Services Program; Shelley McCool, sales manager for the Alpine Lodge and cable radio DJ; and Lavelle’s Bistro chef Tyler Skrivanek.



Below: Jerry Evans, left, presenting the Cookoff Challenge award, a birch spatula made by the Great Alaska Bowl Company, to School of Fisheries & Ocean Sciences Dean Mike Castellini. Castellini was assisted by professional chef Dave Sikorski, center, of NANA Management Services.

Technical College culinary arts program and Castellini with Dave Sikorski of NANA Management Services.

Judges had the tough job of deciding which chef would take home the Iron Chef birch spatula. It was a close call between the shrimp and Lewis’s reindeer. Based on appearance, taste, presentation, timeliness, and nutritional quality, the judges chose Castellini’s shrimp dish by a very narrow margin: a 1.5 point spread in a 150

point possible total. Judges’ comments included: “Yum. This reindeer is tender and tasty.” “It’s all fantastic.” “It’s all delicious.” “It’s a kaleidoscope of tastes.”

Tom Grant, SNRAS post-doctoral fellow, played game show host in a Food Jeopardy competition. The game was a heated competition between academics and farmers, with competitors answering questions about food, nutrition, and Alaska agriculture. Contestants included UAF faculty Bret Luick (SNRAS) and

Andrea Bersamin (Center for Alaska Native Health Research), and farmers Mike Emers, chairman of the Alaska Community Agriculture Association, and Jeff Johnson, cattle rancher and owner of HomeGrown Market. The winner, Bret Luick, received a beautiful basket of produce from ChenaFresh, a garden and greenhouse operation using the Chena Hot Springs geothermal springs as a power source.

More than twenty exhibitors, from the Alaska Community Agriculture Association to HomeGrown Market to UAF Cooperative Extension Service, displayed information and talked to attendees. The UAF Anthropology Society hosted lectures and films.

Perhaps the most popular segment was the Taste of Alaska, a feast of Alaska Grown food donated by farmers and prepared by NANA Management Services chefs. Taking grass-fed beef from the Matanuska Experiment Farm, cold-smoked salmon from Kodiak, and local agricultural products such as honey, lettuce, tomatoes, apples, potatoes, rutabagas, beets, cabbage, and carrots, the chefs prepared appetizers, soups, stews, roasted vegetables, and vegetable medleys. There was much buzz about the food and great interest and pride in the fact that it was all grown in Alaska.

At the end of the day, the team that put on the event knew they had better mark their calendars for the coming years: Oct. 24 as Food Day. After being very involved in Food Day, anthropology student and president of the UAF Anthropology Society, Azara Mohammadi, took one aspect of Food Day to heart. She is leading the charge at UAF for the Real Food Challenge, a national project aimed at improving the quality of food on college campuses. Mohammadi's goal is to evaluate the quality of food being served at UAF and campus food procurement. Following RFC's nationwide, standardized, comprehensive system, she hopes to present a student petition to the UAF Chancellor this spring, with the intent of having 20 percent local food on the table by 2020.



Top: Food Jeopardy panel, from left to right: Bret Luick, Mike Emers, Jeff Johnson, and Andrea Bersamin. Above: Ashley Nelson, right, Chena Fresh greenhouse assistant, presenting winner Luick with a bowl of fresh produce.

Food Day was a fun event but it may have a greater local impact by influencing the future of dining services on campus. Dave Sikorski, NANA's executive chef and assistant general manager, said what he liked best about Food Day was the teamwork it involved. His goals for the direction of campus food are better nutrition education, creating support for local growers, and working toward a sustainable financial business plan incorporating the new ideas for the long term.

"Food Day got me thinking about the future of dining services at UAF," Sikorski said. Soon UAF will begin planning a new dining facility, and because of Food Day Sikorski said he will suggest facets for the project that

will not only incorporate healthier food but that will last for the coming decades. These might include storage facilities for root crops or an area to grow hydroponic lettuce.

In the end adding local foods to the menu comes down to one key factor, Sikorski said. "It needs to be healthy food but it has to taste good too. It has to appeal to a large demographic."



Food Day then and now

Carol E. Lewis
SNRAS Dean and
Director, AFES

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AS SURPRISING AS IT MAY BE TO SOME, food actually comes from farms, not shelves. Separated from the country's bread basket by thousands of miles, Alaskans are in a precarious position concerning food. While some of us think about the production of food every day, others find it easy to shrug off these concerns as trivial. As long as there is food at the super store, why worry? However, if we wait a day or two to worry only after trucks, planes, and barges are stopped en route to Alaska due to weather or fuel crisis or natural disaster and food on store shelves is diminishing, will it be time enough then for everyone suddenly to show concern?

National Food Day was celebrated throughout the nation on October 24, 2011. The idea behind Food Day is to bring people together from all walks of life to think about their food, their eating habits, the producers of their food, and how food gets to their markets. It certainly was a success nationwide. There was a massive celebration in Times Square, a conference on food deserts in San Francisco, the serving of healthy breakfasts in Omaha, a food-safety wheel in Chicago, the building of raised bed gardens in Little Rock, and much more. In Alaska, we at the University of Alaska Fairbanks celebrated Food Day with events throughout the day featuring locally produced foods and local producers.

Though this past year's Food Day was billed as an inaugural event, it really was not. According to the Washington Post's blog post of October 21, 2011, the original Food Day was proposed thirty-six years ago to raise awareness of rising food prices, world hunger, and the declining quality of the American diet. Hoping to capitalize on the Earth



SNRAS Dean Carol Lewis and her reindeer cutlet, prepared for the Iron Chef Cookoff on Food Day 2011. In the background is School of Fisheries & Ocean Sciences Dean Mike Castellini, Lewis' competition. Lewis was assisted during the cookoff by professional chef Michael Roddey of the UAF Community & Technical College's Culinary Arts and Hospitality Program.

PHOTO BY NANCY TARNAI

Day movement, the founders of the original Food Day thought they could also draw attention to the increasing industrialization of the food supply as well as build awareness of potentially imminent health crises. The idea lost momentum after two years when backers grew short of funds and energy to promote it. According to an opinion piece in the Washington Post (October 17, 1975) authored by William Rice, the first Food Day was held on October 17, 1975, but it was held without congressional support for a Food Day resolution. Rice writes:

“The idea of Food Day has provoked charges and counter-charges from consumer-oriented groups and individuals on one hand, food producers and ‘establishment’ nutritionists on the other. ...[T]heir struggle and the controversy over various aspects of diet, food processing, farming techniques, food distribution and the role of government... are confusing and at times even contradictory.”

Rice refers to a number of controversies of the day including the inability of nutritionists to unite, lack of involvement of Americans in the creation and implementation of national food policy, lack of knowledge of human nutrition and its application, lack of commitment to educate ourselves, and a fundamental problem of an attitude of complacency. Rice's article concludes with the reason why we need a Food Day, true in 1975 and perhaps even more relevant today:

“We are what we eat, and therefore we must know better what we eat.”

It is becoming harder to know better what we eat. The agricultural industry continues to become a global production and market place. According to USDA Economic Research Service (ERS) predictions to 2020, despite declining birth rates globally, particularly in the developed nations, the world's population will continue to grow at an average of about 1 percent per year. However, developing nations continue to account for the largest share of the world's population. As economies

in these developing nations strengthen and urbanization continues, the growth of the middle class—a group that is typically younger—will be evident in an increasing demand for food as well as food with a greater diversity than is currently seen. Diverse foods consumed increasingly include animal protein. Russia is building its poultry and pork sectors and beef exports from Argentina, Australia, and Canada are predicted to increase.

Parallel to the increasing demand for a diversified food supply, USDA's ERS foresees the expansion in the US ethanol industry that is based in corn production. Land used for the production of corn for ethanol will not be used for food production. This short summary of the changing world of food supply and demand points to the world movement of a highly diverse array of foods from all areas of the globe. People do not necessarily have a propensity to learn about their foods or their foods' origins, and this global change toward urbanization and diversified foods will make it even more difficult for those who do want to know to learn about their food. The world supply chain is vast and complex. In addition to the difficulty in knowing about the food we eat, the risk involved in obtaining it in a timely and safe manner is also increased.

We, as Alaskans removed from the contiguous 48 states and a dependable food production and supply system, must definitely begin to know what we eat and perhaps the best way we can do that is to begin to use local products and to

increase the variety and amount of local products available. Local production will also decrease the very high risk Alaskans face if there should be a break in the chain of supply due to natural or human-caused disaster. If there is to be an increase in food supplies produced in Alaska, our state food policy and incentives must coalesce with this end in mind, including improving land availability; reasonable financing; better processing, marketing, and transportation systems; and support for new and existing producers alike. Without a positively reinforcing system there will not be an incentive for anyone to begin to farm or stay on the farm. To accompany the physical production and distribution system, it is absolutely critical that research to assure our food's quality and safety is continued, and that education and outreach is available so Alaskans can learn about the food they eat.

As aptly stated by Craig Gerlach, Professor of Cross Cultural Studies at the University of Alaska Fairbanks: "We've got to stop pretending that it's OK that at least 95 percent of our food, if not more, is not Alaska Grown. We have the potential in this state to grow a substantially higher portion of our food but we need the best and most effective integrated production strategies ... to make the system sustainable, and to put Alaska food on all Alaska tables." Continuing to celebrate Food Day to highlight our local producers and our local foods is a wonderful way to emphasize the importance of Alaska Grown.

There were more than twenty participants in the UAF Food Day event, with displays and information booths set up in the William Ransom Wood Center like the one below, for ChenaFresh. Food Day was also celebrated by the Downtown Association in Fairbanks.

PHOTO BY NANCY TARNAI



BUZZ KLEBESADEL

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LESLIE JOE “BUZZ” KLEBESADEL, eighty-three and an agricultural leader in Alaska, died Dec. 30, 2011. SNRAS Dean and AFES Director Carol Lewis said Les Klebesadel will be missed by all who knew him at the school and farm. “His work on forage crops in Alaska helped improve livestock production through better pasture conditions and new varieties,” she said.

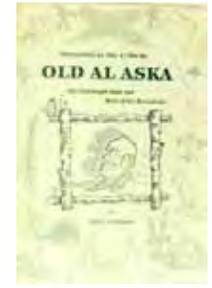
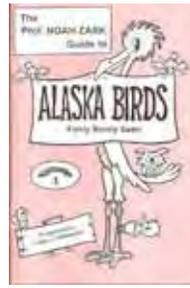
He was born Aug. 18, 1928, on a dairy farm in Wisconsin. In 1949 when he was twenty, Klebesadel first came to the Territory of Alaska after accepting an invitation from his uncle, Harlow Hodgson, to work at Palmer’s USDA Agricultural Experiment Station. Having then left Alaska to enroll at the University of Wisconsin Madison, he came back for the summer of 1953, then went on to earn his doctorate from UW in 1957 with honors.

While attending UW, Leslie met his future wife, Mary Jane Kleinheinz, after being seated alphabetically next to her in a physics class. They married Jan. 22, 1955, and due to his growing love for Alaska, he convinced Mary Jane to move to Alaska with him in 1957, suggesting it was just for two years—three years tops.

They settled in the Matanuska Valley and lived there the rest of his life, raising five children at their hilltop home near Palmer. He dedicated his career to expanding the world’s knowledge of adapting forage crops to northern latitudes, for both individual and global benefit.

Klebesadel served as the first director of Palmer Community College and later taught courses there after it became Matanuska-Susitna College. He authored more than 90 scientific publications and co-authored 20 more. He retired in 1987 as University of Alaska Professor Emeritus following thirty years of research on forage crop management, adaptation to northern climates and plant physiology with the university and US Department of Agriculture.

From an early age, he enjoyed illustrating. With an aspiration to become a professional cartoonist, he worked to refine his illustrating and writing abilities. He had always been intrigued by how striking the map of the state of Alaska resembled the side view of a man’s face. From that, the character “Old Al Aska” was conceived; a Sourdough-styled character epitomizing and giving tribute to that group of “old timers” and pioneers of early Alaska. An “Old Al Aska” cartoon and poetic-story were published weekly in the early *Frontiersman* newspaper editions for several years during the 1960s. Those cartoon-stories eventually were compiled in books, *Observations on This ‘n’ That by Old Al Aska* and *The Sourdough Sage and Bard of the Boondocks*. In recent years,



he penned two more comedic-themed books, including *The Prof. Noah Zark Guide to Alaska Birds Fairly Rarely Seen*.

Klebesadel also felt that Alaska should celebrate an event exemplifying the long days and perpetual sunlight Alaskans get to enjoy. As such, he and some associates created the Mid-Summer Festival in 1971. The theme he created to celebrate the event was the story of “Grotto-Lunkers,” semi-mythical creatures awakened annually on the longest day only to congregate in Palmer before returning to slumber.

Klebesadel loved Alaska, which can be best shown by borrowing a few lines from a poem in his *Old Al Aska* book titled “Thanksgiving:”

We’re thankful now fer folks whose
vision laid this land’s foundations,
Whose sacrifices built it to the finest of the nations,

There’s so much that we’re thankful
fer - if all the things were told,
By the time I finished half the list,
my dinner’d sure be cold!

So, briefly, thanks fer Pilgrims long ago an’ far away,

An’ thanks fer this here moose roast
a steaming here today,

An’ thanks fer all the care Ya give,
whether or not we ask Ya,

An’ last of all, but best of all, thank Ya fer ALASKA!

He is survived by his wife of fifty-six years, Mary Jane; and all their children, their spouses and grandchildren, Lani, Dan (Janet, Amy and Shauna), Jim (Lindell, Hannah and Emma), Bill (Lucy, Jennifer and Danielle) and Tom (Dylan, Morgan and Rayanne). A memorial service was held Jan. 5 at United Protestant Church in Palmer. Anyone desiring to contribute in his honor is encouraged to make a donation to a charity of their choice. He would appreciate knowing that others “down the trail” would be able to benefit in some way by his life’s impact on others.



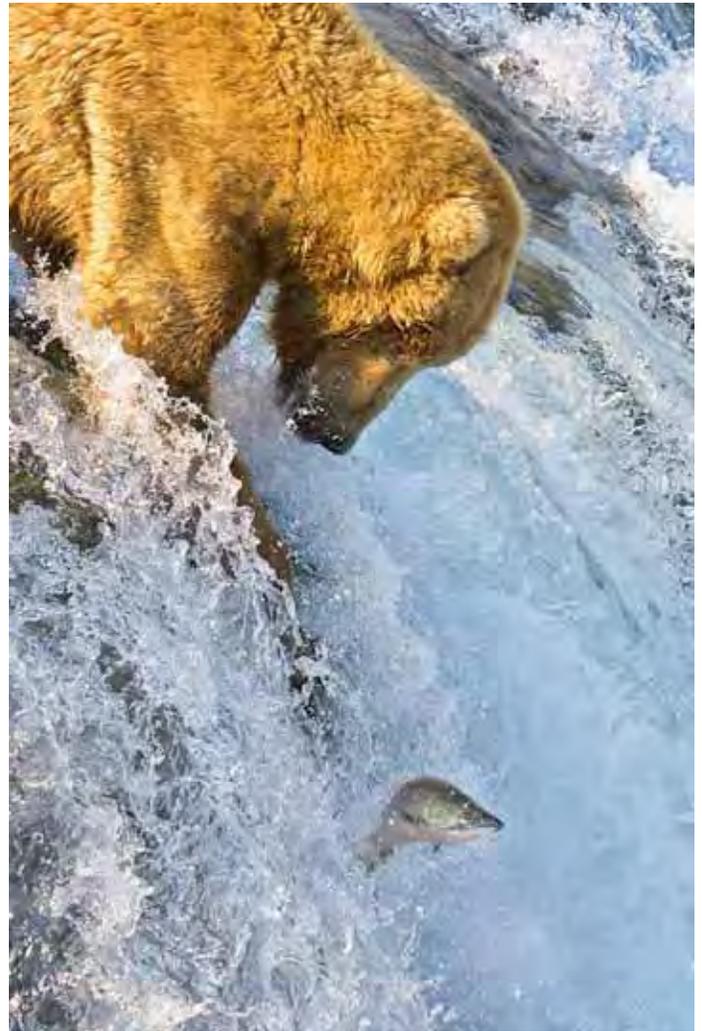
FISHERIES AND FOOD SECURITY IN ALASKA

by Philip A Loring and Hannah L. Harrison

ANY DISCUSSION OF FOOD SECURITY in Alaska is incomplete without at least some attention to the current and potential role of fisheries. For thousands of years, coastal and living marine resources have provided a keystone for the cultural, economic, and environmental health and wellbeing of Alaska's people and communities. Today, Alaska's commercial fishing industry creates over \$5.8 billion in direct and indirect economic outputs, and provides over 50 percent of the United States' wild landings. Fishing and fishing-related industries also employ more workers in Alaska than the oil, natural gas, and mining industries combined, and rank third for total economic value behind North Slope oil and the federal government. Likewise, noncommercial fishing activities continue to be of utmost importance to rural and urban communities across the state: "bush" communities both in Alaska's coastal zone and inland rely on salmon and other fish for much of their yearly food supply, and many urban households in the greater Fairbanks and Anchorage areas share a valued tradition of dip-netting for salmon on the Copper and Kenai rivers.

Visitors to the state are repeatedly reminded of the deep connections between Alaskans and the marine environment by the ubiquity of cultural arts, artifacts, and marketing materials themed on fish and fishing. The so-called "deadliest catch" lifestyle of commercial crab fishing is firmly seated in American pop culture, and many visitors to the state fly on Alaska Airline's larger-than-life "Salmon-Thirty-Salmon" jet, a Boeing 737 that has had its fuselage painted to look like an enormous king salmon. Alaska's fisheries are also widely heralded as sustainable, an image that the Alaska Seafood Marketing Institute (ASMI) markets extensively through their "Wild, Natural, Sustainable" campaign. To date, four of the five major commercial fisheries in Alaska—salmon, halibut, black cod (sablefish), and Alaska pollock—have been certified by a third party as meeting the UN Food and Agriculture Organization's code of conduct for responsible fisheries. The fifth—crab fisheries—is still in the process of being certified, a process expected to be complete before the end of 2012.

However, the colorful images of rugged-yet-thriving people and communities that adorn ASMI's marketing



Grizzly bear (Ursus arctos horribilis) fishing at Brooks Falls, Katmai National Park, July 2009.

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materials betray a more complicated reality characterized by high and growing rates of food insecurity, rural economic decline, and domination of the commercial fishing industry by international corporations and export markets. While it is true that many people in Alaska make their living through fishing, it is hard not to find contradictions when contrasting the gains of a \$5.8 billion food industry with rural food insecurity rates that range between 15 and 30 percent of the population. While the average rate for the state is below the national average for food insecurity, 13.5 percent in Alaska compared to 16.6 percent for the rest of the country, new research with both rural and urban residents suggest that actual rates may be higher, and bring into question institutional methods for assessing whether people are sufficiently fed. In rural communities, challenges such as climate change and rising oil prices are undermining people's ability to consistently put high-quality, culturally preferred subsistence foods on the dinner table; in their stead, one often finds the low-quality, industrially processed and packaged foods that dominate the shelves of village stores. The resulting impacts on the biophysical and psychological health status of rural residents of this dietary transition away from traditional foods and toward the so-called "western diet" are well documented, and were not entirely unanticipated by early health researchers in the state. As more and more people move out of the "bush" to more urban areas such as Fairbanks and Anchorage for a number of socioeconomic reasons that include the high costs of food, fuel, and the paucity of healthcare options, the strain on food banks and other local social services is higher than ever.

Perhaps not surprisingly, the current status and management of many of Alaska's fisheries are hotly contested issues. While many Alaskans, as noted, rely on Alaska's wild seafood in many ways, far fewer Alaskans agree on the fairness of how these fisheries are managed, or on the appropriate allocation of catch among commercial,



Figure 1. The food system, including multiple stages of the "food chain." Local people, when they have the best available information, can influence their food system from within through their purchasing power and also through social channels to influence others. Likewise, existing food system governance, in the way of food safety policies, trade policies, etc., also condition the structure and function of food systems from the outside in.

sport, and personal/subsistence use stakeholders. Bitter and longstanding conflicts between these groups are common. For instance, in Cook Inlet fishermen's associations on all sides grapple for the favor of the state Board of Fisheries, a political body, the appointed members of which decide how to allocate salmon harvests among stakeholders, but face the impossible challenge of accommodating political will (which currently favors the personal-use and sport groups) while not compromising the biological sustainability of the salmon population. Likewise, obligations to Canada and state mandates for management have on multiple occasions seemed to be in conflict with the food needs of rural residents on the Yukon River. For these and other reasons fisheries management

in the state appears to some stakeholders to be ultimately driven more by politics than by biological or social justice concerns.

Building salmon foodsheds

Setting aside the debate regarding the sustainability of Alaska's various fisheries management regimes, the question remains as to what role Alaska fisheries can and should play in improving the food security of Alaskans. Much is made lately of the need to improve the sustainability and self-reliance of Alaska communities through improvements to local food systems. A premise of these small-scale alternative food system movements is that developing local food production systems for local consumption will strengthen the system's sustainability

and security. Alaska fisheries provide for a significant amount of the earned wealth and consumed protein in the state—but how are these benefits distributed among Alaskans? Currently, one is hard-pressed to purchase fresh, locally caught seafood in Alaska; even in such iconic fishing communities as Homer, the self-described halibut capital of the world, local grocery stores do not offer a seafood counter. The commercial fishing industry in places like Homer has developed around national and global rather than local markets. It remains a question as to the proportion of local peoples who are excluded from the benefits of locally caught seafood because they lack the time, resources, or social connections through which to procure fish by barter and trade, but anecdotal reports suggest that a lack of access is more prevalent than one would expect.

Enter the foodshed concept¹ (modeled loosely after the concept of the watershed), which we propose using as a design principle for rebuilding Alaska's community health and security; specifically, to leverage locally caught seafood toward the further strengthening of food security in Alaska. A premise of the foodshed is that healthy communities thrive in healthy ecosystems; the corollary is that degraded ecosystems can degrade human communities through a number of pathways: by reducing local control over the quality, safety, and appropriateness of food; by increasing dependency on the global food and fuel network; and by increasing vulnerability through external linkages in the food chain that expose local systems to increased risk and uncertainty. With a foodshed approach, we can improve self-reliance by putting governance of the food chain in local hands, beginning with food production and harvest, through processing, transportation, marketing, consumption, and waste management (Figure 1). A level of local food production is often implied by those who invoke the foodshed concept (e.g., via small-scale agriculture), though critics often overstate this aspect, and the 'local' aspect of the foodshed is concerned less with the actual locus of production than it is with the geography of control. Thus, criticisms of foodshed and local food strategies are often inaccurate; the assertion is not that a global food system is *incapable* of delivering safe and nutritious food, but that greater localized control over the food chain espouses greater checks and balances over health, safety, and the stewardship of natural resources. This includes having the authority to ensure that local citizens are fed before local food resources are co-opted for export.

We are examining local food procurement strategies in the communities of the Kenai Peninsula and the fisheries of Cook Inlet, which, as noted, are well known as centers of fishing and the fishing industry in the state. The Kenai Peninsula can

provide a microcosm for understanding the rest of the state; while lacking in the extreme socioeconomic and ecological conditions of some of Alaska's most remote places, the Kenai Peninsula nevertheless shares a number of characteristics with the state at large, including communities both on and off the road system, economies heavily dependent on fisheries, tourism, and (now) possibly off-shore oil development, distinct and important clusters of Alaska Native and Russian peoples, a high diversity of habitat types from estuaries to river basins to glacial fjords, extensive federal landholdings, and a single supply route from peninsula communities to Anchorage. Using the Kenai Peninsula as a scaled-down model for Alaska, we hope to diagnose the unwieldy statewide issue of food security within a more manageable frame, and assess the more nuanced issue of the role of local seafood. Questions of interest include whether social justice and environmental sustainability concerns are being achieved through participation in the local harvest and production of food, and we have deployed a peninsula-wide survey to capture on both qualitative and quantitative terms the contribution of fishing activities and locally caught seafood to household food security. While a tremendous proportion of peninsula residents appear to participate in local fisheries, preliminary evidence from this research suggests that a surprising and noteworthy percentage of the local population may lack regular and reliable access to locally caught seafood. Likewise, there appears to be a significant level of uncertainty among residents as to whether the salmon populations on which they subsist so heavily are being managed and harvested in a way that will sustain them in the long term. Both findings, should they prove valid, will beg hard questions about the purported profits of local food systems, questions that will spin off multiple new hypotheses about the roles of food policies, infrastructure, and management approaches in determining the extent to which salmon foodsheds can make for a stronger Alaska.

“Teach a man to sell fish, and feed a community”

Our intuition suggests that what the Alaska food system lacks when it comes to supporting food security is a robust infrastructure for processing, marketing, and distributing food locally. Here, we mean *infrastructure* in the broad sense, to include policies that support a farm-to-table or dock-to-table philosophy, distribution and value-adding infrastructure geared around small-scale rather than industrial production, and legitimate capital investments from both the public and private sectors to boost the standing of local peoples who compete for these foods in an affluent global market. The infrastructure of the local food cycle can be strengthened from the inside through practices such as education, sharing, and commensal celebration, and from the outside through supportive and collaborative governance. 'Building salmon foodsheds' as a narrative would leverage the charismatic and

1. The foodshed is a design concept for building local food systems based loosely on the concept of the watershed, which geographically describes the movement of water across the landscape in a river basin. The foodshed metaphor is intended to insinuate a localized geographic range within which foods are produced, processed, distributed, and procured.

totemic nature of salmon as well as the individualistic and self-reliant character professed by so many Alaskans toward developing these infrastructures. There are several exciting and ongoing projects that fall within this narrative, and aim to improve the presence of locally caught and grown foods in the Alaska marketplace. These include farm-to-school and fish-to-school programs that focus on making our schoolchildren, a group that is currently among the most food insecure in the state, the first beneficiaries of food systems innovation (see e.g., http://dnr.alaska.gov/ag/ag_FTS.htm). Taking a cue from the extremely successful business model of community supported agriculture, some fishermen are also experimenting with community supported fishing (CS-Fish or CSF). These programs are creating new spaces for insinuating food systems reform at the state and community level, and also for developing the beginnings of the civic apparatus necessary for ensuring food security for all Alaskans.

If the adage, “teach a man to fish, and he will eat for a lifetime,” is to be understood as a lesson of individual empowerment, then our revision, “teach a man to sell fish, and feed a community,” is a lesson of sovereignty and sustainability. Alaska fisheries have undergone multiple complex ecological and sociopolitical transitions in the last few hundred years, and some of those transitions are continuing. While the managers of these fisheries can claim many successes, there remains room for improvement. It is our firm belief that it is possible to build salmon foodsheds in Alaska in a way that enriches our peoples and strengthens our communities, without sacrificing responsible management or important commercial activities. Alaska has a globally recognized track record for setting the standard for fisheries management, and as such is particularly well situated to once again lead the world in developing fisheries and food system governance that ensures outcomes of food security and environmental justice.



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SEED LIBRARIES: SEED-SHARING ON A COMMUNITY LEVEL

Deirdre Helfferich

WHAT BOOK LIBRARIES DO FOR READERS, seed libraries do for gardeners. A seed library is like a regular library, but instead of checking out books or movies, patrons “borrow” seeds. Obviously, once planted, those particular seeds won’t be coming back to the library, so borrowers “return” seeds by letting a few of the plants from their library seeds fully mature, and then they harvest, save, and bring back seeds from that next generation to the library, where next season’s patrons can check them out and continue the cycle. In this way, a seed library and its members help to preserve heirloom varieties of garden plants, improve the strain for the local conditions, and keep the seed library’s collection fresh and replenished.

Seed libraries differ from seed banks in that their focus is on sharing seed, rather than preserving seed or conducting research with plant germplasm. Seed banks are a specialized type of gene bank, of which there are approximately 1,400 worldwide,¹ possibly as many as 1,700,² depending on how they are defined. Gene banks are genetic repositories designed to preserve valuable materials for future generations, a living museum of dormant or frozen materials, and may include animal tissue or wild plants, as well as domesticated agricultural species and varieties.

The now-famous Svalbard Global Seed Vault in Norway, established in 2008, is a special example, rather like a financial reserve bank that insures other banks in the system: it is a repository designed solely to act as a backup for other collections around the world in the event of war or other disaster. The depositors to the vault own their seeds, just as bank account holders of safety deposit boxes own the contents of their boxes:

The depositors will retain their rights over the seeds. There will be no way that Svalbard Global Seed Vault, or Norway can give access to the seeds without consent from the depositors. The seeds will be returned to the depositors on request. (www.nordgen.org/sgsv/)

Unlike the Svalbard vault, most seed banks are parts of larger germplasm collections or networks that are associated with universities or agriculture agencies (for example, the USDA’s National Plant Germplasm System of the National Genetic Resources Program, which has germplasm repositories throughout the country, including, until recently, the Arctic and Subarctic Plant Gene Bank in Palmer [see story p. 36]). Other internationally renowned seed banks include the Millennium Seed Bank Partnership,³ which focuses on wild plants and has the goal of saving every

1. “Food Ark,” by Charles Siebert, *National Geographic*, July 2011, 220(1), p. 126 or on line at <http://ngm.nationalgeographic.com/2011/07/food-ark/siebert-text>.

2. “How Seed Banks, Vaults and Exchanges Are Saving Our Food From Disaster”, by Ari LeVaux, *AlterNet*, May 27, 2011. On line at www.alternet.org/food/151087/how_seed_banks_vaults_and_exchanges_are_saving_our_food_from_disaster/.

3. Kew Royal Botanical Gardens, www.kew.org/science-conservation/save-seed-prospect/millennium-seed-bank/index.htm.



Above: Tiger's eye beans grown by Keri Kiefer at Lake Merritt Community Gardens in Oakland, California. Middle: Biblioteca de semillas sign from the César Chávez Branch seed library of the Oakland Public Library, California; bottom: drawers full of seeds at the César Chávez Branch.

PHOTOS BY KERI KIEFER OF SEEDFOLKS COMMUNITY SEED LIBRARIES



plant species in existence; and the Vavilov Institute of Plant Industry's Pavlovsk Experimental Station, the world's first seed/plant germplasm bank (founded 1926), and which faces an uncertain future due to a real estate development project (suspended for now).⁴ Seed banks typically provide seed to a select group of researchers.

Seed lending libraries, on the other hand, tend to be small, local educational institutions or programs that lend to their members or the general public. They concentrate on their area's needs, refreshing and expanding agricultural biodiversity and knowledge by encouraging their patrons not only to check out seeds and grow them, but to learn about seed saving and other agricultural techniques, food security, nutrition and health, food sovereignty and democracy, agricultural history, biodiversity (see p. 53), and related topics. To develop their collections, they may initially buy seeds or solicit donations of seeds from commercial or institutional sources, but they usually rely on contributions from their members to maintain and expand their offerings.

4. See Gary Paul Nabhan's book on this institution, *Where Our Food Comes From: Retracing Nikolay Vavilov's Quest to End Famine*. More on Nabhan's books and on food origins may be found at www.garynabhan.com.

Most seed libraries offer workshops and gardening tips, and have books and other resources that their members can use. Some are free, some have fees associated with them. Many have outspoken stances against genetically modified organisms (GMOs) and variety patenting, agribusiness consolidation or commodity trading, and so on. Most tend to support local preference purchasing, organic agriculture, permaculture, small-scale farming, and farmers' markets. Preservation of agrobiodiversity; concern for the environment, genetic erosion, and sustainable agriculture; continuance of cultural traditions and knowledge relating to agriculture, food and cuisine, and traditional medicine and arts; and improvement of community resilience, food security, health, and local autonomy are often driving reasons behind why their founders established seed lending libraries in the first place. These major areas of concern—environmental health, the extinction of species and agricultural variety, human health, the local economy, and local or traditional culture—are themes which pervade the offerings of seed libraries throughout the country. (See sidebar opposite, 10 Great Things About A Seed Library!)

Poster on how one borrows seeds.

IMAGE COURTESY RICHMOND GROWS SEED LIBRARY



Ten Great Things About A Seed Library!

Adapted slightly from the Seed Library of Los Angeles website, <http://slola.org>.

1. **A far wider variety of seeds can be kept fresh** by many people growing rather than one person growing in one garden. We all gain when we combine our efforts.
2. **Participants can save hundreds of dollars** each season by growing their own food and saving their own seed.
3. **A seed library ensures we have a food supply that is reproducible**, local, uncontaminated by unproven genetic modification, and free from external controls.
4. Our seed library is focused on varieties ideal for home gardeners (full flavor and variety in a small garden) rather than commercial varieties, which often sacrifice flavor and personality for the sake of uniformity and durability for shipping.
5. Over time **the plants will change in response to our local climate and soil**, and gradually will become better seeds for our area.
6. We get to hang out with other **like-minded gardeners!**
7. Growing our own food and saving our own seed **continues the fine American tradition of self-reliance.**
8. **Gardening nourishes the soul as well as the body**, and is a great source of relief from the chaos of urban life.
9. As caretakers of seeds, we cooperate with nature in carrying on priceless genetic material for future generations. **Seeds are a sacred trust** passed down to us by our ancestors. The seed library helps us to best honor that gift.
10. By growing a plant from seed, eating its fruit and returning it back to seed, **we become fully engaged in the rhythm of nature**, grow more attuned to the world around us, and gain a deeper understanding of our own place in the web of life.

While seed exchanges are a traditional part of gardening,⁵ true seed libraries or lending programs at public libraries are, for the most part, a very new phenomenon. The oldest seed library in the United States is BASIL, the Bay Area Seed Interchange Library, located in Berkeley, California, and established by the Ecology Project in May 2000 by Sascha DuBrul. It is a good example of the aims of many such seed-sharing projects and programs:

[BASIL] is a community based urban seed project committed to disseminating and celebrating local varieties of seed stock and raising awareness about the importance and relationship between biological and cultural diversity... [It] is an urban gardening community resource in the spirit of Food Justice and Local Empowerment. (www.basilseedlibrary.org)

The BASIL project was unique for many years, but in the last two or three, an extraordinary explosion of similar efforts has resulted in their establishment across the country: there are now seed libraries in at least twelve states, from California to Connecticut, New Mexico to Illinois, Florida to Alaska (see p. 55). Richmond Grows, the seed library program of California's Richmond Public Library,⁶ lists thirty-four (not including itself) seed lending libraries throughout the country. Almost all were founded in the last two years. Richmond Grows was founded in 2010, and as part of its mission assists others to establish seed libraries by providing information and a model to work from. This is also a goal of Growing Ester's Biodiversity, the seed library in Alaska.

Seed libraries exist in myriad forms, ranging from fee-based memberships in gardening clubs that host seed swaps to full-fledged public library or museum programs with associated seed collections and educational workshops and lectures to seed banks or companies offering "seed schools." Now, some seed banks are offering seed lending programs to the general public, such as Arizona's Native Seeds/SEARCH, enlisting the public's help in preserving and propagating rare varieties of agricultural species.

The Jane Addams Hull-House Museum Heirloom Seed Library, in Chicago, explains the connections behind seed saving, heirloom seeds, their historical background, and the sustainability of seed saving:

5. Informal seed swapping between friends, for example. Larger, more formal exchanges have developed in more recent decades: one of the largest, Seed Savers Exchange, was established in 1975. See the lists of seed exchanges, swaps, and societies available at Primal Seeds (www.primalseeds.org/seedexchange.htm) and the Heirloom Vegetable Gardener's Assistant (www.halcyon.com/tmend/exchanges.htm).

6. Richmond Grows Seed Lending Library is an independent 501(c)(3) organization but is supported financially by Urban Tilth, and is housed in the Richmond Public Library, which is part of municipal government, thus embodying the effort of four public-spirited organizations.

Seed saving is the most secure way to ensure sustainable food systems and healthful food access. By adapting this habit of conservation we are not only fostering biodiversity, but the notion of multiculturalism as well. Saving and planting seeds allows us to gather and conserve what we share culturally: food. Food access is an extensive issue that we currently face. Do we know where our food comes from? Do low-income families have the resources to obtain healthy food? The Seed Library can become a beacon in addressing these issues, while considerably weeding out existing problems. ... Heirloom seeds are similar to family heirlooms. Like family heirlooms, heirloom seeds have been passed down from generation to generation. ...As a Jane Addams' Hull-House Seed Library, we aim to not only provide seeds, but a historical background of each plant. By documenting the seeds' journey from the original farmer to a seed borrower to the plot of dirt, there is an appreciation and comprehension of what heirloom signifies. ... We ask that each seed borrower document their process from planting to fruition through pictures or even in an urban farming diary.

Is there an alternative to purchasing food from big name grocery stores that conserves the unique spirit of neighborhoods, conserves the remaining diversity of our planet's seed stock, yet conforms to modern urban living? The mission of the Hull-House Heirloom Seed Library emulates Jane Addams' belief that healthy food access would lead to more peaceful communities. Not only will the Seed Library promote a healthier democracy, but a more sustainable world.⁷

As described by the Hull-House, the connections between human society and biodiversity are intimate. Seed libraries are one way that people can empower themselves and their cultures, through their food.



Resources

Nonprofit seed banks/catalogues:

Bountiful Gardens: www.bountifulgardens.org

J.L. Hudson, Seedsman, a public access seed bank: www.jlhudsonseeds.net

Thomas Jefferson Center for Historic Plants: www.monticello.org/site/house-and-gardens/thomas-jefferson-center-historic-plants, www.monticellocatalog.org/outdoor---garden-plants---seeds.html

7. From the Jane Addams Hull-House Museum Seed Library's About page at www.uic.edu/jaddams/hull/_programmevents/_kitchen/_seedlibrary/about.html.

Seed initiatives, societies, and other organizations:

Hawai'i State Public Seed Initiative: <http://kohalacenter.org/publicseedinitiative/about.html>

Native Seeds/SEARCH: www.nativeseeds.org (now also includes a seed library)

Organic Seed Alliance: www.seedalliance.org

Permacouture Institute: <http://permacouture.org>

Primal Seeds: www.primalseeds.org

Seed libraries:

Bay Area Seed Interchange Library: www.basilseedlibrary.org (blog), www.ecologycenter.org/basil/

Demeter Seed Saving Consortium: www.demeterseedsproject.org

General Economy Exquisite Exchange: <http://generaleconomyexquisiteexchange.blogspot.com>

Fairfield Woods Seed-to-Seed Library: <http://seedlibrary.wikispaces.com/%2A+Home>

Growing Ester's Biodiversity: www.esterlibrary.org (in Ester, Alaska)

Jane Addams Hull-House Museum Heirloom Seed Library: www.uic.edu/jaddams/hull/_programmevents/_kitchen/_seedlibrary/seedlibrary.html

Lopez Community Land Trust Seed Security Initiative and Seed Library: www.lopezclt.org/seed-library-2/

Lyons Farmette Seed Library: <http://lyonsfarmette.wordpress.com/lyons-seed-library/>

Philadelphia Seed Exchange: <http://phillyseedexchange.wordpress.com>

Pima County Public Library: www.library.pima.gov/about/news/?id=3722

Richmond Grows: www.richmondgrows.org

San Francisco Seed Library: www.sfseedlibrary.org

Seed & Plant Sanctuary for Canada: www.seedsanctuary.com

Seedfolks Seed Library (Oakland Public Library): www.theseedfolks.org

Seed Library of Los Angeles: <http://slola.org>

Seeds of Diversity: www.seeds.ca/en.php

SPROUT Seed Library (Oakland, California): on Facebook

West County Community Seed Exchange: <http://westcountyseedbank.blogspot.com>

Other:

Internet Directory for Botany: www.ou.edu/cas/botany-micro/idb-alpha/botany.html

Our Seeds seed library wiki: <http://ourseeds.wikispaces.com/>

Why is agricultural biodiversity important?

Biodiversity, or biological diversity, is the variation of life forms within a given ecosystem, biome, or over the entire planet. Biodiversity is a measure of the health of ecosystems; plant, animal, and microorganism biodiversity is absolutely essential to the survival of life on Earth. It is not like having extra pairs of shoes: we can live without shoes, but we cannot live without the myriad life-sustaining services provided by the complexes of living things around us—and of which we are a part. Examples of these ecosystem services include cycling and purification of water, air, and soil; stabilizations in the form of disease and pest control, flood and storm mitigation, carbon sequestration, and erosion control; the habitats created by ecosystems, and the genetic library of biological information that represents the enormous range of solutions created by life to environmental challenges; translocation processes such as pollination and the dispersal of seeds; and finally the physical and emotional wellbeing created by aesthetic and recreational beauty of the living world (this last, it is important to note, is not merely an extra benefit—there is scientific evidence that it is indeed intrinsic to health).

Biodiversity may be divided into three basic types: **genetic diversity**, or the diversity of genes in a given species; **species or population diversity**, or the variety of living things in a given area or biome such as rainforest, reef, desert, or tundra; and **ecological diversity**, or the complexity and richness of an entire ecosystem. Since life began on Earth, five major mass extinctions have led to large and sudden drops in biodiversity. These are: the Carboniferous Rainforest Collapse (this was 305 million years ago, and left behind the great oil and coal deposits we are burning today); the Permian-Triassic extinction event, or Great Dying (251 million years ago, which wiped out most insects and marine species); the Cretaceous-Paleogene extinction event (65 million years ago, marking the extinction of the dinosaurs); and the Holocene extinction (from 10,000 BC and happening now: the reduction in species is caused primarily by human impacts, particularly habitat destruction, and climate change, and includes the extinction of the Ice Age megafauna).

Agricultural biodiversity, or **agrobiodiversity**, is one small aspect of biodiversity, but is vital to humanity. It is the diversity of living things used and cultivated by humans, for food, transportation, medicines, dyes, fiber, animal fodder, clothes, shelter, protection, fuel, and cosmetics. “Of all the myriad species of plants or animals whose products can be useful to humans, agriculture utilizes directly only a few hundred. Among those, just 80 crop plants and 50 animal species provide most of the world’s foods.”* These few species (and therefore us) depend heavily upon hundreds of thousands of other, nonagricultural species (such as soil or intestinal microorganisms, plant pollinators or fungi



Richmond Grows Seed Library collection: drawers of different varieties of vegetables, rated by the ease with which borrowers can save the seed (Super Easy, Easy, and Difficult).

dispersants, or pest or disease predators). Agriculture, marine and freshwater food resources, and wild game and plant resources depend fundamentally upon biodiversity to remain strong and to resist disease, drought, flood, weather variability, climate change, and other trauma. The Food and Agriculture Organization of the United Nations** describes agrobiodiversity as

“the result of natural selection processes and the careful selection and inventive developments of farmers, herders and fishers over millennia.... Agrobiodiversity is the result of the interaction between the environment, genetic resources and management systems and practices used by culturally diverse peoples, and therefore land and water resources are used for production in different ways. Thus, agrobiodiversity encompasses the variety and variability of animals, plants and micro-organisms that are necessary for sustaining key functions of the agro-ecosystem, including its structure and processes for, and in support of, food production and food security (FAO, 1999a). Local knowledge and culture can therefore be considered as integral parts of agrobiodiversity, because it is the human activity of agriculture that shapes and conserves this biodiversity.”

The FAO lists several distinguishing features of agrobiodiversity:

- it is actively managed, by both male and female farmers—local knowledge and culture are integral parts of this management;
- many components of agrobiodiversity would not survive without human intervention;
- many economically important agricultural systems are based on ‘alien’ crop or livestock species introduced from elsewhere, creating a high degree of interdependence between countries for the genetic resources on which our food systems are based;

- diversity within species is at least as important as diversity between species;
- because of the degree of human management, conservation of agrobiodiversity in production systems is inherently linked to sustainable use.

The destruction of natural habitats, air and water pollution, and the standardization of plant and animal strains are the major threats to agricultural biodiversity. So, too, is the destruction of cultures: local and specific knowledge of the use and care of plants and animals is as important as the agricultural products themselves. The Green Revolution, which increased productivity, accelerated the current great extinction dramatically in human terms, affecting agrobiodiversity adversely through decreased genetic variability and contributing to the degradation of the environment and natural resources upon which agriculture depends, damaging water, soil, and air—and even the resulting food itself—from the chemical input of hormones, antibiotics, pesticides, fertilizers, herbicides, and other treatments.

The world's dominant cultural attitude toward living things and the globalization of the food system have likewise affected agrobiodiversity: “The extension of industrial patenting, and other intellectual property systems, to living organisms has led to the widespread cultivation and rearing of fewer varieties and breeds.” According to the FAO, for example, “Since the 1900s, some 75 percent of plant genetic diversity has been lost as farmers worldwide have left their multiple local varieties and landraces for genetically uniform, high-yielding varieties.” This shrinkage of food diversity has had other effects:

- changes in farmers’ and consumers’ perceptions, preferences, and living conditions;
- marginalization of small-scale, diverse food production systems that conserve farmers’ varieties of crops and breeds of domestic animals;
- reduced integration of livestock in arable production, which reduces the diversity of uses for which livestock are needed; and,
- reduced use of ‘nurture’ fisheries techniques that conserve and develop aquatic biodiversity.

In modern agriculture, agrobiodiversity is maintained off-farm, in gene banks or with breeders’ materials. Gene and germplasm banks were initially created for research purposes to improve varieties, but have transformed to become preserves of biodiversity—museums, in essence, such as the Svalbard Vault. In one way, this has had the perverse effect of actually contributing to the loss of agrobiodiversity: the FAO describes “the main cause of the genetic erosion of crops—as reported by almost all countries—is **the replacement of local varieties by improved or exotic varieties and species.** Frequently, genetic erosion occurs as old varieties in farmers’ fields are replaced by newer. Genes and gene complexes, found in the many farmers’ varieties, are not contained in the modern.”[emphasis FAO’s]



The Bay Area Seed Interchange Library, in San Francisco, California.
PHOTO COURTESY RICHMOND GROWS SEED LIBRARY

Agriculture, however, is undergoing a radical change as the detrimental effects of standardization and industrialization in agriculture are beginning to be understood, and the very real threat to the world's food supply and production that loss of biologic diversity poses.† Research into biodiversity and agrobiodiversity has shown that the diminishing returns of the Green Revolution may be countered through sustainable agricultural practices and even that small-scale, sustainable, and diversified agriculture may be our best hope to avoid Malthusian catastrophe.

*For a thorough overview of biodiversity, its importance, and threats to it, see “Biodiversity: Its Importance to Human Health (Interim Executive Summary),” edited by Eric Chivian, MD, and produced as a project of the Center for Health and the Global Environment by the Harvard Medical School under the auspices of the World Health Organization, the United Nations Development Programme, and the United Nations Environment Programme. Quote from p. 42. Available at http://chge.med.harvard.edu/programs/bio/documents/Biodiversity_v2_screen.pdf.

**For a discussion of agrobiodiversity, see FAO, “What Is Agrobiodiversity?” available at <ftp://ftp.fao.org/docrep/fao/007/y5609e/y5609e00.pdf>.

†See, for example, the World Resources Institute report at www.wri.org/publication/cultivating-diversity-agrobiodiversity-and-food-security

A seed-sharing program in interior Alaska

The John Trigg Ester Library has established the state's first seed library program, Growing Ester's Biodiversity (GEB).¹ (Ester is a small village just outside of Fairbanks.) Because the Ester library is still designing and constructing a building to house its general collections, the GEB program is unlikely to develop an actual seed collection until 2014, or when the library building is complete. The library is phasing the program in by stages, starting with a discussion group that brings people together to talk about books and movies on food security issues and related topics, and moving on to seed swaps, library grounds landscaping work parties, and participation in events such as Food Day, a food film festival, and an heirloom seed fair. The program mission explains:

Growing Ester's Biodiversity is a community seed-sharing and educational program dedicated to improving the agricultural self-reliance of the Ester area through seeds and educational materials and events on food security and sustainability.

The GEB discussion group addresses issues and topics relating to Alaska's food system, alternative agriculture, biodiversity, biotechnology, climate change, cuisine, diet, domestication, food justice and sovereignty, food policy, gardening, industrial agriculture, nutrition, seed saving, Slow Food, traditional and cultural foodways, and more. The discussion group meets monthly (except for December). The GEB program's first seed swap is in mid-February, with others to follow in the spring and fall, depending on the demand.

Like other seed libraries, the GEB program is working to create an accessible and affordable source of regionally-adapted seeds, and to educate library members and the public about biodiversity, garden and plant ecology, sustainable food production, food sovereignty and democracy, cultural traditions concerning food and agriculture, heirloom varieties, regional agricultural history, and related topics. It also aims to serve as an example to other libraries or food security organizations in the state, and to assist in the development of a local seed industry.

The Ester area is home to several small for-profit farms (Rosie Creek Farms, the Quist Family Farm, Grey Owl Garden, DogWood Gardens, Cripple Creek Organics; others in the Goldstream Valley such as Pingo Farms, Wild Rose Farm, or Spinach Creek Farm are nearby) and to



The GEB program's logo image, designed by Putt Clark.

Calypso Farm & Ecology Center, an educational farm with a complementary mission:

Our mission is to encourage local food production and environmental awareness through hands-on education in natural and farming ecosystems.

Grey Owl Garden and Pingo Farms are growing seedstocks for their own use and possibly for future sale. Calypso is developing a seed garden too, and the GEB program hopes to supplement the work already begun there by working in partnership with Calypso, the Fairbanks Experiment Farm, Grey Owl Garden, and others. Calypso offers many gardening workshops, including seed-starting and seed-saving workshops, and the University of Alaska Fairbanks has many programs on gardening and agriculture (SNRAS's High-Latitude Agriculture degree program, and the Cooperative Extension Service's Master Gardener Program, for example), so the library can point people to already existing educational resources in its immediate area while it is developing its own offerings.

The main focus of the GEB program, of course, is on seeds and seed saving, and the importance of agricultural biodiversity and the rich genetic heritage of the food we eat—and are in danger of losing. Alaska has several hundred years' of agricultural history, from long before the establishment of the Matanuska Colony, and in that time many varieties uniquely adapted to the far north, such as Maria's potato (a Haida variety recently rediscovered), must surely have been grown. Part of the goal of the GEB program is to identify those varieties and others that grow well here, and to make them available again.

For more information or to join the John Trigg Ester Library's GEB program, send an e-mail to geb@esterlibrary.org or write to John Trigg Ester Library, P.O. Box 468, Ester, AK 99725, or see www.esterlibrary.org.

1. Note: The author of this article, Deirdre Helfferich, is the founder and current coordinator of the JTEL's GEB program. She was inspired to create a community alternative upon hearing that the Agricultural Research Service in Alaska and its Arctic and Subarctic Plant Gene Bank were at risk of being closed. The ARS received notice of its imminent closure in February 2011. The original proposal presented to the JTEL's board of directors is available at www.esterlibrary.org.



Bombus polaris, the arctic bumblebee, found in Canada, arctic Alaska, Arctic islands (Devon Island, Ellesmere Island, Baffin Island, and Greenland), northern Scandinavia, and Russia (Nenets, Yamalo-Nenets, Sakha and Chukotka).

PHOTO BY SILVIO SORCINI, CREATIVE COMMONS ATTRIBUTION LICENSE 3.0, FROM WIKIPEDIA

A GUIDE TO BUMBLEBEES OF THE INTERIOR

A TAXONOMIC KEY AND NOTES ON *BOMBUS* SPECIES

Rehanon Pampell,¹ Alberto Pantoja,^{1, 2} Derek S. Sikes,³ Patricia Holloway,⁴ and Charles Knight⁵

THE UNITED STATES DEPARTMENT OF AGRICULTURE (USDA) and United States Forest Service estimate that more than 150 food crops in the US, including almost all fruit and some grain crops, depend on insect pollinators. The estimated worth of these pollinators is more than \$10 billion per year. Of the major food crops grown in the United States, common honeybees (*Apis mellifera* L.) are typically given sole credit for pollination, but native bees, butterflies, moths, and flies play roles in crop pollination that are often as or more significant than those managed by honeybees. The honeybee provides services to crops worth an estimated \$14.8 billion annually. Native bees, such as bumblebees, may be responsible for almost \$3.07 billion of fruits and vegetables produced in the US. No published estimates of the value of bumblebee pollination for crops in Alaska are available.

Imports of pollinators are becoming problematic with high transportation and packaging costs, disease, and concerns regarding non-native species affecting native beneficial insects and habitat. Also, honeybees are undergoing extensive die-offs which do not appear to have a single underlying cause. This phenomenon has been termed Colony Collapse Disorder (CCD). Recently, however, it has been reported that the co-infection by invertebrate iridescent viruses with a microsporidian of the genus *Nosema* could be the cause of honeybee colony decline. Some scientists predict that native bees will buffer potential declines in agricultural production due to CCD, but in many cases, as in Alaska, the native bee fauna is little known.

Bumblebees (genus *Bombus*) and parasitic bumblebees (*Bombus* subgenus *Psithyrus*) can sometimes prove to be more efficient than honeybees in crop pollination, especially when adequate habitat is available near agricultural fields. Only in areas of extensive and intensive agriculture where natural habitat is limited may bumblebee communities be insufficient to replace the pollination services currently provided by honeybees. In Alaska, only 25,719 acres of the total 365 million acres are cultivated in crops. Two hundred ninety-six acres of those crops are vegetables that might benefit from insect pollination. Crops that require insect pollination that might benefit from bumblebee pollination include canola, sunflower, tomatoes, peppers, strawberries, cucumbers, squash, gourds, pumpkins, mustard, and some annual forage legumes. Countless stands of wild berries, which form an important subsistence food source for Alaskans, such as blueberries, lingonberries, and cloudberry, occur throughout Alaska and benefit from bumblebee pollination.

Bumblebees tend to have longer tongues that allow them to pollinate long flowers with narrow corollas, and they will forage during rainy, cool, and windy weather during which honeybee activity is limited. Bumblebees have the capacity to buzz pollinate, a resonant vibration caused when the insect grabs onto the flower and moves its flight muscles rapidly, causing the anthers to vibrate, thereby dislodging pollen.

Commercially-produced bumblebees have frequently been used for pollination services worldwide, typically in greenhouses. The earth bumblebee, *Bombus terrestris*

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L., is the most common species that has been domesticated and used for commercial pollination for crops in Europe, Australia, Israel, Japan, and Korea. This species was originally distributed widely in Europe. In North America, native bumblebees such as *Bombus occidentalis* Greene and *Bombus impatiens* Cresson have been domesticated. Producers in Alaska have experimented with bumblebees for greenhouse use, but it is not a commercial practice.

Commercialized colonies tend to have greater parasitic loads than wild colonies including the bumblebee-specific protozoan pathogens *Crithidia bombi* Lipa and Triggiani (Kinetoplastida: Trypanosomatidae), *Nosema bombi* Fantham and Porter (Microsporidia: Nosematidae), and the tracheal mite *Locustacarus buchneri* Stammer (Acari: Podapolipidae). These pathogens and mites can have negative effects on imported and native colony survival, reproduction, and/or the foraging efficiency of individual workers. Only one published report is available regarding bumblebee pathogens in Alaska; it identifies two distinct lineages of *C. bombi* occurring in Alaska.

Impoverished native bumblebee communities often are associated with the intensification of agriculture (high inputs of capital, labor, or heavy usage of technologies such as pesticides and chemical fertilizers relative to land area) and may be insufficient to replace the pollination services currently provided by honeybees. Alaska farms tend to be surrounded by native vegetation and habitat that would benefit native bee populations, but there is little information on bumblebee species composition, geographical distribution, biology, and factors affecting bumblebee species richness in this state.

There are approximately 246 *Bombus* species worldwide; 44 are known from the US and Canada. Bumblebees can be found among alpine, temperate, and arctic environments of the northern continents. In the southern hemisphere, they are native only in the East Indies and South America. They are generally recognized by their furry, brightly colored hair, the presence of meta-tibial spurs, the absence of hairs on the compound eyes, and the absence of the jugal lobe of the hind wing.

Their color patterns can vary within species in a region and even more so geographically among regions. There are nearly 2,800 bumblebee names that have been published for the 246 species due to color variation, especially members of the subgenus *Psithyrus* which have shown considerable sexual dimorphism. Thus keys focusing on coloration can be unreliable; however, those species occurring in interior Alaska tend to exhibit only one color pattern per species.

Bumblebees and cuckoo bumblebees (parasitic bumblebees) belong to the tribe Bombini of the family Apidae. Bumblebees have been placed in several different taxonomic groups based on behavioral and ecological attributes. Recent classifications are based on male genitalia and place all species in a single genus, *Bombus* (meaning 'booming'), and parasitic bumblebees are placed in the subgenus *Psithyrus* of the genus *Bombus*. The development, behavior, and biology of



Bumblebee specimens in the Agricultural Research Service's insect collections, formerly held in Palmer, but now to be parceled out to museums around the country, including the UA Museum of the North at the University of Alaska Fairbanks and the Smithsonian in Washington, DC. See related story on p. 36.

PHOTO BY NANCY TARNAI

bumblebees and cuckoo bumblebees have been reviewed by Kearns and Thomson. Bumblebees construct wax nests and are eusocial in that they have overlapping adult generations, cooperative brood care, and presence of sterile workers. Fertilized queens emerge from hibernation each spring and individually start a new colony. As the colony develops, workers (females) are produced and start to forage. Each fall, after males and the new queens mate, the colony disintegrates and the old queen, workers, and males die off as the new queens hibernate. Cuckoo females enter the bumblebee nest later in the summer, kill the resident queen and begin laying eggs. The workers will then feed and nurture the cuckoo eggs. The parasite larvae emerge as male and female reproductive forms, never as worker bees.

There is no consensus on the total number of bumblebee species present in Alaska. Bishop and Armbruster state, but do not list, eighteen bumblebee species known from interior Alaska categorized by sites of various thermal regimes (referring to the amount of heat available for plant growth and development during the growing period). Other authors such as Washburn suggest up to twenty-two *Bombus* species. The University of Alaska Museum Insect Collection has twenty-six species of bumblebees from Alaska; however, not all species have been verified yet. Table 1 (p. 60) includes a compilation of species in Alaska based on literature reports. Table 2 (p. 61) presents the habitat, food plants, and nesting behavior of species listed in Table 1.

The objective of this study was to develop a pictorial key to enable quick identification of common bumblebee species in interior Alaska and provide biological information on bumblebee biology for amateur entomologists.

*See Bumblebee Key, p. 58,
and pictorial key on inside back cover, p. 67.*



Bumblebee Key

A key (below and next page) was developed to enable identification of common bumblebee species in interior Alaska. The key was based on hair color at the vertex (looks like a widow's peak), antennal bases (frons), thorax (including the interalar band that is on the top of the thorax between the wing bases), and the hair color pattern on the abdominal segments (Figure 1, p. 67, inside back cover).

58 Other distinguishing characteristics tend to be difficult to describe and thus hard to observe. The key was designed as public outreach to facilitate identification of the great majority of Alaska bumblebees; however, to ensure accurate identifications we encourage users to seek verifications of their identifications by experts or other sources.

The most common color patterns observed from Alaska specimens were used in the guide. Possible variations in color pattern that occurred within a species are noted in Table 3 (p. 62), which also outlines each species' color pattern for the frons, vertex, thorax, and abdominal segments. The key characters were based on personal observations by the senior author, personal communication with bee experts, and other descriptions and keys by Stephen, Thorp et al., Williams and updated web pages of Williams' checklist at the Natural History Museum *Bombus* database (www.nhm.ac.uk/research-curation/research/projects/bombus/index.html), as well as Ascher and Pickering with updated web pages at DiscoverLife.org (www.discoverlife.org/mp/20q?guide=Bumblebees). Finally, comparisons were

made with specimens in the voucher collection identified by Jamie Strange, USDA Agricultural Research Service, Pollinating Insects Research Unit, Logan, Utah. Species not included in the key, but considered to be occurring in Alaska, are also mentioned in Table 3, but are hard to distinguish based on color pattern; thus their absence from the key below. Most of these species require further scientific investigation to determine the taxon.

The key was created for queens and workers (females). The key could be used for identification of males, but males tend to show greater color variation so identification errors are more likely than with females. Females have six dorsally visible abdominal segments called tergites (T); have a stinger present; antennae with ten antennomeres (segments) and mandibles that are wide and scoop-like. Males have seven visible tergites with the tip of their abdomen blunt; stinger absent; antennae with eleven antennomeres, and mandibles that are narrow and bearded.

The color diagrams (see inside back cover) were created in Microsoft PowerPoint. The key was well received by those who were asked to validate it. The key was validated by both those who have identified bumblebees before and those who have never looked closely at a bee. For each issue raised by the testers, edits were made within the key. Table 4 (p. 64) lists synonyms and taxonomic notes on selected species reported from Alaska.

Simplified Guide to Bumblebees of Interior Alaska

Sex Determination

Females: 6 visible abdominal segments called tergites (T); stinger present; antennae with 10 flagellomeres (segments); mandibles are wide and scoop-like.	Males: 7 visible tergites with the tip of their abdomen blunt; stinger absent; antennae with 11 flagellomeres; mandibles are narrow and bearded.
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Species Determination

Appearance (to use key, choose from description a or b under #1, then go to the number indicated under Species Identification, as needed)	Species Identification OR go to #
#1	
1a. Corbiculae (pollen basket) present (metatibia concave and shiny or with pollen ball); some hair on T1-T2 (subgenus <i>Bombus</i>)	2
1b. Corbiculae not present (metatibia convex and opaque); bald or black hairs on T1-T2; yellow hair sparse and laterally or absent (subgenus <i>Psithyrus</i>)	15
#2	
2a. Thorax yellow with black hair	3
2b. Thorax yellow (although sometimes with a small black bald spot between the wing bases); T1-T2 yellow; T3-T5 black; T6 black or with few blond hairs	<i>B. perplexus</i>

TABLE CONTINUED ON THE NEXT PAGE

Bumblebee Key, continued.	
#3	
3a. T1-T5 with any rust or orange hair	4
3b. T1-T5 with no rust or orange hair but with yellow or black or white	10
#4	
4a. T1-T2 with yellow hair only	5
4b. T1-T2 with yellow, black or orange/rust	7
#5	
5a. T1-T2 yellow; T3 black	6
5b. T1-T2 yellow; T3 rust; T4 rust or orange; T5-T6 black	<i>B. centralis</i>
#6	
6a. T4-T5 rust or orange; T6 dull with black and orange hairs; black frons and vertex	<i>B. balteatus</i>
6b. T4 completely orange or with some black; T5-T6 rust or orange; black frons; yellow vertex	<i>B. frigidus</i>
#7	
7a. T2 with rust/orange or black hair	8
7b. T2 predominately black with yellow hair centrally; T3 predominately black with some light yellow or rust hairs; T4 all rust or orange; T5-T6 black or with some blond hairs	<i>B. mixtus</i>
#8	
8a. Thorax yellow with a black band between the wings that extends below the wing base; the black also typically extends into an anterior v-shape	9
8b. Upper thorax olive with black and yellow hairs; T1 yellow; T2-T3 rust; T4 yellow; T5-T6 black with or without sparse yellow hairs	<i>B. melanopygus</i>
#9	
9a. T2-T3 rust, sometimes with black hairs mid-segment; T4 yellow, sometimes with black hairs mid-segment; T5-T6 black with sparse yellow hairs	<i>B. sylvicola</i>
9b. T2 black that typically extends into a v-shape; T3 orange sometimes with black hairs; T4 mainly yellow; T5 black; T6 dull with few black hairs	<i>B. bifarius</i>
#10	
10a. T1 yellow	11
10b. T1 black or with few yellow hairs	13
#11	
11a. T2 yellow; T3-T6 black or white	12
11b. T2-T4 yellow/blond; T5 yellow or blond with black hairs; T6 dull and black	<i>B. borealis</i>
#12	
12a. T3-T6 black (but sometimes with rust colored hairs intermixed)	<i>B. flavifrons</i>
12b. T3 black; T4-T6 white or blond hairs	<i>B. jonellus</i>
#13	
13a. T2-T3 black; T4-T5 black and yellow; T6 black or with few blond hairs	<i>B. rufocinctus</i>
13b. T5 with white or blond hairs	14
#14	
14a. T2 black; T3 yellow; T4 black; T5 white (sometimes more yellow or blond); T6 black with some blond hairs	<i>B. occidentalis</i>
14b. T2 yellow or blond; T3 black; T4-T5 white; T6 black or with few white hairs	<i>B. moderatus</i>
#15	
15a. T4 completely yellow	16

Bumblebee Key, continued.

15b. Thorax yellow with black spot between the wing bases; T1-T2 black; T3-T5 black or hairless with yellow hair laterally not medially; T6 black and shiny	<i>P. insularis</i>
#16	
16a. Black frons and vertex; posterior half of thorax is yellow while the anterior half is black (sometimes with yellow hairs intermixed); T1 usually yellow, but sometimes black; T2 black; T3 black with yellow hair laterally; T4 yellow; T5 black with yellow hair laterally; T6 black and shiny	<i>P. ashtoni</i>
16b. Black frons; yellow vertex; yellow with a black spot between the wings; T1 black or yellow; T2 black; T3 black; T4 yellow; T5 black; T6 black and dull	<i>P. fernaldae</i>

Table 1. List of *Bombus* species reported from Alaska.

Species	Author	Dist.*	Literature Records
<i>B. appositus</i>	Cresson	WN	UAM 2010
<i>B. ashtoni</i>	(Cresson)	WN, EN	Washburn 1963; Ascher and Pickering 2010; CNC 2010; Pampell 2010; UAM 2010
<i>B. balteatus</i>	Dahlbom	A, P, WN, EN	Ashmead 1902; Bequaert 1920; Washburn 1963; Karlstrom and Ball 1969; Milliron 1973; Williams and Batzli 1982; Thorp et al. 1983; Ascher and Pickering 2010; CNC 2010; Pampell 2010; UAM 2010
<i>B. bifarius</i>	Cresson	WN	Washburn 1963; Thorp et al. 1983; Ascher and Pickering 2010; CNC 2010; Pampell 2010; UAM 2010
<i>B. borealis</i>	Kirby	WN, EN	Pampell 2010; UAM 2010
<i>B. californicus</i>	Smith	WN, EN, SN	Bequaert 1920; Milliron 1973; Ascher and Pickering 2010; UAM 2010
<i>B. centralis</i>	Cresson	WN	Washburn 1963; Thorp et al. 1983; Pampell 2010; UAM 2010
<i>B. distinguendus</i>	Morawitz	P	Williams and Thomas 2005; Ascher and Pickering 2010; UAM 2010
<i>B. fernaldae</i>	Franklin	WN, EN	Ashmead 1902; Washburn 1963; Thorp et al. 1983; Guinn 1991; CNC 2010; Pampell 2010; UAM 2010
<i>B. flavifrons</i>	Cresson	WN	Ashmead 1902; Bequaert 1920; Washburn 1963; Thorp et al. 1983; Guinn 1991; Bishop 1992; Henrich and Vogt 1993; Bishop and Armbruster 1999; Davis 2002; Ascher and Pickering 2010; CNC 2010; Pampell 2010; UAM 2010
<i>B. frigidus</i>	Smith	WN, WN, A	Ashmead 1902; Bequaert 1920; Washburn 1963; Guinn 1991; Bishop 1992; Henrich and Vogt 1993; Bishop and Armbruster 1999; Davis 2002; Ascher and Pickering 2010; CNC 2010; Pampell 2010; UAM 2010
<i>B. hyperboreus</i>	Schönherr	A, P, WN	Washburn 1963; Milliron 1973; Williams and Batzli 1982; Ascher and Pickering 2010; CNC 2010; UAM 2010
<i>B. insularis</i>	(Smith)	WN, EN	Bequaert 1920; Washburn 1963; Thorp et al. 1983; Ascher and Pickering 2010; CNC 2010; Pampell 2010; UAM 2010
<i>B. jonellus</i>	Kirby	P, A, WN	Ashmead 1902; Washburn 1963; Bishop 1992; Bishop and Armbruster 1999; Ascher and Pickering 2010; CNC 2010; Pampell 2010; UAM 2010
<i>B. melanopygus</i>	Nylander	WN	Ashmead 1902; Bequaert 1920; Washburn 1963; Thorp et al. 1983; Guinn 1991; Ascher and Pickering 2010; CNC 2010; Pampell 2010; UAM 2010
<i>B. mixtus</i>	Cresson	WN	Ashmead 1902; Bequaert 1920; Washburn 1963; Thorp et al. 1983; Bishop 1992; Bishop and Armbruster 1999; Ascher and Pickering 2010; CNC 2010; Pampell 2010; UAM 2010
<i>B. moderatus</i>	Cresson	A, P, WN	Ashmead 1902; Bequaert 1920; Washburn 1963; Milliron 1971; Williams and Batzli 1982; Davis et al. 2003; Ascher and Pickering 2010; Pampell 2010; UAM 2010
<i>B. neoboreus</i>	Sladen	A, WN	Ashmead 1902; Washburn 1963; Milliron 1973; Williams and Batzli 1982; Ascher and Pickering 2010; CNC 2010; UAM 2010
<i>B. nevadensis</i>	Cresson	WN, EN	Ashmead 1902; Thorp et al. 1983; Ascher and Pickering 2010; CNC 2010
<i>B. occidentalis</i>	Greene	WN, EN	Ashmead 1902; Bequaert 1920; Washburn 1963; Thorp et al. 1983; Guinn 1991; Bishop 1992; Bishop and Armbruster 1999; Milliron 1971; Ascher and Pickering 2010; CNC 2010; Pampell 2010; UAM 2010

Table 1, List of species, continued.

<i>B. perplexus</i>	Cresson	WN, EN	Washburn 1963; Ascher and Pickering 2010; Pampell 2010; UAM 2010
<i>B. polaris</i>	Curtis	A, P, WN	Ashmead 1902; Washburn 1963; Milliron 1973; Williams and Batzli 1982; Henrich and Vogt 1993; Ascher and Pickering 2010; CNC 2010; UAM 2010
<i>B. rufocinctus</i>	Cresson	WN, EN, SN	Washburn 1963; Pampell 2010; UAM 2010
<i>B. sitkensis</i>	Nylander	WN	Ashmead 1902; Bequaert 1920; Washburn 1963; Thorp et al. 1983; Ascher and Pickering 2010; CNC 2010; UAM 2010
<i>B. suckleyi</i>	(Greene)	WN, EN	Washburn 1963; Karlstrom and Ball 1969; Thorp et al. 1983; Ascher and Pickering 2010; UAM 2010
<i>B. sylvicola</i>	Kirby	A, WN	Bequaert 1920; Washburn 1963; Thorp et al. 1983; Bishop 1992; Henrich and Vogt 1993; Bishop and Armbruster 1999; Davis 2002; Ascher and Pickering 2010; CNC 2010; Pampell 2010; UAM 2010
<i>B. vagans</i>	Smith	WN, EN	Washburn 1963; UAM 2010

* Distribution codes based on Williams (1998): EA = East Nearctic Region, WN = West Nearctic Region, SN = South Nearctic Region, P = Palaearctic, A= Arctic

Table 2. Habitat, tongue length, & nesting behavior for bumblebees reported from Alaska.

Subgenus	Species	Habitat	Tongue Length	Nesting Behavior
<i>Alpinobombus</i>	<i>B. balteatus</i> , <i>B. hyperboreus</i> , <i>B. neoboreus</i> , <i>B. polaris</i>	grasslands and shrublands in high arctic and alpine areas	medium to long tongue-length	underground or on the surface
<i>Bombias</i>	<i>B. nevadensis</i>	open grassland and mountain meadow	medium to long tongue-length	underground or on the surface
<i>Bombus</i>	<i>B. moderatus</i> , <i>B. occidentalis</i>	forest edge, mountain meadow, and grassland	short tongue-length; frequently bite holes in corollas and rob deep flowers	underground
<i>Cullumanobombus</i>	<i>B. rufocinctus</i>	high alpine grasslands, mountain meadow, and semi-desert	short to medium tongue-length	underground or on the surface
<i>Pyrobombus</i>	<i>B. bifarius</i> , <i>B. centralis</i> , <i>B. flavifrons</i> , <i>B. frigidus</i> , <i>B. jonellus</i> , <i>B. melanopygus</i> , <i>B. mixtus</i> , <i>B. perplexus</i> , <i>B. sitkensis</i> , <i>B. sylvicola</i> , <i>B. vagans</i>	mountain-meadow, forest-grassland, semi-desert, and tropical montane forest areas	short to medium tongue-length; workers tend to visit flowers where they have to hang upside down due to their small body sizes	underground or on the surface
<i>Psithyrus</i>	<i>B. ashtoni</i> , <i>B. fernaldae</i> , <i>B. insularis</i> , <i>B. suckleyi</i>	mountain meadows, forest edges and grassland	short to medium tongue-length; females lack corbiculae on their hind legs	obligate social parasites ("cuckoos") in colonies of other social <i>Bombus</i> ; therefore, no worker caste
<i>Subterraneobombus</i>	<i>B. appositus</i> , <i>B. borealis</i> , <i>B. distinguendus</i>	alpine grassland, open grassland, and semi-desert	long tongue-length	underground or on the surface
<i>Thoracobombus</i>	<i>B. californicus</i>	open grassland, mountain meadow, semi-desert, and tropical montane and lowland forests, less often in temperate forests	medium to long tongue-length	nests on the surface, sometimes underground Adapted from Williams (1998)

Table 3. Distinguishing features of bumblebees reported from Alaska.

Species	Frons	Vertex	Thorax	Tergite descriptions	Other
<i>B. appositus</i>	yellow	yellow	yellow with a black band between the wings	T1-T5 yellow/blond/brown; T6 black with few hairs	
<i>B. ashtoni</i>	black	black	posterior half of thorax is yellow while the anterior half is black (sometimes with yellow hairs intermixed)	T1 usually yellow, but sometimes black; T2 black; T3 black with yellow hair laterally; T4 yellow; T5 black with yellow hair laterally; T6 black and shiny (in males, T1 and T4 pale yellow; T2-T3 black; T5-T6 black, but can have yellow hair laterally)	in males, flagellomeres 1-3 longer than basal segment
<i>B. balteatus</i>	black	black	yellow with a black band between the wings that extends below the wing bases	T1 -T2 yellow; T3 black; T4-T5 rust or orange; T6 dull with black and orange hairs	clypeus with punctures
<i>B. bifarius</i>	yellow	yellow	yellow thorax with a black band between the wings that extends below the wing base; the black also typically extends into an anterior v-shape	T1 yellow sometimes with a few black hairs; T2 black that typically extends into a v-shape; T3 orange sometimes with black hairs; T4 mainly yellow; T5 black; T6 dull with few black hairs	orange corbiculae fringe
<i>B. borealis</i>	black	black	yellow with a black band between the wings	T1-T4 yellow/blond; T5 yellow of blond with black hairs; T6 dull and black	clypeus smooth and shiny
<i>B. californicus</i>	unsure	unsure	yellow with a black band between the wings	T1 yellow; T2-T3 black with possible traces of orange; T4 yellow; T5-T6 unsure	
<i>B. centralis</i>	yellow possibly with black hairs intermixed	yellow possibly with black hairs intermixed	yellow with some black hairs intermixed and black between the wings	T1-T2 yellow; T3 rust; T4 rust or orange; T5-T6 black	
<i>B. distinguendus</i>	black	black	yellow with a black band between the wings	T1-T4 yellow/blond; T5 yellow of blond with black hairs; T6 smooth and shiny	possibly only found in the Aleutian Islands
<i>B. fernaldae</i>	black	yellow	yellow with a black spot between the wings (in males, anterior half is black)	T1 black or yellow; T2 black; T3 black; T4 yellow; T5 black; T6 dull and black (in males, T1 and T4 yellow; T2-T3 and T5 black; T6-T7 black but sometimes with yellow hair laterally)	in males, flagellomeres 1 and 3 equal in length
<i>B. flavifrons</i>	mainly yellow with black hairs intermixed	mainly yellow with black hairs intermixed	yellow and black hairs intermixed with black interalar band between the wings	T1 -T2 yellow sometimes with a black hairs in a v-shape pointing to anterior end; T3- T6 black but sometimes with rust colored hairs intermixed	ventral side of bee with yellow hairs
<i>B. frigidus</i>	black	yellow	yellow with a black band between the wings	T1-T2 dense yellow; T3 black; T4 completely orange or with some black; T5-T6 rust or orange	corbiculae fringe made of black and orange hairs
<i>B. hyperboreus</i>	black	black	yellow with a black band between the wings that extends below the wing bases	T1-T2 yellow; T3-T5 black; T6 black or hairless	ventral side of bee completely black; ocelli below supraorbital line

Table 3, Distinguishing features, continued.

<i>B. insularis</i>	black with some yellow intermixed	black with some yellow intermixed	yellow with black spot between the wing bases (in males, anterior half can be black)	T1-T2 black; T3-T5 black or hairless with yellow hair laterally not medially; T6 black and shiny (in males, T1-T4 yellow; T5-T7 black with a small amount of yellow on T6 laterally)	
<i>B. jonellus</i>	black	yellow	yellow with a black band between the wing bases	T1-T2 thin yellow hairs; T3 black; T4-T6 white or blond hairs	
<i>B. melanopygus</i>	olive or clouded with black and yellow hairs intermixed	olive or clouded with black and yellow hairs intermixed	posterior half of the thorax is olive or clouded with black and yellow hairs with a black band between the wing bases and the anterior half of thorax with more yellow	T1 yellow; T2-T3 rust; T4 yellow; T5-T6 black with or without sparse yellow hairs	in males, yellow hair above antennal bases
<i>B. mixtus</i>	olive or clouded with black and yellow hairs intermixed	olive or clouded with black and yellow hairs intermixed	thorax typically more olive than yellow with black band or spot between the wing bases	T1-T2 predominately black with yellow hair centrally; T3 predominately black with some light yellow or rust hairs; T4 all rust or orange; T5-T6 black or with some blond hairs	corbiculae fringe black
<i>B. moderatus</i>	black	black	yellow above wing bases and black between and below wing bases	T1 black; T2 yellow or blond; T3 black; T4-T5 white; T6 black or with few white hairs	
<i>B. neoboreus</i>	black	varies	yellow with black band that extends below the wing bases	T1-T3 yellow; T4 most often black, but can be orange or with orange hairs laterally; T5 most often black, but can be orange or with orange hairs laterally; T6 black or with few hairs	moderately even and close medial clypeal punctuation
<i>B. nevadensis</i>	varies	varies	yellow with black band that extends below the wing bases	T1-T3 yellow; T4-T6 black	black below tegula; ocelli below supraorbital line; in males, flagellomere 1 as long as 2 & 3
<i>B. occidentalis</i>	black or with yellow hairs intermixed	black or with yellow hairs intermixed	posterior half of thorax yellow with black band between the wing bases that extends below the wing bases; anterior half of thorax black with some yellow hairs or all black	T1-T2 black; T3 yellow; T4 black; T5 white, sometimes more yellow/blond/white; T6 black with some blond hairs (in males, T1-T2 black; T3-T4 yellow; T5 black sometimes with yellow; T6-T7 yellow/blond/white)	corbiculae fringe orange
<i>B. perplexus</i>	black	yellow	yellow possibly with a small black spot between the wing bases	T1-T2 yellow; T3-T5 black; T6 black or with few blond hairs	
<i>B. polaris</i>	black	black	yellow with a black band between the wings that extends below the wing bases	T1-T2 yellow; T3 black; T4-T5 rust or orange; T6 black or few hairs	clypeus smooth or with very few punctures
<i>B. rufocinctus</i>	mainly black	yellow	yellow thorax with a black spot between the wing bases	T1 black possibly with a few yellow hairs; T2-T3 black; T4-T5 yellow; T6 black or with few blond hairs (in males, T1-T2 yellow, T3-T4 black, T5-T6 yellow, T7 black)	in males, flagellomere 2 shorter than 3; 3 & basal segment equal in length

Table 3, Distinguishing features, continued.

<i>B. sitkensis</i>	olive or clouded with black and yellow hairs intermixed	olive or clouded with black and yellow hairs intermixed	black with the outside edge olive that extends below wing bases	T1-T2 yellow; T3 black, sometimes with yellow hairs intermixed; T4-T5 black; T6 black with some blond hairs	
<i>B. suckleyi</i>	black	yellow	posterior half of thorax is yellow while the anterior half is black (sometimes with yellow hairs intermixed)	T1 black or yellow; T2 black; T3 black with yellow hair laterally, sometimes even medially; T4 yellow; T5 black with yellow hair laterally, sometimes even medially; T6 black and shiny	
<i>B. sylvicola</i>	yellow	yellow	yellow thorax with a black band between the wings that extends below the wing base; the anterior black also typically extends into a v-shape	T1 yellow; T2-T3 rust, sometimes with black hairs mid-segment; T4 yellow, sometimes with black hairs mid-segment; T5-T6 black with sparse yellow hairs	black corbiculae fringe; in males, very little yellow hairs above antennal bases
<i>B. vagans</i>	black	black	yellow with a black band between the wing bases	T1 yellow, sometimes mostly hairless; T2 yellow; T3-T6 black	ventral side of bee completely black

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Table 4. Synonyms and taxonomic notes

Species	Synonyms	Taxonomic Notes
<i>B. appositus</i>		Could be a misidentification of <i>B. borealis</i> since Western keys generally do not include <i>B. borealis</i> (J. Strange, pers. comm.).
<i>B. ashtoni</i>		Status requires investigation (Ascher and Pickering 2010).
<i>B. balteatus</i>	<i>Megabombus kirbyellus</i> (Milliron 1973; Williams and Batzli 1982); <i>Bombus kirbyellus</i> Curtis (Bequaert 1920; Washburn 1963); <i>Psithyrus tricolor</i> Franklin (Ashmead 1902)	Considered conspecific with <i>B. kirbyellus</i> by most, although Milliron (1973) considered them separate species in Alaska (Thorpe et al. 1983; Williams 1998).
<i>B. californicus</i>	<i>Megabombus fervidus californicus</i> (Smith) (Milliron 1973); <i>Bombus californicus</i> Smith (Bequaert 1920); <i>Bombus neglectulus</i> sp. nov. (Ashmead 1902)	<i>Bombus fervidus</i> and <i>B. californicus</i> sometimes regarded as conspecific and as separate species, but Williams (1998) treats them as parts of a single variable species (Williams 1998); further investigation warranted in Alaska (Ascher and Pickering 2010); Ascher and Pickering (2010) suggests that <i>B. neglectulus</i> is a synonym of <i>B. californicus</i> .
<i>B. distinguendus</i>		Reported in outer Aleutians (Williams and Thomas 2005).
<i>B. fernaldae</i>		Might be conspecific with <i>B. flavidus</i> (Williams 1998); most common parasitic associations with <i>Pyrobombus</i> (Thorpe et al. 1983).
<i>B. flavifrons</i>	<i>Bombus pleuralis</i> Nylander (Bequaert 1920; Washburn 1963; UAM 2010); <i>Bombus juxtus</i> Cresson (Ashmead 1902)	<i>Bombus pleuralis</i> is the oldest name available, but rarely ever used (Williams 1998); Baquaert (1920) suggests <i>B. juxtus</i> identified by Ashmead in 1902 was a synonym of <i>B. pleuralis</i> .
<i>B. frigidus</i>	<i>Bombus couperi</i> Cresson (Ashmead 1902)	Baquaert (1920) suggests <i>B. couperi</i> identified by Ashmead in 1902 was a synonym of <i>B. frigidus</i> .
<i>B. hyperboreus</i>	<i>Megabombus hyperboreus</i> (Milliron 1973; Williams and Batzli 1982)	Workers rarely found (Milliron 1973); <i>B. arcticus</i> is most likely to be conspecific with <i>B. hyperboreus</i> (Williams 1998); <i>B. hyperboreus</i> is thought to be a social parasite in colonies of <i>B. polaris</i> at least facultatively (Williams 1998).

Table 4, Synonyms and notes, continued.

<i>B. insularis</i>	<i>Psithyrus consultus</i> Franklin (Bequaert 1920); <i>Bombus crawfordi</i> (Franklin) (Washburn 1963)	Most common parasitic associations with <i>Pyrobombus</i> , <i>Subterraneobombus</i> , and <i>Cullumanobombus</i> (Thorp et al. 1983).
<i>B. jonellus</i>	<i>Bombus alboanalis</i> Franklin (Ashmead 1902; Bishop 1992; Bishop and Armbruster 1999; Ascher and Pickering 2010; Washburn 1963)	<i>Bombus alboanalis</i> morphologically similar to <i>B. jonellus</i> , but treated as single variable species (Williams 1998); <i>B. alboanalis</i> has been regarded as separate species and conspecific with <i>B. frigidus</i> or <i>B. jonellus</i> (Williams 1998); some Alaskan specimens cited as <i>B. alboanalis</i> (UAM 2010).
<i>B. melanopygus</i>	<i>Bombus edwardsii</i> Cresson (Ashmead 1902)	Conspecific with <i>B. edwardsii</i> (Williams 1998).
<i>B. mixtus</i>	<i>Bombus oregonensis</i> Cresson (Ashmead 1902)	Baquaert (1920) suggests <i>B. oregonensis</i> identified by Ashmead in 1902 was a synonym of <i>B. frigidus</i> .
<i>B. moderatus</i>	<i>Bombus lucorum</i> (Linnaeus) (Ashmead 1902; Bequaert 1920; Milliron 1971; Williams and Batzli 1982; Ascher and Pickering 2010; CNC 2010; UAM 2010); <i>Bombus terrestris</i> (Linnaeus) (Davis et al. 2003)	<i>Bombus moderatus</i> was sometimes misidentified as <i>B. lucorum</i> which was also sometimes lumped with <i>B. terrestris</i> , however, <i>B. moderatus</i> is now a clearly defined taxon, characterized by morphology and DNA markers (Bertsch et al. 2010); Cameron et al. (2007) suggests there is a genetic divergence between <i>B. moderatus</i> and <i>B. lucorum</i> of about 2.1%.
<i>B. neoboreus</i>	<i>Megabombus strenuus</i> Cresson (Milliron 1973; Williams and Batzli 1982); <i>Bombus strenuus</i> Cresson (Ashmead 1902; Washburn 1963; CNC 2010)	Hard to distinguish from <i>B. polaris</i> , <i>B. neoboreus</i> , and <i>B. hyperboreus</i> based on coloration; all three taxa needs further investigation (D. Yanega, pers. comm.)
<i>B. occidentalis</i>	<i>Bombus terricola occidentalis</i> Greene (Milliron 1971)	Separate species from <i>B. terricola</i> (Thorp et al. 1983); suffered dramatic decline across much of the western part of its range (Evans et al. 2009).
<i>B. polaris</i>	<i>Megabombus polaris</i> (Curtis) (Milliron 1973; Williams and Batzli 1982); <i>Bombus kincaidii</i> Cockerell (Ashmead 1902; Washburn 1963); <i>Bombus arcticus</i> Kirby (Ashmead 1902)	<i>Bombus arcticus</i> is a synonym for <i>B. polaris</i> , but not frequently used (Williams 1998).
<i>B. suckleyi</i>		Closely related to <i>B. ashtoni</i> and most common parasitic associations with <i>Pyrobombus</i> and <i>Bombus</i> (Thorp et al. 1983); when reviewing UAM specimens identified by Krombein 1957–1961 during this project, there was no noticeable difference between <i>B. suckleyi</i> and <i>B. ashtoni</i> .
<i>B. sylvicola</i>	<i>Bombus gelidus</i> Cresson (Bequaert 1920); <i>Bombus lapponicus</i> (Fabricius) (Ascher and Pickering 2010; CNC 2010; UAM 2010)	Morphologically similar to <i>B. lapponicus</i> and been suggested they are conspecific (Thorp et al. 1983), but DNA comparison from 16S gene shows they could be two separate species (Williams 1998); Ascher and Pickering (2010) suggests that <i>B. gelidus</i> and <i>B. lapponicus</i> are synonyms of <i>B. sylvicola</i> .
<i>B. vagans</i>		Possibly only exists in the southeast Alaska panhandle (S. Droegge, pers. comm.).

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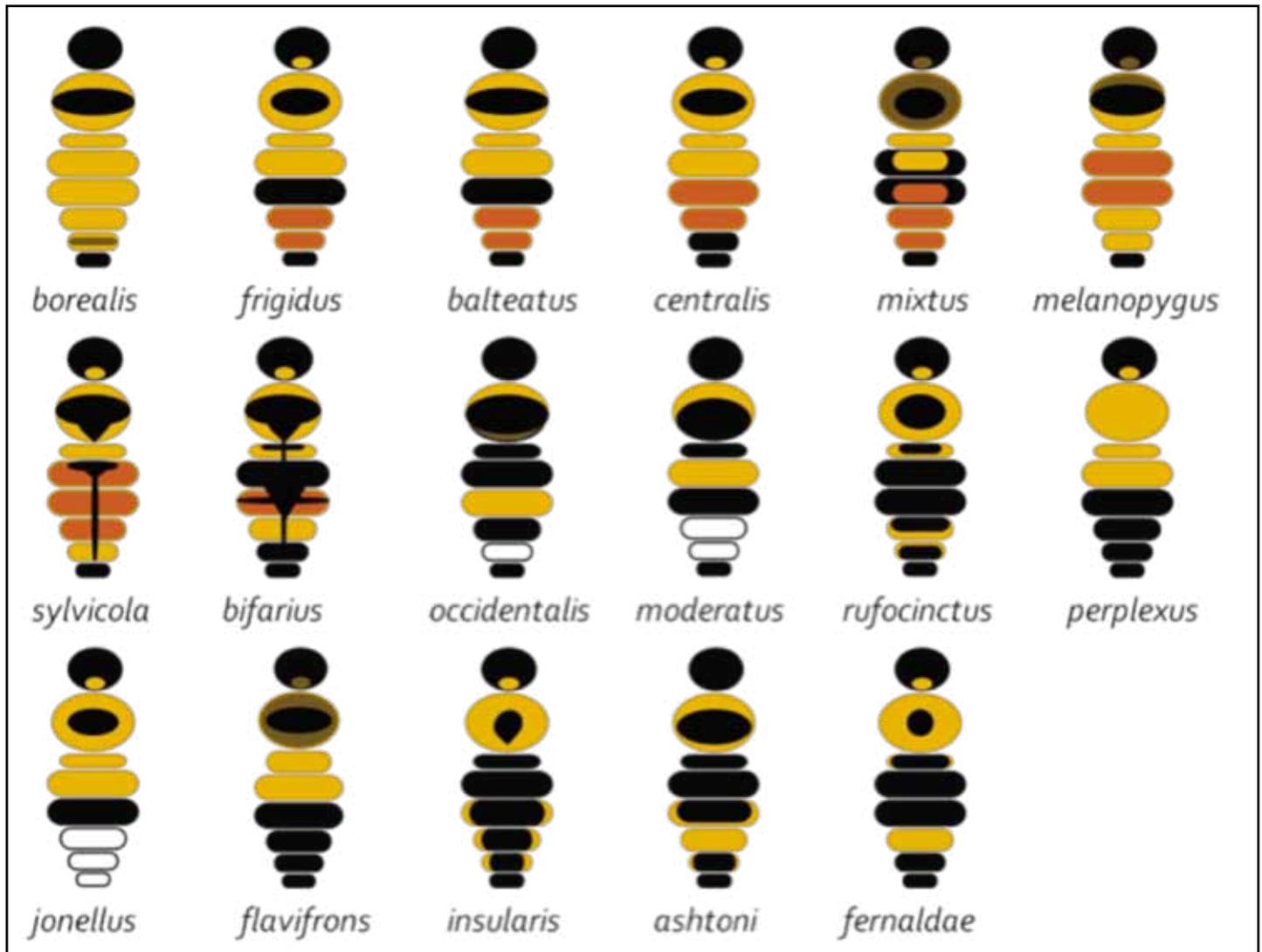
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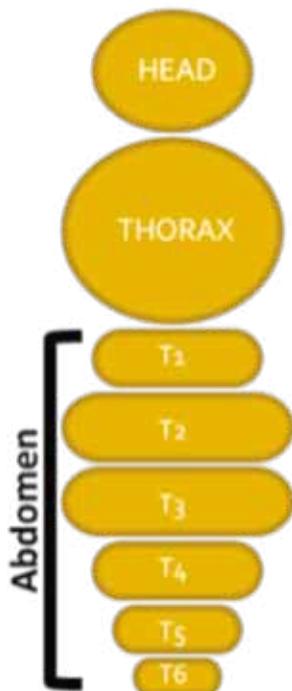
Figure 1. Color key to the most common Interior Alaska bumblebees.



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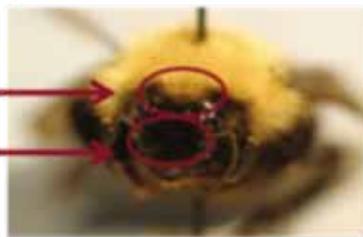
Key Terms

Diagram Outline



Vertex

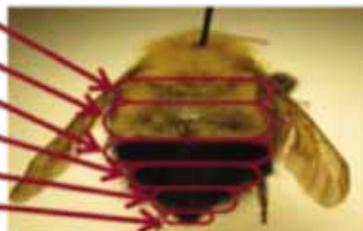
Frons



Thorax



T1
T2
T3
T4
T5
T6



Color Scheme

Black or Hairless

Yellow

Rust or Orange

White or Blonde

Black and Yellow



**SCHOOL OF NATURAL RESOURCES
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Food Day was a nationwide event on a par with Earth Day, celebrated for the first time on October 24, 2011. The University of Alaska Fairbanks was the scene of several events on Food Day. The School of Natural Resources & Agricultural Sciences is seeking participants for the 2012 Food Day celebration, already being planned. SNRAS employee Martha Wesphal carved the pumpkin. See story on p. 39.

PHOTO BY NANCY TARNAL