
Program
Update

New Faculty
Member

Senior
Capstone
Outreach

Alumni
Updates

FRESH ROOTS

STUDENT AND ALUMNI NEWS



Senior Capstone Class 2013

Programs Update

Sustainable Food & Bioenergy Systems has become a strong and fast growing program at MSU. Currently 82 students have declared SFBS as their major. In May 2014 our third class of seniors will graduate with their Bachelor's of Science Degree, and SFBS will have approximately 40 alumni!

In fall 2013, Selena Ahmed began her MSU career as an Assistant Professor of Sustainable Food Systems and is currently serving as the Program Leader for SFBS. Her research, teaching, and outreach interests are at the interface of health, culture, and the environment. Prior to moving to Bozeman, Dr. Ahmed was living in Boston where she was a NIH Post-doctoral Fellow at Tufts University. While in Boston she taught several courses on food systems including courses on sensory ethnography and eating and the environment. Dr.

Ahmed has an interdisciplinary background in economics (BA), anthropology (MSc), biology (PhD), and the biomedical sciences (post-doctoral training). She integrates this background to examine pressing issues on the ecological, cultural, and human health aspects of food systems. Since 2003, she has conducted extensive fieldwork on biodiversity, cultural practices, livelihoods, and health outcomes associated with indigenous food systems in China, India, Morocco, Venezuela, Belize, the Dominican Republic, and the USA.

At MSU, Dr. Ahmed initiated the collaborative Food and Health Disparities Lab to carry out research on food system quality. She is currently collaborating with Dr. Byker to assess the food system quality in rural and tribal communities in Montana. Her current international work focuses on the effects of climate variability on tea quality and socio-economic responses that is funded by a large interdisciplinary grant by the National Science Foundation and builds on her work previous on tea ago-forests in southwestern China. Dr. Ahmed is carrying out a parallel project in eastern USA on the effects of climate variability on sugar maple resources and socio-economic responses.

Since joining SFBS, Dr. Ahmed has developed two new courses for the program including "Measuring Innovation in the Food System" and "Food System Resilience, Vulnerability, and Transformation". In addition to these courses, she also teaches the introductory SFBS course and oversees student internships. Dr. Ahmed is looking forward to further developing the SFBS curriculum including incorporating innovative pedagogies and developing shared curriculum and opportunities with partnering universities.

Dr. Ahmed loves living in Bozeman and being surrounded by glorious mountains. She is enjoying exploring the state's socio-ecological landscape and food systems.



Faculty photos top to bottom: Carmen Byker, Bill Dyer, Alison Harmon, Chaz Holt, Bruce Maxwell, and Mac Burgess

2014 Senior Capstone Outreach Articles

Reinstating Agriculture's Natural Controls

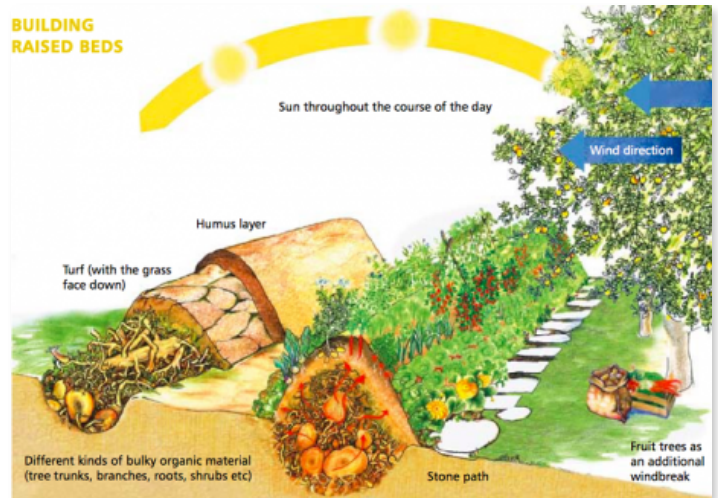
Ben Shepard

The practices of modern agriculture are changing. The Green Revolution brought about drastic changes in the way that agriculture is implemented towards the goal of providing for an ever increasing population. The main result of the Green Revolution is an agricultural system focused almost exclusively on the increase of one service provided by the agroecosystem: yield (Renard *et al* 2012). This has been done by the extensive replacement of natural controls of ecological processes with outside inputs (Renard *et al* 2012). To maintain a sustainable agricultural system, these internal controls need to not only be re-applied to the system but studied and understood. In this way we can facilitate the continued production of food, fuel, and fiber in a more ecologically responsible manner.

Both physical and biological aspects of agriculture should be addressed when attempting to re-integrate internal controls. Crater gardening, Hugelkultur, and polycultural design are some useful approaches to begin this re-integration.

Crater gardening, which primarily addresses the physical component of ecology, is essentially a term applied to the utilization of terracing, earth-sheltering, and the management of moisture to alter climate characteristics for the cultivation of food. The difference between crater gardening and the slope terracing practiced for thousands of years by cultures in Asia, South America, Africa, and Europe lies in the fact that crater gardens are sunk into the earth (Holzer 2011). The purpose of such subterranean placement is to provide shelter from certain elements for the added benefit of minor climate modifications. This is opposed to increasing arable surface area as in the historical cases, though crater gardens provide that benefit, too (Holzer 2011).

Hugelkultur is a technique for creating raised beds. The word Hugelkultur, a German word, translates roughly to "hill" or "mound culture" and also largely pertains to the physical realm of ecology (Miles 2010).



The defining characteristic of Hugelkultur is the inclusion of a core of organic matter, generally logs and slash, to increase size, store moisture, increase aeration, and slowly compost into rich hummus, releasing heat all the while (Holzer 2011). The mounds are constructed by digging a ditch, removing the sod, setting aside the topsoil, arranging the logs to form a pyramidal core, re-applying the sod face down on the logs, and finally placing the topsoil back on the mound (Holzer 2011).

Polyculture pertains chiefly to the biological side of ecology and is a method of ecological design that mimic groups of plants responsible for performing key ecosystem functions in nature by ensuring that every niche is filled. This leads to many benefits including additive yielding, diversity of yields, reduced work, integrated pest controls, and other ecosystem benefits (Jacke 2013).

The utilization of such techniques in concert with one other opens up new food production methods that rely less on outside inputs. Along with the food produced, many other benefits are realized through the increase of biodiversity and modification of the environment such as an increase in system resilience and the reinvigoration of the hydrologic cycle.

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Hands-on Food Education for Kids in Livingston, MT

Andrew Berg

Teaching young people about food can be difficult, especially if you are explaining the advantages of eating kale and eggplant when your audience is more interested in pizza and hamburgers. Teaching them about sustainability, environmental science, or any complex scientific concept or phenomena is more challenging still. Farm to School programs have clearly defined objectives such as bringing local foods into the school cafeteria, and teaching children about the merits of eating local foods and about making healthy food choices. The Livingston Farm to School program joins the local food community and the school to accomplish common goals.

Children are being exposed to new forms of education all of the time. Hands-on learning stimulates all the senses and is more effective than simply listening to a teacher. An emphasis on healthy eating choices and supporting the local economy through eating foods grown by local producers was a strong part of the Livingston Farm to School Program during Summer and Fall 2013. Young students have a variety of interests; some like sports, some like music, and some even enjoy gardening. A few elementary students even gave up their recess time to help the Farm to School

Coordinator and her interns help harvest, wash, and package vegetables. Children know that their food is important. Teaching children where their food comes from and how it needs to be cared for while it is growing really sticks with them. Children learn best in situations that fit their learning style. Care is needed to plan and design each lesson and field trip.

Farm to School programs can result in a world where more sustainable practices are the norm rather than the exception. The education portion of the program helps shift the paradigm away from eating as usual, to doing things differently. It challenges the notion that food originates in the grocery store or a restaurant, magically appearing there. The students who participate in the program start to understand what is meant by “local foods” or “seasonal foods” and how to support local farmers.

When it comes to achieving sustainability in the food system, awareness is a key factor. Farm to School programs bring awareness to young children while providing them with the same local food that they learn about in class, for some it peaks their interest and brings a new generation of informed consumers, new gardeners and hopefully future farmers.

She Thinks My (TURKEY) Tractor's Sexy

Patrick Certain

Turkey: the centerpiece to a wholesome, all-American harvest. Turkeys are a great addition to any diversified cropping operation, and it would be a shame to view them as simply a walking pile of breast meat, awaiting the dinner table on Thanksgiving. Two key functions that all poultry can serve are pest control and soil nutrient management. This article will review my foray into turkey husbandry in Summer 2013 and what I learned about their potential on an organic vegetable crop farm.

Situated between an alfalfa field and a small apple orchard, the Espenchied vegetable farm faced intriguing, spatial and temporal pest control issues. Dick Espenchied, a veteran agrarian knew well that starting in late June,

grasshoppers begin their onslaught on the vegetables coming from the alfalfa field. Knowing this, and knowing we were ordering turkeys soon, I jumped at the opportunity to create a poultry tractor for the farm. Poultry tractors are “shelter-pen system[s] where animals such as chicken, turkey, geese... become integral parts of agricultural environments... scratching, pecking, tilling, and manure spreading behavior of animals is used to prepare, clean, or maintain planting areas.”¹

The advantages of mobile housing structures are much more practical for a farm that intends to slaughter the birds at the end of the growing season, as they are not built to provide adequate shelter in the winter months. Our pen was built from a combination of salvaged material and some store bought lumber and had the capacity to sleep around twenty fully grown turkeys. Once, every two or three mornings we would move the tractor to a plot of fresh cover crop, which bordered and intersected the field. Through careful observation, we could strike early when it seemed like pests were creeping in from one side of the field or another. After turkeys knock down insect pests they will make a second pass to eat down the weeds, thus further limiting pest habitat. The other obvious advantage of this system is green matter conversion into nutrient rich manure. It will be especially exciting to see what effect this has on the cover crop alleyways which will be turned back into vegetable cropping ground next season.

There are several means of incorporating turkeys, chickens, and geese into integrated agriculture systems. From small backyard gardening to the, relatively speaking, massive scale that Polyface Farms employs poultry, there are several adaptations that can make poultry tractors a system-enhancing component of any sustainable farm. As one of the guiding doctrines of the Sustainable Foods and Bioenergy Systems program states, sustainability requires economic viability, social acceptability, and environmental stewardship. With careful consideration, all three pillars can be supported.

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1. The turkey tractor in action! Articulating shoulder arm to pick up the front end.



2. Electronet fencing gives the birds ample space for grazing and provides predator protection



3. Minimalist frame to save weight.

Advantages of Specific Livestock Breeds

Charlie Fereday

In the livestock industry, alternative livestock production is a growing trend that could benefit producers by utilizing specific heritage breeds to their advantage.

For example, I worked on an alternative livestock operation in June 2013 raising Irish Dexter Cows in Boise, Idaho. This small cow is known for its extremely efficient conversion of grass into high quality meat and milk. In fact, compared to other breeds the Irish Dexter Cow is the most efficient meat and milk producer per pound of grass consumed. This attribute can improve market penetration, diversification, and could lead to niche market access.

Irish Dexter Cows also take very good care of their young from the moment they are born. My internship mentor informed me that she does not assist her Irish Dexter Cows in any way during spring calving. The Irish Dexter Cow's natural ability to take excellent care of their young benefits producers by reducing labor, saving time, and other management costs associated with calving.

Guinea Hogs are another breed that could prove to be very beneficial to livestock producers. Guinea Hogs are a smaller heritage breed (150-250 lbs) that are extremely adept in foraging pastures and grasslands. I had the opportunity to observe their foraging skills--consuming a wide variety of grasses, plant roots, rodents, and snakes. Guinea Hog meat is desirable and the lard, if raised on pasture, is even more desirable. When raised on pasture, many minerals and micronutrients are stored in their fat, making the lard nutritious. I also observed that Guinea Hogs possess a very docile disposition, which makes them a very easy animal to raise.

Incorporating and experimenting with new and old heritage breeds can pay dividends for alternative and small livestock producers. Improved marketability, reduced labor, or reduced overall costs; alternative livestock

breeds have the potential to increase overall efficiency of livestock operations across the country.

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Farm to School Grows in Montana

Tara Culbertson

history-of-guinea-hogs/

Farm to school programs are growing across the country, and Montana is no exception. Montanans are actively working to change the current food system and farm to school is an important part of that change. Farm to school programs in Montana include everything from 'Beef to School' to school gardens. They are supported by community members, FoodCorps and AmeriCorps service leaders, schools, universities, producers and processors, non-profit and state organizations and local businesses.

How can farm to school affect Montana? The Montana Office of Public Instruction reports 80,000 students are served lunch at school every day. That makes 80,000 opportunities to show school children Montana's amazing agricultural bounty! Farm to school programs have the capability to not only financially support local farmers and ranchers but also to create a school food environment that provides healthy meals and nutrition education to students. Schools in Montana are increasingly initiating farm to school programs and events.

In a recent USDA Farm to School census, 65 school districts representing 153 schools reported incorporating farm to school activities within the school. The report also noted that approximately 956,304 dollars were spent on local food by school districts in the

Local Food Distribution in the Gallatin Valley

Emily Fountain

2011-2012 school year. Not only are more school districts trying to serve local food but many are beginning to increase the amount of local food served every year. The Bozeman School District served over 2,500 pounds (\$130,000) of local foods in the school year 2011-2012. Missoula County Public Schools are beginning the 2013-2014 school year by processing and freezing local foods to be used well into the winter including 500 pounds of blanched broccoli, 800 pounds of shredded zucchini, and 600 pounds of blanched green beans. There are growing efforts to get Montana beef into schools and some schools have been successful in purchasing local beef while staying within budget constraints.

Not only are schools able to procure local foods for school meals, but they are also able to reinforce the concept of local and whole food with education about nutrition, gardening, and agriculture. Montana FoodCorps service members are working in different communities around Montana to educate youth about how food is grown and where it comes from. Garden City Harvest in Missoula operates the Program in Ecological Agriculture and Society or PEAS Farm. The PEAS Farm has a youth harvest program, offers community education field trips, summer camps, and hosts students from the University of Montana's Environmental Studies Program. Madison Farm to Fork in Ennis uses their school garden as an outdoor classroom teaching weekly nutrition and garden education. Schools in Ennis also are getting to experience a growing Chefs Move to Schools Program that brings nutrition and food lessons into the cafeteria with taste tests and sampling activities. These are only a few of the many farm to school educational programs that are expanding throughout the state.

School gardens are also being integrated into farm to school activities by being used as outdoor classrooms in many communities across the state including Bozeman, Livingston, Fairfield, Great Falls, Chinook, Sidney, Glendive, Billings, Kalispell, Missoula, Deer Lodge, and several others. The efforts of many Montana community members are working together to ensure farm to school is an important and growing part of youth education.

The distribution system of food in Bozeman has changed significantly in the past several years with the emergence of the local food movement that has become so prevalent in the area. It is clear that Bozeman cannot completely provide for its residents' total demand for food, as people want bananas, fruits, etc., and the growing season in Bozeman is just not long enough. However, is it possible for the producers to benefit from a local distribution system?

A local distribution system would have challenges and rewards. There would be fewer breakdowns in communication between sellers and buyers, which would lead to a more streamlined, easier way to get food for everyone involved. However, many area farmers operate on a scale in which they prefer to market their own products. A distributor is seen as a "middleman" who provides no additional desirable services to the producer, other than selling produce at a 25% mark-up to the consumer. Finally, the farmers and producers in Bozeman have an inclination to "Brand" their products. When a distribution system is put into place then the brand is lost and all the product is aggregated, which is not attractive to farmers.

The Gallatin Valley Area currently has two distribution companies that work with farmers and those who produce value added products. These companies are called Market Day Foods and Quality Food Distributors.

For more information please visit:

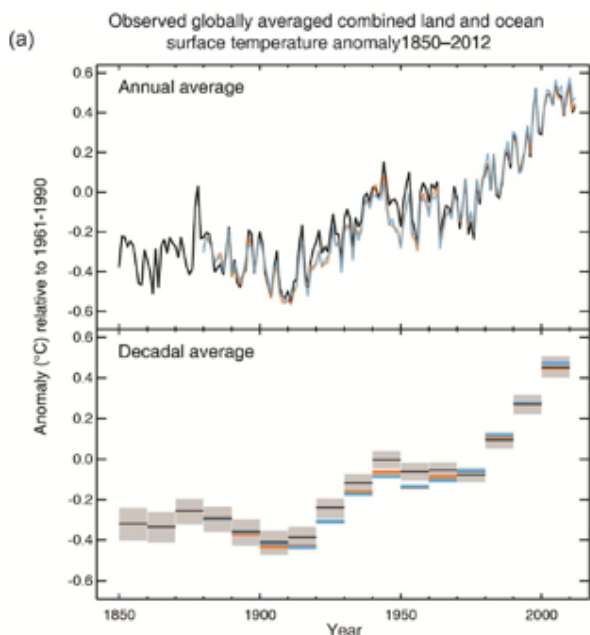
<http://marketdayfoods.com>

<http://www.qfdistributing.com>

Sustainable Agriculture as a Necessity

Ben Hughes

We are living in a time of unprecedented change. Never before in human history has the world been in such a dynamic transition. Climate change, rising sea levels, and unpredictable natural phenomena are occurring at such rapid levels that they defy the models that were created to predict them. The Union of Concerned Scientists, the Intergovernmental Panel on Climate Change, and many other scientific organizations have concluded, with 90% probability, that these steady trends are driven by human activity (1).



Decades-long drought in the west, record high temperatures across the country, and increasing severity of storms are just a few of the repercussions of a warming planet, however the cumulative effects of these elements are already being felt by agricultural producers. In the face of a changing world, we must adapt in order to keep ourselves fed. Our current agricultural methods, while effective, contribute more to the problem than

they do to the solution. This has driven many to the realm of sustainable agriculture (2).

Slowly but surely, we must transition away from antiquated system of chemically intensive food production to more ecologically focused, environmentally sound practices. Resistant weeds and bacteria, rampant pollution, and dead zones in the ocean are just a few of the results of our current agricultural production schemes. These degrading effects serve to highlight our need for change to a more beneficial form of food production (3).

Through this transition, agricultural producers will be able to utilize scientific methods to lower the cost of inputs, increase the health and tilth of their soil, and create a better environment downstream. Through improved practices, as well as increased investment in their infrastructure, farmers and ranchers can create much of their own fuel on site from waste products (crop residues, manure, etc.) while using the end product as compost. This would decrease both the cost of fertilizer and fuel inputs, while increasing the producer's autonomy. Further actions such as integrated pest management and an increased knowledge of nutrient cycling could further decrease the agricultural footprint (4).

Internalization of external costs would also serve as an impetus for the transition to a more sustainable agricultural base. By attaching some sort of monetary recompense to nonpoint pollution, producers would be forced to confront the damaging effects of current production models. While there would be heavy resistance on the part of producers and the industry in general, this is a necessity in order to bring the degrading impacts of many practices to light.

Making this transition will be difficult. Political opposition, general misinformation, and resistance from conventional agricultural producers keep sustainable practices moving at a snail's pace; while a lack of governmental

support keeps many of these beneficial processes as “back yard” experiments. The need to modify our behavior in the face of a changing world will become more apparent as the shortcomings of our current production system come into focus. As the importance of sustainability slowly gains momentum, the change will come; as much out of necessity as anything else.

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The Co-op Business Model is Awesome: Here is Why

Julie Williamson

REI, ACE Hardware, Sysco and Organic Valley. Which of these is not like the other? Sysco is the odd man out because the other three companies are actually cooperatives! Yay cooperatives.....umm what is a cooperative?

The term cooperative, when applied to a group of people, implies that there is a willingness to work together and a common goal or ideal knitting the group together. There are three main ideas that differentiate a cooperative business from the standard business model.

A co-op is a business that is not a slave to the conventional idea of a bottom line; a co-op's bottom line is meeting the shared needs of the members. For example a purchasing

cooperative is a group of people or businesses who purchase goods together as a group reducing the per unit price because of the increased buying power or ability to buy in bulk.

A cooperative is owned by its members. This unique characteristic gives each person a say in how the co-op operates. Important business decisions are made by the votes of its members and each member has one vote, regardless of their status within the organization. One member=one vote. In many conventional business structures people employed in the top positions of the company have more control over the company than the employees at the bottom of the ladder. For the sake of efficiency day to day business decisions are made by a general manager at his or her discretion. Long term goals and cooperative direction are developed by a board of directors. Any decisions that involve changes in capital or large changes in company operation require a member vote.

Profits are allocated differently in a cooperative. A percentage of the profits go back into the cooperative to support the business and the rest are refunded to the member owners. There are numerous methods for reallocation of profits but the underlying principal is that profits are reallocated to members rather than given in disproportionate sums to the heads of the company. The percentage of profit that is reserved for co-op operation is used to improve co-op services and increase satisfaction of member owners. In this model the risks are mitigated and the rewards are more fulfilling because they benefit everybody.

Cooperative businesses are wonderful tools to bolster a struggling local economy. For example many rural coffee growers form cooperatives because together they are able to compete in economies of scale and sell their product on the global market. This is an option that is not available to a single rural

coffee grower. Creating a co-op also gives small producers advantages in terms of marketing and advertising

The cooperative business model has many advantages over the conventional models. Due to the focus on member owners and sharing the benefits and pitfalls of the market, these businesses are uniquely sustainable. Sustainable business practices are becoming increasingly important. I believe that the growth of cooperative businesses will be an integral part of our future food system.

Gaining Valuable Experiences

Kara Landolfi

For those of us interested in food, the desire and ability to learn more is always available. Over the past few years I have immersed myself in all things food, with each experience contributing to my broader understanding of our food system. Learning the intricacies of how multiple parts of the food system function has helped me better comprehend how and why things are the way they are, and how to support the aspects I want to see grow.

Students often lack those real-life, hands-on experiences that can help to guide them in a direction that they may not have previously considered. If an opportunity related to your interests arises, take it. You can learn just as much from the experiences you do not enjoy as those you do.

On Campus

Some of the most beneficial experiences I have had have been doing things I was unfamiliar with. When I first moved to Bozeman to start the SFBS program, I joined the SFBS Collaborative, 1,000 New Gardens, NECO, and the yet to be named Fruit Bats. These clubs offered me experiences, skills and friendships I would not have acquired alone. The SFBS program also provides a

practicum at Towne's Harvest Garden – our organic vegetable farm 1 mile from campus.

Research opportunities are always looking for student's assistance as well. This may help you to develop better relationships with professors, who can help you land internships, jobs and recommendations down the road. If you find a project that interests you, consider applying for a Undergraduate Scholars Program grant at MSU to compensate you for your time and to pay for project-related expenses .

In the Community

The community provides a wealth of opportunities to lend your time and knowledge. Nonprofits and small businesses are around every corner looking for help, so find one that can utilize your skills. The Bozeman Youth Initiative provided a place where I could teach kids about plant growth and nutrient cycling on their BOB Greenhouse Bus. Area farms also offered me the ability to learn about other farm practices besides what I saw at Towne's Harvest. The Gallatin Valley Farm to School program looks for help throughout the year as well.

Internships and Employment

If you want a more in-depth experience, consider applying for an internship. The SFBS program requires an upper level internship geared to helping you reach your career goals. For me, I was able to witness everything that occurs at the Co-op's Central Kitchen. Other students' internships have lead to jobs after graduation, so developing those relationships within your field of interest can definitely be beneficial.

All of your efforts will not go unnoticed. Given enough time, your experiences will add up and help you acquire jobs. My work has included grading nutrition papers on campus, assisting in food insecurity research, running a free lunch program through the Livingston Food Pantry, working as a field tech at MSU's Northern Ag Research Center in Havre, and supervising at the GVFB's Community Café.

Now's the Time

I believe that every experience I have undertaken has opened my eyes to something I had not been aware of before. There are so many aspects to the food system that one needs ample time to experience them. Put in the effort to find experiences you can become involved in over time to gain as much as you desire. Involvement includes a combination of classwork interactions, club membership, community volunteerism, internships, work experiences, and community event attendance. It is up to all of us to find and get involved in what will best benefit our own food related interests. Students in the SFBS program are active individuals, so if you haven't yet, join the fun by getting involved.

Classroom in Bloom

Claire LeDuc

The farm to school movement has progressed across the country, providing students with access to locally-produced, farm-fresh foods like never before. During Summer 2013, I had the unique opportunity of working with a school garden in my hometown of Winthrop, WA; a perfect example of the possibilities available to schools nationwide.

Classroom in Bloom is a non-profit organization dedicated to producing healthy, organic, sustainable foods that can be added into the school lunch program at Methow Valley Elementary School and Liberty Bell Jr. / Sr. High school. They work to create a hands-on introduction to growing, harvesting and consuming fresh fruits and vegetables. This experience has been beneficial to both students and community members alike, symbolizing the connection between production and consumption. The garden has become a teaching opportunity for many students, offering a plethora of scientific and creative experiences.

Alexa Whipple, head of Classroom in Bloom shared some of her joys and frustrations with supplying food to the school cafeteria. Due to the ease of utilizing mainstream food service products, Classroom in Bloom has to work

hard to compete and provide comparable produce to the cafeteria. Budget cuts have provided substantial hurdles, especially regarding cafeteria staffing. The garden has focused on certain varieties of fruits and vegetables, known for their size or versatility. Staff can also be wary of "exotic" vegetables in their meals. The salad bar is one area that requires minimal work for the staff, making it a perfect place for the garden to focus. The garden has succeeded in providing more variety in the form of beets, carrots and mixed greens, healthier options for students and staff.

School gardens similar to this model have begun to pop up all over the country. The Farm to School Program has offered an incentive for educational facilities to utilize additional government funding and resources.

Farm to Table

Melissa Lippy

The idea of a farm-to-table operation, one in which a culinary venture is fueled by food grown nearby or even on-site, is no longer new. The farm-to-table movement is quickly growing, and expanding nationwide into schools, restaurants, and other local entities. But there is always more opportunity for creativity and new ideas directed towards getting consumers instantly connected with homegrown, just-picked, nutrient-dense produce.

Farm Pizza Night is one such idea that is growing popular in the Midwest. Small farm owners are building outdoor pizza ovens on their property, or incorporating brick ovens into their existing buildings, and firing them up once a week for a community-wide pop-up-restaurant night. A day will be spent in preparation for the event, mixing small mountains of pizza dough, harvesting, dicing and chopping produce, and putting together any other necessary ingredients. Four to six menu items will be set, based on what's ripe

and ready that week, and the oven will be fired up to about 700°F.

That evening, the farm will open its doors and its grassy front lawns for people to pack in chairs, picnic blankets, glasses, and silverware, and get in line for a taste of the nightly pizza special. Some farms will serve other salads and salsas, and a few have gone as far as acquiring a beverage license to sell local beer and wine along with their pizzas.

Pizza Night is a great way for community members to directly support and connect with local food, under the guise of a low-pressure, highly enjoyable dinner out. Many farms utilize the opportunity to showcase other local ingredients such as sausage, cheeses and wheat. The J. L. Hawkins Family Farm in North Manchester, Indiana epitomizes the sustainable model in its endeavors; the family uses wheat flour grown ten miles away for their dough, and uses honey from their own bees as a sweetener. They also raise pigs which are used for sausage and pepperoni. The Hawkins weekly pizza night event offers local musicians a venue to play, and on occasion will invite a Guest Chef to come and prepare a pizza topped with specialty ingredients such as smoked duck or rabbit confit.

Outdoor pizza ovens can be used for other food ventures as well. For example, A to Z Produce and Bakery in Oregon, WI has expanded their successful venture into bread baking. With a grinder to make their own wheat flour, and a passion for sourdough, they have turned their built-in brick oven into a value-adding branch of their working farm, making and selling bread on a daily basis.

Within the farm-to-table model, many options and possibilities exist to expand into other areas. In a supportive community such as the Gallatin Valley, new ventures and ideas like the Pizza Night could be undertaken with a high probability of success, which gives reason for young entrepreneurs to think creatively and

build new connections within the local food system.

High Desert Food Production

Candace Moyer

This past summer, as a solution for supplying high quality, fresh, locally grown, nutrient dense, organic produce, I was asked to design, build, and grow a garden for owners of a local ranch. The food was also meant to augment ranch employee lunches during the week. Growing vegetables using sustainable methods lowered the carbon footprint for forty people for one-third of their meals.

The project was started in March 2013, with the raising of a 20' X 24' high tunnel, and the expansion of an existing garden into a terraced 40' X 60' slope. Ranch hands and private contractors assisted in the construction. The high tunnel contains (4) 4 X 8 raised beds and a double sink for washing vegetables.



Sustainable methods for production included a terrace made of sandbags filled with soil from the property, which halved the garden into upper and lower beds. There were (12) 20' rows in each. Water saving drip-line irrigation was set up. Amendments of

compost soil and mulch were incorporated into the soil before planting. A crop rotation was established, and green manure crops were planted between rows to ensure soil stability and productivity. Row cover was used early in the season and as shade for tender crops during the heat of the summer.

The high tunnel provided a jumpstart as a season extension, and produced a variety of herbs and greens by Memorial Weekend. Tomatoes, peppers, fall greens, and cantaloupe finished out the season. Crops in the high tunnel beds were rotated as well. Growth slowed during the heat of the summer, but fall temperatures extended the end of the season with a second round of salad greens. The garden produced greens such as spinach, arugula, lettuce, romaine, kale, chard, dill, cilantro, and parsley. Successful legumes included peas, and both green and yellow beans. Root crops included varieties of carrots, beets, green onions, parsnips, turnip, and last fall's garlic crop.



Tasty cucurbits flourished in the form of summer squash, with a diversity of patty pan, zucchini, and crookneck. Winter varieties included butternut, Hubbard, and the favored, spaghetti squash. Both pickling and green cucumbers were prolific, and the corn was sweet and tender. Edible nasturtiums were planted along the base of the terrace. They made a lovely border and, surprisingly, served

as a trap crop for flea beetles. The drip irrigation kept down the weeds, and because water went directly into the soil of the plants, mold was non-existent. There were no major insect issues, other than late season aphids. Ladybugs were released and held them at bay.

The yield and variety of vegetables made for a successful growing season. Another garlic crop has been planted, and plans for next year's garden are already underway. I am very grateful for the opportunity to apply the principles I learned in the Sustainable Food and Bioenergy Systems program, and would recommend these farming methods for growing vegetables in the dry, short season of the Gallatin River watershed.

Education and Its Impact on the Sustainability of Our Current Food System

Tyler Nyman

With an ever increasing population and decreasing land available for food production there must be increased awareness about the origins of our food and the practices employed by the people growing it. Too often in our modern world there is a disconnection between people and their environment. Improved awareness about our impact could lead to many adaptations, behavior changes, and the possibility of sustainability.

One of our challenges today is to have more people farming (on small-scale vegetable production farms of course) with as much mechanization as possible, in order to produce food that improves the land while maintaining profitably and encouraging social justice. Reducing the scale of farms and employing more people in food production could also fuel economic development.

Education is one strategy for change. Breaking up this task into age specific

demographic groups would be an effective start to this undoubtedly lengthy process. If children were taught the basic pillars of sustainability before they were responsible for making choices on their own, their decisions might be influenced. If they relay what they are learning to their parents, then another target group can be reached.

Educating adults is tricky; making small changes can be difficult especially if you are required to forfeit convenience. Lifestyle changes are easier said than done, and necessary steps mean better planning by everyone, especially people who hold power. It takes collaboration in many small ways in order to make a change on a national or global scale.

Why not include this education into school curricula and community outreach programs? With education and effort, we can change some of the bad habits we as a society have been participating in knowingly or unknowingly.

Old McDonald Had Bees

Karen Page

With the growing awareness of the depletion of our honeybee population, our efforts to help bees flourish has become critical. Many crops are pollinated by honeybees, over 150 varieties to be exact! Fruit and berries, nuts, melons, cucumbers and broccoli, clover and alfalfa make up nearly one-third of the US diet, and are 90% dependent on honeybee pollination. Not only is this service vital to our food system, but honey and bee pollen provide important agriculture products. Keeping bees on your property is an easy way to boost crop yields, and it isn't as hard as you would think!

The first consideration is to understand the legalities of keeping bees in your area. Permits and registration information should be obtained through the state department of

agriculture. Next, you want to pick your hive location. Forage for pollen can happen within four miles of the hive, and you want to be sure not to disturb your neighbors. Bees are also happier (less aggressive) in the sun. Putting their hive in a sunny spot will help keep observers from getting stung. If bears are a concern, keeping hives on a roof is an option, but be sure you are able to regularly maintain the hives.

Bees need a steady supply of water. It is used to cool the hives and dilute honey used to feed the young. Providing a constant source nearby will prevent them from dipping into your neighbor's pool, or the water for other animals. Temperature and wind conditions are another important factor. Increased heat means higher water needs, and a windbreak could be useful in protecting the bees.

To manage your hive, keeping bees calm is the most important task. Opening the hive will increase tension in the bees, and once one bee is agitated a pheromone is sent out to warn all the others. Warm sunny days are a good time to catch the bees in a good mood, plus there is increased probability they will be out foraging pollen and not in the hive.

Knowing what is going on in your hive is important. The queen bee lays up to 2000 eggs per day, and fertilized eggs become female (worker bees) while unfertilized eggs turn male (drone bees). Worker bees cannot reproduce. They pick their lifetime role of housekeeper, construction worker, nursemaid, grocery shopper or guard. Drone bees are around simply to reproduce, and are kicked out of the hive in autumn.

Honeybees are not native to the United States, so they need all the help they can get. The small scale farmer is dependent upon these little creatures, and they need our help! A reported loss of 30% in hives in the past 10 years is a scary reality. Einstein once said, "Once bees have left the earth, man will have

four years left on the planet.”This is an idea we do not want to test.

Restaurant Gardens: Growing for High Quality and Marketability

Henry Randall

While several restaurants over the past several years have been working to purchase as many ingredients as they can from local sources, many others are going a step further and growing their own vegetables or raising their own livestock. This method raises the term “Farm-to-Table” to a much higher level. Incorporating gardening into a food service operation has many benefits and can be very successful in the Gallatin Valley.

The local food movement has taken the restaurant industry by storm over the past several years. Some businesses have been advocates for decades and others are just beginning. Purchasing ingredients from local sources helps fuel the local economy by keeping money in the community where it may be used again and again before going further away. Chefs are realizing the marketability of having local sources listed on their menu. Customers are more aware of practices in the conventional food industry, are eager to know more about how their food is produced and where it comes from. Many customers are willing to pay higher prices to see local farms and ranches referenced on the menu or elsewhere in the restaurant. Finally, chefs are striving for the best quality produce and meat that they can find. Oftentimes, foods produced by nearby farms are of much higher quality than that obtained from national or international distributors.

Pushing the envelope further is the emerging trend, in the United States, of restaurant gardens. Internationally the idea of a restaurant garden has been active for a long time. There are many examples of successful gardens managed by the restaurant. Chefs and owners are moving closer to the ideal of helping drive the local economy, marketing local, and using the best possible ingredients in their dishes and find that they can do this even better by growing the food themselves. Whether the garden consists of herbs and a few specialty items or is a larger diversified farm, there

are many benefits to a restaurant that produces its own food.

Customers not only will see a farm name on the menu, they will see *your* name and may even see your gardens. Customers get very excited when they can see the garden where their salad was grown. Many are willing to pay a higher price for this experience. By utilizing minimal space, expensive ingredients such as herbs can be grown on-site. Imagine getting the freshest and best tasting herbs from right outside your door; without having to buy them from a distributor or grower. Costs are quickly earned back from investments in growing supplies.

A major challenge faced by restaurants is the availability of space. If there is a large field on the property you might start small and work your way up to a very large garden. Once a certain size is reached it even becomes economical to hire extra help. If space is limited look into the installation of window boxes or see if you can gain roof access. If the building can support the weight there are tons of rooftop garden designs available. If it is big, flat, and empty up there; put it to good use! Maybe you have a parking lot behind the restaurant. There are urban designs for building container gardens, many out of cheap or reused materials. It is amazing the quantity that can be grown in the space of one or two parking spots. Materials do not have to be top of the line. Many chefs are very resourceful when it comes to finding materials to complete a task. A garden does not always have to be a very costly investment.

Economic returns are, of course, very important. Chefs and owners will see there are benefits to marketing ingredients that they grow.

- Look for Urban or Market Gardening Books at your local bookstore or online.
- Ask area farmers for regional growing tips
- Look at your space with a fresh eye, start small, and be creative!

Coffee, Trash & Mushrooms: Growing Food on Society's Scraps

Tyson Stillman

It is estimated that on average Americans throw out more than 20 pounds of food waste every month (Buzby, 2012). One way to make use of that waste is to compost it, but what if food waste, as well as other forms of waste, could be turned directly back into food before being composted? By repurposing used coffee grounds (among other things) to grow mushrooms, it is possible to do exactly that.

Coffee is one of the most widely consumed commodities in the whole world. Whether you are in rural Montana or metropolitan China, you can usually find somewhere to get a coffee. As a result, coffee is one of the most common components of food waste. This net cost for communities can be converted to a net benefit. Rather than paying for coffee grounds disposal they can be collected and used as a high nutrient substrate to grow a variety of edible mushrooms such as Tree Oysters (*Pleurotus ostreatus*) and Shitake (*Lentinula edodes*) (Stamets, 2000).

Both varieties of mushroom are extremely nutritious and rich in protein and natural sugars or polysaccharides, commanding

premium prices at market. Both Shitake and Oysters are sometimes classified as wood mushrooms, which means they usually grow on dying or dead trees, but they can also grow on other substrates such as coffee, grain, corn cobs, sawdust, woodchips, straw/hay, newspaper and much more! Most of these products can be obtained from primary sources inexpensively (wood mill sawdust) and secondary sources at no cost (collected used coffee & newspaper)!

Fig 1.) A wild Oyster (*Pleurotus ostreatus*) mushroom growing on a Cottonwood (*Populus deltoids*) tree in the Yellowstone river drainage. This species can be propagated easily using many different methods; this specific delicious specimen was harvested and devoured.

That fact that mushrooms can grow on what would otherwise be wasted is what makes them so amazing and precious to a community's food system. This is because the value of the waste product (lets say coffee) doesn't end at its original purpose, but continues to be used to produce additional valuable products (mushrooms & compost). This not only benefits the community by lowering the amount of waste it produces, but it also creates additional jobs and sources of food and food security for the community. For example the non-profit organization "Montana Roots" or MT roots for short, is an organization based in Livingston, MT that engages in several different forms of food production and community outreach programs. MT Roots has begun collecting coffee from several local coffee shops and restaurants. The coffee is used with other materials like wood shavings and straw to grow mushrooms and compost, and all of it obtained free of charge! (See Fig 2.) This is a two-sided approach to sustainability, first it reduces the amount of food and non-food waste a community "wastes", and second it produces a nutritious bulk product (mushrooms) that can be dried to give it an extended shelf life. Finally the used substrate can be composted and thanks to the mushrooms digestive enzymes the blocks of used substrate compost easily and thoroughly (Stamets, 2000).





Fig 2.) Mushroom mycelium incubating in the MT Roots greenhouse on locally collected waste material (sawdust & coffee) and using down-cycled trash materials like used coffee bags for incubation chambers (Seen at far-top of picture).

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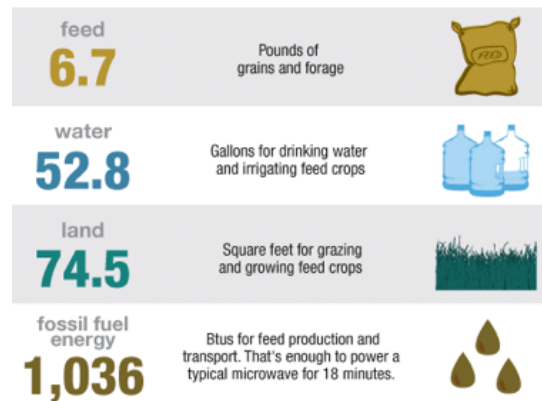
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Sustainable Meat Consumption and Production: The Conscience Carnivore

Michael True

More and more people are becoming increasingly conscience and aware about where and how their food is produced, and the impact their dollar has on the market. This is a positive trend because, according to NPR (2012), the United States consumes about 52 billion pounds of meat per year, compared to about 40 billion pounds in 1990. The production of meat is very energy intensive; and meat is one of the most "energy" dense foods we consume daily.

Take a look below to see what goes into one quarter-pound of hamburger (Capper, J.L., 2011). The Bozeman community as a whole has become very aware of the issues surrounding our food system locally and nationally. During my time spent working on an organic lamb operation last winter, it occurred to me that a large number of the population are curious about the processes of raising meat sustainably and safely. My hope is to share some tips with you so that you may become a more conscience carnivore the next time you run to the grocery store and stare at all the varieties of meat available on the market.



Be label savvy. There are a lot of buzz words the meat industry likes to use as marketing tools like natural, grass fed, 100% grass fed, organic, etc. Educate yourself so you are an informed buyer, and you can purchase exactly what you need.

Call for a visit. Producers love meeting their customers and often times their website or contact information can be found on the packaging of the product. Send them an email or give them a call to schedule a time to visit the farm. Come prepared with questions.

Ask the butcher. For the most part, butchers are becoming few and far between. If you are lucky to have one, the butchers can provide important information on the sources of their meat, and can suggest appropriate cooking methods. He can also do custom cuts and

grinding for you. Be aware that you might get charged extra for these services.

Know your ingredients. There are numerous ingredients added to processed meats to help with color stabilization, increase yields, cures, brines and various flavors. You don't have to be a doctor to understand what is in the product you purchased. Food labels have become fairly standardized over the years, so once you learn to read one, you can read most others. In addition, one thing to keep in mind is that some ingredients go by names other than what you'd expect. For example sugar. It's also called dextrose, corn syrup, fructose and maltose, just to name a few (American Heart Association, 2013).

Enjoy and tell your friends. The best form of advertising is word of mouth and when you have your friends over to eat that delicious roast you just prepared, they will want to know about it and where you bought it. Be excited to share your knowledge. Plus, local producers love new customers.

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Alumni Updates

Tim Reusch (December 2011) is completing his Master's Degree at MSU in Health and Human Development, emphasizing Sustainable Food Systems in May 2014. Way to go Tim!!

Kallie Chittenden (May 2012) is now the Manager of the Center for Sustainable Living at Gateway Technical College in Southeastern Wisconsin. Way to go Kallie!!

Antonette Lininger (May 2012) has started her own business—the Patch Market Garden, and is focusing on season extension. Look for her in Belgrade, MT. Way to go Antonette!!

Dylan Strike (May 2013) is now the proud owner of Running Strike Farms in Bozeman. This summer he will be selling vegetables and herbs through a CSA, Farmers' Markets, Market Day Foods, and the Bozeman Co-op. In 2014 Running Strike Farms will also be a partner farm for Towne's Harvest Practicum students. Way to go Dylan!!

Andy Stickle (Dec 2012) is the president and co-founder of Montana Maverick Organics (Simply the finest in range-reared, organic bison—www.maverickbison.com) and is in the process of launching Organic Systems Inc. (www.organicssystemsync.net) which is a sustainability holding & accelerator company. Way to go Andy!!

Max Smith (May 2013) has started a CSA and market farm producing vegetables, grains and pulses in Missoula. You can find Missoula Grain and Vegetable Co. on Facebook. He and his partners are experimenting with a variety of innovating marketing strategies. Look for the Missoula Grain and Vegetable Co. on Facebook. Way to go Max!!

Ben Shepherd (December 2013) is already busy creating a mushroom business. His organization is called Mountain Mycoworks, which will host its first workshop this spring in partnership with Paradise Permaculture (an educational organization in Livingston, MT). You can find information about the event on his web site: <http://www.mountainmycoworks.com/events/2014/5/17/an-introduction-to-mycopermaculture>. Way to go Ben!!

Have an update? Send it to Alison Harmon harmon@montana.edu. We would love to hear from you