

agroborealis

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SNRAS AND THE WORLD

livestock systems • peonies in China
soils & typhoons in Taiwan • conservancies in Namibia
freshwater systems research
forest biomass



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



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—PHOTO BY L. COREY-LUDDEN

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For more information about our research and education programs, please contact us at:

School of Natural Resources & Agricultural Sciences

P.O. Box 757140
Fairbanks, AK 99775-7140

Office of the Dean
(907) 474-7083
fysnras@uaf.edu

Student Information
(907) 474-5276

or visit our website:
www.uaf.edu/snras

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Managing Editor
Deirdre Helfferich
dahelfferich@alaska.edu

Information Officer/Science Writer
Nancy J. Tarnai
njtarnai@alaska.edu

Webmaster
Steve Peterson

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NEWS

8th Circumpolar Agricultural Conference/ University of the Arctic Food Summit

The **8th Circumpolar Agricultural Conference/University of the Arctic Inaugural Northern Food Summit** will be held from September 29 through October 3, 2013 in Girdwood, Alaska, and is sponsored by SNRAS, UAF Cooperative Extension Service, and the University of the Arctic. This is the second time the conference has been held in Alaska: the third CAC was held in Anchorage in 1998. The conference theme is "Advancing food security and sustainable agriculture in the circumpolar north—Building an integrated vision and creating a process for sustainable food security in northern communities."

The **four main goals** of the conference are to:

1. Educate world leaders on the critical nature of food supplies in the Circumpolar North;
2. Encourage the exchange of information, material, and technology of agriculture and rural development in circumpolar areas;
3. Establish and maintain relations with other organizations whose interests are related to the objectives of the Circumpolar Agriculture Association and the thematic network on northern food security, the University of the Arctic; and
4. Discuss and define the barriers, challenges, and opportunities of expanding the regional food economy.

The **Food Security Summit** is a timely addition to the featured focus of the CAC: people all over the world as well as in the Circumpolar North are becoming keenly aware of the problems of being at the end of a food chain, or facing food insecurity in other ways, and are searching for ways to strengthen their communities. The summit adopts the perspective that food security is a driver to community development and sustainability. This includes taking a balanced approach between traditional subsistence natural resource access and agricultural production. Key areas include food production; food access and distribution systems; sustainable practices; land use planning; and food policy and food safety issues.

The conference will consist of invited plenary talks organized around featured topics followed by formal poster sessions, discussions, and breakout sessions organized around the conference goals.

For more information, please see the conference website, at www.uaf.edu/cacl, or contact: Milan Shipka at mpshipka@alaska.edu or Karen Tanino at karen.tanino@usask.ca.

Interested parties are invited to submit abstracts online on topics relevant to all aspects of circumpolar agriculture and food security in the north. Abstracts must be submitted by April 5th, 2013. Notification of acceptance will be provided by e-mail prior to April 30th, 2013.

CIRCUMPOLAR AGRICULTURE CONFERENCE PRESENTATIONS:

Dr. Lassi Heininen, "Redefined Northern Food Security - A Challenge to Arctic Geopolitics?" (Univ. of Lapland, Univ. of Arctic Thematic Network, Lead Geopolitics and Security, Finland)

Steffen Weber, "Key Policy Issues for Advancing Food Security in the North" (European Parliament, Belgium)

Prof. Tom Allen, "Food Production by Indigenous People, Challenges and Success Stories" (CIBC Chair, Entrepreneurship Dept., Bioresources Policy, Business and Economics, Univ. of Saskatchewan, Canada)

Dr. Oystein Ballari, "Arctic Agriculture and Land Use—Norway Perspectives" (Head of Division, Bioforsk Nord Holt, Norway)

Prof. & Dean Matsuo Uemura, "Global Perspectives in Advancing Food Security In the Circumpolar World - View from Japan" (United Graduate School of Agricultural Sciences, Cryobiofrontier Research Center, Iwate Univ., Japan)

Dr. Randy Lewis, "Land Use Planning and Management of Traditional First Nations Food Resources" (Vice President, Circumpolar Agriculture Assoc., Whitehorse, Canada)

Prof. Arja Rautio, "Food Safety in the Arctic and Human Health: Contaminant Exposure by Dietary Intake" (Univ. of the Arctic Thematic Network Lead - Arctic Health Centre for Arctic Medicine, Univ. of Oulu, Finland)

Ms. Kreesta Doucette, "Ten Years of Creating Partnerships in Community Food Security and Northern Rural Development" (Founding Executive Director, Food Matters Manitoba, Canada)

Prof. Svein Johansen, "Developing Sustainable Small Businesses in the North: The Case of Northern Food Producers and Distributors" (Univ. of the Arctic Thematic Network Lead - Managing Small and Medium-sized Enterprises in the North, Harstad Univ. College, Norway)

Prof. Emeritus Josef Svoboda, "The Keewatin Gardens and Green Igloos—the Production of Horticulture Crops in the High Arctic" (Dept. of Biology, Univ. of Toronto, Canada)

Biomass and STEAM

Nancy Tarnai

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BAK LAP crew (left to right - Andrew Allaby, Ryan Jess, Thomas A. Grant III) preparing for fieldwork along the Yukon River, August 2012, holding aloft tools of the trade (chainsaw, GPS locator unit, tape measure).

—PHOTO BY GLENN JUDAY

A new SNRAS project at the University of Alaska Fairbanks will increase research on the sustainable management of boreal forests for wood biomass energy, and offer expanded opportunities for kindergarten through twelfth grade (K–12) and college students and teachers to work directly with forest resources. Both areas fall under the auspices of BAK LAP, short for Boreal Alaska – Learning, Adaptation, and Production, a project funded by a \$1 million appropriation from the Alaska Legislature.

The research side of the project seeks to upgrade Alaska forest research facilities, improving the value of forests to meet the rapidly expanding need for wood products and energy from biomass. Researchers will identify management techniques that have successfully met demands for wood biomass, examine the results of new species trials, and determine the optimal methods for forest regeneration.

In order to do that, the scientists are going to visit a network of plots and stands established in the 1980s or earlier across central Alaska's forest lands. Using a variety of measurement methods, they'll monitor locations near Delta Junction, Tok, and Fairbanks. They then will establish permanent marked data collection points and develop a database to track data over time. Additional research will compare forest regeneration following timber harvest and different management techniques. Overall the two research areas will provide valuable information about forest productivity for biomass energy and the sustainability of our timber harvesting.



The BAK LAP field crew in August 2012 surveyed areas of high aspen mortality along the Yukon River.

—PHOTO BY THOMAS A. GRANT III

“Species and management practices that were appropriate for the circumstances of decades ago when the installations were established need to be re-evaluated for the new products and environment of today,” said Glenn Juday, project director and professor of forest ecology at the UAF School of Natural Resources and Agricultural Sciences. “Collecting these measurements and conducting evaluations will provide the basis for identifying optimum management practices for the new products, especially biomass, in today’s shifting environment. These facilities make an essential contribution to achieving local self-reliance in energy production using wood biomass and to avoid forest management practices likely to fail.”

Juday went on to explain further: “Years ago these sites were established as individual study plots. A number of sites attracted continuing studies or additional studies and became research facilities. Now we are interested in repurposing and rethinking the use and value of a number of sites that have the potential to provide important perspectives about forest management into the future. These can now be thought

of as forestry research installations after we make the appropriate investments in georegistration, database development, and updated measurement.”

The second component of BAK LAP will expand an existing K-12 education and outreach program called OneTree Alaska that the School of Natural Resources and Agricultural Sciences has been leading for three years.

Jan Dawe, pictured at right, research faculty in SNRAS, is co-principal investigator and director for education and outreach. She will lead the K-20** education component of BAK LAP, which involves integrative curriculum development, K-12 teacher professional development, service learning opportunities for university students, and citizen science training; all focused on the science and multiple uses of Alaska’s forests.

A forest entrepreneur camp for K-12 students is planned for August 2013 and a two-week STEAM (Science, Technology, Engineering, Art and Math) teacher training will be held in June. Professional development training, being held from January to May under the title “OneTree: From Seed to Tree,” will prepare teachers to become

leaders in passing on the science and art components of OneTree. “Tapping into Spring,” a project working with the birch sap resource will be part of the project in April and May 2013.

“BAK LAP represents the next step in developing a full-scale set of facilities and project-based curriculum, designed to improve science and math learning outcomes and meet twenty-first-century workforce needs,” Dawe said.

**kindergarten through master’s degree level graduate work

BAK LAP is funded by a \$1 million capital legislative appropriation to the Alaska Department of Natural Resources, Division of Forestry, contracted to the Agricultural and Forestry Experiment Station.



Below: birch chair made for a OneTree art show by Jesse Hensel.



HIGH-LATITUDE AGRICULTURE

Pedology at the Forefront of Climate Change

6



The campus of I-Shou University in Kaohsiung, Taiwan.

Typhoons, Culture, and Engineering in Taiwan

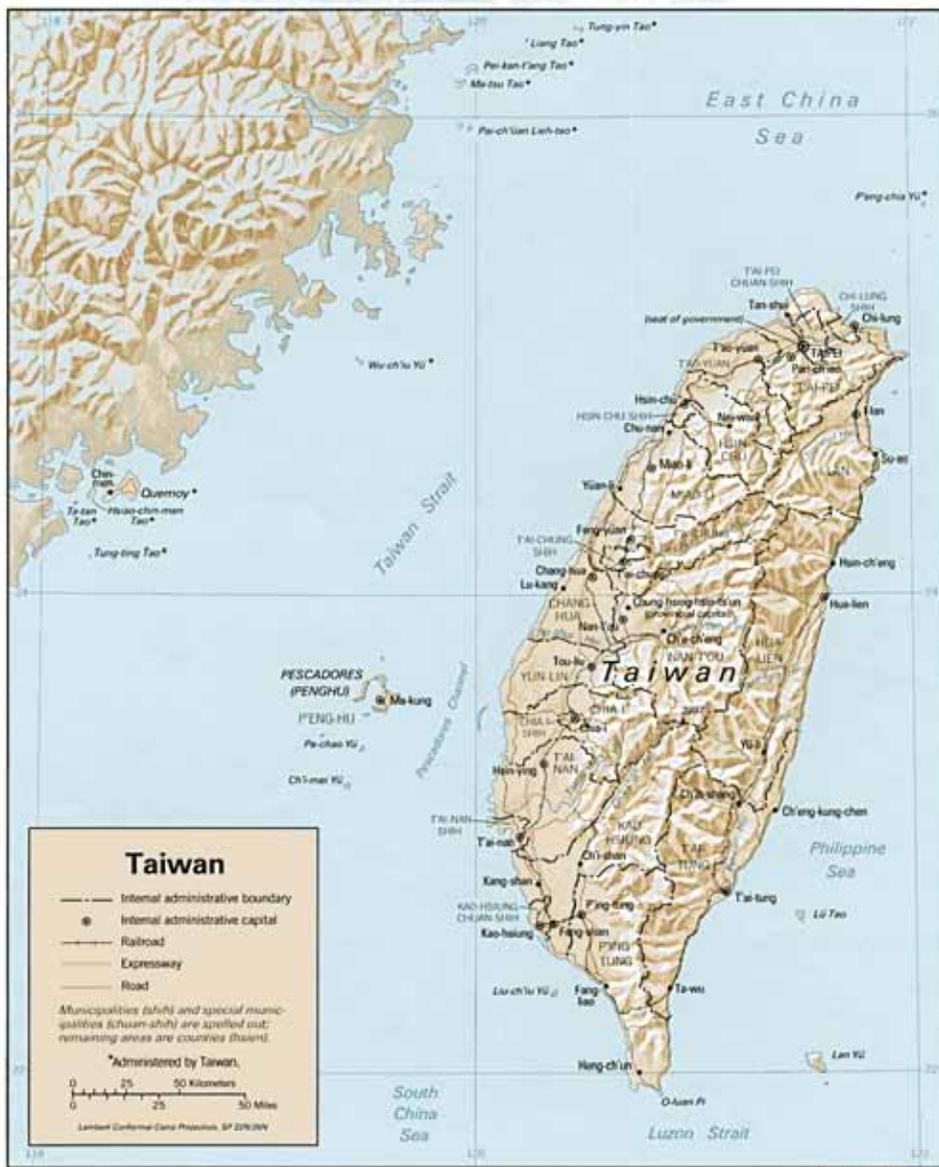
Chien-Lu Ping

*On sabbatical at I-Shou University, Kaohsiung Municipality, Taiwan
September 8, 2011 to February 17, 2012.*

Chien-Lu Ping is a professor of soil sciences at SNRAS. His interests include soil genesis and classification of permafrost-affected soils, soil organic carbon dynamics in soils of the Arctic and boreal regions, and soil climate and its application in land-use interpretation.

Introduction

I first met Professor Fu Shengli, president of I-Shou University in Taiwan, at the Alaska-China Higher Education Exchange held in August 2008. During the conference he invited me to visit his university. I corresponded with him and later visited I-Shou University on my way back from a visit to China in the fall of 2009. President Fu introduced me to the chair and faculty of the Department of Civil and Ecological Engineering (DCEE) because he thought my field of study was the closest to that department. I was invited to give a seminar at the DCEE on the subject of the design, construction, and permafrost environment of the Tibet Railroad in western China. The department head, Professor Weng, invited me to have my sabbatical there



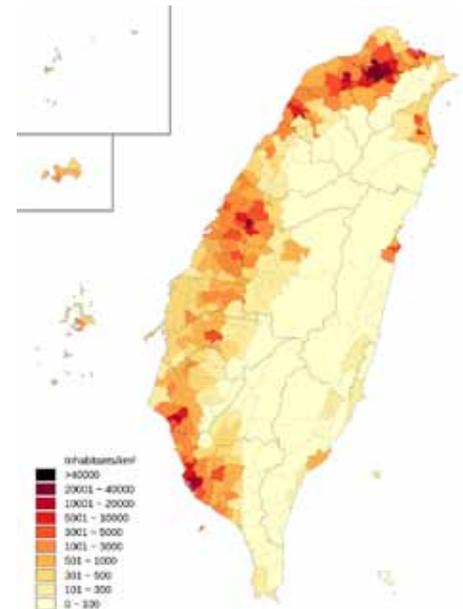
Relief map of Taiwan.

—CIA MAP, PD-USGOV. IMAGE DOWNLOADED FROM WIKIPEDIA.

and appointed Dr. Liao Chien-sen to proceed with the application to the administration of I-Shou University. During our discussion I proposed to give a lecture series on soils and climate change, and the application of pedology (soils science) in civil engineering design and practices. Dr. Liao then invited me to participate in his ongoing wetland and biochar research projects; I planned to join his group to collaborate in the wetland soils portion of the study plan during my sabbatical. However, the original intended cooperative research with Dr. Liao fell through because of a funding problem. Thus I changed my direction to look into the effects of climate change on Taiwan.

In my previous year's visit to I-Shou University's Department of Civil and Ecological Engineering, I had found that basic pedology was not taught at the department, and later I found out that pedology was not taught in any of the civil engineering departments in Taiwan, as it is in most of the civil engineering departments in US universities.

I moved to change this: My argument to the department was that they are involved in the excavation of soil, move the materials, and reshape the landscape—yet they don't have adequate background of how soils behave in their natural settings! So, I was invited to give a weekly series of



Population density by district as of end 2011: The majority of the population, about 80 percent or 18.4 million, lives on the western plains. The mountainous areas are to the east.

—IMAGE FROM WIKIMEDIA, CREATIVE COMMONS
 ATTRIBUTION-SHARE ALIKE 3.0 UNPORTED

lectures on environmental soil science for the graduate students, and another weekly seminar series in soil and water conservation practices for seniors and graduate students.

Taiwan: The Forefront of Climate Change

Taiwan is one of the eight hardest hit areas of climate change, according to a World Bank report, because of the combination of geology condition, earthquake, and abnormal weather patterns. The total land area of Taiwan is only 36,000 sq km (14,062 sq miles) yet 73 percent of the island is occupied by high mountain ranges and hilly terrain. There are 258 peaks with an elevation greater than 10,000 feet! In addition to steep slopes there are high geological hazards due to the bedrock composition and structure. The bedrocks of the northern part of Taiwan are dominated by relatively

8 stable igneous and metamorphic rocks. But in southern Taiwan the bedrocks are mainly sedimentary, including sandstone, shale, and mudstone. Located along the Rim of Fire, earthquakes are frequent. The most severe one in recent memory was the Richter 7.3 scale quake that occurred in central Taiwan in 1999 which shocked the whole island and caused many casualties and tremendous economic loss. The indirect damage of this earthquake and the following aftershocks include the loosening of the sedimentary rocks, which are thus prone to landslide and slope failures. Abnormal precipitation and steep slopes in the mountain region suffered the worst catastrophes due to slope failure, landslide, and accelerated erosion. The direct impact on the aboriginal tribes includes the effect upon the sustainability of their lifestyles and preservation of cultural traditions. Many engineering practices ignored basic soil and water conservation principles, aggravating problems created by the earthquake.

Thus the threat of climate change is twofold in Taiwan. The most commonly regarded concerns the coastal plain and floodplains on the west side of Taiwan, which suffered ground subsidence due to overdrawn groundwater and the rising sea level. More than 80 percent of the total population (23 million) of Taiwan lives on these plains. The next is the combination of steep terrain compounded by the poor geological conditions and abnormal weather patterns such as unusual intensity of precipitation.

Climate change poses an even greater immediate threat to the fourteen aboriginal tribes living in mountainous terrain than that faced by the people living on the plains. These mountain people account for less than 2 percent of the total population in Taiwan, where the majority are Han Chinese. The tribal people are ethnically related to South Pacific Islanders and each tribe has its unique language and customs. But facing the increased level and frequency of disasters, the sustainability of their



The Lukai Tribe's farmland, up in a narrow valley in the mountains. The main crops are taro and millet.

lifestyles and cultures is in question. My investigations in Taiwan concentrated on finding out the extent of the damage caused by the increased intensity of precipitation brought by typhoons and their impact on the sustainability of the lifestyle of the aboriginal tribes.

To investigate the impact of climate change on the ecosystem of southern Taiwan, the first step I took was to study the government webpage for background information, and then I went on field visits to the damaged areas along the three major drainages from the floodplains all the way to the source areas high up in the mountains in southern Taiwan.

Since 1996 earthquakes and typhoons caused major disasters, particularly from:

- July 1996: Typhoon Herbert
- September 1999: Jiji Earthquake
- September 2001: Typhoon Nelly
- July 2004: Typhoon Manduli
- August 2009: Typhoon Morakot

Each of the typhoons brought a tremendous amount of precipitation within a short period, usually within two to three days. The intensity of the

precipitation often far exceeded the holding capacity of the shallow forest soils on the mountain slopes, resulting in massive slope failures, debris, and mudflow.

Professors R.F. Cheng and C.H. Weng provided me with the opportunity to visit several damaged drainages: the Laonong River, the Moulin National Recreation area, the Zhuokou River, and Nanzihian River (a tributary of the Laonong Stream), all heavily damaged by the most recent disastrous storm—Typhoon Morakot. At one stop I was invited to the annual tribal festival on a high mountain. At the only coffee shop of the native village there I met a high school teacher, Mr. Huang, who belongs to the Piewan Tribe. He was quite astonished by my lack of knowledge of the native culture of his people and decided to give me a crash course. We spent the whole weekend traveling from the disaster relief housing project to the torrent-damaged river and eventually upstream to the end of the road and the “Cloud Village” inhabited by the Lukai Tribe. In addition, Professor Cheng told me the natural history of the island and Professor Liao introduced me to the religious heritage of the island, from Daoism to Buddhism and their role in the daily life of the people.



The author, right, and the chief of the Lukai Tribe at the Black Millet Festival, October 2011.

Dancers at the Lukai Tribe's Black Millet Festival. The dancers with the red ribbons are the festival's princes and princesses.



Flood and Drought

Taiwan has been described as one of the most uninhabitable places on Earth due to the frequent typhoons and earthquakes that pound this island nation. According to the Soil & Water Conservation Bureau of the Interior Department and the Agricultural Commission of Taiwan, the torrent rain frequency has increased from every six years to only two years over the past fifteen years due to climate change. The damages caused by typhoon are mainly from high-intensity rainfall and less from the high winds. Taiwan has such high annual precipitation yet it often suffers from drought because of the flushing effects due to steep slopes. According to the World Bank statistics, per capita fresh water allocation in Taiwan is less than Saudi Arabia!

The average annual precipitation of Taiwan over the past 60 years was 2,286 mm (90 inches) and the southern part of Taiwan was drier, with annual precipitation ranging from 1,500 to

1,944 mm (59 to 76 in). Yet, Typhoon Morakot dumped 99 to 112 inches of precipitation in three days from August 6 to 10, 2009. The heavy rain far exceeded the holding capacity of the ecosystem and the drainage capacity of the rivers and public spillways. Massive landslides and debris flowed down the mountain slopes and blocked the river system, caused a sequence of dammed lakes, and with consistent heavy rain the dams gave way causing further damage downstream. At the end, 490 people were buried alive, their village covered by debris flow due to slope failure, another 160 lives were lost further downstream, and there was a total loss of half a billion USD from farmland loss, road damage, and destruction to housing, livestock, and fisheries. Most of the 490 people killed by the mudflow belonged to a single native tribe.

In one of the communities I visited, the streambed was dramatically higher than before the storm flood, filled with gravel, rocks, and boulders washed from upstream. At one of the bridges across the stream the current bed was only five feet to the bridge surface but the original streambed was twenty feet below! The heavy rain had scoured the mountain slope, stripping it of vegetation and soils. It's estimated that the water-holding capacity lost due to loss of porosity of soils was close to one

hundred million cubic meters. This number means that an equal amount of rainfall next time will go directly into the runoff—slope collapse and loss of topsoils are double jeopardy problems.

The damage to the stream ecosystem was tremendous. The repeated flushing of the stream basically wiped out the primary biota from production (algae, etc.—creatures at the bottom of the food chain) thus threatening fishes and other higher aquatic species. Several protected species were totally lost due to such large-scale erosion. The torrent flow with all its load, mostly rock fragments

and boulders, caused riverbank erosion and destruction of infrastructure along the river corridor.

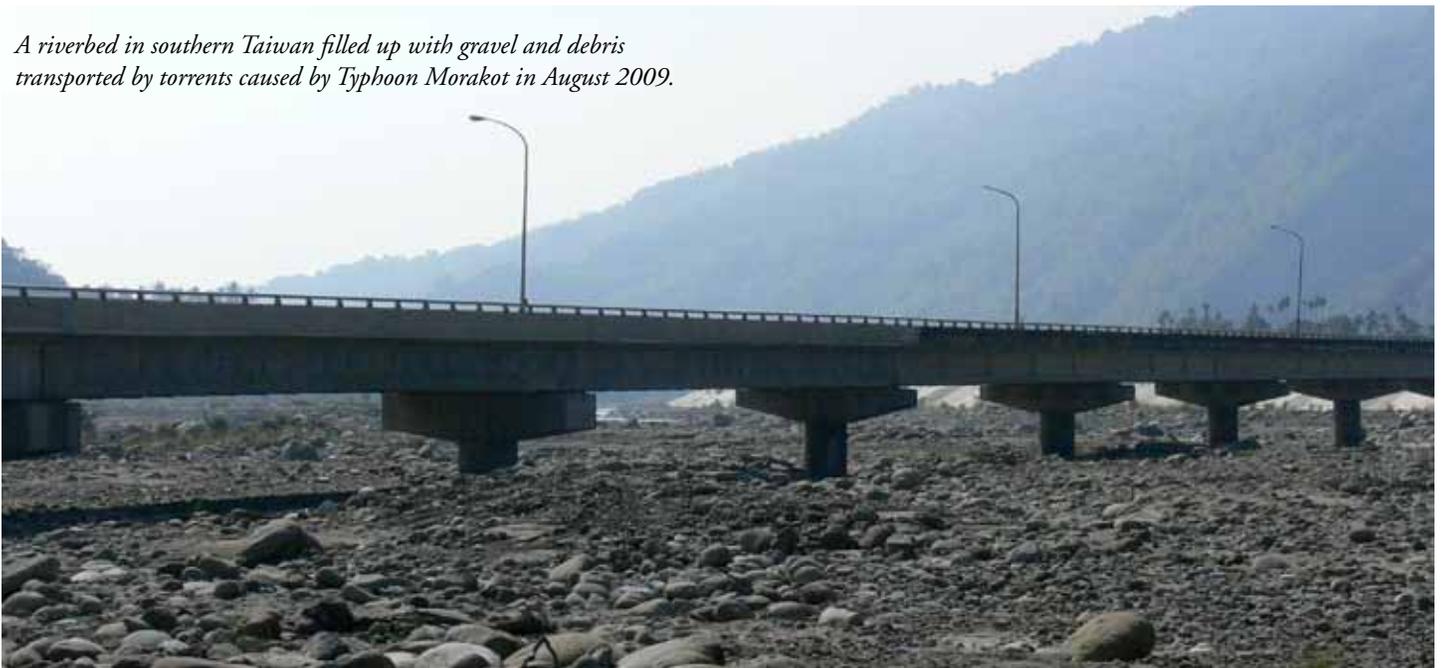
The Recovery and Reclamation Projects

For the damaged native villages and infrastructures, the reconstruction funds are largely from donations and government allocations. Here a good model of government-NGO collaboration has been established after Typhoon Morakot. The government



The heavy rains brought by Typhoon Morakot caused massive landslides and destroyed and buried Xiao Lin Village beneath.

A riverbed in southern Taiwan filled up with gravel and debris transported by torrents caused by Typhoon Morakot in August 2009.





Landscape experts and construction workers lay nylon nets over a steep slope where the soil and vegetation were stripped by Typhoon Morakot. The nets are anchored and vegetation replanted.

agencies only provided policy support and guidelines. All the funds for the restoration and reconstruction of native villages were managed by the nongovernmental organizations. Dozens upon dozens of NGOs worked together to find locations to build new houses for the tribes that lost their villages, designed the buildings with an aim to preserve the integrity of the native culture, and in some cases rebuilt the native village situated at the original sites. The leading NGO in this effort is the Tze-Ji Foundation, a Buddhist charity organization that has spread its work through all five continents. There were some problems in engaging the trust of the mountain villagers at first, however. The antagonistic history between the primarily Buddhist Han Chinese flatlanders and the Pacific Islander indigenous highlander tribes in Taiwan contributed to their distrust. Most of the native tribes are Christians, mostly Presbyterian due to the work of a Calvinist English missionary who started preaching there more than a century ago. So when the Buddhist Tze-Ji Foundation approached the villagers, they were very suspicious because they suspected the Tze-Ji would ask something in return. There are many other Buddhist, Daoist, and Christian organizations, including World Vision,

actively engaged in this relief effort. Since this is a grassroots activity, many volunteers from different walks of life have contributed their professional expertise, and the reconstruction has effectively used these resources.

There is a different story in the public projects involving roads and river channel stabilization. After each disaster the government dispensed emergency funds to repair the infrastructure, roads, bridges, and to compensate for

the losses. In the public engineering projects, different contractors bid for the projects as in the US. In many places where I visited the hillsides were stripped of all vegetation cover and most topsoils. These areas are located in the geological hazard zone of fragile bedrock structure, such as shale, sandstone, and worst of all, mudstone. The engineers used nylon or metal nets to cover the bare slopes and used anchors to fix the wire net in places, then planted grass in the middle of each square. It's very tedious work, labor intensive needless to say, and very dangerous. Wire cages filled with cobblestones locally called "pig cage" by the workers were very effective in stabilizing the eroded banks and slopes. Some of the pig cages, or rock cages, as the engineers referred to them, were piled in terraces to protect the banks and bridge foundations.

In the review process, the biggest problem I saw was the "cementalization" of the river or stream banks. Many segments of the riverbanks were stabilized by cement banks even in areas where private properties were not affected. Such practices diminish the meandering action of the stream and so increase the dynamic energy of the flood and increase the flow rate, causing more damage in segments

Rock cage: Wire cage filled with crushed rocks or gravel being lowered onto the river bed.





Riverbank stabilized with rock cages.

below the cement walls. Also, the cement walls along the riverbank block the biological exchange between the riverbank and the river systems. Many species depend on access to the river for feeding and breeding, and then retreat back to uplands. The cement wall and streambed decrease the hydrological exchange between the riverbank and the river and between the river channel and the groundwater. The net result of this ecology-ignorant engineering practice is increased flooding hazard and decreased water storage, in addition to the biological damage. In the village restoration, it's the NGO volunteers who fully exert their talent and energy without asking for reward. However, in the public engineering projects, the bidding processes were often interfered with by the local elected officials, affecting the quality and best material/practice options—a story familiar to many countries and cities.

The Sustainability of the Native Lifestyle

A question must be raised as to how these disasters occurred. The native tribes arrived in Taiwan much earlier than the Han Chinese, who first sailed to Taiwan around 500 AD,

with the earliest estimates at 8,500 years ago. There has been a constant battle between the two ethnic groups and eventually the native tribes were forced to migrate to the highlands and mountains. They have maintained a lifestyle based on hunting and small grains plots, mainly millet and taro fields. Starting in the early 1970s when the economy of Taiwan took off, both the government and the tribal leaders saw the need to develop tourism to increase their income and improve their living standard. The road system was developed through the mountainous regions where the geology hazards are high because of the bedrock structure, mostly fractured shale and slate. The native people also expanded their villages and cleared more mountain slopes for crops in order to accommodate the tourists and increased population. The results are the massive slope failures and debris flow following the road systems and farm plots. It is estimated that soil erosion and slope failure caused by road building is four times that caused by clearing farm plots on hill slopes.

After the typhoon damage, the NGOs and the government built new settlements for the tribal members who lost their land and houses. The project is called “Da-Ai Woo,” meaning “great love houses.” The houses were well

built and the settlements are mostly on flatlands. The housing layout is like a small town, unlike in the original villages. Most of these settlements are one to two hours' drive from their old villages. Some tribal members go back to the damaged village once a week but there are people who go back every day. The lost land and lifestyle haunt them. But according to recent climate models, such disasters as the one caused by Typhoon Morakot will be more frequent and in many cases, it is either very costly or impossible to repair the road system in areas frequented by landslides after each heavy rain. Thus the villages have to be moved to safer ground, usually flatlands with urban development or near the edge of cities. Uprooted from their villages, would the people be able to keep their traditional lifestyles and heritage? The question is beyond economics and engineering feasibilities.

Summary

Today there are 24 million people in Taiwan yet there are 120 universities. In 1950 there were only 7 million people and three universities. Higher education is faced with a shortage of students in the future. In the past decade Taiwan experienced negative population growth because of economic development coupled with a higher living standard. The Education Ministry estimated that by 2015 there will be 50,000 less to fill those 120 universities and the lower tier universities were faced with the possibility of closing. In Taiwan, the universities adopted the unified exam system in that high school graduates going on to college take an entrance exam and are assigned to the tier of university based on their scores. Thus the best students go to the top or first to second tier universities, leaving the third tier universities with students of lower standards. A similar situation is occurring in China too.

I-Shou University is one of those third tier institutes and fights hard to elevate its academy standard. Based on

my observation, the faculty members in the engineering school at I-Shou and several other private universities have qualifications comparable to the first tier universities. However, the dilemma is trying to maintain the academy standard yet not to lose or to maintain qualified students; a very delicate dance in the face of decreasing enrollment. This university is the most aggressive one in Taiwan to develop an international program, even ahead of those first tier universities. It has an all-English academy from elementary to college. Spring semester 2012 the regular undergraduate programs, for example, attracted 420 Chinese exchange students spread in every school from hotel management to engineering. In addition there were thirty degree-seeking Chinese exchange students as well as exchange students from more than fifteen countries. UAF can learn from the I-Shou's experience in attracting international students.

My involvement with the Civil and Ecological engineering department at I-Shou was to introduce knowledge of soil environment elements to their engineering practices. There are many environmentalists who are concerned about the way the reconstruction and rehabilitation programs after each typhoon damage the environment. To apply the eco-engineering approach takes time in planning and design and the outcome would be more economical, more sustainable, and environment-friendly. However, pure engineering practices are often favored because of the shorter construction period, hence faster cash flow for the contractors, who are often backed by the above-mentioned elected politicians.

Against the conventional belief that the cement riverbanks last longer to protect the riverbanks, I proposed to the designers that riverbanks should be made that give rather than resisting river scouring. Based on field observation, there are hardly any "permanent" riverbanks made with cement. Rather, using the pig cage method can dissipate the rivers' motion energy and also allow

water exchange between the riverbanks and recharge the groundwater, without excess erosion. Some faculty members agree but it is up to debate with a large audience.

In the assessment of typhoon damage due to heavy rain, often the soil aspect was ignored. The assessment always emphasized the hazards of debris flow, mudflow, and slope failures. But equally important is the loss of topsoils from the mountain slopes. Soils have water storage capacity because of the porosity (averaging 40 percent). Once these soils are washed off the slopes, the precipitation on the eroded areas would go directly as runoffs.

Coupled with the frequent flood damages to farmlands after each typhoon season, urban expansion also contributed to the dwindling of farmland. Taiwan's food self-sufficiency has dropped from 70 percent in 1970 to the current rate of only 30 percent. Faced with the same problem and increased grain prices, countries like China, South Korea, and Japan are actively looking for arable lands overseas—a rush to lease or purchase farmlands. In Taiwan, even though there is a Farmland Bill that protects farmland status, this legislation has been heavily abused or challenged over the past decades. Many farmland owners changed their land into chalets or residential units and regulatory agencies are powerless to reinforce the policy. Faced with ever-increasing natural hazards such as earthquake and typhoon, along with shrinking farmland and food production, there is urgent need of a national land use policy and most important, the mechanism and determination to reinforce the law. It is the key to the sustainability of the ecosystem and lifestyle in Taiwan.

So how can what happened in Taiwan be related to Alaska? Alaska still has a large area that can potentially be developed into productive farmland. As the contiguous US has been faced with drastic weather patterns in the past decade, crops and livestock have been threatened by severe drought or

flooding, and food security becomes an ever more pressing issue. With the gradual warming trend and increased growing season, Alaska may hold the key to serve as a farmland bank to meet this emergency. Alaska policymakers should take note of this.

This sabbatical provided me with an excellent opportunity to learn first-hand the impact of climate change on the livelihood and cultural heritage of such a small island with so many people. It is a miniature of the larger picture of what can happen and is already happening in many other parts of the world. During my sabbatical I was invited to five other universities to present seminars on topics related to climate change and the permafrost environment of the Arctic. The faculty and staff of I-Shou University as well as those in other institutions were very friendly and kind enough to provide accommodation and assistance to make my sabbatical an unforgettable experience. I hope my sabbatical is just the beginning of a cooperative exchange relationship between our two universities.

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Two Thousand Years of Peonies: Lessons for Alaska Peony Growers

Mingchu Zhang

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Mingchu Zhang is an associate professor of agronomy and soil sciences at SNRAS.

In Alaska, peonies have been a favored garden flower for more than sixty years, but worldwide their cultivation history is much longer, with evidence of their extensive use as long as 2,000 years ago and even longer. Peonies belong to the family Paeoniaceae and the genus *Paeonia*, which includes a number of species and cultivars. Both tree and herbaceous peonies are perennials, but tree peonies, which grow to eye level on woody stems with few branches, are not used for cut flowers. Herbaceous peonies are bushy plants, with green, pink, or red stems that grow two to four feet tall. The herbaceous peony, known as the “queen of flowers” in China, has been cultivated there for 2,500 years; the tree peony, or “king of flowers,” has been cultivated in China for 1,500 years. The tree peony is not winter hardy enough to withstand Alaska’s cold weather; however, herbaceous and some hybrid cultivars are.

The UAF School of Natural Resources & Agricultural Sciences and Agricultural & Forestry Experiment Station have been working for the last decade on a long-term project exploring the potential for the cut flower market in the 49th state—which looks to have significant potential. For more information, please see the listing at the end of this article and the links below:

Alaska Peony Growers Association
www.alaskapeonies.org

**Georgeson Botanical Garden UAF
peony research listing**
<http://georgesonbg.org/research/peonies/index.html>

From January 15 to April 30, 2012 I took a relatively short sabbatical to China, collecting impressions about China’s peony research and commerce. I gained information about the peony market, and established personal connections with researchers and peony growers in China. The Alaska peony industry has been growing rapidly in recent years due to the state’s unique flowering time (late June to September) and the demands of the market for these flowers. This flourishing new industry needs information to improve peony production in the state.



Dual color (chimera) flower in Luoyang commercial peony garden. This cultivar dates back from the Song dynasty (960–1279), and is one of the major tourist attractions in the garden.

—PHOTO BY MINGCHU ZHANG

Cultural history

China has more than 2,000 years of peony cultivation history. In the Tang dynasty (618–907), Luoyang was already famous for its tree peonies. A couple of poems written by different authors living during the Tang dynasty paint a picture of how popular the tree peony was in the northern part of China by that time.

The Red Peony

by Wang Wei*

*Voluptuous green so leisurely and tranquil
and robe of red now light, now dark
heart of the flower sadness about to break
but how could we know this from such spring colors.*

Drinking with Friends Amongst the Blooming Peonies

by Ling Huchu

*We had a drinking party to admire the peonies.
I drank cup after cup till I was drunk.
Then to my shame I heard the flowers whisper,
“What are we doing, blooming for these old alcoholics?”*

Matching Premier Linghu’s “Taking Leave of the Peonies”

by Liu Yushi

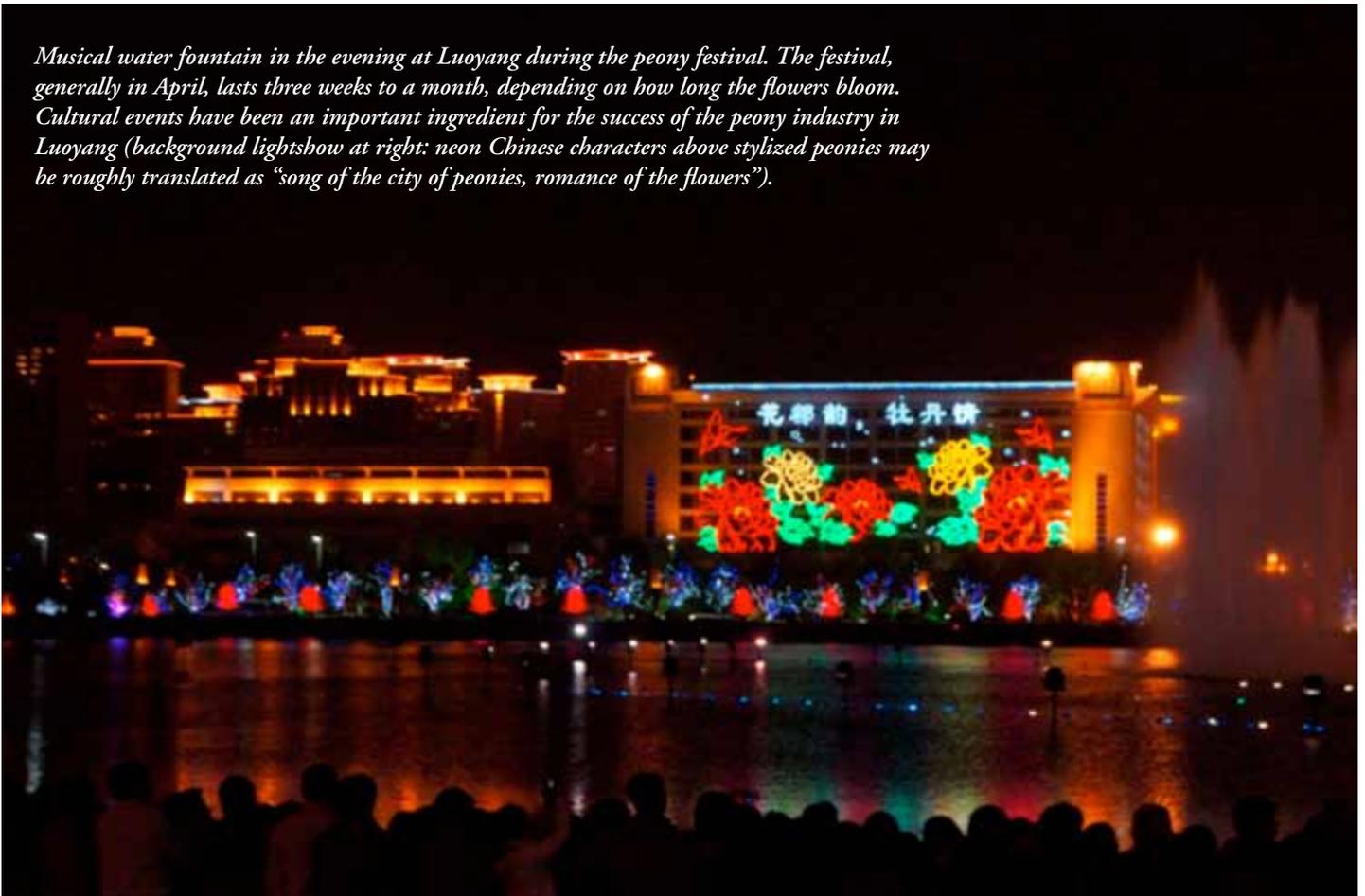
*In my official mansion, a balustrade of flowers.
But when it’s time for them to bloom, I’m always away from home!
Do not say the Twin Capitals are not far distant parted.
The springtime brilliance beyond my gate is the very abyss of Heaven.*

During the Tang dynasty, there were twin capitals in China: one was the city of Xi’an (where in modern times the terracotta army of the ancient emperor Qin Shi was found); and the other was Luoyang, where the tree peony was and continues to be famous. In the modern day, on the streets as well as the buildings, one can easily see signs of the peony’s influence throughout the city: sculptures, friezes, gardens, artworks, building and business names with peonies. As such, visitors are immersed into the culture of peony flowers. In combination with the peony festival, there are musical water fountain shows and music shows.

The herbaceous peony has been loved in southern China since the Sui dynasty (589–618) as well as in the Tang dynasty, but their culture thrived in the Song Dynasty (960–1279) with the center in the City of Yangzhou. In ancient times, streets were named after the herbaceous peony and some still remain today (Xu, 2005). Even now, the herbaceous peony is one of the two city flowers for Yangzhou.

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Musical water fountain in the evening at Luoyang during the peony festival. The festival, generally in April, lasts three weeks to a month, depending on how long the flowers bloom. Cultural events have been an important ingredient for the success of the peony industry in Luoyang (background lightshow at right: neon Chinese characters above stylized peonies may be roughly translated as “song of the city of peonies, romance of the flowers”).



Peony tourism

16 The city of Luoyang now is the tree peony capital in China, and has the largest commercial tree peony garden in the country. Each year, these commercial gardens attract millions of tourists to the city, which contribute millions of dollars to the Luoyang economy. I visited one of the largest commercial gardens there and met the private owner of the garden, Mr. Fu Zhenling. He told me that only the day before, around 30 thousand visitors had entered the garden. I noticed the garden entrance fee was 50 Yuan (~\$8.00 USD). The total gross revenue for that day, I calculated, was around \$240 thousand USD. Of course, in Alaska, we are unlikely to expect similar amounts of visitors and income to a commercial peony garden if such a one existed. However, the message I received from this is that people love peony flowers in China. Because their peony flower season is so short—only from April to early May—this could be a potential market for Alaska growers.

Research pertinent to Alaska

While in Luoyang, I visited the Henan University of Science and Technology, College of Agriculture, and met their leading peony researcher, Professor Shi. While at the University of Yangzhou, College of Horticulture, which has

a research garden housing many herbaceous peony species, I met the dean and the department chair, who lead the peony research group there, and also listened to a presentation of their peony research. My general impression is that they have done a great job on peony research and generated a wealth of information on peony plants.

Here are two examples that can be used to demonstrate their advancement in understanding herbaceous peonies. First, they studied medicinal use of above-ground tissue for its isomeric pentacyclic triterpene oleanolic (OA) and ursolic acid (UA) concentration. These two acids have been proved to function as antioxidants, antibacterials, anti-inflammatories, and anti-tumor agents. They evaluated fourteen cultivars for their OA and UA concentration, and found some cultivars have higher concentration of these two acids as compared to others (Zhou et al., 2011). Second, they did research work on cut stems, and based on which they found CaCl_2 can be used to strengthen flower stems (Li et al., 2012). This information is useful for us in Alaska.

Besides visiting their research institutes and peony gardens, I also collected and read 40 journal papers from China on tree peonies. In a very brief summary, these papers cover areas of : 1) predicting blooming time based on air or soil temperature; 2) chemicals used to extend cut flower vase life, 3) literature review; 4) marketing research;

The author, Dr. Mingchu Zhang, left, with a commercial peony garden owner, Mr. Fu Zhenling, in Luoyang.



5) physiology study; 6) disease control; 7) tissue culture; 8) stem transplanting; and 9) taxonomy of flower types. Of these research papers, I found two areas particularly interesting to me and if they are successfully adapted in Alaska, there will be large economic benefits to Alaska growers. Specifically, these are tissue culture and stem direct transplanting. Even though the tissue culture is conducted for the tree peony, the results still can be adapted for herbaceous peony. The best culture medium is MS + 6-BA (0.5-1) + NAA (0.1 - 0.2). The suitable light intensity is 2,000 lux (10 h/day), and room temperature (25°C) is desirable. One paper dealt with stem direct transplanting. For 10 tested peony species, the survival rate varied from 53 to 93%. These are pretty high survival rates. This result shows that it is possible to plant peony stems rather than roots. The root growth promotion chemicals used are ABT-6 (Auxin Bequeathed with Third component), and indole-3-acidic acid. The survival rate from ABT-6 treated plant is higher than the ones treated by indole-3-acidic acid. I would certainly like to see this research conducted at our school. In fact, Dr. Patricia Holloway has a plan to try some

of these methods for tissue culture using Alaska herbaceous peonies.

In summary, this trip, even though it was short, has helped me to understand more about peonies and peony research in China. More important, this trip allowed me to build relationships with researchers and peony gardeners in China. The information collected during my sabbatical will certainly bear fruit as we strengthen the leading role of our school in peony research in Alaska.

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Herbaceous peony variety trial in Yangzhou University garden.



Livestock Systems in Alaska: New Ideas, Practices, and Possibilities

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Jan Rowell, S. Craig Gerlach, and Milan Shipka



“Everything
around us is
changing.”

Jan Rowell is a research assistant professor of animal science at SNRAS.

Scott Craig Gerlach is a professor of cross-cultural studies.

Milan Shipka is a professor of animal sciences at SNRAS.

Everything around us is changing: the climate, the economy, the food, farm, and social environment, and it comes as no surprise that the agricultural and culinary institutions in Alaska are also in transition. Consumer demand for local food crops and livestock produced in healthy, sustainable ways continues to increase; a growing number of restaurants value and seek out locally grown meat; meat cutters are experimenting with “nose to tail” custom processing using homegrown livestock; various producers are examining the potential of “value-added” fiber production as well. Although the state of Alaska is not widely appreciated as an agricultural state, we do have huge untapped potential to increase in-state food production and address head-on the very serious food system challenges facing all Alaskans today. Because our food system is based on a long supply chain from global production through a network of mid-level distributors to in-state consumers, we remain vulnerable. We currently produce less than five percent of what we consume; there is little to no commercial storage capacity within the state; we still have too few farms, too few farmers, and too few livestock producers.

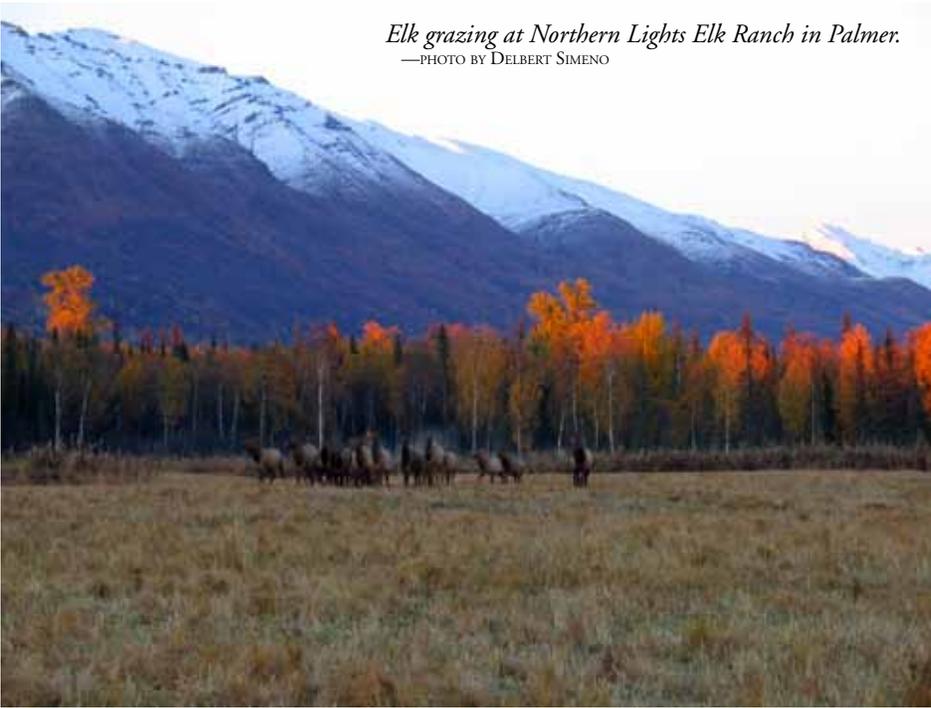
The role of country foods harvested from the land continues to be important in both rural and urban Alaska, but the goal of the High Latitude Agriculture group at the University of Alaska Fairbanks is to enhance development of the Alaska food system by finding new ways to craft economically viable, ecologically healthy, and sustainable ways to grow red meat. Management models need to reflect our high latitude ecology, and incorporate the use of both traditional and non-traditional livestock species. Moreover, we are interested in helping to find and implement best practices for incorporating livestock into functionally integrated farm and grazing systems.

By contrast to confined feeding operations, natural systems grazing is a low-cost component of livestock production that is especially well suited to Alaska. There are a multitude of different grazing practices being advocated throughout the US, with multi-species rotational, successional, and targeted methods in use, methods that are as diverse as the different ecosystems that support grazing animals. At the 2011 Sustainable Livestock Conference, grazing practices emerged as an area of keen interest among Alaska producers. Joining forces with the Alaska Diversified Livestock Association (ADLA) and the Division of Agriculture, State of Alaska, we hosted a second conference and workshop on feeding and grazing practices in Alaska in 2012. In the initial planning stages, Amy Pettit from the Division of Agriculture put us in touch with a group of fiber people interested in adding a workshop for fiber producers and users to the meeting. From this collaboration a multi-faceted, dual purpose conference and workshop emerged: *Feeding and Grazing Practices for Multiple Species in Alaska: Problems and Prospects*, followed by *Fiber Production in Alaska: from Agriculture to Art*.

Feeding and Grazing Practices for Multiple Species in Alaska: Problems and Prospects

Readily available agricultural grazing lands in Alaska are still limited in kind, quality, and accessibility, forage production is highly variable and the grazing season is short,

Elk grazing at Northern Lights Elk Ranch in Palmer.
—PHOTO BY DELBERT SIMENO



although this varies from south to north along a latitudinal gradient as well as coastal versus inland considerations. In an effort to foster sustainable livestock production at different scales and for different species, we need to design grazing systems that are compatible with the diverse ecology of the state, systems specific to the species being raised, and systems consistent with the goals of individual livestock growers.

“When properly applied, grazing systems are powerful tools that can help livestock managers achieve management objectives related to range-land and livestock production (e.g., forage production, average daily gain), as well as those related to ecosystem structure (e.g., wildlife habitat) and function (e.g., erosion control, water quantity and quality). However, selection of the proper grazing system is contingent upon the uniqueness of the setting in which it is applied (e.g., topography, soils, vegetation types, climate, etc.).”

—Larry D. Howery, *et al.*, from the introduction to “A Summary of Livestock Grazing Systems Used on Rangelands

in the Western United States and Canada,” available on line at www.ag.arizona.edu/pubs/natresources/laz1184.html.

Forty-five registered participants attended the first day of the feeding and grazing meeting in Wasilla. The keynote talk was presented by Dr. Ben Bartlett, a retired cooperative extension agent, veterinarian, livestock grower, and grass manager. Bartlett hails from the Upper Peninsula, Michigan, where he and his wife run a 640-acre grass farm (see inset). Bartlett talked about holistic management practices in some detail, with the general approach outlined on the first day, backed up with an on-farm pasture visit at the AFES Matanuska Experiment Farm near Palmer the next day. Holistic Resource Management (HRM) is based on two key principles: 1) Nature functions as an interlocking whole comprised of multiple components, energy and nutrient webs, and 2) on the human and cultural side, the imperative that a producer must understand how the natural system works, especially within a context of intensive or extensive management practices. The holistic approach recognizes that all our decisions are interrelated. Understanding, planning, and decision making underlie the

goals and objectives that arise from practical farming problems, economics, ecological or social considerations, or more likely, a combination of all of these. Any one decision impacts all other aspects of your life as a farmer. Understanding these relationships is fundamental to making decisions that result in a more effective, efficient, and economically viable food producer.

Secondly, not all tools work in all natural systems, there is no “magic bullet” and no “one size fits all” solution, in marked contrast to the industrial agricultural paradigm. The HRM process is incremental, flexible, and under the right conditions with the best practices, innovative. Producers in Alaska are acutely aware of this, but it is always useful to look into a new “toolbox” for the novel application of old ideas. Bartlett’s keynote talk framed these broad principles of holistic management in some detail, while the workshop the following day focused on how the principles could be applied to individual grazing situations. Using a worksheet, Bartlett walked participants through a series of questions to help establish a grazing plan, including but not limited to, a discussion of rotational, successional, and targeted grazing options. Any successful grazing plan revolves around long-term (ten to twenty years) personal goals, followed by a series of short-term strategies and steps that are required to realize the goal. The benefit of such a plan is the ability to manage pastures efficiently and proactively within the context of an individual producer’s resources and goals. The challenge now is to start planning and setting up goals, the first and perhaps most difficult step. As several HRM advisors and many farmers and ranchers acknowledge, “our first job is to manage grass, our second to manage animals.”

While Bartlett’s talk dealt with the principles and practice of holistic grazing, the other presentations brought the grazing issue closer to home. Erik Johnson, Natural Resource Specialist II, Division of Agriculture and Adam

Smith, Natural Resource Manager, Department of Natural Resources, both with the State of Alaska, explained grazing lease policies in Alaska. Johnson has followed up on this by circulating the new Alaska Forage Manual (www.plants.alaska.gov/forage/index.php) and A Field Guide to Alaska Grasses (<http://digital.ipcprintservices.com/publication/?i=116723&pre=1>), both important resources for anyone embarking on a grazing program. Steven Seefeldt, Agriculture/Horticulture Agent with the Cooperative Extension Service, talked about the principles of pasture management using invasive species as the frame of reference. Catherine Hadley, Resource Conservationist, NRCS, USDA, revealed her broad knowledge of grazing in Alaska using practical examples from her own mixed breed flock of sheep in the Delta Junction area, and from her experience in working with diversified stock growers throughout interior Alaska.

Under the theme of Emerging Opportunities, Delbert Simineo, owner and operator of Northern Lights Elk Ranch, gave an overview of what it took to start, build up, and maintain an elk ranch in the Matanuska Valley and accompanied his talk with some wonderful pictures. Todd Brinkman, Assistant Professor at UAF, Tom Paragi, Wildlife Biologist at the Alaska Department of Fish & Game, and Craig Gerlach, Professor at UAF, have collaboratively been exploring boreal pasture management at a personal level, recording the browsing, rooting, and grazing habits of goats and Tamworth hogs on their respective farms. Although this project is in its infancy and still modest in the results produced, they willingly shared their insights, pitfalls, and successes.

John Blake, Director of Animal Resources and Associate Vice Chancellor for Research at UAF talked about the university's new 2 + 2 Veterinary Program. This program will enable Alaska students to take the first two years of veterinary school at UAF (post-baccalaureate), and then finish



Tamworth hogs at Craig Gerlach's small farm in the Interior.

their final two clinical years at Colorado State University College of Veterinary Medicine and Biomedical Sciences in Fort Collins. For the students, there are obvious savings in tuition and subsequent debt load, as well as opportunities for gaining a foundation in the theory and practice of large animal veterinary medicine. For producers, this program will train, and hopefully retain, more veterinarians with strong Alaska roots, and provide for greater diagnostic and forensic capabilities within the state; as any stock grower in the state will attest, the lack of reliable, affordable, and predictable large animal health care is currently a barrier to increased production and herd health.

Promoting a healthy livestock industry in Alaska is about much more than growing healthy animals though. Livestock are only one part of a food system that incorporates everything from producing animals all the way to the processor, retail distributor, and to the consumer. The final two speakers represented the entrepreneurial spirit needed to link local meats with Alaska consumers. François Vecchio, author of *Salumiere, Charcutier & Würstmeister* (www.francoisvecchio.com), is reviving the ancient craftsmanship of the

butcher, meat cutter, and artisanal sausage maker. Now located in Alaska, Vecchio is an avid promoter of the local production of livestock for the high-end deli market. Vecchio was followed by Clayton Jones, an award-winning chef, one born and raised in Alaska, and an articulate champion of locally produced food.

Fiber Production in Alaska: From Agriculture to Art

This one-and-a-half-day workshop was sponsored by the Division of Agriculture in response to a request by artists and fiber producers to have a day of presentations and discussion dedicated to Alaska fiber production, an unrealized value-added component for the meat producer, and another avenue linking farmers and ranchers to consumers, and in this case, artists and craftspeople as well. The meeting attracted thirty registered participants, with Dr. Lyle McNeal, the Carnegie Professor from Utah State University, as the keynote speaker. McNeal is widely known and respected for his work with the Navajo Nation on the Navajo-Churro sheep project (see

insert), among many other significant contributions to the fields of animal science and animal husbandry. Drawing on a lifetime of experience with fiber and fleece, he walked us through an informal discussion of what constitutes fleece quality and commercial fleece evaluation. Using fiber from a variety of locally raised species, the demonstration pointed out characteristics that could enhance or decrease the commercial value of locally produced fleeces. A more formal talk the following day covered aspects of hair and wool growth physiology, animal husbandry, and marketing strategies for fiber. McNeal was speaking to a very enthusiastic and receptive audience with a collective, grassroots agenda to organize formally as an association and/or cooperative, and to pursue in-state options for fiber processing. For many sheep and goat producers, there is no value added in fiber if they have to ship it to processors in the lower 48 states, so the interest in developing cost-effective infrastructure for in-state fiber processing was high. Although this is not the first time in-state processing has been discussed or investigated, there is clearly new motivation to look again and to explore all the options now available to us from new technologies and a diverse and growing fiber production base. Before adjournment, participants filled out survey questionnaires, set up a steering committee to provide background information on different associations, and now are spreading the acquired information through guilds and by word of mouth in their respective communities. There is no doubt that we will hear more from this strong grassroots movement.



Eighteen-month-old cashmere doe, Hedda, of Shepherd's Moon Keep Farm, Clam Gulch, Alaska. Photo taken September 2012, showing Hedda's fall coat.
 —PHOTO BY L. COREY-LUDDEN

The three-day feeding, grazing, and fiber conference was hosted in conjunction with the Alaska Diversified Livestock Association (ADLA), and the Alaska Division of Agriculture. The ADLA has now modified their requirements for membership to include producers of any livestock species, buyers, chefs, wild game processors, butcher shops, stores, restaurants, associated businesses, and any interested individuals, expanding both the venue and the stakeholder base. By broadening their membership, all Alaskans vested in the food system and in value-added production will have a strong collective voice at the local, district, and state levels. The meeting

garnered fourteen new members for the association.

People walked away from the conference with new ideas, new toolkits, with new collaborations emerging, and a rekindled interest in and hope for a new vision of the Alaska food system, from local production to local consumption, from fiber to artist, and hope for a whole new kind of agriculture in Alaska. This conference is only the beginning—there are many good ideas on the table and we are working hard and looking forward to the next steps.



Left: exotic fiber samples.



Right: Lyle McNeal discussing properties of various wools during the Fiber Production in Alaska workshop.



Dr. Ben Bartlett, recently retired from Michigan State University where he worked as an extension dairy and livestock agent (for which he received MSU's Distinguished Extension Academic Staff award), shares his expertise as a livestock consultant specializing in grazing practices, low stress animal handling, and new enterprise analysis. Trained as a veterinarian, Dr. Bartlett is also

a certified educator in holistic management and served as past board chairman of Holistic Management International, a private nonprofit foundation promoting healthy and profitable land management. He was chairman of the North Central Sustainable Agriculture Research and Education (SARE) committee; acted as co-leader for ten Michigan and Great Lakes Grazing conferences; a member of the Upper Peninsula Wolf Management Taskforce; and published a self-funded agriculture newsletter for over thirteen years. Throughout all these activities he has, with his wife, owned and operated Log Cabin Livestock, a cattle and sheep grazing operation in Traunik, Michigan.

He has won numerous awards and has extensive international experience, studying grassland and grazing systems throughout the world.

The following excerpt highlights perfectly why Dr. Bartlett was invited as a keynote speaker and workshop presenter.

Ben Bartlett has three decades of experience with Michigan State University prior to his retirement and has been one of the most visible figures in upper Midwestern grazing. Ben and his wife operate a 640-acre grass farm in the heart of Michigan's Upper Peninsula. In 2011 Ben and his wife lambed 400 ewes, produced 640 lambs and backgrounded* 200 dairy steers. Ben has been a leader in the Holistic Management school of grazing and has applied these principles to his farm where over the past thirty years he has dealt with the encroachment of woodlands and predatory wildlife including bear, wolves, and coyote. Holistic Management is often considered to be a Western rangeland management system. Ben will share how its principles are applicable in northern environments, or wherever grazing is practiced.

Ben and his wife Denise have three children and nine grandchildren.

*backgrounding is a term commonly used in the cattle business to describe weaning calves and preparing them for market with grain or pasture.



Dr. Lyle McNeal, sheep, wool, and range specialist, is a Carnegie Professor at Utah State University. This prestigious award recognizes outstanding professors for their influence on teaching and their commitment to teaching undergraduate students. This is only

one in a long list of teaching awards conferred on Dr. McNeal, making him one of the land-grant university system's most decorated teachers.

As well as teaching some of the largest enrollment courses within the College of Agriculture, he serves as the Animal Science Program faculty coordinator, Honors Adviser, Internship and Cooperative Extension Supervisor, advisor to the USU Sheep Club, and academic adviser to more than 125 animal science majors and minors, and a member of the Curriculum Committee. He has served as a member of the Utah Wool Growers Association and the USU annual "Sheep and Goat Day" Planning Committee since its inception.

In addition to his skills as an educator, Dr. McNeal is widely known and respected for his work with the Navajo Nation. Together with his wife, he founded the Navajo Sheep Project; Serving People, Preserving Cultures, Inc., established 1977. His almost thirty years of pioneering work in genetic conservation of domestic animals with the Navajo-Churro sheep, and outreach education in the Intermountain West and on the Navajo Nation has brought national and international recognition to that program. On the reservation, Lyle McNeal was adopted by the Begay family, who called him "The Blue-Eyed Warrior."

Lyle and his wife Nancy have been married for fifty years, have eight children (four boys and four girls), a Navajo foster daughter, and ten grandchildren.

This was not Dr. McNeal's first trip to Alaska. In 1997 he judged the sheep and fiber show at the Alaska State Fair, Palmer, and gave presentations to Alaska sheep producers—and many years ago, did fiber analysis in his Wool & Animal Fiber Lab at USU, for the Musk Ox Project in Palmer.

Acknowledgement:

The authors wish to express gratitude to all who helped in making the Feeding and Grazing Practices for Multiple Species in Alaska: Problems and Prospects and the Fiber Production in Alaska: Agriculture to Art conferences a success. We would especially like to thank Theresa Isaac for her assistance in registering participants of both conferences and helping folks check in at the conferences. We would like to thank Jim Ericksen, Keith Barton, and Brian Johnson for helping at the Matanuska Experiment Farm with everything from driving the tractor to cooking. The conferences would not have been successful without their dedication to Alaska agriculture.



Gemsbok at Etosha National Park.

Gemsbok Gazette: an Alaskan in Namibia

Susan Todd

Susan Todd is a professor of natural resources management and collaborative planning at the University of Alaska Fairbanks with SNRAS. From July 2011 to July 2012 she spent a Fulbright sabbatical in Namibia studying wildlife management on communal conservancies and teaching at the Polytechnic of Namibia, in the city of Windhoek. While there she kept a blog to recount her adventures. This article is taken from that blog.

My flight left Namibia at 10 AM on 27 July, 2012. I sat at the window watching the familiar landscape fade away as tears poured down my cheeks and I tried not to sob out loud. I could hardly believe my thirteen months in Namibia were over. It was a dream come true and a magical adventure that I somehow thought would never end. Now back in Fairbanks, I refer to Namibia so often that one friend said, “I know, I know: they walk on water in Namibia!” I didn’t witness that, but I wouldn’t be surprised. I do know that the people are wonderful, the landscape and wildlife are magnificent, and the government’s dedication to the environment is one of the strongest in the world.

History of Namibia

Namibia was once at the center of the ancient continent of Gondwanaland. What was it like back then? Perhaps it was like Iowa; green and lush with deep, black soils. But that continent tore apart, and the chasm that ripped South America from Africa was right on the coast of Namibia.

You see the words *Gondwana* and *Gondwanaland* often in Namibia, as though the cataclysmic event took place just a few years back. The memory is especially fresh in the northwest of the country, where a steep escarpment and layers of bare basalt rock are reminders of a violent geologic past. That area receives less than one inch of precipitation per year, so the rocks have eroded little in the past several million years.

The people in the region raise goats, sheep, and donkeys, but still hunt for wild meat, primarily with spears. The “click” languages spoken by some of the tribes are the oldest languages on the planet. Between the primordial landscape, the prehistoric technologies still in use, and the ancient languages still spoken, a trip to parts of Namibia is like stepping back—*way back*—through time.

Located on the southwest coast of Africa, Namibia was once a German colony. In the famous “Scramble for Africa,” the British, French, Portuguese, Belgians, and Germans claimed colonies throughout Africa in the last decades of the nineteenth



Namibia in the continent of Africa.
—CIA WORLD FACTBOOK

Namibian glossary:

Ablution block = building in a campground with sinks, showers, and toilets, often made of reeds (and often frequented by spiders and snakes)

Bakkie = pickup truck

Bonnet = hood of a car

Boot = trunk of a car

Braai = barbecue, grilled meat

Mossies = mosquitoes

Potjie = stew cooked in a big three-legged pot

Torch = flashlight

Vors = sausages

“The people didn’t believe how valuable wildlife was until they saw it. Two elephants were sold and poaching stopped overnight and word spread like wildfire.”

—CHRIS WEAVER, WORLD WILDLIFE FUND, NAMIBIA

“Namibia’s communal conservancies are the greatest African wildlife story ever told.”

—KEITH SPROULE, WORLD WILDLIFE FUND

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century. In 1890, Germany and Britain agreed on the boundaries of a colony called “Southwest Africa” that would become present-day Namibia. After World War I, South Africa became the administrator of the colony.

In the late 1940s, when South Africa introduced apartheid legislation, the same laws applied to their Southwest African territory. Tribes had their lands confiscated by whites and they were forced to move to hostile environments in the north and west of the colony where they had no history and could not practice their traditional subsistence agriculture. Even today, the land north of a veterinary fence (built to prevent the spread of hoof and mouth disease) is largely communal land owned by tribes, while the land south of the line is largely owned by whites.

In 1960, opponents of South African rule formed a liberation force called the South West African People’s Organization (SWAPO). Its first clash with South African forces occurred in 1966 and fighting continued for over twenty years until a mediated agreement called for a phased withdrawal of South African troops from Namibia starting in 1988. On March 21, 1990, Africa’s last colonial territory earned its independence when the Namibian flag replaced South Africa’s over Windhoek, the capital city.



Wildlife and Tourism Conservancies in Namibia

One of my purposes in coming to Namibia was to see if the model of wildlife conservancies would work on Indian reservations in the US and Native land in Alaska. Could village corporations in Alaska use this approach?

What is a communal conservancy?

In Namibia, a conservancy is a legal entity with set boundaries and members who are granted certain rights to wildlife and tourism activities. It rests on the assumption that if local residents see a benefit from wildlife, they will conserve it. The income from the sale of trophy hunts and animal products such as meat go to the conservancy, as do the profits from tourism ventures (or a portion of the profits from joint ventures). The first four conservancies formed in 1998 and now there are about 59 conservancies covering 14.4 million hectares (16.1 percent of Namibia) and one in eight Namibians live on a conservancy. Twenty-one of the conservancies are now financially self-supporting and wildlife populations and tourism have increased significantly since 1998. In 2009, the conservancies contributed an estimated US\$34.5 million to Namibia’s economy.

A short history of wildlife management in Namibia

Throughout the colonial period, rights to “big game” were reserved for whites, who forbade Africans to hunt, yet it was the Africans who had to deal with deaths and crop destruction due to wildlife. With no benefit and plenty of costs, Africans had no reason to conserve game and, naturally, many saw wildlife as a symbol of imperialism.

Until the 1960s, white farmers throughout southern Africa shot wild grazers, such as kudu and zebra, because

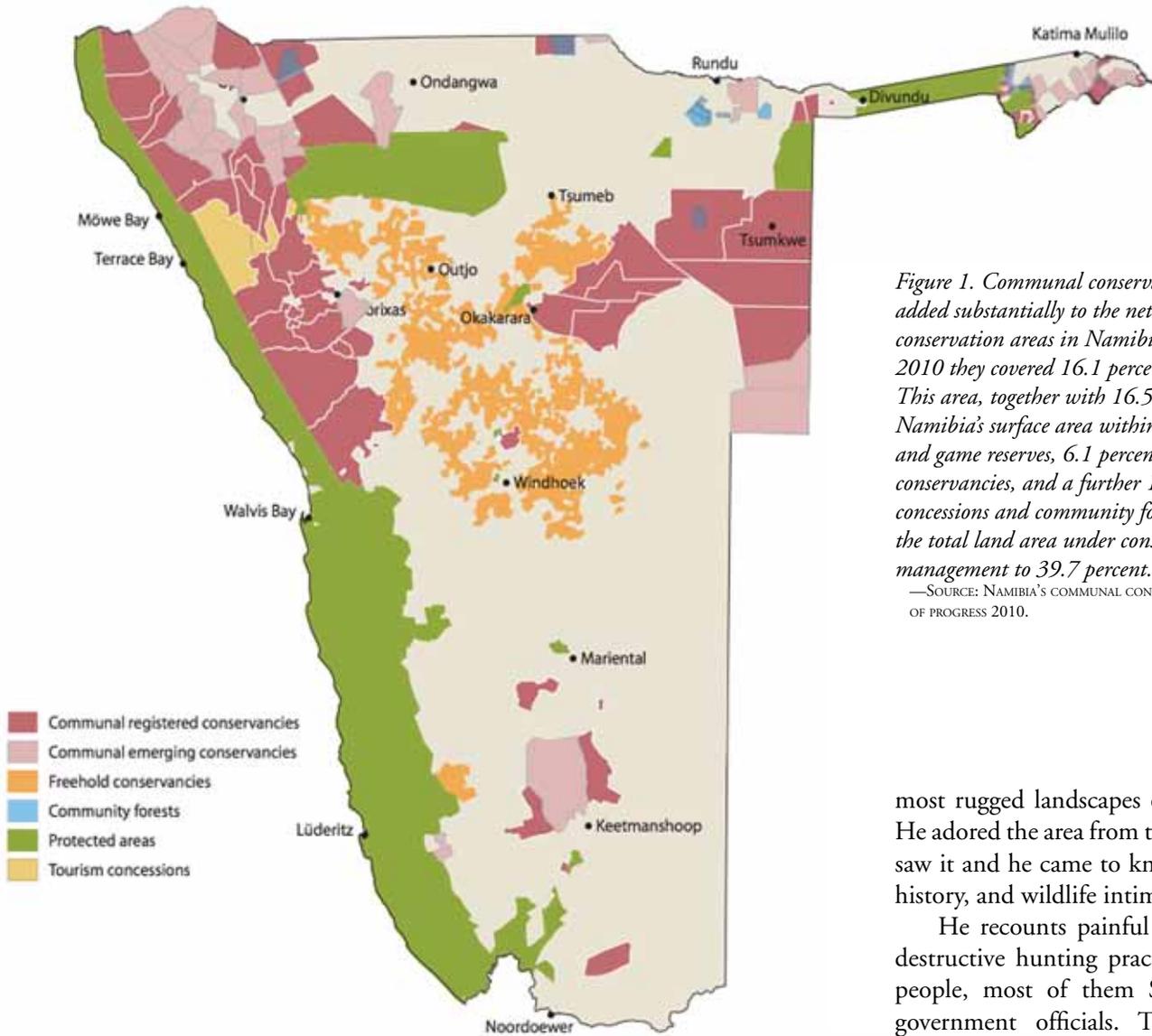


Figure 1. Communal conservancies have added substantially to the network of conservation areas in Namibia. At the end of 2010 they covered 16.1 percent of Namibia. This area, together with 16.5 percent of Namibia's surface area within national parks and game reserves, 6.1 percent in freehold conservancies, and a further 1 percent under concessions and community forests, brought the total land area under conservation management to 39.7 percent.

—SOURCE: NAMIBIA'S COMMUNAL CONSERVANCIES: A REVIEW OF PROGRESS 2010.

they competed for the grazing resources their cattle needed. Farmers also eradicated elephants, lions, and other “problem” species. The South African administration created a commission to consider the declining status of wildlife on private land and the result was legislation to give white farmers rights over the use of wildlife on their lands. The Nature Conservation Ordinance of 1975 consolidated these rights. As a result, white farmers began to value wildlife as much if not more than their livestock. To qualify to use the wildlife on their land, a farmer had to fence his or her land and if they installed a robust game-proof fence, they would have the right to buy and sell wildlife and to offer trophy hunting. The result was a boom in the wildlife industry, including trophy hunting, hunting for

meat, buying and selling of live game to restock farms—and a major increase in wildlife numbers on private farms.

In Namibia, 80 percent of wildlife occurs outside protected areas on private and communal lands. However, from the 1960s onward, South African officials and soldiers were poaching on communal lands (where native peoples had been resettled) and wildlife in those areas declined sharply.

Garth Owen-Smith, one of the architects of the conservancy program in Namibia, tells of his experiences as a park ranger in the Koekaveld Desert of northwest Namibia in his book, *An Arid Eden*. His work started in the Koekaveld in the mid-1960s. At that time, it was the largest protected area in the world and much of it remained a blank spot on the map. It is still one of the driest,

most rugged landscapes on the planet. He adored the area from the moment he saw it and he came to know its people, history, and wildlife intimately.

He recounts painful stories of the destructive hunting practices by white people, most of them South African government officials. This waste of thousands of animals inspired Owen-Smith to become an activist. He found the pastoral peoples lived in harmony with wild animals. They detested lions, but tolerated the rest very well. When asked what they used a particular tree for, a Himba man said that people didn't use the tree for anything, but “birds like to sit in it,” and thus it was still a very valuable tree. The book is a poetic narrative and a great introduction to the history of conservation in Namibia, as well as much of the rest of southern Africa. Namibia in the 1960s sounds much like Interior Alaska in the 1930s. Adventures were all around you! The book gives me a deep respect for the work conservationists have done here to protect wildlife and wild places.

Owen-Smith knew the headmen of the area well and asked them how to stop the poaching. They wanted ownership

of the resource and in exchange for that, they would appoint game guards to find poachers. Of course these people turned out to have been poachers themselves, but who better to know the tricks of the trade? The program was a great success and two South African officials were even charged with poaching on the basis of the evidence found by two game guards.

To form a conservancy, a group of communal residents (typically a tribe or group of villages within a larger tribal area) had to come together to define boundaries, list their members (membership in a conservancy is voluntary), become a legal entity, choose a management committee, and devise a way to distribute benefits to their members. To some extent, conservancy boundaries coincided with areas of traditional leaders. The conservancies also had to monitor and protect the wildlife within their borders by training game guards. If the Ministry of Environment and Tourism accepted the proposal, the conservancy was formally “gazetted.”

The first four conservancies became official in 1998 and wildlife populations in these areas increased soon afterward. In the northwest, where there had been serious abuses by poachers, black rhino more than doubled their population between the 1980s and 2005.

In the conservancies, people have added wildlife and tourism to their normal agricultural activities, such as grazing and crop production. Job creation comes mostly through tourism. If a conservancy wants to develop a lodge, they can develop their own, but most enter into a joint venture partnership with a tourism company. Puros Conservancy, for example, is in a rugged, remote area of the northwest and has a population of only 300 people, but they have four lodges and three campsites and every adult in the conservancy could have a job in tourism if they so wished. However, Sheya Shuushona, the most populous conservancy, has a population of 35,000 people. In that and other heavily populated areas, it is not possible for a

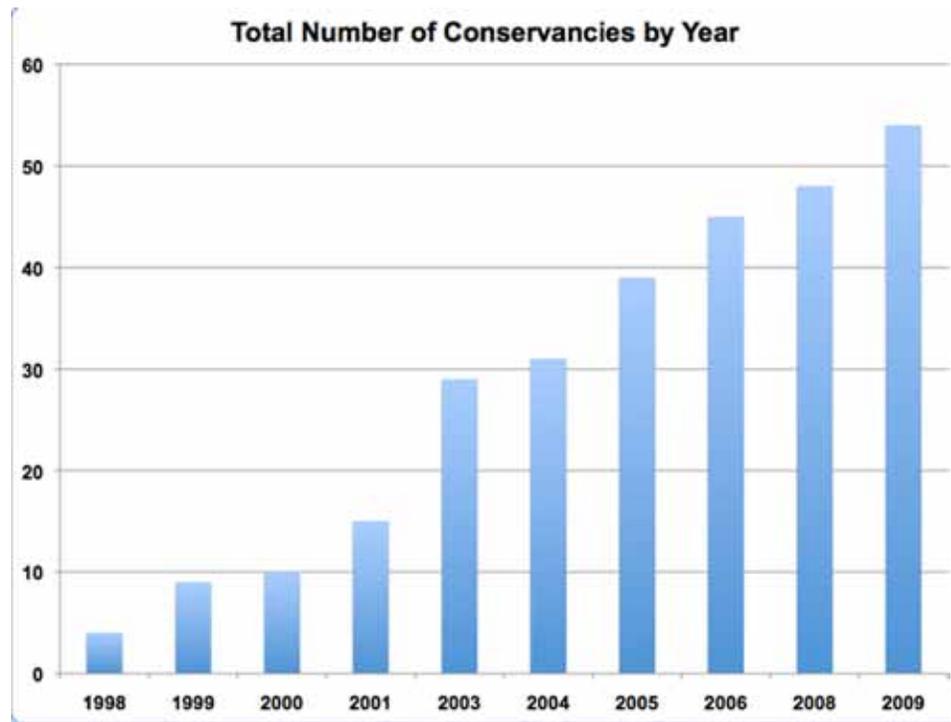


Figure 2. Growth in the number of Namibian conservancies by year.
—DATA FROM WORLD WILDLIFE FUND NAMIBIA.

conservancy to provide a major share of the employment.

Recently, most of the income to conservancies has come from joint venture tourist lodges followed by trophy hunting. However, between 1998 and 2009, income from trophy hunting provided 50 percent of the total income earned by conservancies while joint venture lodges provided 35 percent.

Since the conservancies do not have the resources to build luxury lodges, they have partnered with companies like Wilderness Safaris. They build and operate the lodge on conservancy land and train the local people to work in the tourist industry. Although they start in fairly menial jobs, with training the residents are able to move up. Two tribal women in the northwest became managers of luxury lodges. Both women and men have become game guards protecting “their” wildlife from poachers. Women tend to be trusted as conservancy treasurers and this has given women new political influence in their communities. A few women have even become directors of their conservancies, which was unthinkable a short time ago.

I visited the Ehirovipuka Conservancy west of Etosha National Park where the people are quite poor, but trophy hunting brought them not only income but also a new school. They contract with a professional game guide to bring hunters onto their land. Their game guards accompany the hunters every time they go out to ensure that the quotas and rules are followed. One of the clients was so impressed with the local efforts at conservation that he pledged to build a new school and I saw the local people making bricks for the project.

Women do not normally play a role in decision-making, but a grandmother played a major role in forming this conservancy. She spoke with our class on one of our excursions and told how she joined with several men who had always liked wildlife and they fought for the creation of the conservancy. “Lions are our cattle now,” she told us. In other words, the income from tourism and trophy hunting that lions and other wildlife create is taking the place of income from cattle. A single lion can bring \$10,000 US and an elephant with large tusks can bring over \$50,000 US. Quotas are strictly enforced by the game

guards with oversight from the Ministry of Environment and Tourism.

Wildlife numbers are up remarkably in the northwest, where black rhino were almost extirpated. There were only six black rhino in all of Kunene in the early 1980s and there are over 1,400 today. Cheetahs have doubled from 2,000 to 4,000 in the same period. Elephants have more than doubled nationwide and hippos are recolonizing areas that were devoid of them for decades. Crocodiles are also up sharply and lions went from 20 in Kunene to 125 today. With these increases come more human-wildlife conflicts, but people are now seeing a financial return on their investment in protecting these species. They also see the value of the social empowerment that they are getting from making decisions about “their” wildlife and being employed in wildlife-related work.

Alaska

Here in Alaska, village corporations are similar to the small businesses that conservancies have become in Namibia. A few village corporations are running lodges and ecotourism businesses and at least one has an agreement with a professional guide to bring clients onto their land. Stevens Village is raising plains bison in Delta and several villages are thinking about releasing wood bison on their lands. Mentasta Village recently was allowed a quota of a few moose to have for funeral potlatches. These are all similar to the efforts in Namibia.

Trophy hunting is not well regarded in most villages in interior Alaska, but in Namibia trophy hunting has proven to have several advantages over regular tourism. Hunters are willing to endure many hardships that regular tourists do not expect to encounter, so villages that do not have lodges can still offer hunting in tent camps. And while most local residents may not know how to cook for a five-star resort, some are renowned trackers and this builds on their traditional skills. Hunting is also less sensitive to changes in the economy, while tourism is vulnerable to even a slight recession.

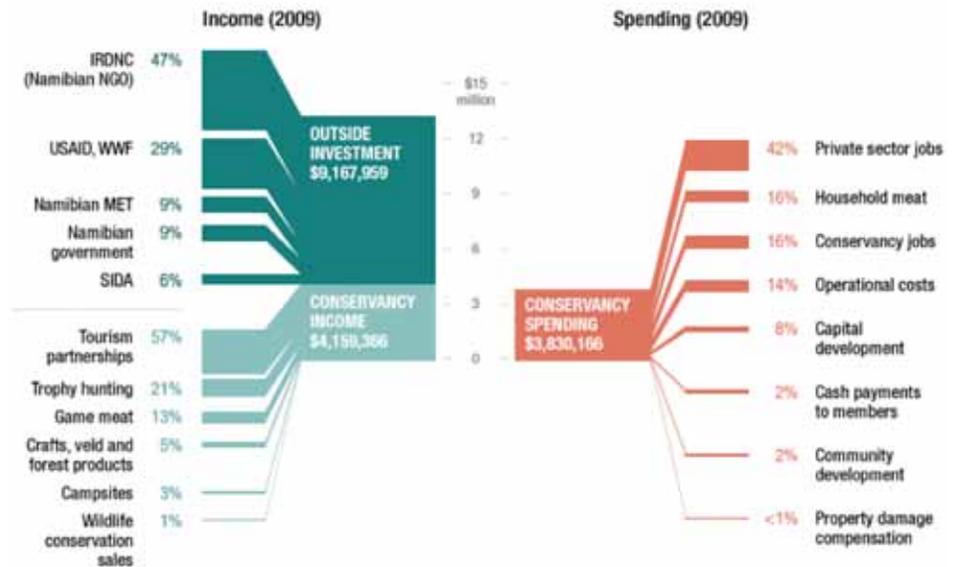


Figure 3. Income and Spending of All Conservancies in 2009.

—SOURCE: UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT; WORLD WILDLIFE FUND; INTEGRATED RURAL DEVELOPMENT AND NATURE CONSERVATION; INTEGRATED COMMUNITY-BASED ECOSYSTEM MANAGEMENT PROJECT.

Gemsbok Gazette

27 Gemsbok and 1 Polar Bear

“The gemsbok can withstand the intense heat of the Namib Desert because of its intricate system of blood vessels and nasal passages, which cool blood before it reaches the brain. If no water is available, gemsbok will let their body temperature rise before they begin to sweat, and will also raise their respiration rate from 20 to 120 pants per minute. As a result of the gemsbok’s many adaptations, it is able to tolerate high temperatures and go days without water.”

—WWW.PBS.ORG/EDENS/NAMIB/MORNING.HTM

I will be going on a week-long camping trip with twenty-seven Namibians who are adapted to this climate. I will feel like a lone polar bear—panting and sweating—in a herd of gemsbok! There will be three faculty members, counting me, and twenty-five students. That’s a huge number to take on a field trip. We will go to Etosha National Park to count wildlife around the old research station. Then we will head to Waterberg Plateau, where the trees are much thicker, to count black and white rhinos and other wildlife that come to the waterhole there.

I just returned from helping to pack up the meat from a sheep “harvested” yesterday for our trip. One of the faculty members cut it into chops and stew meat and we packed and labeled it for the various meals. We set aside one bag of mutton steaks for “brai” (the Afrikaans word for grilled meat) and put small pieces into a separate bag for “potjie” (pronounced “poy-key”). Potjie is the name for any stew that they cook in a big, black three-legged pot. There will also be their old stand-by, mutton knuckles for stew. There doesn’t appear to be any discernable meat on these knuckles, so we’ll see how that works out.

This will be an experience. I’m just hoping I don’t get heat stroke or snake bite—or scream at a spider and make the students roar with laughter. These gemsbok-people don’t even break a sweat, but as the lone resident polar bear, I need to show how normal creatures react to this heat, strictly for their edification, you see...



Above: Cheetahs at CCF are kept in enormous fenced areas and are fed fresh meat each day. But they require the exercise of the chase. To simulate that, they run a cloth flag on a cable around a hectare square for the cheetahs to chase. It's wonderful to see them run.

Right: springbok at left and greater kudu (male) at Etosha National Park.

—PHOTO BY FRANK VASSEN, CREATIVE COMMONS ATTRIBUTION 2.0



Above: Shirley Bethune.

Below: Dave Joubert inspecting a bottle tree.



My First EXCURSION!

I am working for the Department of Nature Conservation at the Polytechnic of Namibia. Here they call field trips “excursions.” I like that word—it’s kind of a cross between expedition and picnic! They take their students out for at least a week of fieldwork for every six weeks in class. These are not “cushy” field trips however. Students do the cooking, the loading and unloading, and everyone sleeps on the ground or in heavy thorn-proof canvas tents that are difficult to assemble. I can hardly believe my good fortune to be part of this.

Our excursion of September 7–14, 2011 visited sites north of Windhoek, including the Cheetah Conservation Fund Namibia, and Etosha and Waterberg National parks. The academic purpose was threefold: to practice wildlife science, plant studies, and ecology first hand.

Professor Shirley Bethune, an aquatic ecologist who teaches the plant studies class and knows a great deal about trees, plants, animals, and fish, was assisted by two wildlife ecologists from the department, Evert Kasiringua and Dave Joubert. She did the Herculean task of organizing a camping trip for twenty-eight people; can you imagine the logistics involved? Meals, tents, cooking pots, carrot peelers, bird books, binoculars...so much to remember. She had the students

organized into groups, which helped a lot. There was a cooking group of about three students responsible for each day’s meals and they would rotate. There were equipment groups responsible for checking out equipment like binoculars and transport groups that checked the bus tires and oil every morning and directed the packing and unpacking of the bus. Everyone had jobs to do and they did them marvelously well.

The Cheetah Conservation Fund

At the Cheetah Conservation Fund (www.cheetah.org) we heard about the Anatoly dogs from Turkey that are useful for guarding the sheep and goats from cheetahs. The CCF is breeding the dogs and providing them to farmers who are willing to work hard to avoid shooting cheetahs. They don’t want someone to take a dog and still shoot cheetahs. Wild kudu are actually the main wild prey of cheetahs, but sheep and goats are probably easier to catch.

Eurasia and Africa used to have large populations of cheetahs. They were easily tamed and kept as pets by pharaohs and royalty through the ages. Emperor Akbar of India loved cheetahs so much he had some 9,000 of them in his stables. But by 1975, there were only 30,000 cheetahs left in Africa and Iran. Today the situation is even worse: there are about 12,500 in Africa (3,000



in Namibia, which has the largest population) and 200 in Iran. Do stop here if you are visiting Namibia—it is about 90 minutes north of Windhoek and on the way to one of the gates into Etosha National Park.

The Hide at Waterberg

We were here to help with a wildlife count organized by the Ministry of Environment and Tourism. This was a forty-eight-hour count that the Ministry does every year under a full moon, when it is easier to see the animals.

We stayed in wooden structures called “hides” (because we hide in them!) and looked out a window that was about 10 cm high and several meters long. There was a 200-meter-long passageway into the hide so that animals wouldn’t see you enter the building. There were two bathrooms with showers (and plenty of spiders and cobwebs) near the entrance, so that wildlife would not hear or smell you in the hide itself and all cooking had to be done near the entrance. Once you were back in the hide, you couldn’t talk out loud and had to be very careful with food and no regular lights were allowed. There were seven people in the hide and all of us slept in the same room.

There was an artificial waterhole about thirty yards from the observation window and it was kept full of water.



Clockwise from bottom left: mineral lick at the Waterberg hide; some of the excursion members looking out at animals coming up to the waterhole; and student Phineous Siseho standing at the beginning of long passageway that kept us from disturbing any animals near the hide.

There was also a mineral lick close to the hide that encouraged the animals to come near so that we could see them better. That was especially important when counting the notches on the rhinos’ ears. The Ministry keeps very close track of the black and white rhinos in Waterberg because of increased poaching pressures recently. Over 300 rhinos were poached in South Africa in the first nine months of 2011, but very few in Namibia. The Ministry also keeps close track of the beautiful but rare sable and roan antelope that they are raising in Waterberg to reintroduce to other areas. Each of those animals is worth about \$30,000 US, while rhinos can go for \$70,000-\$150,000 US.

We remained “stuck” inside for forty-eight hours—but it was the best part of our trip. Everyone loved being in the hide, although it was dirty, there were spiders the size of saucers and bats flying all around. Amazing what one can put up with for the chance to see so much wildlife. Students had to work on compiling the data for hours at a time and whenever you could, you took a nap on the hard concrete platforms. We were happy to get out of there, but it was an unforgettable experience. We saw 89 sable, 5 roans, roughly 300 buffalo, about 18 white rhinos, and 3 black rhinos (that are rare and endangered). There was a poor little black rhino we saw that was an orphan. They do not know what happened to its mother.

A Special Moment in “The Hide”

Freshman student Elia woke me for our shift from 1 to 3 AM in the hide. Everyone else was sleeping and it was our turn to count the wildlife that came into the clearing and note whether they were male or female and a calf, juvenile, or adult. Elia and I were partners and we had two-hour shifts every eight hours. It was so cold we could see our breath, there was no heat or electricity in the hide, and I was half asleep.

At this point, we had been in the hovel for forty hours straight, catching whatever sleep we could and Elia could tell I was tired. He offered to do the shift by himself, but I was not going to leave him there in the cold alone. He was wearing nothing but a light windbreaker and jeans, while I was in a warm fleece jacket, Patagonia raincoat, long underwear, turtleneck, and wool socks (and I was still cold). Most of the students had very little warm clothing or sleeping bags. I gave him my windbreaker, got my sleeping bag liner to put around our shoulders and we put my sleeping bag over our laps (he had only a light blanket to sleep under and it gets close to freezing at night).

To keep me awake, he asked what music I like; he likes hip-hop and reggae. We had to whisper to avoid scaring the animals. I answered that I like African music and that I had some on my iPhone. I grabbed the phone and we shared my headset to listen. One of the songs was “Weeping” by Dan Heymann, an unwilling soldier drafted into South Africa’s army in the 1980s. I found myself choking back tears and told Elia that the song made me cry. It was only twenty years ago that apartheid ended in Namibia and Elia is twenty-one and reminds me of my kids. Thank God this sweet, energetic, and always-smiling kid grew up in a different world than the one in the song.

I whispered that I also have several audiobooks on the phone. Elia had never heard of them. Would he like to listen to Elizabeth Marshall Thomas’s book, *The Old Way*, about the Bushmen

in the 1950s? He was enthusiastic about that, so I put it on and there we sat, watching for animals that didn't come, while listening to tales of an ancient way of life on this very veld. Had you been sitting behind us, you would have seen the silhouette of two tired workers wrapped in a blanket, staring out at the waterhole in the moonlight and looking extremely content. It was a moment I will never forget.

30 Eland: Larger Than Moose and Very Gentle

The giant eland (right) is the largest of the antelopes. They can withstand extreme droughts and although huge and ungainly, can leap like their smaller cousins; they can clear a two-meter fence from a standing position. They have a great deal of meat on them and are so tame that there have been many attempts to domesticate them, but their leaping ability makes them ill-suited to private ownership. We saw a group of seven eland including several young ones while we were in the hide at Waterberg.



I was glad to see them because people warn you about them all the time, but I wasn't sure what they looked like. There were also several crocodiles in the exhibit.

I asked two students from northeast Namibia how they dealt with crocodiles, as there are lots of big Nile crocodiles there. "Oh, crocodiles are not a problem," they said. "You just have to know how to kill them."

"So how do you kill them?" I asked.

"The crocodile hits you with his tail to knock you into the water, then he gets on top of you to drown you. You keep a knife handy and just stab him in the chest, then push him off and that's how you kill him."

"Problem is," said the other, "you'll lose your knife."

The Problem with Crocodiles...

We visited an exhibit of snakes and crocodiles near the east entrance to Etosha National Park where we saw the famed puff adder, the strange vine snake that looks just like a branch, and the spitting cobra, that can spit right into your eyes at two meters and if you don't wash them thoroughly, you'll go blind. We also saw a three-meter-long black mamba.



Burchell's zebras, also known as the common or plains zebra, one of three zebra species in Africa.

Etosha National Park: the Yellowstone of Namibia

Wildebeest walk calmly in a long single file, proceeding like a conveyor belt across the veld to the waterhole, drink, then turn and depart the way they came. Next to them is a chain of zebras, slowly doing a cycle of their own. This is Etosha National Park.

The primary attraction is the waterholes—or “pans”—that concentrate the wildlife during the dry season. Almost all the animals have to visit a waterhole sooner or later, so you’ll see zebras, rhinos, lions, elephants, wildebeests, hyenas, jackals, springbok, kudu, gemsbok, etc. A German military officer created Etosha as a game reserve in 1907. Other African parks may have more game in terms of total numbers, but Etosha’s are easier to see due to the waterholes and the sparse vegetation. Here, the wildlife come to you rather than you having to bounce along rough roads looking for them.

As a result of this bounty, you also have dozens of tourists lined up at each waterhole, but safely separated from the game by a stone wall and a series of fences, including an electric one. To avoid scaring the wildlife, the tourists are totally quiet—even the kids. You can stay in a campground, a “standard” room, or a pricey chalet that is just a few meters from the waterhole. Lights around the pan keep the area well-lit through the night. The chalets sell out six months in advance.

Excursion #2: Load the Lorrie and the Bakkie, Grab the Potjies and Vors...

Just south of the far northwestern Koakoland, Damaraland is the second most remote wilderness in Namibia. It is extremely dry (less than 8 inches of rain a year), windy and dusty (we were told to take bandanas to cover our faces), and sparsely populated. There are few roads and no permanent rivers (can you imagine?). People use the dry river beds for roads at this time of year.



Willie Adank who normally leads the trip couldn’t make it, so Professor Dave Joubert and I were the only faculty.

Willie instructed us not to allow students to take tents or to sleep in or on top of the lorrie. “These kids have got to learn to sleep right out with the hyenas, lions, and elephants,” he instructed us. “They’re scared of these animals, but they’ve got to learn.” Do I need to learn this, though? There is one big tarp for us to sleep on and I suppose we’ll have to draw straws to see who has to sleep along the edge!

I am actually looking forward to it, and we will visit four conservancies and talk with the local people about how their conservancies are working. That would be hard for me to do on my own.

The lorrie is a Mercedes truck geared very low. It looks like it dates back to World War II, it rides like it’s welded right to the axle, and it makes as much noise as a jet plane, though its top speed is only 80 kph. They warned me there would be sand in the sandwiches. It beats sitting around in Windhoek and I really love getting to know the students.

The first night we pulled off the gravel road and camped on a grassy plain. The students took care of everything; we didn’t need to supervise. It is wonderful that the students take care of all the details; that removes a major source of stress on such trips. Building a fire and cooking stew from

scratch takes several hours each night, but there’s so much to talk about the time goes quickly.

We piled onto the huge tarp around 11 PM. The tales of cobras, scorpions, and lions and the fact that we could hear hyenas all around us didn’t even bother me. I was so tired I could have slept through anything.

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Camping at the End of the World

Wereldsend (“World’s End” in Afrikaans) is a small oasis in the desert that is now a headquarters for Integrated Rural Development and Nature Conservation (a major player in the formation of Namibian conservancies). Our class was here to learn more about conservancies and it just happened that many key people in the conservancy world were going to be there the next day. Our entire class attended the meeting and John Kasaona chaired it. Kasaona’s father was a poacher-turned-game-guard in the Kunene region, and John Kasaona is a champion of conservancies. He’s a great speaker (see his Ted Talk, “From Poachers to Caretakers”) and he is one of the stars of the documentary *Milking the Rhino*. Like most of the people engaged in conservation in Namibia, he got his degree from our Department of Nature Conservation at the Polytechnic.

We saw many welwitschia plants nearby (above left). These strange plants look like they’ve been dead for over a century, but they are often several hundred to a few thousand years old! They are not a succulent, but are actually a coniferous species—note the cones. They have only two leaves, never more than that, which twist and curl over the decades. It is the national plant of Namibia.

Should Residents Be Evicted to Make Way for a Park?

I asked my Namibian students to list reasons for and against evicting residents to create a park. That is how

America created its parks; John Muir could not tolerate the idea of “those filthy savages” living in “his” sacred Yosemite. It wasn’t until the Alaska Lands Act of 1980 that we tried to avoid completely evicting people from new protected areas. Parks around the world copied our model of evicting locals—places like the Serengeti where the Maasai were reduced to selling trinkets outside their sacred area and in India where desperately poor people were given the boot.

But England and Norway followed a different model. Maybe we should call it the “please close the gate” model, where you are welcome to walk through the farms that comprise a national park, just remember to close the gate behind you.

The inspiring thing about Namibia is that it is building a third model—something new under the sun. My students were amazed that people were ever evicted from protected areas. They have grown up knowing that conservation can actually be stronger when you enlist the help of the locals instead of throwing them out penniless with no place to go. And when you enlist the local people, as they have here, they stop poaching, they stop resenting the government, they start catching poachers, and they start benefitting when tourists come to see the wildlife on their well-managed lands.

So here are some of the reasons the students gave for NOT evicting local people from a new protected area:

- If you evict them, the local people will lose the land where the spirits of their ancestors still live.
- If they evict the local people, where will they go?
- The local people were living here for centuries and taking good care of it. If they hadn’t cared for it, you wouldn’t want to make a park out of it. You should ask for their help, not kick them out.
- The government should allow local people to have rights and benefit from the resources, then they will take good care and use them sustainably forever.
- You should involve local people because they know the area better than anyone and they are best at catching poachers.

The Caprivi Strip

The Caprivi Strip is a panhandle that extends eastward from the northeast corner of Namibia. The Germans traded land with the British in 1881 to secure this strip of land for a future railroad that they hoped would connect then-Tanganyika to the Atlantic coast. That railroad was never built, but a modern “tarred” highway passes the entire length of the strip, which requires a long day’s drive from end to end. The Caprivi Strip resembles the rest of Namibia as much as southeast Alaska resembles Alaska’s Interior: not at all. It receives much more rainfall and thus is more green and lush and has a lot more people. It is one of the poorest areas of Namibia, where subsistence agriculture and fishing provide the livelihoods of most of the people. HIV/AIDS is rampant here, where an estimated 50 percent of those between fifteen and forty have the disease.

At its narrowest point, the Caprivi Strip is just 15 miles (~25 km) wide. Angola, Botswana, Zambia, and Zimbabwe are just a stone’s throw away, while Windhoek is a hard two day’s drive! Not surprisingly, the languages and cultures of Caprivi are more closely related to those of the nearby countries than to the cultures of the rest of Namibia.

I couldn’t wait to see this unusual part of the country that people call “the African part of Namibia.” Its lush fields and woods and large populations of elephants, hippos, Cape buffalo, crocodiles, and leopards make it more like tropical Africa than the desert lands of Namibia. Fellow faculty member Dave Joubert and I left at noon on February 8 for Rundu on the Angolan border. We drove a Toyota bakkie that had seen better days. It takes nine hours to get to Rundu, the first leg of our journey to the Caprivi. On the way, we bought some of the famous huge mushrooms that grow on termite mounds in the north. The termites essentially “farm” the fungi inside the mound and each year these enormous mushrooms “bloom” on the outside. Locals sell them by the side of the road for about \$2 US each.

Dorotea’s Medicinal Plant Project

Our primary purpose was to visit our student Dorotea Nakatana who was doing her freshman internship in Kongola

The author standing in front of a termite mound. It’s an unusually large one near Ongwediva, at the tip of the Oshana Region in northern Namibia.

—PHOTO BY DOROTHY HVOZDA



on the Kwando River. At eighteen, she probably didn't weigh 100 pounds sopping wet. We met her at her tiny "house" which is just a cement block building with no windows. It takes courage to do an internship like this. She was two days' drive away from her family, she doesn't know the local language or anyone in the area, she has to make most of her own decisions about her research project, and her study sites are way out in the bush where she'll have to find some means of transport to get there. It's like a mini-Peace Corps project and all students at the Department of Nature Conservation have to do these somewhere in the country. Most of them work for an NGO or agency while doing their internship. Nakatana took us to the Kwandu Conservancy to visit her study sites.

The conservancy wanted her to inventory the devil's claw plants they have and decide how many they could harvest that year. Devil's claw is a traditional remedy for pain that has found favor for use in racehorses suffering from arthritis. It is also being tested for use in people. Hundreds of pounds of the tubers are dried and sent to pharmacies each year and they are worth hundreds of thousands of Namibian dollars to the conservancies that harvest them. In order to harvest the plant sustainably, they must determine how many are in a given harvest area and only harvest two tubers from each plant every three years.

We drove over very rough roads to get to one of her sites. Just getting there will be an effort for her. One of the people she worked with was Hoster, the coordinator of the devil's claw harvesting effort in that conservancy. In addition to doing her project, Nakatana was responsible for knowing the trees in the immediate area and the names of the most common birds. Dave asked the name of a particular tree and Hoster, who didn't realize we were quizzing Nakatana, came out with the common and scientific names of the species. He did not even finish high school. I asked how he knew the scientific name and he said he'd always been interested in trees and when he saw a tree book, he tried to memorize the scientific names. Hoster also knew the medicinal uses of different plants. He dug up a huge tuber from one plant that he said is very good for treating malaria. By burying the tuber in another spot, he was able to start another plant of that species. He told me the "local forests are our oxygen," and therefore need protection. I enjoyed talking with Hoster and his boss Charles so much that I decided I would do a case study on their conservancy, even though I hadn't been planning to do that particular one. I want to get to know these two people better.

Monika Shikongo Fights Poachers

Next we visited an honors student, Monika Shikongo, who is the superintendent of the remote and wild Babwana National Park. Shikongo wrote an excellent paper in my class on whether it is ever necessary to cull elephants to protect habitat. She concluded that it should only be done when there is obvious habitat damage over an extensive range.

Shikongo is short and stocky with a gruff voice. All the better to deal with poachers, who are increasingly common in this area. In 2011, five elephants were found slaughtered with the front of their faces sawed off to get their ivory tusks. She and a few rangers patrol for poachers regularly and almost caught one group, but they got away thanks to the superior horsepower of their Toyota Land Cruiser. This twenty-six-year-old woman is dedicated to conservation and is passionate about stopping poaching. She lives alone in the dense woods, although there are a few other rangers living nearby. I asked if she was ever scared living alone with poachers around her. She said she wasn't, even though she knows they would shoot her on sight if they thought she was going to try to stop them.

She was out on patrol with one of the female rangers on her staff when they saw a bakkie stuck in a swale below them. She shouted, "What are you up to?" And they answered with machine gun fire! She and her companion hit the ground and used their radios to call the army for help, as they are not expected to try to capture armed poachers themselves.

Our student body is 55 percent female and I asked the women students if they were afraid to deal with such issues. "No," they replied. "We are trained to handle these things!"

They are also young and feel invulnerable. But in the US, we don't think of conservation as a career that is extremely dangerous. Here in Africa, where poaching—not to mention deadly snakes and ornery elephants, hippos, and crocodiles—are common, your life could easily be in danger. These students are so dedicated that they are willing to put their lives on the line for conservation.

Katima Mulilo

The regional center of Caprivi is a town of about 25,000 people called Katima Mulilo, or Katima for short. We stopped at a large open market where lots of strange vegetables, beautiful cloth, and carvings were for sale. In addition, Elephant Energy had a booth. This solar light company makes excellent solar-powered reading lights and torches (flashlights). I bought a solar torch that has a clip and it charged on the dashboard of the bakkie in an afternoon. Seems the perfect thing for Namibia.

We also went to a nice coffee shop that offered espresso, lattes, and smoothies. How did such drinks get to such a small town on the Zambezi River about eighteen hours northeast of Windhoek? I don't know, but we certainly enjoyed the stop. We met a very knowledgeable South African woman who has worked on conservation projects in this area for over ten years. I wanted to learn more about the Salambala Conservancy south of Katima on the Botswana border, where I will be doing a case study and where she has worked many times. She knows of several translators who could interpret for me, as almost no one in Ngoma village speaks English.

We drove to Ngoma and found the conservancy office, but by then it was late on a Friday afternoon and it was closed. That was okay, as I just wanted to see the area, but

did not have time on this particular trip to do interviews. I was most interested in getting a feel for the place so that I'd be more comfortable coming back by myself. One thing I did not like was that the conservancy office was surrounded by at least five noisy shebeens (bars) and lots of broken glass. I was glad to find that out before coming to the place on my own in a few weeks. I realized I would not feel comfortable camping alone in Ngoma.

We headed back to Katima where we stayed at Namwi Camp, on an island in a channel of the great Zambezi River. This is the most beautiful camp I have ever seen. The grounds were lovely and the ablution block was large and spotless. Best of all, we had a site overlooking the mighty river. Despite the "Beware of Crocodiles" signs, I slept very well in the sturdy canvas tent. When I woke in the morning, it was raining softly and the big channel of the river was very impressive. If this was just one channel, imagine how large the entire river must be. Dozens of colorful songbirds serenaded us and I saw a chameleon near the tent. When he was on the grass, it was almost impossible to see him and I almost stepped on him. He rocked back and forth at least three times before taking each step. Apparently they can run fast when necessary, but why rock several times for every step? That seems strange.

As we drove back toward Windhoek, we passed two tiny women roughly five feet tall each carrying at least fifty pounds of firewood on their heads. Dave thought the wood was probably from mopane trees. This wood is heavy even when dry, but the wood they were carrying was freshly cut and would have been extremely heavy.

Popa Falls Camp on the Kavongo River

Popa Falls is not actually a falls at all, but just rapids on the Kavongo River. The Kavongo starts in Zambia, flows through Angola and then forms the boundary between Angola and Namibia before turning south where it forms the famous Okavango River Delta in Botswana. This is one of the world's few rivers that never make it to an ocean, but instead have a delta in the interior of a country. The Okavango Delta is said to be one of the most productive habitats on the planet. While Popa Falls itself is not very impressive, it is interesting to camp on this river that forms the famous delta. Popa Falls Camp has been in existence for decades, but is now managed by Namibia Wilderness Resorts, a semi-public entity that is notorious for corruption, high prices and bad management. The women's ablution block was full of spider webs and smelled of ancient mold. The boards and thatch on the outside were rotting in the wet weather and the lights didn't work. There were about fifteen campsites crowded together in a small space next to a swiftly flowing channel of the river. Dave and I were always the only ones in each campground on this trip. While it's nice to have an entire campground to yourself, it is a bit unnerving when the darkness and woods are so thick all around you. If there were robbers about, there wouldn't be any help available.

We decided not to build a fire that night, but set our chairs where we could watch the river. It was pitch dark, but a lovely temperature and we had a bright fluorescent light that plugs into the cigarette lighter. We were sitting there enjoying cold meats and cucumbers (I'm not much of a cook) and a nice glass of wine. There were lots of jungle sounds and several mosquitoes. Although the mosquitoes (or "mossies" in Dave's lingo) carry malaria in this area, they are nowhere near as thick as they are in Alaska. You might see five of them in an entire evening. But we did put on the mild mosquito dope that they sell here. It's not Alaska-strength, but it seems to do the job.

While we were enjoying the peace and quiet, we saw a light in the woods that was coming closer. We were far from any houses or people and it was unsettling to see a light coming our way in the pitch dark. Slowly we could make out that it was a man with a gun over his shoulder. I took a deep breath and shouted, "Hello?"

"Hi," he shouted. Do thieves say hi? As he came into the light, he introduced himself as Magnus, the security guard. I took a huge sigh of relief. He told us his job is to patrol for crocodiles and hippos that are too close to the tourists during the night. "Last night I saw a huge croc lying right here where you are sitting now. It was HUGE...at least three meters!" His job is to fire his gun over the heads of crocs and hippos when they are too close to scare them off. He showed us the big bullets he carried for this purpose.

I asked if there was really a crocodile here the night before, or if he's just trying to scare us. "There really was one right here," he said, stomping on the ground and pointing. "I saw it and I shot my gun and scared it off."

He said goodbye and continued on his rounds. I asked if he could just sit near us all night, since we were the only campers, but he shook his head and walked away. Dave and I studied the water intently, looking for crocs and hippos. I mused that the campground might hire Magnus just to say that to tourists because it adds to the excitement of being there, but Dave thought he was telling the truth.

A storm was brewing and suddenly let loose. I have never heard louder or more frequent thunder in my life and it rained like a fire hose. We dashed around the camp putting things away and jumped in the tent. I was wide awake worrying that we were just twenty feet from the river channel and there was no bank to hold the water if the river rose. If it rained hard for long, we could end up under at least a few inches of water. I could hear lots of hippos grunting in the darkness. They sound just like loud pigs. I wondered if there might be a crocodile out there. Dave insisted that crocodiles and hippos don't bother you as long as you're in the tent. It was raining so hard and occasionally loud cracks of thunder made me leap. Not much sleep that night.

But the rain finally stopped early the next morning. We were covered with mud, the tent was sopping wet, my sleeping bag had sand and mud in it, the river was much higher but still several feet from us, and there were hippo

tracks nearby. But I didn't find any crocodile tracks, so I was literally a Happy Camper.

The next morning we stopped to get a latte in Rundu, which is generally considered a very rough town, but it was the finest tasting latte ever. Nothing like a sleepless night to make a good cup of coffee taste great.

Elephants in Namibia and Botswana

In contrast to the declines in elephant populations in the Central African Republic, Zimbabwe, and Gabon, an excess of elephants is a problem in both Namibia and Botswana. There are about 18,000 elephants in Namibia, but some 180,000 in northern Botswana (where there is more rainfall so they can handle more than in Namibia). There are an estimated 350,000 elephants across southern Africa. Adult elephants can exceed 7 tons in weight and eat roughly 250 kg (550 pounds!) of plant material and drink over 50 gallons of water every day (and much of Namibia gets less than 7 inches of rain a year).

It would be okay if elephants remained within protected areas, but they ignore fences, migrate widely, raid farmers' crops, and threaten people living nearby. Tourists are constantly told to stay in their cars, but they often fail to do so and a few are killed each year. Many residents are also killed every year by elephants.

After six months in the country, I was very comfortable traveling and camping alone in my little pop-up tent. One night I was the only person in a campground on the Kwando River in Caprivi. By then I was accustomed to the grunts of hippos at night, but around midnight I heard elephants trumpeting on the farm nearby. Soon the farmer and his family were all out making as much noise as possible to scare the beasts away from their corn crop. I had heard many urbanites say this was THE answer to conflicts with elephants; farmers simply had to make lots of noise to keep the animals away. They use the plastic vuvuzela trumpets made famous in the 2010 World Cup Soccer Tournament in South Africa. The horns make a sound much like an angry elephant. They also use pots, pans, drums, and pop guns. I was fascinated to hear this first hand. One thing I hadn't realized is that this cacophony needs to go on all night long. As a result, the children don't go to school the next day and everyone is exhausted. This can also occur night after night from the time the crop begins to ripen until it is finally harvested. It brought home the fact that it's hard to imagine what life is like for people living with dangerous wildlife until you experience it yourself.

The one thing that seems to work to keep elephants away is "chili bombs." These are made by mixing elephant dung, water and hot red peppers into something the size of a soccer ball. When lit, these "bombs" put off an acrid smoke that will burn for eight hours. However, you need enough of them to surround your field and lots of peppers to put in them. Conservancies are hoping to create local businesses growing peppers and making the bombs for farmers to purchase.



Above: Elephant whitened after rolling in the sediment of the salt pans in Etosha National Park.

Below: Elephants prefer mopane trees in Namibia and can destroy many of them in one day.



Elephants can do tremendous damage to trees when they break them to eat their favorite parts. The international community gets upset about any attempt to limit elephant populations, but they do not have to live next to them. Botswana is about twice the size of California. Can you imagine California trying to deal with 90,000 African elephants known for their tempers and their prodigious appetites? It is certainly a problem here. Of course, we were all thrilled to see them in the wild and no one is advocating their elimination. But now, few are culled because of the uproar it causes. Perhaps the world needs to review this adoration of elephants—or offer compensation to those who have to live with an excess of them.

Between March and June of 2012 I spent most of the time on the road by myself, equipped with my little tent, a tape recorder, my computer and my trusty VW Polo. I was increasingly comfortable in villages and more adept at meeting people. I made a pilgrimage of sorts to Tsumkwe, the center of Bushmanland in the middle of the Kalahari. I had read *The Old Way* six times and wanted to meet the people. I ended up an honorary member of Dopous Village, spent almost three

weeks there, and learned to pronounce several of the different clicks they use in their speech. The only problem was they were so desperately poor and it was so cold, getting down to freezing at night. All they had to sleep on was straw and most had no blankets, coats, socks, or shoes. I spent a sizable chunk of my savings on clothing, blankets, and supplies for the entire village.

In June I organized a field course on conservancies in Caprivi for twelve of our students, Dave Joubert, and two guest faculty from the States. It felt good to have enough knowledge of the region to arrange a full week of activities for the group. Everyone had a great time. Of course, who wouldn't have a great time in such a magical place as Caprivi?

There were lots of other adventures, but this may give you an idea of what a fabulous country this is. I definitely miss the elephants, and even the snakes, hippos, and crocodiles. A certain amount of danger in the natural environment makes me feel more alive. I also miss the wonderful faculty at the Polytechnic and the enthusiastic, dedicated students. I must go back. I have much more to learn about Namibia and many other countries in Africa to explore. A whole continent beckons!

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The author (back row, second from left) and Doupous villagers standing in front of a new community hall still under construction. The building will be thatched when complete. Doupous Village is in the Kalahari Desert; the villagers are Ju|’hoansi (a tribe of the !Kung or San people).

—PHOTO BY |KUNTA BOO



Freshwater Social-ecological Systems and Sustainability in Alaska

Findings from Undergraduate Research Experiences

Cindy Fabbri

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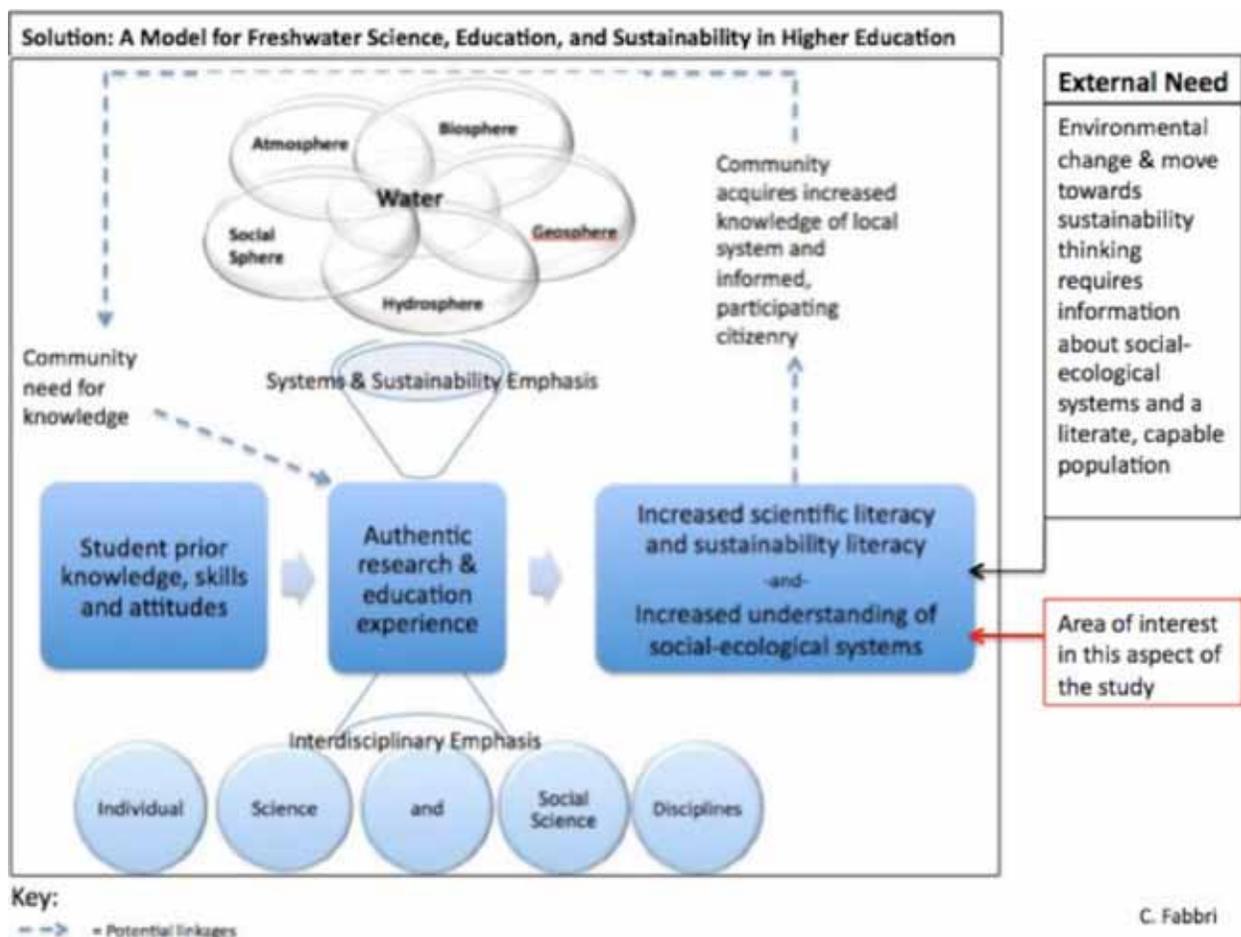
Cindy Fabbri is an assistant professor and instructor at the UAF School of Education and SNRAS.

Introduction

Many institutions of higher education include the goals of conducting research, instructing students, and serving communities in their mission statements. The National Science Foundation's (NSF) strategies for action further extends this idea by emphasizing the importance of integrating research with education and leveraging collaborations to provide insights on socially important issues (NSF, 2006). Furthermore, professionals and communities need research-based information for informed decision-making and adaptation in a changing environment. Institutions of higher education have opportunity to better meet all of these needs by finding ways to integrate research and learning in the classroom.

When beginning this work, I wanted to find out if an integrated research and education experience, in the context of a university course, could facilitate the production of new knowledge about freshwater, social-ecological systems. Here knowledge is purposefully defined in a broad sense to mean information generated by investigation. Methods for investigation can vary and knowledge can be culturally

Figure 1. A model for increasing understanding of freshwater social-ecological systems and sustainability.



situated, but in the end, the investigator has produced information and understanding. Assuming that such gains could be made, I intended to share the findings and describe the nature of knowledge produced. With these goals in mind, I developed a model for delivery (Figure 1), designed a new course, *Water in the Environment and Society*, and set out to explore this idea.

I taught the 400-level three-credit class during spring semester 2011 at the University of Alaska Fairbanks. I cross-listed the class as Liberal Arts and Science and Natural Resources Management to attract both social science and science students to the course. Five students took the course. Three students were social science majors, one student was pursuing a science degree, and one was an engineering major. Over the course of the semester, the group studied freshwater systems using interdisciplinary and sustainability perspectives (Figure 1). To build understanding of freshwater social-ecological systems and to increase scientific and sustainability literacies, students were required to complete independent research projects (reflected as “authentic research and education experience” in Figure 1).

Here I use the student projects to show that new knowledge about freshwater social-ecological systems can effectively be produced in the context of a university course, describing their findings and generalizing about the types of knowledge gains made. Three projects are presented in this article.

Methods

One aspect of this work focuses on evaluating an a priori model/theory (Figure 1) and is exploratory in nature. The work is based on a scholarship of teaching and learning action research framework (Huber and Hutchings, 2005; Reason and Bradbury, 2008). This study uses a multiple case, holistic design method (Yin, 1989), and I use a qualitative methods approach for data collection and analysis. Data

are generated from course instructor observations and notes, as well as document analysis of student work. Data analysis, to generalize from case study to theory, is based on the process of analytical generalization (Yin, 1989). I also use these methods to generalize about the nature of the knowledge produced in the case studies/student projects.

The students used various quantitative and qualitative methods in their work, and in some cases I conducted additional data analysis. Specific methods are detailed below.

The following cases are a distillation of the most important aspects of the research conducted by the students. Large pieces of these summaries are taken directly from the students’ final papers. Student names are not included to provide anonymity. Any significant changes made to the students’ work for this publication are noted in the individual cases.

The Projects

Case 1: The Arctic Water Resources Vulnerability Index for Minto, Alaska

Introduction

Environmental change, from both climate and human pressure (population growth, land use/cover), is affecting water, the water cycle, and related earth systems over time, space, and scale (Dozier et al., 2009). Increased understanding of freshwater systems and their responses to change improve the ability to manage resources for sustainability. The Arctic Water Resource Vulnerability Index (AWRVI) can be used to assess relative vulnerability or resilience to factors influencing freshwater resources at the watershed scale (Alessa et al., 2008). It does so by methodically evaluating individual physical and social component of a community’s interaction with their water resources. The AWRVI helps

identify aspects that contribute to overall water vulnerability and/or resilience and can provide information that is useful in helping determine how a community might want to adapt or adjust their water-related resources.

Two students collaborated and completed the AWRVI for the community of Minto, Alaska. This community was chosen for its relative proximity to Fairbanks, Alaska, a nearby location for which more data are available. It was also chosen for its location in interior Alaska, as the students wanted to compare results of an interior community with those found for western and southcentral communities previously studied by Alessa et al. (2008).

Methods

These two students collaborated to complete the AWRVI as described in Alessa et al., (2008) (Figure 2, next page). Student one focused on the physical sub-index and student two completed the social sub-index. The students accessed existing data sets and public documents to collect data. They also conducted informal interviews with key informants, including UAF faculty, a Minto community member, and a public official with the Tanana Chiefs Conference. Methods for individual sub-indices (physical and social) are described in Alessa et al., (2008) and students followed those recommendations. In general, data are collected for various indicators to measure the degree of vulnerability or resilience on a standardized rating scale (Figure 2). The ratings for these indicators combine to give scores for “constituent sub-indices.” The constituent sub-indices combine to give scores for physical and social sub-indices and these scores are then used to calculate an overall vulnerability-resilience score for the community. I corrected one calculation error made when finding a total score for the physical sub-index but the summary is otherwise as produced by the student researchers.

Results

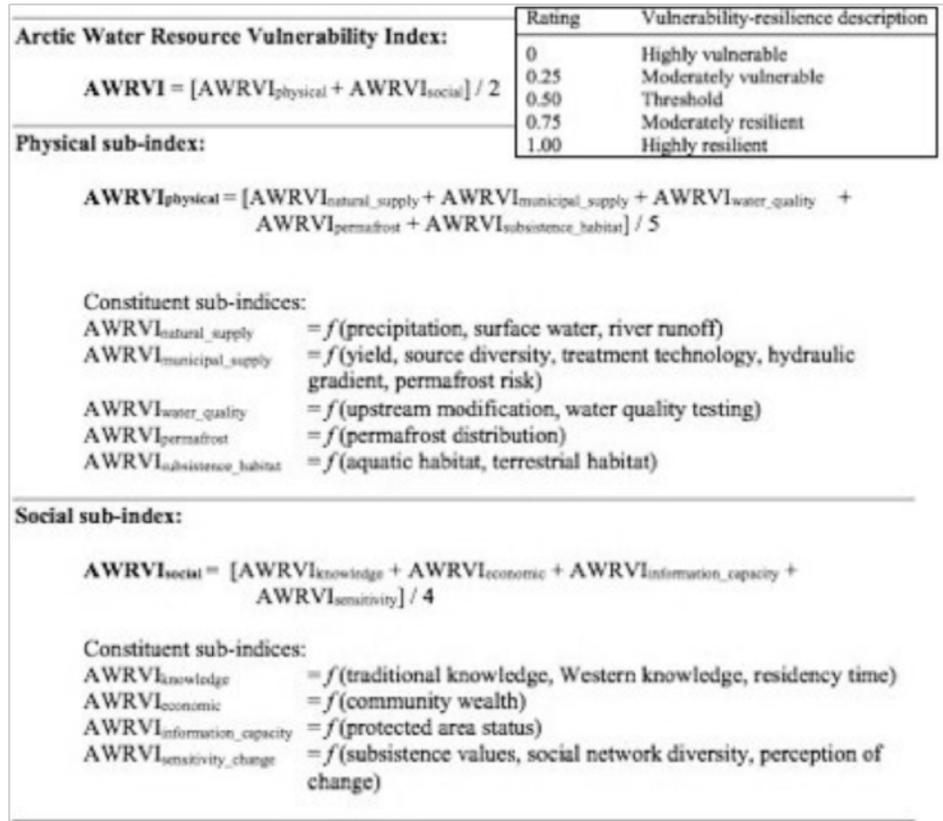
The score for the physical sub-index is 0.48 (Table 1), the social sub-index score is 0.48 (Table 2), and the resulting overall AWRVI score for Minto is a rating of 0.48. This score indicates the community is nearly at a threshold rating (0.5) falling just slightly on the vulnerability side of the vulnerability-resilience scale (Figure 3).

Discussion

The physical sub-index score for Minto was higher than those found for other small rural communities (White Mountain = 0.33 and Wales = 0.27) but lower than the larger, road-accessible town of Eagle River (0.72) (Alessa et al., 2008). The indicators of least resilience for Minto for which there are possibilities for improvement are: source water diversity, treatment technology, placement of water infrastructure in regards to permafrost, the number of upstream development sites, and measurement of water quality. These parameters are areas that the community and government agencies may want to consider when dealing with water issues in Minto.

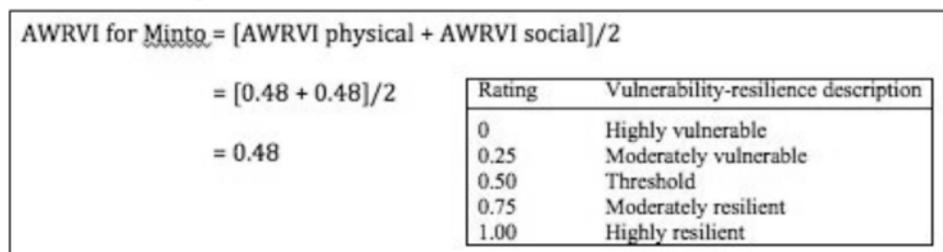
The social sub-index score for Minto was lower than those found for White Mountain, Wales, and Eagle River, with respective values of 0.63, 0.54, and 0.77 (Alessa et al., 2008). This may be due to the fact that no data were available for the “network diversity” indicator so it was eliminated in index computation. In general, Minto’s knowledge capacity is its strength, and its economic capacity is the area of vulnerability. Minto’s information and sensitivity sub-indices fall at threshold levels (0.50), and along with economic capacity, these areas could be evaluated to see if improvements could be made to make Minto a more resilient community. The student noted that, for the social sub-index, it would have been very useful to have a partner from the village to collaborate with and verify the values in this report. She attempted to find a resident of Minto to work with but was unable to do so.

Figure 2. Arctic water resource vulnerability index, sub-indices, and rating scale for indicators (Alessa et al., 2008)



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Figure 3. The vulnerability-resilience rating systems and final AWRVI rating for Minto, Alaska



“...Building the AWRVI, in my mind, was the ultimate sustainability task to do because this index and the use of it enhances abilities to apply/improve the sustainability of a community.”

Table 1. Results for the AWRVI physical sub-index for Minto, Alaska.

Sub-index	Constituent Sub-indices	Parameter/Indicator	Value for Minto	Resilience / Vulnerability Rating for Minto	Subtotal and Total
Physical Sub-index	Natural supply	Av. ann. precip. (mm/yr)	272.5	0.5	0.6
		Variance in av. ann. precip.	0.04	1.0	
		Surface water storage (%)	7.9	0.5	
		Change in surface water over recent 30 year period (%)	-1.8	0.25	
		Av. ann. river runoff (cumecs/km ²)	No data	-	
		Variance in ann. river runoff	No data	-	
		Seasonal variation in discharge	1.71	0.75	
	Municipal supply	Reservoir and well yield per capita per day (liters)	2,128	1.0	0.4
		Water-source diversity	2 ground wells	0.25	
		Treatment technology	Chlorine	0.25	
		Hydraulic gradient of water supply (m/m)	0.002	0.5	
		Infrastructure on permafrost (%)	70%	0.0	
	Quality	Upstream development sites (#)	2 mining	0.5	0.375
		Streams with water quality data (%)	16.7	0.25	
	Permafrost	Permafrost Distribution (%)	70	0.0	0.0
	Subsistence Habitat	Aquatic habitat – fish recruiting streams (#/km)	0.57	1.0	1.0
		Terrestrial habitat –tundra and boreal forest cover (%)	100	1.0	
Total Rating Physical Sub-index = 0.48					

Table 2. Results for the AWRVI social sub-index for Minto, Alaska

Sub-index	Constituent Sub-indices	Parameter/Indicator	Value for Minto	Resilience / Vulnerability Rating for Minto	Subtotal and Total
Social Sub-index	Knowledge	Traditional (% of population)	27	1.0	0.67
		Western (% of population)	4.7	0.25	
		Residency (% of population)	27	0.75	
	Economic	Per capita income (\$)	9,742	0.25	0.25
	Information Capacity	Area in protected status (%)	25	0.5	0.5
	Sensitivity	Subsistence harvest (kg)	66.09	0.5	0.5
		Network diversity	No data	-	
		Perception (existence of water action plan)	YRITWC draft plan	0.5	
	Total Rating Social Sub-index = 0.48				

As a whole the AWRVI rating of 0.48 for Minto indicates that they are only slightly below the threshold between vulnerability and resilience. This result indicates that Minto has areas it could work on to improve its resiliency but is not in an altogether vulnerable position. Like any community, Minto has both assets and challenges it can consider as it deals with change and thinks about sustainability of its freshwater system.

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Case 2: The Prevalence of Non-Precipitation Watering Techniques Among Alaska Commercial Growers, Farmers, and Ranchers

Introduction

Approximately 70 percent of the world's freshwater consumption is devoted to agriculture (Black and King, 2009), but it is widely recognized that many agricultural watering systems do not use water efficiently. To find ways to help producers improve their systems it is important to understand the prevalence and extent of non-precipitation watering techniques (NPWT). These include any use of water that does not come directly from the sky. The goals of this student project were to quantify the prevalence of NPWT used in commercial growing, farming, and ranching operations in Alaska (see sidebar), to gauge future use, and to evaluate the importance of increasing NPWT efficiencies in Alaska. For the purposes of this study, the state was divided into six regions: North Slope, Bering Strait, Interior, Bristol Bay and Aleutian Chain, Southcentral, and Southeast.

Methods

To acquire information about commercial operations across the state, the student used two methods to disseminate a survey. She acquired e-mail addresses from the Alaska State Division of Agriculture and from the Alaska Division of Agriculture Source Book (directory of farmers and ranchers). The sample group of 182 received an e-mail request to participate in the online survey. She also disseminated paper copies of the survey at the Seventh Annual Sustainable Agriculture Conference, held in Fairbanks in 2011, to a group of fifteen individuals who had been pre-screened and were identified as recognized commercial operators.

The survey contained three sections. Section one of the survey records demographic information. The second section

gathered data from individuals who had never used NPWT to gauge if they would like to use it, and if so what would make the transition to NPWT feasible. The final section collected information from individuals who have used NPWT, currently or in the past, to determine how much water is used and how motivated they are to improve the system. The student performed basic descriptive statistical analysis of the data. I performed further analysis of the student-collected data to provide additional insights about agriculture and water use in Alaska and these data are included here.

Results

Sixty-one individuals responded to the survey (30 from Southcentral, 26 from Interior, 3 from Bristol Bay/Aleutian Chain, 2 from Southeast, 0 from North Slope, 0 from Bering Strait, and 1 from an unspecified location). Respondents represent a diverse set of operations including hay, dairy, vegetable, fruit and perennial operations, a greenhouse producing rose seedlings, a group based out of a natural forest that produced syrups, and an aquafarm producing geoduck clams.

A large percentage (86.9 percent) of the respondents indicated they used NPWT. Data for NPWT users are presented in middle column of Table 3. This group included representatives from all four regions of the state for which

Important definitions for Case #2 as established by the student researcher

Non-precipitation watering techniques (NPWT) include any use of water that does not come directly from the sky; this definition does not include contained rain catchment systems, but does include any system that draws water from ground or surface water sources, such as irrigating or filling stock tanks from wells or rivers.

Growers are those who grow or produce plant products that are sold without the intent of their being consumed by animals or humans; this includes the growing of flowers, starter plants (even if the starter plants are vegetable or fruit starts, since the plant itself hasn't usually produced the edible portion at the time of sale), etc.

Farmers are those who grow or produce agricultural plant products for animal and/or human consumption; this includes those who produce edible goods from purely natural resources, such as the gathering of wild mushrooms or berries, or the production of syrups from natural forests.

Ranchers are those who keep animals and use the animal or animal products to make merchandise, such as meat, eggs, milk, live young, or materials from animal fibers.

Table 3. Results for NPWT users and non-users.

Question	Responses for NPWT Users	Responses for NPWT Non-users
Do you use NPWT?	86.9% (53/61)	13.1% (8/61)
	These 53 respondents report...	These 8 respondents report...
Their operation is located in: Bristol Bay/Aleutian Chain Interior Southcentral Southeast	5.7% (3/53) 43.4% (23/53) 49.1% (26/53) 1.9 % (1/53)	0% (0/8) 37.5% (3/8) 50% (4/8) 12.5% (1/8)
They run a crop (farmer & grower) operation	81.1% (43/53)	87.5% (7/8)
They run a livestock (rancher) operation	18.9% (10/53)	12.5% (1/8)
The operation is their main source of income	40.4% (21/52)	37.5% (3/8)
Acres of land in use Range Mean Median Mode	<1-1700 120.7 5 <1	<1-500 155.9 70 500
# gallons of water used from NPWT (annually) Skipped question (8/53 respondents) Reported "no idea" (14/53 respondents) Unusable data (7/53 respondents) Usable data (24/53 respondents) Range Mean Median Mode	 300-1,500,000 gal/yr 89,883 gal/yr 11,850 gal/yr 10,000 gal/yr	 NA
Would you like to use NPWT?	NA	50% (4/8)

42

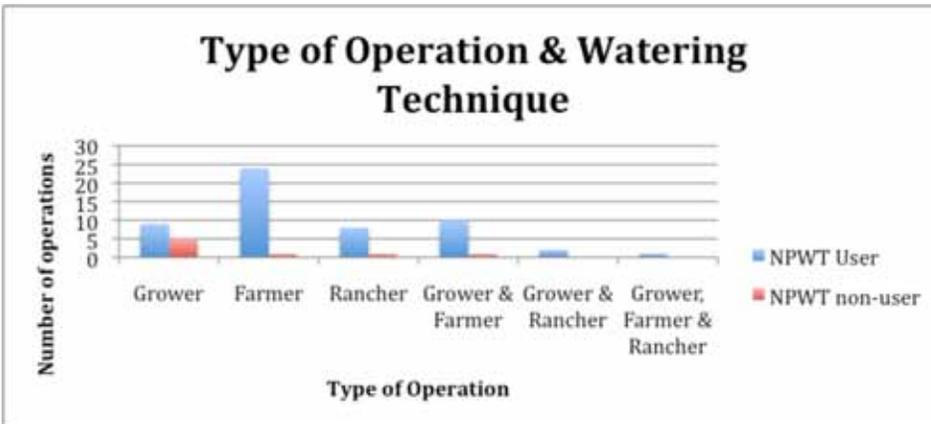
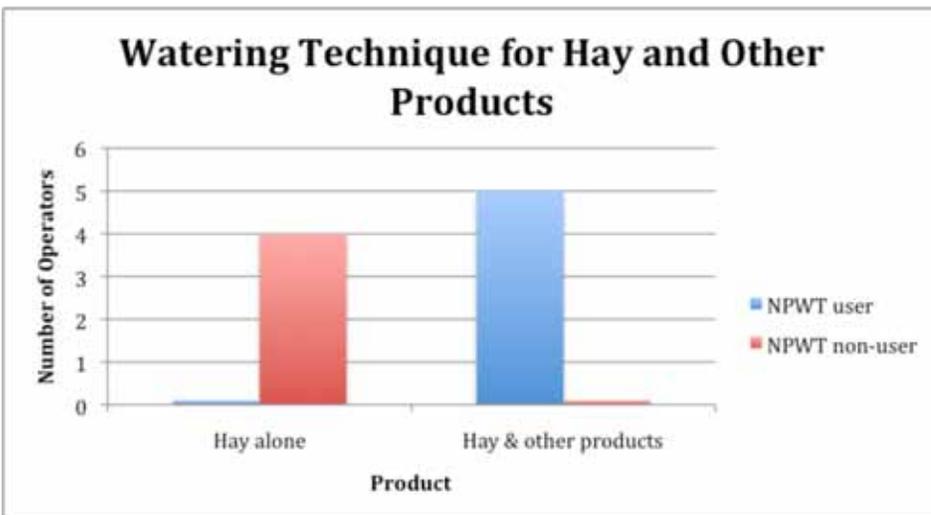


Figure 4. Type of operation and watering technique.



responses were collected. 81.1 percent of the operations are crop-based and 19.9 percent are livestock operations. 40.4 percent of these respondents indicated that the operation is their main source of income. These operations vary in size from less than an acre to 1,700 acres. Operators who knew their annual water usage indicated that they use from 300-1,500,000 gallons of water per year.

Only 13.1 percent of the operators said they have never used NPWT; they represented three out of four regions of the state for which responses were collected. Data for these respondents are presented in the right-hand column of Table 3. The majority (87.5 percent) of these operations are crop-based. 37.5 percent of the respondents report that the operation is their main source of income. The size of their operation ranged from less than an acre to 500 acres. 50 percent of the respondents

indicated that they would like to use NPWT.

Data depicting the type of operation (grower, farmer and/or rancher) and the watering technique they use (NPWT user or non-user) are presented in Figure 4. This figure also shows watering

technique (NPWT user or non-user) for operations growing only hay versus operations growing hay and some other product.

Additional findings for respondents who do not use NPWT follow. When asked why they do not use it,

respondents stated a variety of reasons, the most common being cost (Figure 5). The respondents who don't use NPWT but would like to said that lower costs would make it more feasible for them to do so. Making practical information readily available would also be helpful.

Respondents who currently use NPWT report varying levels of motivation to improve the efficiency of their watering systems (Figure 6).

Figure 5. Reasons operators do not use non-precipitation watering techniques.

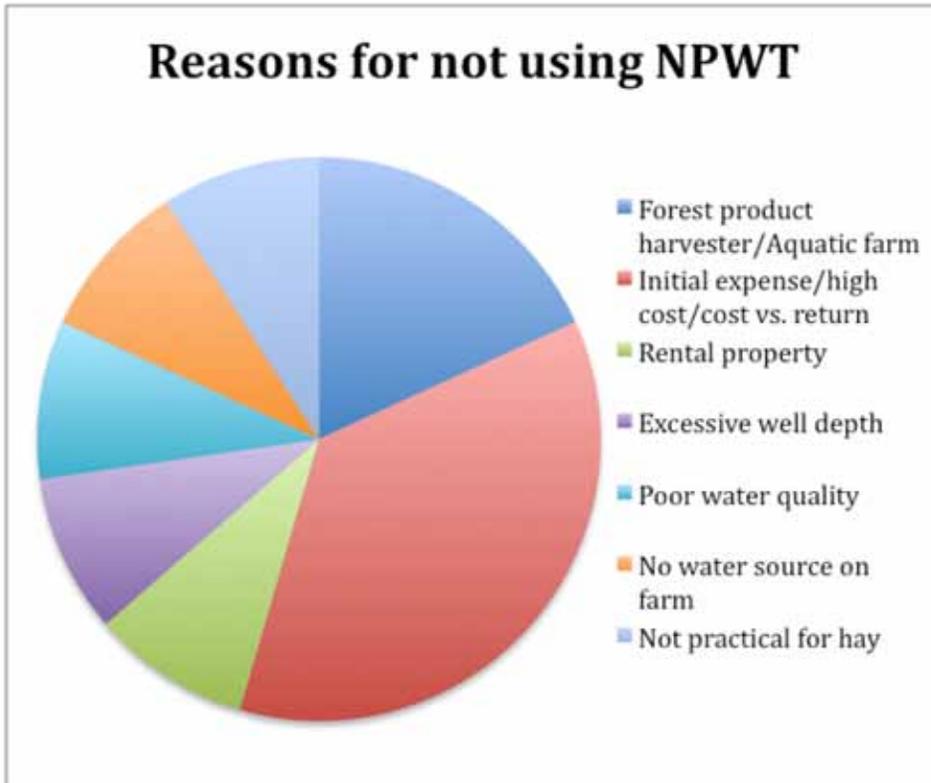
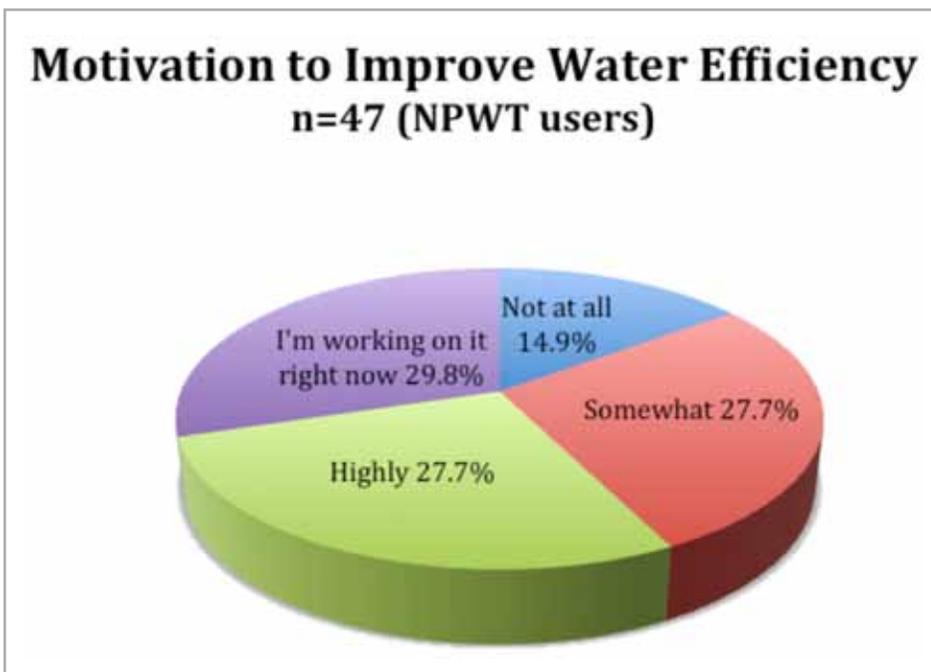


Figure 6. Level of motivation to improve water systems amongst NPWT users.



Discussion

There are some noteworthy results from this study. Cost is a key factor in people's decision to not use NPWT. Lowering costs through subsidies is an important area where government agencies can assist operators. Furthermore, making additional information available will help people set up NPWT systems, and this is an area where universities, non-governmental organizations, and/or agencies may be able to provide assistance to operators.

The vast majority of respondents are using NPWT across all four regions for which data were obtained. Of the eleven respondents running livestock operations, ten of them use NPWT (one non-user was the geoduck clam operation). Also of note is that those operators growing hay alone do not use NPWT, and those growing hay along with another product do use NPWT (Figure 4). Over a quarter (26.4 percent) of NPWT users who responded did not have any idea how much water they were using. Another 28.3 percent skipped the question or did not report usable data (e.g. gal/day without total number of days). This means those with no idea how much water they are using could potentially be more than half of all the NPWT users. Of the NPWT users who responded to the question (n=47), 85.1 percent want to improve the efficiency of their water system. These results indicate that there is interest in running more sustainable agricultural systems in Alaska, but one significant challenge to this is operators' lack of information on how much water they are using and how often. This

interest in improved efficiency and lack of knowledge about water use are areas where more work could be done in the future.

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Case 3: Drinking Water and Sanitation in Rural Alaska Villages

Introduction

Approximately 75 percent (Griffith, 2011) of the 280 rural villages (Magee, 2011) in Alaska have indoor plumbing. However, in 73 villages, one fourth of the homes do not have piped water and sewerage, while in other villages

systems need to be repaired and there are often limited skill sets and resources to make needed repairs. Across the state, the cost to repair old systems and put in new ones could cost more than \$7 million (Griffith, 2012). As such, it is necessary to find emerging, innovative technologies that will lower cost and maintenance, and be sustainable and adaptable to climate change (B. Griffith & C. Rosa, pers. communication, March 22, 2011). Connecting these homes to water systems is essential to help prevent illnesses that a lack of running water may cause (Hennessy, 2011; Ritter, 2012).

Methods

Improved in-home running water and sanitation services in rural Alaska are one of the priority goals for the US Arctic Research Commission and the Centers for Disease Control, and the student working on this project assisted them by

assessing various emerging technologies that might be useful in achieving this goal (USARC, 2012). The aim of this student project was not to generate new primary knowledge but instead to add value to existing information by evaluating, summarizing, collating, and communicating it in a useful form (MEA, 2005). This synthesis represents new (secondary) knowledge insofar as it uses investigation and an evaluation system to bring information together in a new form.

The student researched a variety of water treatment systems and compiled a review of promising technologies that met the following criteria. The system is:

- an emerging technology from a research institution, an innovative idea from anywhere in the world, and/or an improvement on an old technology;

Table 4. Water treatment systems identified for possible use in rural Alaska.

Purpose	Name	Main Technology Used
Drinking Water Systems	Kanchan Arsenic Filter (KAF) Gem505	slow sand filter that can be modified to include a basin with rusty iron nails to remove arsenic
	Trekker by Noah Water	uses a sediment filter, carbon block filter and ultraviolet (UV) light to purify the water
	Piranha by Act2 Technologies	the system digests sludge and is designed for water re-use and "zero discharge"
	AQUACHLOR30 by Bakhir & Zadorozhny	uses an electrochemically activated oxidants mixture, produced from sodium chloride, for purification
Wastewater Systems	Imhoff septic tank	uses a sedimentation tank to separate solids for decomposition and subsequently creates an effluent that is suitable for easier treatment
	Infiltration System septic tank	lightweight plastic tank and leachfield system
	Constructed wetland	constructed with an impermeable liner, a layer of gravel/stone, and planted with native emergent wetland species
Water Saving Systems	Water saver toilet	has an option to use a reduced amount of water per flush
	Sink on the back of the toilet tank	graywater from hand washing goes directly into the bowl to be used during the next flush
	AQUS Toilet System	water from the bathroom sink goes into a storage/filter tank under the sink for disinfection and is then plumbed to the toilet tank
Graywater systems	5-step activated sludge graywater system	water is diverted from the greywater sources in the house to run through five barrels for filtration and then the water is piped to a holding tank
	Constructed marsh for graywater filtration	uses gravel and native plants to filter graywater
Rainwater systems	Catchment and Cistern systems	uses pipe and barrel system to catch and store water

- a decentralized, in-home system;
- sustainable;
- adaptable to climate change; and
- appropriate for a regional climate in Alaska.

Results

Five main types of water systems (drinking water, wastewater, water saving, graywater, and rainwater) may offer solutions to improving in-home running water and sanitation services in rural Alaska (Table 4).

Discussion

There are a wide variety of innovative technologies that have the possibility to be suitable for rural Alaska villages. With the proper research, collaboration between stakeholders, and open-mindedness about exploring new options, all homes in rural Alaska can have indoor running water and sanitation systems. No one system is the perfect answer for any specific climactic region and how the area may change in the future should be a consideration before installation of any given system.

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Discussion and conclusion: Students generating new knowledge

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These three cases support the theory/model put forth (Figure 1) that an integrated research and education experience, in the context of a university course, can facilitate the production of new knowledge about freshwater social-ecological systems. Students asked unique questions of interest to them, developed and implemented a research plan, and communicated their findings. In each case, students produced new information that adds to the knowledge base about freshwater systems.

By evaluating these cases, some common characteristics emerge about the nature of the new knowledge. Through this research and learning experience students:

- created new knowledge about freshwater systems and contributed it to the broader knowledge base;
- put forth knowledge that included insights about both social and ecological aspects of the area they studied;
- produced knowledge that was place-based, as all studies addressed local (Alaska) systems;
- conducted applied research studies, in so far as their work could be used to address practical issues and/or improve the human condition; and
- created knowledge that related to and/or informed sustainability of freshwater systems.

While the model proved successful in producing new knowledge about freshwater systems, it is important to articulate challenges and areas that deserve further consideration. The extent of the research is limited by time (one semester)* and students working individually had to focus on smaller projects. The path of the research could potentially be limited by the professor's expertise, as they might guide students in one direction over another. The quality of the projects could potentially be hindered by a lack of time for the professor to advise, supervise, and give feedback on the research, at regular intervals, and this could be especially problematic in a class with a large enrollment. Some students struggled with initial stages of the research and had problems choosing a topic. Some students had some difficulty with facets of the research itself and it affected the quality of their final product. Projects could also be affected by a student's ability to contact experts or community members and/or the willingness of these people to work with the students.

There are some possible solutions and areas for future work that could help address some of the issues described above. A course spread out over a longer time frame (two

semesters) might facilitate more in-depth projects. The possibility of co-instructing the class could solve issues of professor time and expertise. Expanding the “project-bank” and “contact list,” prior to formal course delivery, could help facilitate high quality projects. In the case described here, I had identified some possible projects before the course began and the ideas were given to the students to pursue, but this should be developed further. It would be useful to continue this line of research, collect more data, and evaluate the additional cases to determine if they too support the findings put forth here.

Using the proposed model (Figure 1) proved useful in generating new knowledge about freshwater social-ecological systems. In one case (e.g. the study of NPWT), the student generated entirely new primary knowledge. In another case (e.g. the water and sanitation study), the student produced a new knowledge based on a synthesis of ideas from existing information. Finally, in the third case (e.g. AWRVI), the students used a combination of existing data sets and new research to generate new knowledge. In all cases, new knowledge was produced insofar as the students generated information based on investigation.

This knowledge is useful, not only for the student as a learning experience, but may be valuable for professionals and communities interested in freshwater systems. Knowledge generated through these integrated research and learning experiences may be especially useful because it may provide fresh insights from students not entrenched or encumbered with certain ways of doing things. Knowledge generated this way could also be particularly useful as it may be especially relevant in terms of addressing a current need and/or could be important to a specific community or location. This knowledge also provides an excellent jumping-off point for further studies. All knowledge is potentially useful as communities and professionals look for ways to make freshwater systems more adaptable in changing environments and this work adds to that knowledge base.

“It [the research project] definitely increased my knowledge on sustainable drinking water treatment and sanitation systems. It allowed me to interact with professionals who are working on sustainability issues and to take part in a small way.”

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* Editor's Note: SNRAS students majoring in a bachelor of science in Natural Resources Management are required to take a two-semester senior thesis course (NRM 405-406) to graduate. Like the course discussed here, the senior thesis course involves a rigorous research project, from defining the question to be answered, to conducting the experiment or research, defending the conclusions, and sharing the findings. Exceptional theses, as judged by students' advisory committees, are published in a special series on the school's website.

2012 SNRAS EVENT ROUNDUP

Nancy Tarnai

When it comes to events, SNRAS represents the University of Alaska Fairbanks quite well, locally, regionally, and internationally.

Events in 2012 ranged from an isotope spectrometer user gathering to a wild and wooly lumberjack competition. While SNRAS faculty, staff, and students participate in a broad range of events, the focus here will be on ones sponsored by SNRAS.

US Morrill Act Commemoration



Cake served for 150th anniversary of Morrill Act.

In April, SNRAS joined with the UAF Cooperative Extension Service to celebrate the 150th anniversary of the Morrill Act, the 1862 legislation that opened up higher education to the masses in the US. The Morrill Act created land grant colleges for every state and territory.

On April 21, SNRAS and CES hosted a public event at the UAF Wood Center to commemorate the landmark date and share knowledge about how land grant universities have affected education in this country. Classes, lectures, exhibits, and contests helped make the event educational and fun.

Russian Tea Party

The Georgeson Botanical Garden, a program of SNRAS, annually hosts a tea party and summer 2012 was no exception. The theme for the June 24 soirée highlighted Alaska's Russian heritage with tea, food, games, music, artists, and garden tours.



Above: Lola Oliver (left), SNRAS Forest Soils Laboratory supervisor, coordinated the ASITA event. A volunteer from the Fairbanks Convention and Visitors Bureau helped share information about Fairbanks. Below: The GBG Russian Tea Party brought out the Russian in Fairbanksans. The annual fundraiser, hosted by the GBG Society, has a different theme each year.

Stable Isotope Fest

Experts in stable isotopes traveled from near and far to attend the ASITA (Advances in Stable Isotope Techniques and Applications) meeting June 10-13 at UAF. Hosted by SNRAS's Forest Soils Laboratory, the conference featured workshops on stable isotopes in honey, western Aleutian seabirds, methane, and more. Attendees learned of the latest advances in stable isotope techniques and applications and bonded during a





Above: Who would walk on a log in October in Fairbanks with chilly water awaiting? It seems many people would, and do, at the SNRAS-sponsored Farthest North Forest Sports Festival.

Below: This incredible "bouquet" of appetizers was just the beginning of the elegant dining experience at Farm to Table.



reception at the UA Museum of the North, a riverboat cruise on the Chena River, and other occasions.

Farm to Table

August found SNRAS partnering with UAF Dining Services to serve an elegant Alaska-grown dinner to

legislators and public officials, driving home the point that the state's bounty isn't just for the casual table. The menu featured pickled Alaska king crab and cod, Thai spiced steak and lettuce wraps, roasted vegetable cheesecake, fresh vegetables with savory rhubarb dip, green salad, Alaska beef steaks with rosemary chimichurri, rhubarb lentil curry with kale and red peppers, salmon, bacon potato roast, tandoori roasted vegetables, barley flour cheddar rosemary drop biscuits, Brown Betty with rhubarb, Saskatoon berries, and raspberries.

Lumberjack Competition

Perhaps the best known of SNRAS's events is the Farthest North Forest Sports Festival, held the first Saturday in October. The lumberjack-style competition draws woodsmen and woodswomen to compete in ax throwing, crosscut sawing, log rolling,



Above: Volunteer Britta Schroeder, a SNRAS graduate student, leads young people in a mapping activity at the Fairbanks GeoFest Nov. 17, 2012. Participants checked the tags on their clothing to see where it was made and looked up the location on a world map.

Below: It takes a village to make Food Day happen. Here chefs, judges, and helpers in the Iron Chef cookoff pose for a group photo.

—PHOTO BY JR ANCHETA, UAF MARKETING

campfire building, and the crowd-pleasing birling (staying afloat on a log in a frigid pond). At the end of the day, individual and team awards are presented, with the naming of the Belle of the Woods and the Bull of the Woods being the culmination of the rendezvous.



Alternative Livestock

SNRAS and CES hosted the second alternative livestock conference (covered on page 18) in October in Palmer and Wasilla. This year's event covered fiber production as well as feeding and grazing practices.

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Food Day 2012

For the second year, SNRAS marked Food Day with a major celebration. The Oct. 17 event carried a strong message about the value of Alaska-grown food—that it is tasty, wonderful, and good for you. An Iron Chef Cookoff pitted the deans of the fisheries and agriculture schools in a fierce competition employing mostly local ingredients. A Food Jeopardy game put the graduate students against professors in answering tricky questions about food, fisheries, and nutrition. A free-to-the-public Taste of Alaska buffet featured delicious items made with local ingredients, and more than twenty educational exhibits about food, healthy lifestyles, agriculture, and nutrition were on display.

Geography Galore

Participating in Geography Awareness Week is a priority for SNRAS, as it is home to the geography department. In November, the governor issued a proclamation stating Alaska's observance of GAW, and SNRAS and the Alaska Geography Alliance hosted GeoFest events in Juneau and Fairbanks. The family days showcase hands-on geography-themed activities and include many agency representatives, all with a purpose of showing how important, relevant, and fun geographic education is. Throughout that week, schools across the state are involved in special lessons based on the theme set by National Geographic each year. The 2012 theme was "Declare your interdependence!"



Dean Carol E. Lewis at the Fairbanks Experiment Farm on a sunny day. Rip the reindeer is in the background, being introduced to a group of schoolchildren.

—UAF PHOTO BY TODD PARIS

CAROL LEWIS RETIRES

Nancy Tarnai

After thirty-nine years with the University of Alaska Fairbanks, ten-plus years as dean of the School of Natural Resources and Agricultural Sciences and director of the Agricultural and Forestry Experiment Station, Carol Lewis retired in October 2012.

Stephen Sparrow is serving as interim dean and director.

Lewis joined SNRAS in 1973. "I thought it would be an interesting challenge," she said. "Agriculture in the U.S. was changing and developing agriculture in the state of Alaska is a challenge. The experiment station had been stagnant for five years and wasn't matching the research needs of the state and I wanted to change that."

Also, for SNRAS the curriculum needed to be revitalized and recruiting re-emphasized. "We needed to pull ourselves out of a downward sloping enrollment curve and I knew we couldn't do that quickly," she said. "It would take some effort and it has. Now we are headed in the right direction."

Lewis came to Alaska with no real job objective in mind. She and

John Lewis came to hunt and fish and enjoy the state. They decided to stay and Lewis accepted a research position at UAF with the Agricultural and Forestry Experiment Station to work with General Electric on the management and production and economic efficiency of agricultural products in controlled environments. She shortly became a member of the faculty, and also taught at Kenai Peninsula Community College. As a professor of resources management at UAF, she focused on conservation tillage, product marketing and on economic development in the natural resource arena, including applications and systems for conventional and alternative energy in remote areas.

Lewis received her bachelor's and master's degrees in mathematics from the University of Florida, and her PhD in theoretical physics (ultrasonics) from Georgetown University.

While pursuing her PhD at Georgetown, Lewis was employed by the US Navy. Her job was to design a system for inspection of solid explosive loads for the five-inch guns on naval

warships. The objective was to keep the loads from exploding before ejection. This was accomplished. Lewis holds four patents on ultrasonic systems that provide inspection for solid loads. They are used on gunships today. The USS *Missouri* was recommissioned with Lewis's loads in the ship's five-inch guns.

Lewis began her MBA work before coming to Alaska and completed the MBA at UAF. She served as interim dean of SNRAS from 2000 to 2002 and became dean of the school and director of the Alaska Agricultural and Forestry Experiment Station in July 2002. As dean and director she led the school and experiment station to focus on sustainable resource management in the circumpolar north including appropriate resource-based products and industries as well as alternative and renewable energy sources.

During her watch, the school and station established a reindeer herd as a part of the Reindeer Research Program, began work in biomass and bioproducts, developed new research, educational and outreach programs at the Palmer Center for Sustainable Living in the Matanuska Valley, including turf research and second and third generation biofuels research, led research on the Endangered Species Act for the state of Alaska and led research on controlled environment agriculture for northern latitudes.

Lewis served on the Board for International Food and Agricultural Development, the advisory board to USAID, for six years; on the executive board for the Western Regional Development Association for eight years; as senior advisor to the Experiment Station Committee on Policy for one year; was chair of the Western Experiment Station Directors' Association for two years; was chair of the Board of Directors for the Agricultural Development in the American Pacific program for two years; and she currently serves as a member of the board of directors for the Fairbanks Economic Development Corporation.



Lewis with Jay Kertulla, left, at the dedication of Kertulla Hall at the Matanuska Experiment Farm in 2008 in recognition of Kertulla's many contributions to agriculture in Alaska.

—AFES PHOTO BY NANCY TARNAI

Lewis looks forward to spending more time with her husband John and their dachshund, Hammer, and plans to play more tennis and write a book on agricultural research in Alaska. "That story has never been told in its entirety," she said.

Professor Stephen Sparrow is now interim dean and director. He has been associate dean for eight years.

"I have a lot of experience here in the school and experiment station and at UAF," Sparrow said. "Over the past thirty years I've gained a lot of institutional memory that will come in handy."

Sparrow is a professor of agronomy who researches bio-energy crops and soil management. He holds a BS in soil science from North Carolina State University, a master's in agronomy from Colorado State University and PhD in soil science from the University of Minnesota.

"My charge is to move the school ahead," he said. "We'll be revising the curriculum and planning a long-term sustainable financial plan."



Stephen Sparrow, interim dean and director of SNRAS and AFES.

—PHOTO BY TODD PARIS, UAF MARKETING AND COMMUNICATIONS



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Interim Dean and Director Stephen D. Sparrow and the entire SNRAS faculty and staff express their deepest appreciation to our volunteers and our financial donors, from those who donate their time, effort, and/or money to the Reindeer Research Program, Georgeson Botanical Garden, scholarships, or to our graduate fellowships. You are helping us fulfill our mission in Alaska. Thank you.

The SNRAS Food Day organizers express their gratitude to the School of Fisheries & Ocean Sciences, Johnson Family Farms, and Chena Fresh, who donated food for the 2012 event. Because of your generosity and the excellent food preparation by NANA Management Services we were once again able to provide healthy, fresh, and above all tasty local foods to members of the public who had no idea that Alaska Grown food could be so good. Thank you.

A gemsbok, the largest of the four members of the Oryx genus of antelopes. See story on page 23.
—PHOTO BY CHANNON PRICE

