

KBS K-12 Partnership

Winter Newsletter

Issue 10 Ecological Literacy in K-12 Classrooms November 2011



From the Directors

Dear KBS K-12 Partners,

We've had our first official snow fall and the K-12 Partnership is preparing for another fantastic school year workshop – it must be winter! So far this year your students and teachers have worked hard to conduct research on the BEST schoolyard research network, MSU faculty and staff (with the help of your teachers!) have collected mounds of student data in the Math Science Partnership teaching experiments, and we even gave a talk about our partnership at the National Outreach Scholarship Conference. We are also excited to have welcomed 10 GK-12 Fellows to our team. On the following pages, you'll find district updates written by our fellows – they'll fill you in on lots of the exciting things happening in classroom, the schoolyard, and here at KBS. As always, we would love to hear from you. Contact the leadership team with any questions and don't forget to visit our new KBS GK-12 website at kbsgk12project.kbs.msu.edu.

Until next time,

Phil Robertson, Tom Getty, Andy Anderson
Sara Syswerda, & Robin Tinghitella

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A Note from our Teacher in Residence, Marcia Angle



Teaching science is the best job in the world! You can take students outside and it's socially acceptable for your classroom to be smelly and loud at times. Kids are curious and that makes them fun students of science.

I graduated from Allegan High School in 1979 and trekked up to Mt. Pleasant, Michigan to begin my quest for a teaching degree. I soon earned a Bachelor of Science degree and later graduated from Western Michigan University in 1990 with a Masters Degree in Science Education. My husband, Bob, and I have been married for 30 years now and have two daughters, Ashley and Leslie.

I began teaching for Lawton Community Schools in 1984 and have made it my home for the last 27 years, teaching different combinations of 7th, 8th and 9th

In the Fall of 1996 Lawton Schools paid for me to travel to Peru with CET (Children's Environmental Trust) with the intent of starting a tropical travel program for Lawton Community Schools. Crazy as it sounds I was hooked on the experience and traveling with middle and high school students. Watching more than 180 students over the last fifteen years grow in their knowledge about themselves and our planet has certainly been inspiring. The Lawton Environmental Studies program has yet another wonderful group of students working their way through fundraising and additional assignments in preparation for travel in the summer of 2012.

In the summer of 2003 I attended my first summer workshop here at the Kellogg Biological Station. Having had this opportunity to be a part of many workshops and summer institutes, mentoring five fellow scientists over the years has refreshed my enthusiasm for learning and science research. The past two summers have been busy helping to revise a teaching experiment, develop and test materials, and coding student data as an RET (Research Experience for Teachers).

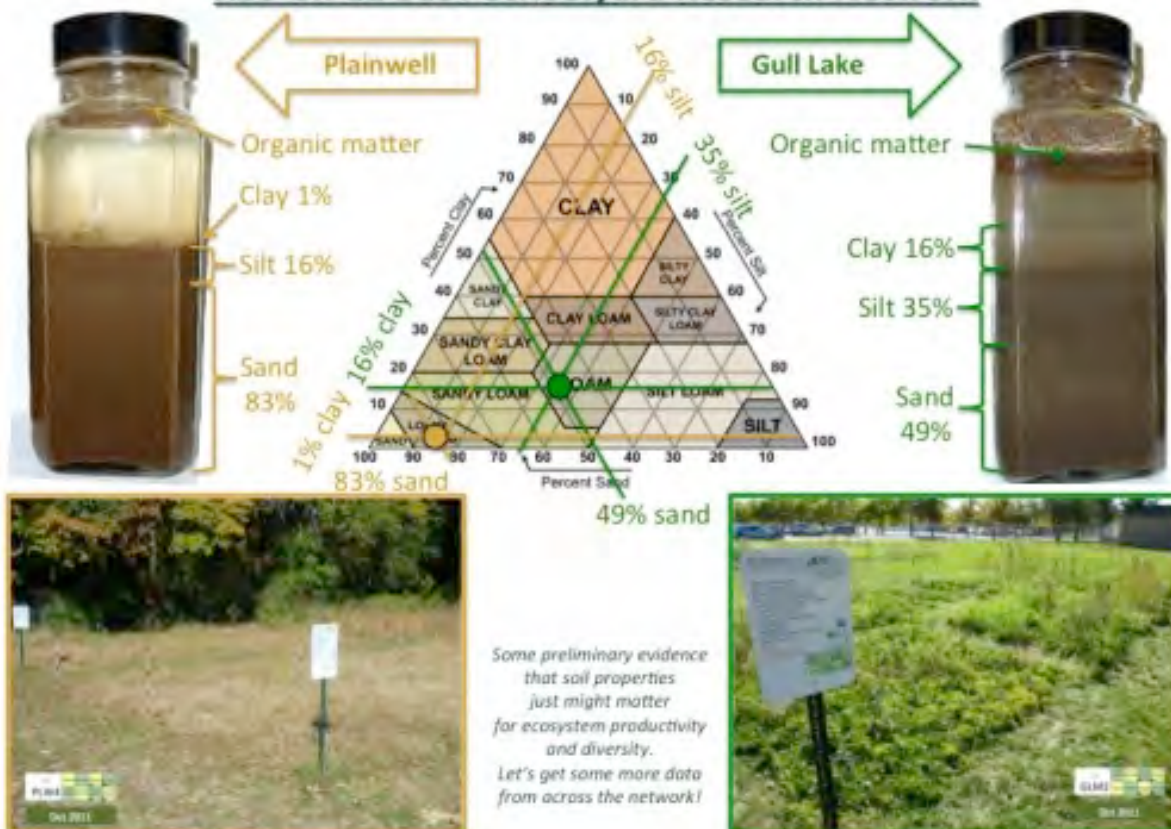
Now, as the Teacher in Residence more opportunities and time are available to me for different projects. Advocating the teacher perspective to various MSP groups is part of my responsibilities this year while developing curriculum materials and professional development sessions. Collaboration with other researchers from different universities on multiple projects like the Biodiversity TE and Carbon TIME, testing materials and procedures for new or existing lessons, coding student responses to unit tests, observing fellows and helping them to grow as presenters and instructors round out the rest of the weekly calendar. This has been a rewarding and fun experience so far and I would recommend taking advantage of the opportunity to everyone.

A Chat with our Partners at Kalamazoo Area Math and Science Center

On November 3rd, KAMSC teachers Cheryl Hach and Chris Chopp, accompanied by TIR Marcia Angle and KAMSC student Ainnie Hussain (additionally doing independent research at KBS) visited Kellogg Forest to place biodiversity bags in the Augusta Creek. The project is part of Cheryl's AP Environmental Science curriculum. The entire class will revisit the site in mid-December for "harvesting" of the bags and water testing in the classroom at the forest. A fun and frosty afternoon is expected! Hot cocoa will be provided!



KBS GK-12 BEST Schoolyard Research Network





I have been studying river ecosystems and food webs for some time. Studying food webs in rivers is challenging because you can't always see what is happening. For instance, a huge amount of leaves fall into the river and are carried downstream every year. At the same time, rivers can be deep and turbid. Can you see to the bottom of most rivers? Many scientists think that because rivers are so turbid, there is not enough light to produce algae. In college, I collected data to see how important algae were in the food web in the Mississippi River. At Michigan State, I have been collecting data along the Kalamazoo River, from Battle Creek to Allegan, to understand how dams affect stream food webs. I was measuring food source changes and the invertebrates that live there.

One thing I never expected to study was the effect of an oil spill. On July 26, 2010, a pipeline leak pumped 800,000 gallons of oil into the Kalamazoo, changing my dissertation significantly. I have been working to understand how the oil spill impacted the base of the food web. What I have learned is that oil spills in marine systems are often well studied for decades after a spill, while oil spills in rivers have only studied for a few years after a spill. We have learned important lessons from the Exxon Valdez spill that happened in Alaska. Scientists are still asking questions about the spill. We will learn about the effects of spill on the Kalamazoo River over time as well.

Gobles

By GK-12 Fellow Leila Desotelle

I have been working with Becky Drayton to collect data with her classes, just like real scientists on our BEST plots. These plots are located near the bus garage and the high school. The plots are amazing at Gobles this year! We put seeds on our plots in December with snow on the ground, and I didn't know what to expect. They were bare in the spring, but the New England Aster was in full bloom when I took the students to the plots this fall.

The goal of the project is for the students to ask questions and collect data just like scientists at field stations such as the Kellogg Biological Station near Gull Lake. We are looking at how growing either just switch grass or a prairie can impact how much plants mass we can collect and how many kinds of insects there are. We have many other questions too, but what we want to know is, "Can we grow our fuel and butterflies too?" These same plots are at 13 different school districts in Southern Michigan. Which district will grow the biggest plants? The data that we are collecting are just like kinds of data when I worked at a field station when I was in college. The kids enjoy collecting data like real scientists, and they are doing a great job! I also participated in a field trip where Chris Quist's 3rd grade class came to the KBS Long Term Ecological Research Station (LTER). The students went to the bird sanctuary, dairy and saw the research at the LTER. The kids really enjoyed getting their hands in soil and science.



I look forward to working with Becky Drayton's 8th grade class looking at earth systems and cycles. I plan to bring inquiry activities and bring real data to Becky Drayton's earth science class. I am excited to work with Chris Quist's class and Kristi Tullis' classes and introduce the students to the BEST plots!

Gull Lake

By GK-12 Fellow Tyler Bassett

I was raised in Holland, MI on lovely Lake Michigan, where I discovered at a young age how valuable wild nature is for the human spirit. It wasn't until I moved to Kalamazoo to attend Western Michigan University, however, that I discovered that I was born to be a botanist (although the four years of Latin I took in high school have proven beneficial in learning scientific names of plants). After taking my first botany course at WMU with the late Dr. Woody Ehrle I was hooked. Upon graduating from WMU I worked as a botanist (yes, you can do that!) for the Kalamazoo Nature Center, Michigan Natural Features Inventory, and as an independent consultant. From 2006 until starting my PhD in 2009, I worked for a company in Three Rivers called Native Connections, doing botanical consulting and habitat restoration. I still live in Kalamazoo, with my wife Jenny, and our two children, Zak (12), and Fen (9).

I am excited to share my scientific insights with students at Gull Lake, and to improve their knowledge of scientific facts, principals, and most importantly application of the scientific method. Most students may not go on to a career in science, but mastering hypothesis-driven inquiry will help them in any aspect of life and make them better thinkers.

I spend most of my time in Mrs. Clancy's 6th Grade and Mrs. Boyle's 8th Grade science classes. So far, we have been exploring the BEST (Bioenergy Sustainability) Plots that were established in Fall 2010 at Gull Lake Middle School and in 12 other school districts in the region. These plots mimic a research project being done at the Kellogg Biological Station called GLBRC (Great Lakes Bioenergy Research Center), directly south of Kellogg Elementary. Both projects (GLBRC and BEST) are designed to explore the impact on the environment of growing different types of biofuels. Biofuels are made from plants rather than coal or petroleum, and produce less pollution. In the process we are learning about the value of plant and insect biodiversity, how different properties of soil influence ecosystems, and collecting valuable data that will be used to compare the BEST Plots at Gull Lake with those at other school districts. In the future, I look forward to helping students learn about science and the natural world by helping them develop their own hypotheses and guiding them through their own process of discovery.

Native ecosystems everywhere have seen lots of abuse as the human population increases and we demand more of the natural environment, and the upper Midwest is no exception. They are smaller, more fragmented, support less species than they used to, and many of those species are exotic (invaders from other continents). Ecosystems provide important "ecosystem services" – clean air, clean water, erosion and flood control, pollination, natural pest control – so scientists are trying to find out the best way to restore ecosystems. KBS graduate student and GK-12 fellow Tyler Bassett is exploring how many plant species are necessary to successfully restore native prairies that were a major part of southern Michigan's landscape prior to European settlement. (In fact, the village of Richland sits at the center of where the 2,500 acre Gull Prairie once stood.) Ecosystems with greater diversity (more species) tend to be more resistant to invasion by exotic species and provide more ecosystem services consistently over time, but seed for restorations is expensive and adding more species may not necessarily lead to increased restoration success. You can see some of Tyler's research on this issue at the Southwest Michigan Land Conservancy's Woodlawn Preserve near KBS.





Every organism needs food to survive, and like humans, many other animals have favorite foods. It's not always easy to find the most nutritious food, however, so sometimes an animal will make a trade-off, and eat something that is easier to find. In my research, I study how an animal's behavior changes when presented with different types of food, and different costs associated with obtaining that food. In agricultural systems, humans have some control over what an animal eats. It is important for farm animals to have a healthy diet, because they, in turn, produce food for us to eat.

My research focuses on the behavior and foraging choices made by cows in a pasture dairy system. Even though their habitat is controlled by humans, cows in a pasture have the choice of which plant species they want to eat, and how much energy they want to expend in order to find their favorite plants. Cows also have the choice of when to visit the barn to get milked. The cows at Kellogg Biological Station, where I conduct my research, have a robot that milks them whenever they decide to visit. Since milk is used to make some of my favorite foods (cheese and ice cream!), I want the cows to make lots of visits to the robotic milker. If a cow knows that a tasty pasture is waiting on the other side of the barn, she will spend the energy to get there by traveling through the barn, getting milked on the way. By understanding how cows make decisions about their food, we can offer different pasture choices that give them both a healthy diet and a motivation to visit the milker frequently, producing more delicious milk for us!

Hastings

By GK-12 Fellow Kate Steensma

I am a graduate student at Michigan State University, in the second year of my master's degree. This is my first year participating in Kellogg Biological Station's K-12 partnership, and I have been having a lot of fun teaching at Hastings High School. When I was in high school, I was very lucky to have a biology teacher who valued hands-on experience, both in and out of the classroom. My exposure to experimental and experiential learning in this class was an important influence on my decision to become a research biologist. This is why one of my goals through GK-12 is to work with teachers to generate inquiry-based curriculum that encourages students to develop a perspective of the natural world that extends beyond their classroom. I don't think that everyone needs to become a biologist, but I think that everyone deserves to gain a curiosity and excitement about the world around them. Another one of my goals in GK-12 this year is to bring my own research experience to the classroom, giving students an opportunity to see and hear about what a scientist does, while I gain experience in discussing science with a diverse audience. This past summer, I worked with Mr. Buehler to develop a lesson that simulates population change over time, and can be used to model natural selection, or the establishment of an invasive species.

This fall, I have been helping out in biology classes with Mr. Buehler, Mrs. Withey, and Mr. Dixon. In September, we made leaf packs (by stuffing mesh bags with different types of leaves), and put them in the Thornapple River for 1 month. In late October, we collected the leaf packs, and counted all of the aquatic invertebrates that had colonized them. We saw how leaf type can affect the biodiversity of organisms living at the bottom of a stream. In November, we did an experiment with bean and radish plants to better understand the process of photosynthesis, and how plants incorporate matter from their environment into their own tissues. Mr. Buehler's honors biology class is responsible for collecting data from the Hastings bioenergy plot for the cross-district bioenergy-sustainability experiment. They have already sampled plant biomass, and plant and insect biodiversity in their plot.



Harper Creek

By GK-12 Fellow Leilei Ruan

I come from China and study for my PhD degree since 2007. Being a kid raised in a family that both parents are middle and high school teachers, I feel extremely excited when I became aware of the GK-12 program through my colleagues. Due to language barriers, I didn't apply until this year. However, I keep telling myself, "prepare enough and you can do it"! I love interacting with kids, talking to them and teaching them what I have learned. Besides this, as my advisor told me, "The best way to learn is to teach", and I expect to enhance the understanding of my own research and develop teaching skills in addition to improving my communication skills from this program.

I work at Harper Creek high school and middle school with my partner teacher Ms. Sandra Erwin for her Chemistry I class. Also, I work with other teachers such as Mr. Stephen Barry, Ms. Amy Smith and Mr. Erik Crooks on the protocols we use for our BEST plots. At the beginning of this semester, I helped Mr. Stephen Barry with his independent study class. We went through each protocol and then the kids help other classes to finish sampling and analyze data from the BEST plots. I also helped Ms. Amy Smith and Mr. Erik Crooks with their 8th graders. Kids are friendly and curious about our BEST plots with many interesting questions. Sometime, if we are ahead of the schedule, teachers would also like to have kids in the class ask me questions about science or myself. It has been a good time working with them.

I'll help my partner teacher Ms. Sandra Erwin with her chemistry class, too. She is very enthusiastic to combine my knowledge with high school chemistry. For example, when we discussed that most soil particles have negative charges during the summer session; she immediately said that it can match our "bonding" part. Also, Mr. Stephen Barry, teaching the same level chemistry, suggested we can explain to the kids why we use KCl solution instead of water to measure nitrate and ammonium in the soil. I feel inspired from their attitude and encouragement and I feel excited that my knowledge can be used in their classroom. The most gratifying thing for me is that every time I go back to work with teachers and they keep telling me "Hi Leilei, kids keep asking me when you are coming back...", or when I walk in the hall way, so many kids say "Hi" with big smile to me. I feel there have been some connections between teachers, kids, and me.



My name is Leilei Ruan, a fifth year PhD student at KBS from the department of Crop and Soil Sciences and Environmental Science & Policy program of Michigan State University. My advisor is Dr. G. Philip Robertson. My research focuses on greenhouse gas (GHG) emissions from biofuel crop cultivation. A GHG is a gas in the atmosphere that absorbs infrared heat. This process keeps the earth warm because infrared heat otherwise would be radiated into space. However, more GHG in the atmosphere will absorb more heat and cause the earth to be warmer. Burning fossil fuels can release more CO₂ into the atmosphere. Also, agricultural activities can emit two other GHGs: methane (CH₄) and nitrogen dioxide (N₂O).

Biofuels are one option to reduce GHG emissions and thereby slow global warming. However, GHGs can be produced from soil during growing biofuel crops such as switchgrass and prairie. CO₂ is released when soil carbon is oxidized following tillage, methane oxidation is reduced when unmanaged lands are returned to cultivation, and nitrous oxide is released when soils are fertilized. This will decrease the value of biofuel for reducing CO₂ emissions. My research is to look for appropriate agricultural practices such as fertilization and tillage to mitigate GHG emissions from growing biofuel crops.



Ever wonder why females are so picky about their mates? You should ask the stickleback fish that live

in British Columbia, Canada. In a few lakes in Canada, two species of stickleback fish live in the same lake, and females are really good at picking mates that are of her own species. Females are also very particular about mating with males that are the most colorful and do the most impressive courtship dances. That's right; fish dance! Studying these fish, we can learn a lot about how mate choice can lead to differences between species. We can also learn how the environment is extremely important to this process.

In one lake, people accidentally introduced an invasive crayfish, which has changed the lake environment so that females can no longer tell the difference between males of the different species.

My work explores how behavior and the environment are important for evolution. This research is also important for conservation of these stickleback species, which are endangered in Canada. More broadly, my work helps us understand dynamics of biodiversity, which is important for the stability of our world. Organisms interact with each other in lots of ways we do understand and many more ways that we don't understand. The loss of a small, seemingly unimportant species can have big impacts on species we are more concerned with, such as fish we eat, trees we use for lumber and paper, or crops we grow for food and fiber. Therefore, it is essential to understand how changes in biodiversity occur, and that is one of the important outcomes of my research.

Harper Creek

By GK-12 Fellow Alycia Lackey

We've been working hard this fall to collect data from all of Harper Creek's BEST plots! We're collecting data to figure out how many different species of plants and invertebrates (including insects) occur in the plots. We're also asking questions about what the soil is like and how the surrounding landscape, including the presence of hills, woods, and streams, could affect what's going on in the BEST plots.

Steve Barry and his high school student team have been amazing in guiding elementary students to collect data! These high school students serve as scientist mentors to elementary students. This is a great way to engage students across grade levels and provide a variety of role models in science.

I visited Maria Farkas' 3rd grade class at Wattles Park Elementary to explore which invertebrates are in their plots. Students practiced identifying invertebrates and sorting them into groups. The students were really excited to use scientific tools like magnifying glasses, petri dishes, and tweezers! I also visited Alissa Renner's 6th grade class at the middle school. We collected invertebrates using sticky traps that catch mostly flying insects and pitfall traps that catch lots of slugs, spiders, and grasshoppers. Students got to compare their data on invertebrates caught in these different types of traps and hypothesize why certain invertebrates are more likely to be caught in particular traps.

I've also been working on ideas for K-4 lessons that connect state standards to activities on the BEST plots. My goal is to create multiple lesson plans applicable to multiple elementary grade levels. The lesson plans involve relating earth materials and weather to plant and animal life, understanding differences between life cycles of annual and perennial plants, and learning to categorize different types of invertebrates. As data collection on the plots winds down for the fall, I'll ramp up my visits to elementary classrooms and share the lessons I've been developing.

I'm looking forward to getting lots of teachers involved with these new lessons across multiple grades levels at each of Harper's three elementary schools. I hope to visit your classroom soon!



Lawton

By GK-12 Fellow Liz Schultheis

This is my second year as a GK-12 fellow at Lawton, and it's great to see the Bioenergy Plots starting to grow! This year I have worked with students from Dave Williams' and Holly Visich's classes to collect information on the diversity of insects and plants living in the plots. With Holly's classes we had students design and implement their own study to answer the question, "Which habitats at Lawton have the highest insect biodiversity?". Using sticky traps, the students collected insect data all around the school property, including the bioenergy plots, woods, parking lot, and a wetland. Students used their data to conclude that the wetland had the highest diversity of insects (total number, and kinds of insects).

Students in Dave Williams' Environmental Class have done a lot of work with the plots and have been focusing on the "weeds" – or the plants in the plots that we did not seed in. We worked outside in good weather and bad, identifying the diversity of weeds growing in our two plant communities – Switchgrass and mixed prairie. With his classes, I lead lessons on plant identification and making dichotomous keys for identifying plants in the field. Students became very good at identifying plants that have come into our plots from surrounding habitats, such as Lamb's ear and crab grass. They learned the traits that make plant species unique even when they're not in flower, such as square stems or a minty smell when leaves are crushed. We will continue to monitor the plots to see how they change over seasons and years, and will compare the data we collect at Lawton to other schools across SW Michigan.

In the remainder of the school year, I look forward to tying the bioenergy plots to my own research on invasive species and herbivory, and the environmental effects that bioenergy farming would have on Michigan. By comparing our plots to the diversity of ecosystems available near Lawton schools, we can determine how land use decisions by farmers influence benefits we get from nature, such as biodiversity and soil resources. Also, we can compare the plots at Lawton to other schools to determine if our treatments have the same effects at a large landscape scale.



Insects and mammals that feed on plants are called herbivores, and they can have big effects on how plants grow. They can change the size and shape of plants, the number of flowers and seeds, and even what species can survive in a habitat. A plant with more herbivore damage will most likely end up smaller and produce fewer seeds. Native plants, which naturally occur in an area, have interacted with the same herbivores over long time spans and have evolved defenses against them, such as chemicals in their leaves or small hairs that prevent insects from taking a bite. An exotic plant is one that has been moved into a new area, and may not have evolved defenses against the insects occurring in its new range. Therefore, exotic plants may receive more damage from herbivores, compared to native species.



For my dissertation research I study the role that herbivores play in controlling exotic plants. Herbivores may damage some exotic plants so much that it prevents them from becoming troublesome invasive species. I predict native species will have less insect damage than exotic species. To test my prediction I conducted an experiment with a mix of native and exotic plants, all found in Kalamazoo County. I performed herbivore removal treatments to see which type of species was most harmed by herbivores. I predict native species with evolved defenses will not benefit from my removal of herbivores, while exotic species without these defenses will benefit a great deal.



A common complaint among fisherman is that fishing is not as good as it used to be and the depletion of fish

populations is often given as the reason why. While this is likely true, I believe a contributing factor is that the fish that are left to be caught do not strike at bait/hooks as eagerly as fish used to. The aim of my PhD research is to investigate this hypothesis.

What I can tell so far from my research is that fish show consistent differences in their behaviors and that the catchability of a fish depends on how it behaves. It appears that when people fish they selectively remove the easier to catch, bold individuals, while leaving the shy ones behind to do the majority of the reproducing. This means that over-fishing leads to fish populations full of shy fish that won't take the bait (in addition to being depleted in number).

What's worse is that if fish inherit their level of boldness from their parents then once a population becomes full of shy fish it will stay that way even if fishing pressure is reduced because the shy fish left will still just produce more shy babies. Thus, if my predictions turn out to be correct, it will mean fish populations must be managed in a way to keep them from becoming full of shy fish.

Olivet

By GK-12 Fellow Nick Ballew

I am a PhD student in the zoology department at Michigan State University and this is my second year as a GK-12 fellow. Last year I was able to share my passion for science with students of all ages at Olivet and I look forward to a similar opportunity this year. It is my goal as a GK-12 fellow to help the students I work with gain a better understanding of what science is all about. To me, science is the process of using evidence and reason to understand the world we live in. Unfortunately (but understandably), many students instead view science as a discipline that is all about memorizing information and ideas. I aim to shift students away from this view and to help them realize that science is a tool that can be used to address issues that interest them in almost any facet of their lives.

In the first part of the fall semester, I have spent much of my time in Olivet working with Mr. Stolberg's 8th grade earth science class. I have been fortunate enough to share many of my experiences in science with his students. Additionally, once a week I have presented an activity to Mr. Stolberg's students that covers the material they need to learn in earth sciences while also developing their reasoning skills and their ability to make claims based on evidence.

The action has not just been limited to Mr. Stolberg's 8th grade earth science class though. After installing the biofuel plots at Olivet with the 8th and 9th grades last year, this year classes at all levels have begun to collect and analyze data from them. Mrs. Toburen's 4th grade class investigated the soil in the biofuel plots and what it could mean for plant growth while Mrs. Maurer's high school class investigated the number and types of insects that live in the biofuel plots. Additionally, Mr. Pennington's high school class sampled the amount of plant growth on the plots and Mr. Stolberg's 8th grade class investigated the landscape surrounding the plots. I think it is safe to say that the biofuel plots at Olivet are serving their intended purpose by getting students at all grade levels involved with real, meaningful science.



Plainwell

By GK-12 Fellow Tomomi Suwa

My name is Tomomi Suwa and I'm a first year GK-12 fellow and a fourth year PhD student in Dr. Jennifer Lau's lab. Before I started my PhD program at MSU, I did a Masters degree at University of Nebraska-Lincoln. I studied invasive species and looked at the effects insect and plant competition on invasive plant, bull thistle.

For the GK-12 program, I am working with Mrs. Breitenbach in Plainwell High School. This is my first time working with high school students. Actually, it's my first time going to American high school! I am having a lot of fun learning about school in Michigan, which is quite different from my own experience (I went to a British high school in Mexico).

I work closely with the AP Biology students who are doing their own research projects this year. In this class, students get to learn about the entire scientific method and to go through the exciting process of learning from the scientific questions they ask. Each week, I meet with students one-on-one to talk about their progress and challenges. I have also given talks on the scientific method and experimental design. I really like being able to guide them through the entire process! So far, each student has come up with original project ideas, conducted some background research and designed an experiment. Next trimester will be exciting, because they will be running their experiments! This will be the time where they learn from the questions they asked this fall.

I also work with students in the Biology Club who work on the BEST plot data collection. The club is small but there are a bunch of motivated students.



When I started my PhD program at MSU, I became really interested in mutualism, relationships between two organisms or species where both benefit from the partnership. For example, flowering plants and bees are classic example of mutualism because they both benefit from each other; flowers get pollinated by bees and the bee gets pollen.

My research at Kellogg Biological Station is about mutualism between plants and rhizobia. Rhizobia are soil bacteria living inside roots of some plants. Rhizobia can convert nitrogen in the atmosphere to a form that plants can use for growth. In turn, the plant provides food and shelter to rhizobia.

For my research, I am looking at how rhizobia can make it possible for plants to live different habitats. Because plants cannot move, they have a tough life. So they need to land where there is enough water, nutrients and sunlight. They also need to deal with competitors, predators (like insects and rodents) and disease, which they all interfere with plant's survival and growth. Rhizobia, on the other hand, may help a plant to live and spread in an area with low nutrients. Using a plant (called a hog peanut) that is native to Michigan, I am studying how rhizobia may help plants to live and spread in areas that they cannot live otherwise without rhizobia.

If you have ever lived near a pond or swamp then chances are every spring your nights were filled with the sounds of singing frogs. Male frogs form these large choruses where they can call to attract females. We know that females prefer to mate with males that call at a high rate and produce long calls; however, not every male calls this way. Why wouldn't every male try to call as frequently and as long as possible? Well one reason is that calling is costly; singing takes a lot of energy and exposes the frog to predators. Being eaten while trying to attract mates is obviously never a good thing, but it actually may be worse for some frogs than for others. A young male frog that gets eaten is losing out on several years worth of future mating opportunities. On the other hand, an old frog that gets eaten is not losing as much because he was near the end of his life anyway.

In my research I investigate whether this difference in the cost of calling for old and young frogs influences their calling behavior. By making numerous recordings of frogs singing I can see whether older males are putting a greater effort into calling than younger males as a result of the younger males having more to lose by dying.



Plainwell

By GK-12 Fellow Michael Kuczynski

This is my first year with the GK-12 program and I am very excited to have such a great opportunity to work in the K-12 districts. So far this year I have been able to visit many of the science classrooms at the middle school, covering a variety of subjects for grades 6th, 7th, and 8th. In the classroom I have had the opportunity to present a number of different activities and exercises from a very broad range of topics. Some of these activities included teaching students about the life cycle and behavior of frogs, having students search for evidence to test the theory of continental drift and Pangaea, and having students play a card game that demonstrates the importance of biodiversity. By working in the classroom engaging the students with these activities I hope to not only teach the students valuable information and scientific concepts, but also to make science in general more approachable to the students. One of my goals is to show the students that science isn't just the stereotypical old man in a lab coat with crazy hair hunched over an array of beakers and chemicals. Using my own research as a springboard I want to show the students that scientists can do so much more than work at a lab bench. I work in ponds and swamps in the middle of the night, and I can't even remember the last time I wore a lab coat. Hopefully, by being as approachable as possible to the students while exposing them to all of the possibilities that science has to offer I can spark their interests in research and scientific investigation.

I believe that getting students interested and involved in research at a young age is very beneficial. This belief largely stems from my own personal experiences both as undergraduate, and even at the K-12 level. When I was in high school in Rochester, Minnesota, my biology teacher was a strong supporter of getting students outside conducting experiments and collecting data. Later as an undergraduate at the University of Minnesota my department greatly encouraged students to get involved with research. I had the opportunity to work in several different labs and the research experience not only solidified my interest in science, but also improved my understanding of the scientific method as a whole. Now that I am in the position to teach others I feel it is my responsibility to give the students the same opportunities I had to ignite an interest in science and research. In the coming months I hope to continue developing fun and informative activities for the middle school that exposes students to research and what it truly means to be a scientist.

KBS K-12 Partnership

Vicksburg

By GK-12 Fellow Christine Neiman

The Vicksburg Community schools are getting off to a good start this fall. I am working with Lisa Harbour in the 8th grade at the Vicksburg Middle School. At the beginning of the school year I introduced the students to my research at KBS. I think they were very impressed with all the work I do with the rumen cannulated cows at the dairy. A rumen cannulated cow is a cow that has undergone a surgery to create a "window" into the rumen. The "window" allows me to get into the rumen and take samples. For Ms. Harbour's class I have also completed a lesson on soil texture. In this lesson the class got to collect their own data by measuring sand, silt, and clay from glass bottles. The class learned about how soil texture can vary based on location. We also learned about collecting data and analyzing that data. I compared the data collected by one class to the data from another class to demonstrate causes of error. I will continue to bring research into the classroom, so students are able to develop their skills with data collection and analysis.

Another part of my involvement in Vicksburg includes the Environmental Club. This club is available to both middle school and high school students. The environmental club is run by both Lisa Harbour and Liz Ratashak. So far this year we have collected data from the BEST plots, examined and compared sticky traps set up at the students' homes, and set up leaf packs at the Vicksburg Outdoor Education Center. The Vicksburg Environmental Club will continue the quest for knowledge with several field trips planned for the rest of the semester and into spring, including a trip to the Kalamazoo Valley Museum to see CSI: Crime Scene Insects.



Eventually, the environmental club will take a trip out to the KBS dairy and they will be able to view the robots and the dairy's rumen cannulated cows.



I am a first year fellow in the GK-12 program. My research at the Kellogg Biological Station concentrates on dairy nutrition at the pasture based robotic milking facility. When dairy cows are in a pasture based system they get most of their feed from the pasture. Pasture grazing has become uncommon.

My work focuses on the effects of feeding not just the grass in the pasture but also providing a cut forage in the barn. I am looking to see if the feed provided in the barn will increase milk production. I am also interested in seeing if feeding some forage in the barn will decrease the amount of grass eaten in the pasture. Another very important factor in my research is the use of the automatic milking system by the cows. In the KBS dairy system the cows choose when they want to be milked by the robot. I am predicting that feeding the cows in the barn will increase the amount of visits to the robot. It was a very fun and interesting summer! I am currently working with all of my data and plan on bringing some of it to Vicksburg to help students learn more about data collection and analysis.

2012 Opportunities for Teachers

At Kellogg Biological Station and Beyond...

This year we will again have **Research Experience for Teachers** positions at KBS (as well as other sites). Possible positions include both science and education research. We're making plans now, so please email Sara Syswerda parrsar1@msu.edu to express your interest.

Interested in soil ecology and biogeochemistry? The **3rd Annual Summer Soil Institute** will take place at Colorado State University in Fort Collins, CO from July 8-21, 2012. For more information, visit <http://soilinstitute.nrel.colostate.edu/>. Gain an integrated perspective with world-renowned faculty to address critical questions using current analytical techniques, experimental approaches, and instructional models. If interested, please email: soil@nrel.colostate.edu

The **Toolik LTER Summer Pluck** will take place from July 23-Aug 4, 2012. This scientific sampling trip will extend from Fairbanks to Toolik up Dalton Highway to scope out biomes and assist in data collection and processing at Toolik. More details to be released later, but contact Sara Syswerda at parrsar1@msu.edu to express your interest.

The **Albert Einstein Distinguished Educator Fellowship Program** is accepting applications until January 5, 2012. Einstein fellows are typically elementary and secondary; science, technology, engineering, and mathematics classroom teachers who serve in the national public policy arena - **even with the GK-12 program!** Fellows provide practical insight in establishing and operating education programs. They provide practical insights and "real world" perspectives to policy makers and program managers developing or managing educational programs. See <http://www.trianglecoalition.org/einstein-fellows>.





Mark Your Calendars- Happenings at KBS

December

12/21: Holiday Walk at the Kellogg Manor House. Call for availability, 269-671-2160

January

1/11: Birds and Coffee at the Bird Sanctuary. 8:30-10:00am. Contact birdsantuary@kbs.msu.edu for details.

February

2/11: Get ready for the Great Backyard Bird Count. Be a citizen scientist! The Great Backyard Bird Count is an annual four-day event that engages bird watchers of all ages in counting birds to create a real-time snapshot of where the birds are across the continent. Anyone can participate, from beginning bird watchers to experts. 1:00-2:30pm. Contact birdsantuary@kbs.msu.edu for details.

2/29: KBS K-12 Partnership Workshop, Academic Bldg. Auditorium, 8am-4pm. RSVP to parrsar1@msu.edu

April

4/11: KBS K-12 Partnership Workshop; Academic Bldg. Auditorium, 8am-4pm. RSVP to parrsar1@msu.edu





Phil Robertson, Co-Director

Phil is a University Distinguished Professor of Ecosystem Science in the Department of Crop and Soil Sciences at MSU. His research interests include the biogeochemistry and ecology of field crop ecosystems. He studies how nitrogen and carbon cycle in terrestrial systems and their impacts on crop yield, water quality, and atmospheric chemistry.



Tom Getty, Co-Director

Tom is a Professor of Behavioral Ecology in the Department of Zoology at MSU. His research focuses on the role of information in various aspects of behavior, ecology, and evolution including: mate choice, aggression, cooperation, predator-prey interactions, and habitat choice.



Charles (Andy) Anderson, Co-Director

Andy is a Professor of Science Education in the Department of Teacher Education at MSU. His research centers on the classroom teaching and learning of science. He studies how students' prior knowledge, language, and social relationships affect their engagement in science learning and the development of environmental science literacy.

Sara Syswerda, MSP Coordinator

Sara earned her PhD in Crops and Soil Sciences and Ecology, Evolutionary Biology, and Behavior from Michigan State University. Her interests are in nitrogen and carbon cycling, environmental pollution, sustainable agriculture, and science education. Sara works with teachers, visits schools, manages the K-12 Partnership web pages, and coordinates workshops.



Robin Tinghitella, GK-12 Coordinator

Robin earned her PhD in Evolution, Ecology and Organismal Biology at the University of California-Riverside. Her interests are in behavioral ecology, particularly sexual signaling and mate choice, and science education. Robin recently finished a post-doctoral position at University of Michigan. She meets with fellows, visits schools, manages the K-12 Partnership web pages, and coordinates workshops.



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