KBS K-12 Partnership

Winter Newsletter

Issue 8 Ecological Literacy in K-12 Classrooms January 2011

From the Directors

Dear KBS K-12 Partners,

This has been another busy fall for the KBS K-12 Partnership! Our professional development workshops have been lively and full of new teachers (including from Parchment and Hastings who recently joined the ranks), and our nine graduate student fellows began work in partnership classrooms in September. Perhaps the fellows' biggest accomplishment thus far has been installing and planting over 300 research plots at 22 partnership schools in six counties, as part of the BEST (BioEnergy SusTainability) research network (p.2). Partner teachers also began piloting Teaching Experiments in biodiversity, water, and carbon as part of the Math Science Partnership this fall. We are also excited to announce that Andy Anderson's research group at MSU received another grant from the National Science Foundation in which they'll partner with National Geographic to produce web-based environmental literacy resources and tools. Finally, we are pleased to welcome our Teacher In Residence, Sue Zygadlo, who will assist project staff in working with elementary school teachers and students (p.3). Until next time,

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

Inside

The KBS K-12 Partnership is supported, in part, by Michigan State University, and the National Science Foundation. Opinions expressed in this publication are those of the authors and do not necessarily reflect the views of these institutions.

KBS K-12 Partnership Students Gain Authentic Research Experiences as Part of "BEST" Schoolyard Research Network

This fall, students and science teachers are working with graduate students at KBS to plant the seeds for the "BEST" BioEnergy SusTainability Schoolyard Research Network. The network includes > 300 research plots at 22 schools in 11 districts in six counties in southwest Michigan. The research plots will mimic long-term, collaborative research at the KBS Long Term Ecological Research site and Great Lakes Bioenergy Research Center. KBS faculty, staff, and graduate students are collaborating with teachers on experimental design, research protocols, and curriculum development for the research network. This week students are planting switchgrass and native prairie seeds on their research plots. Both are crops that researchers at KBS are studying for their potential value as bioenergy crops. Over the next five years, students will make observations and take measurements about the biodiversity, productivity, and soil quality on these plots to answer the question, "Can we grow our fuel and our flowers and butterflies too?"

The project is supported by a GK-12 grant (Graduate STEM Fellows in K-12 Education) from the National Science Foundation Division of Graduate Education. GK-12 programs are designed to instill graduate students in the sciences with skills that will broadly prepare them for their professional and scientific careers. Through interactions with teachers and students in K-12 schools, graduate students are expected to improve communication and teaching skills while enriching science instruction in K-12 schools.

For more information on the "BEST" new GK-12 BioEnergy SusTainability Project, please contact program director Tom Getty (getty@msu.edu) or program manager Robin Tinghitella (hibbsr@msu.edu).

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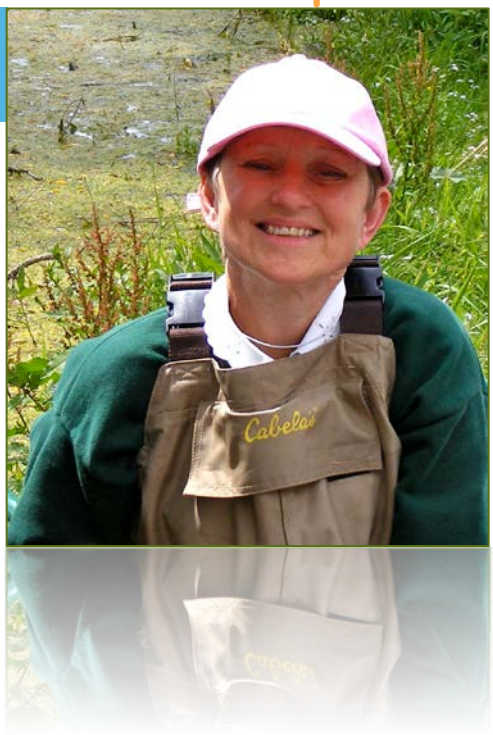
A note from Sue, our teacher in residence

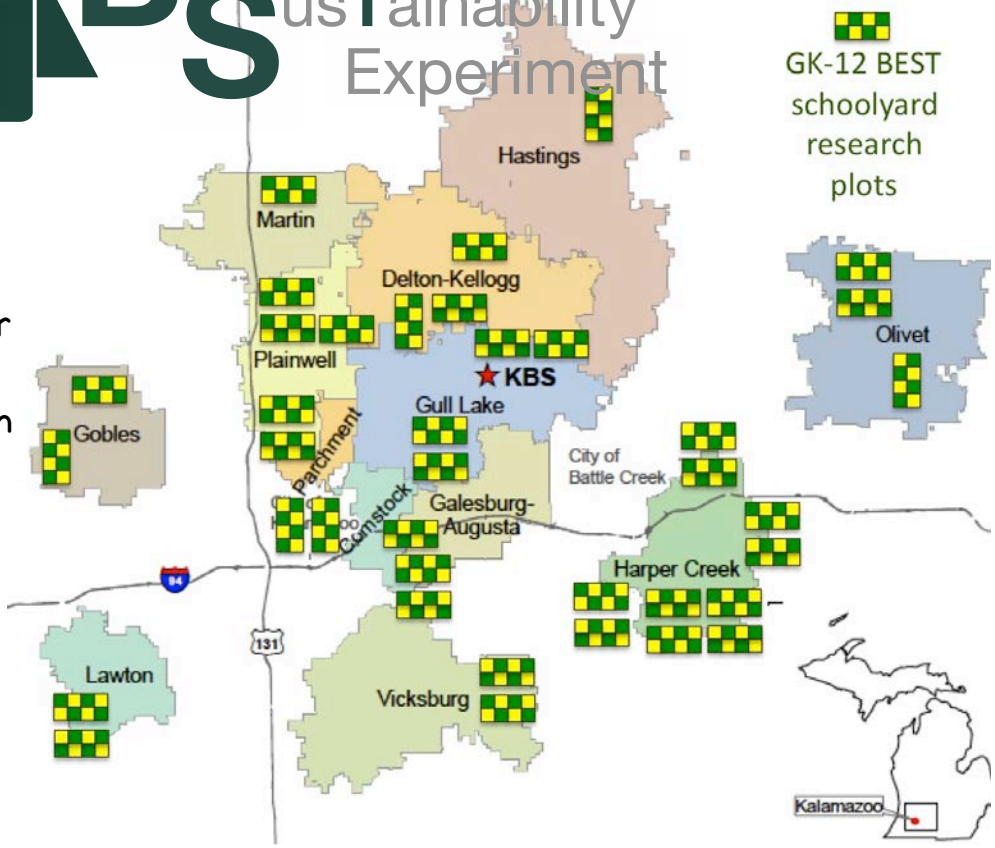


My name is Susan Zygadlo and I am the Teacher In Residence at KBS for 2010-2011. I have been teaching since I was 16 when I started as an aide in the Michigan Migrant program in Bear Lake, Michigan. I attended Central Michigan University for my undergrad work in Elementary Education and UC Fresno, Pacific State College, Florida State University and Western Michigan University for my graduate work. I worked summers teaching in the Migrant Program for 18 years and also taught Kindergarten in California, First Grade in Florida, Kindergarten at St. Mary's in Paw Paw and fourth grade for 16 years in Lawton. I have always loved science, so when I saw an article in the paper about the K-12 program at KBS, I called and signed up. I have been coming to KBS for over eight years and I have had four scientists in my classroom. I am now working with the staff and scientists here at KBS as an advisor and teacher. I will be working mainly with elementary teachers developing materials and assisting them in implementing inquiry-based projects in their classrooms.

The BEST schoolyard experiment

BioEnergy SusTainability Experiment

This map indicates the locations of our GK-12 BEST schoolyard research plots in SW Michigan.



My research focuses on perennial grain crops and their physiology. These are plants which are perennial (last for several years) and are being investigated as alternative agricultural crops which could produce food and raw materials. Many environmental benefits are associated with perennial plants, including higher populations of beneficial insects, less damage to the soil, and lower use of fertilizers and fossil fuels. The plants I am currently looking at include intermediate wheatgrass (a hardy prairie grass related to wheat), perennial wheat (a hybrid of wheat and intermediate wheatgrass) and perennial rye. The basic research question I am interested in is how these plants balance putting resources in producing seed, vs. putting resources into a longer lifespan and survival across multiple years. I am comparing different genotypes to see how sharp the tradeoffs are between seed yield and survival, and I am also looking at photosynthesis and metabolism of the plants. So far, I have found that the perennial plants seem to have very high photosynthetic rates, and can adjust their photosynthesis depending on how high their demand for resources may be. These results suggest that perennial grain crops could be able to maintain high seed yields without losing perenniality, and might be ecologically and economically friendly crops. I am also doing some experiments comparing different types of perennial wheat and wheatgrass to see which of them are the most resistant to common wheat diseases.

Comstock

My name is Nikhil Jaikumar, and I am currently the GK-12 fellow in Comstock for the 2010-2011 school year (I worked with the Martin school district in 2008-2009). I am a graduate student at Michigan State University, interested in plant ecology and sustainable agriculture. In the last couple of years, as well as previously through experience with high schools and with environmental education as a Peace Corps Volunteer, I have had experience working with K-12 students at a variety of grade levels and from a variety of backgrounds, and have enjoyed the opportunity to help students deepen their understanding of the natural world and develop an interest in science. My research touches on both agricultural issues as well as more basic questions about how plants function, and I hope to in help students understand how both human land use and natural processes help shape the world we live in.

So far I have been working primarily with elementary and high school students in Comstock. I have done experiments with high school biology classes (Mary Lester's and Kristie Poulson's classes) in Comstock High School in which we looked at osmosis and compared whether plant tissues lost or gained water in salty or less salty solutions. We also looked at plant photosynthesis, and used leaf discs in water to observe oxygen production. With Ms. Rodwan's earth science classes, I did an experiment looking a magnetic forces and how they differ from other types of basic forces, and on the factors that affect water flow in the environment and in living things. Ms. Lester's physical science classes also did soil tests on the soils around the high school, looking at nitrate, phosphate and potassium levels.. My work in the elementary school has been primarily with Ms. Jameson's and Ms. Anderson's classes and we have done lessons and activities on air pressure, climate, limiting factors, mutualism, and other earth science and life science topics. Perhaps most exciting, we have planted the GK-12 bioenergy plots at four schools in Comstock which will form part of a collaboration across school districts in the succeeding several years. Classes at the high school, middle, and elementary schools are looking forward to soil testing, insect surveys, plant sampling, and other experiments involving the bioenergy plots in the future.

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Delton-Kellogg

Hi! My name is Melissa Kjelvik, I am excited to be the GK-12 Fellow at the Delton-Kellogg school district for the 2010-2011 school year. This is my third year working with the Kellogg Biological Station's K-12 partnership. Over the years, I have visited many classrooms from different school districts and have worked with first graders up to high school students. These opportunities have revealed just how important hands-on experience with real-world ecosystems and inquiry-based study can be for a K-12 science education. One goal of mine is to apply my knowledge of aquatic ecosystems to help teachers at Delton-Kellogg become more familiar and confident to develop ways to engage their students in science lessons outside of the classroom. Delton-Kellogg provides access to a unique educational setting with Crooked Lake situated right on campus! This goal is deeply rooted in how I was taught science. My undergraduate institution, Northland College, is known for its emphasis on taking students outdoors to learn about ecology where it happens-in nature! My time at Northland has shaped who I am today and also who I aspire to be when I complete my PhD- a professor at a liberal arts college. GK-12 will help prepare me to reach my goals by giving me experience communicating scientific topics to diverse audiences.

On my first day in the classroom, I joined Mrs. High's class on a hike around Delton-Kellogg's campus to check out the wonderful science and research facilities available. We explored the nature trail, the newly-installed dock on Crooked Lake, and the bioenergy plots. One particular lesson invited chemistry students to test their sleuthing skills as forensic investigators (picture at left). We developed a lesson that demonstrated how soil properties such as texture and composition can help trace the origins of a sample. The students conducted four tests on three samples (crime scene soil, soil found in the suspect's garage, and soil from another site) to link the suspect to the crime scene!

I also had the opportunity to work with the elementary and middle schools. Liz Schultheis, Lawton's GK-12 fellow, joined me for a very successful class activity on invasive species for all the fourth grade classes. We adapted Liz's research on invasive Norway Maples into a lesson on how introduced species become invasive. I also got to meet some of the 5th, 6th, and 7th graders when they seeded the bioenergy plots in November. Keep your eyes open in the next newsletter for updates on the recently installed solar panels at the high school. In only one week they have saved 79 pounds of carbon dioxide from being released!

Spend enough time around a pet and their personality traits will often become apparent: some cats are "needy", others are "independent". Do organisms like fish have personality? Behavioral ecologists (like me) define animal personality as consistent, repeatable behaviors by an individual. Researchers in my field have shown that many types of animals have personality-even insects!

Consistent individual behaviors are a current topic of debate in behavioral ecology. Examining differences of individuals within the same population is important because an animal's actions affect their growth and survival in nature. If we see individuals act differently, we should also see differences in growth and survival depending on the consequences of an individual's actions. My research examines costs and benefits of different foraging behaviors in young bluegill sunfish. For example, a fish that is willing to take risks to eat a lot of food will grow fast, but may also encounter a predator more frequently. A conservative forager may survive, but will probably not consume as many resources, which will limit how much it can grow. So which foraging strategy is better? There may not be a right answer!

I am a 4th-year Ph.D candidate in Michigan State University's Zoology department. My research is based at the Kellogg Biological Station's experimental pond lab facility.

I have been working on the Kalamazoo River to learn how the dams such as at Morrow Lake and dams further downstream impact the river food web. The Kalamazoo River has been studied in the past to learn which food sources are important for the food web. The base of the food web can be leaves from the trees next to the river or algae in the river. Different kinds of insects focus on different kinds of food sources. Did you know that the leaves that fall in the river in autumn are important for the stream food web? Some insects will shred the leaves and eat the microbes on the leaves. Just like peanut butter on a cracker! Other insects will scrape the slime on rocks. The slime is actually a mix of algae and microbes. Other insects will make little nets or use long hairs on their legs to capture bits of food particles in the water that flows over them. The food particles can be many things but includes bits of leaf particles or algae that come off the rocks. Another food sources is produced by dams on the river. Dams can retain food particles from upstream and then release downstream algae, called phytoplankton, that grow in the reservoir. These different food sources likely impact the insects in the river. It is important to measure these food sources in rivers because most rivers have dams on them. Next time you look at the water in the Kalamazoo River, watch for bits of particles in the water. These can be feeding the bugs, which feed the fish! I have enjoyed working on this highly dynamic system and I hope that my work sheds light on how food webs change when food sources are different.

The picture above is of me collecting data on the Kalamazoo River. The park behind me is Merrill Park in Comstock!

Gobles

Gobles is part of the new GK-12 Bioenergy Sustainability Project and has a new GK-12 fellow, Leila Desotelle. I have been working with Becky Drayton's 7th and 8th grade classes. Before coming to Gobles, I taught a variety of college biology labs such as introductory biology and developmental biology lab at Michigan State. I am excited to work in a K-12 classroom I am working on my doctorate in river ecology and study the Kalamazoo River. My research focuses on how dams, such as the one at Morrow Lake, influence the downstream food web. I collect data from Battle Creek all the way to Allegan. The Kalamazoo River passes through many of the GK-12 partner school districts. Some of my research sites were impacted by the oil spill, and I was very busy sampling in the oil impacted sections of the Kalamazoo River. I have been active in the community showing kids some of the fun stream insect larvae such as dragonflies, mayflies and caddisflies that live in the Kalamazoo River. I look forward to talk to the students about the river in their backyard.

Becky and I have worked together to prepare plots over the summer for the Bioenergy Sustainability Project. You may have noticed the large bare patches of ground near the maintenance garages and behind the middle school, but these will soon be converted into plots of switch grass and native prairie. These plots are similar to the larger research plots at the Kellogg Biological Station at Michigan State University. Watch for the sprouts this spring!

We have had a great time in the classroom. I have been assisting with teaching the 7th graders about energy and matter and carbon cycles. We have had the students weigh air, discuss how candles burn, and the students weighed plants that they started to grow earlier this year. Ever wonder where the plant's mass came from? The students discussed these questions and they learned science in a fun and interactive way!

I also worked Becky's 8th grade earth science class. They are learning about rocks and water cycles. I was excited to show them my research on the Kalamazoo River and the Kansas River. They students applied what they learned about river systems while looking at real data. I look forward to the coming school year to create lessons that get kids in the plots and to create lessons to show my research.

KBS K-12 Partnership

A few shots from our Fall 2010 KBS K-12 Partnership workshops...

Gull Lake

Kellogg Elementary teacher Bev Brown has been working on making sure no child at Kellogg Elementary is left indoors! She has been a strong advocate for the school's Outdoor Classroom. This fall she took not only students out to release monarch butterflies into "Milkweed Valley," (above) but also gave other teachers and community members a tour of the Outdoor Classroom. Bev hopes to introduce many new teachers to the Outdoor Classroom this year so more students will be able to gain from the enrichment. Gull Lake teacher Debi Kilmartin and her students also established and planted their own schoolyard research plot as part of the GK-12 Bioenergy Sustainability research network this fall.

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 such that females can no longer tell the difference between males of 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 seemingly 'unimportant' species can have big impacts on species we are more concerned with, such as fish we eat, trees we use for paper, or crops we grow. Therefore, it is essential to understand how changes in biodiversity occur, and that is one of the important outcomes of my research.

Harper Creek

I'm Alycia Lackey, and I'm a scientist with a passion for teaching. This is my first year as a GK-12 fellow, and I work primarily with the Harper Creek school district. For me, science is addictive because of everything you can learn and discover. And it's fun! I love to bring my science experiences into the classroom and share my enthusiasm for science with others. While I was in college, I taught summer science camps for children ages 4-11. In camp, we explored all kinds of science, including the mechanics of how things work, the biology of insects, and the connections between art and science. I also love participating in outreach activities that make science hands-on for children and adults, such as the MSU Museum's Darwin Day and Lansing's Girls' Math and Science Day. For me, discovery experiences like these are what led me to pursue a career in science. Through the GK-12 program, I have the opportunity to work with students from the elementary through high school level. While I get to share my enthusiasm and knowledge of science in these K-12 classrooms, I also gain invaluable experience communicating with others about science. This will greatly help me in my future career teaching and doing research with undergraduates at the university level.

We've been making great strides in the Harper Creek school district! Teachers at all the district's schools have been actively involved at the KBS workshops. We had lots of teachers and classes participate in planting the two research plots at each of the schools. At the high school and middle school, we collaborated with Ms. Hinds and her class, Ms. Subers, and Mr. Shipley and his class. At the elementary schools, I planted the plots with Ms. Swaton and her fourth graders at Beadle Lake, Mr. Eckert and his fourth graders at Wattles Park, and Mr. Remus, Ms. McCulloch, and Ms. Mackinder and their third and fourth graders at Sonoma.

I have also been working with Mrs. Overgaard (3rd grade, Sonoma), Mr. Eckert (4th grade, Wattles Park), and Ms. Swaton (4th grade, Beadle Lake) to develop lessons that integrate inquiry science with state standards and the Battle Creek science kits. Third graders explored different properties of earth materials (e.g., soil, sand, and wood chips) by testing how quickly each earth material absorbed water. In 4th grade, students learned about what organisms need to live and how they meet those needs using resources in the environment. These lessons and others we've developed will be shared with teachers in Harper Creek and across other districts. It's been an exciting first semester of trying new things and developing new teaching materials. We are looking forward to incorporating more science activities in the classroom and using the research plots in the coming months.

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Lawton

My name is Liz Schultheis and I am excited for the opportunity to be able to share my research with students at Lawton. My research focuses on invasive plants in Michigan, and what makes them so successful when introduced from other areas. This past summer teacher Marcia Angle helped me incorporate my research into a science lesson where students can examine whether invasive or native species are more likely to be eaten by insects. With another fellow, Melissa Kjelvik, I developed an activity to help students learn about troublesome plant invaders in Michigan, characteristics that help them become successful, and the role that people play in introducing and spreading invaders. We did the activity in several classrooms, grade levels, and districts and look forward to expanding its applications to other topics such as biodiversity and invasive animals.

The bioenergy plots will provide another venue for me to help students learn about invasive species. Students seeded each plot with a mix of native prairie species, yet over time we will see many species we did not plant move into the plots (just like weeds in your garden!). I look forward to working with students to develop hypotheses and experiments where we can try to explain why we see certain invaders and what causes our Lawton plots to differ from other school districts.

In Fall 2010 I got to work with Marcia Angle's 8th grade lab classes as they focused on decomposition. We brought her classes to the forest where they collected leaf litter and learned to identify herb, shrub, and tree species and how they might influence the kind of litter in their plot. The classes came up with unique hypotheses to test, focusing on what time of year they predicted decomposition of the leaf layer to be greatest, and will be returning to the same forest locations each season. Later, her classes learned about the diversity of life found in streams. For example, each species of decomposer has a different requirement, such as particular oxygen levels and water speeds, which allow them to coexist in the same stream.

I'm excited to work with teachers at Lawton on the bioenergy plots established this year. These plots are an exciting opportunity for students to be involved in real research – we don't know the answers to the questions we will be asking! As researchers, Lawton students and teachers will be able to do similar research to scientists studying bioenergy at Michigan State University, and learn about bioenergy sustainability. The students of Lawton have already shown great interest in the plots – they came out in huge numbers for our planting day in November!

Invasive species, like zebra mussels and garlic mustard, negatively impact places they invade and cost the United States over $100 billion in damage per year. Prevention of future invasions is easier and cheaper than getting rid of them once they have become pests. What information do scientists need to help prevent new invasions before they occur? How can we predict which species are most likely to become invasive?

To make these predictions it is important to understand how an invasive plant might interact with plants, herbivores, and disease in the invaded community. My research focuses on invasive plant species and how release from natural enemies (like disease or predators) may be a key factor explaining invasiveness. Enemy release predicts that invasive species may be more successful and aggressive when moved to a new range because they have left behind things that once controlled their growth. Relatedness between invasive species and their new neighbors may further play into enemy release – just as you are more likely to catch a cold from another person than your pet, closely related plants are more likely to share diseases and pests. Invasive species entering a community with close relatives may be more likely to encounter a new disease as quickly as they left behind an old one.

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 collect evidence to see if this is true, and if so, why.

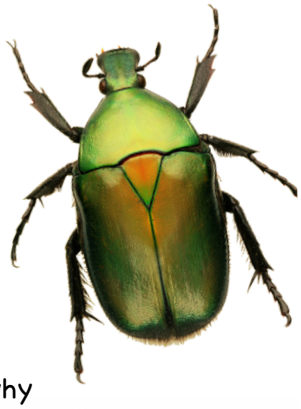
What I can tell so far from my research is that fish show consistent differences in their behaviors and that the catchablity of a fish depends on how it behaves. It appears that when people fish they selectively remove the easier to catch, bold individuals, while leaving the shy ones behind to do the majority of 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, fish populations must be managed in a way to keep them from becoming full of shy fish.

Olivet

I am a first time GK-12 fellow and I am very excited to have the opportunity to interact with students in the Olivet school district. While this will be my first experience working in K-12 classrooms, I do have two years of experience teaching a basic sciences class to non-science majors at MSU. During that time I found that many of the students entered the class with strong misconceptions of what science is all about. It became my goal for the course to help them view science as a tool that can be used to address a wide range of issues and questions, as opposed to the acts of memorizing facts and collecting data. I have this same goal as a GK-12 fellow working with students at Olivet.

Additionally, I love being outdoors and exploring natural areas and I have been lucky enough to find a career that allows me to do these very things. My hope is to share experiences I have had with students in Olivet to get them excited about science and the outdoors, and to make them aware of opportunities that exist in science that I never knew about when I was their age.



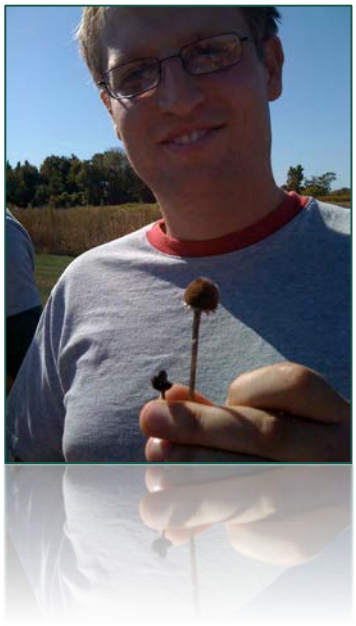
In the first part of the fall semester, I spent much of my time in Olivet working with Mrs. Morton's 9th grade chem-bio and 10th grade biology classes. The highlight of the semester was when the students in chem-bio spent a few class periods getting dirty outdoors just like many real scientists do as they collected bugs that live in the nearby stream. They then brought the bugs back into the classroom and answered a whole bunch of cool questions about them, where they were found in the stream, and why they were found there.

The action has not just been limited to the high school level though, as more recently I have had the opportunity to be involved with Mr. Stolberg's 8th grade earth science class where recent lessons have focused on volcanoes. Students have been finding out how volcanoes are made and why some volcanic eruptions are more explosive than others.

In other news, work has continued on the development of the three bio-fuel plots at Olivet. The preparation stage of plot development went well and several classes were able to be involved when it came time to sow the seeds for the switchgrass and prairie treatments.

KBS K-12 Partnership

Plainwell



I am Iurii Shcherbak, a GK-12 Fellow at Plainwell Middle School this academic year. It is my first year in the program, but I already met with many classes at middle and elementary school levels and I was astonished by differences not only in teaching styles that I encountered but also in students' reasoning and learning processes.

I am very excited to be a fellow with Plainwell Middle School this year as it promises great opportunities for children, teachers, and me. I have been working with several classes in Plainwell, including those of Marty Green, Jackie Warners, Maggie McGregor, and Bob Farris. I received a lot of great questions from students while talking about my background and research.

To my surprise, middle school science curriculum comprises many subjects from various disciplines, so I have been able to make use of my background in physics and chemistry, as well as biology and ecology. We've discussed the carbon cycle, ground water, biofuels, took a field trip to newly established plots, and worked with Google Earth at the school computer lab.

Together with Marty Green, high school fellow Kali Bird, and Sandy Breitenbach we also established a school yard biofuel plots at Plainwell, which are now part of a larger school yard network of plots. Children from the 6th grade helped us a great deal with seeding the plots to switchgrass and prairie grass mixture.

I look forward to our work sampling the schoolyard plots this spring. My plans are also to continue the lessons to enhance understanding of the carbon, water, and rock cycles, laws of motion and forms of energy. I will help organize a district-wide science night and will also help students to develop projects that they will present there.

I am a fourth year student at the MSU Kellogg Biological Station. I do most of my work on agricultural fields to study the process of denitrification – one of the ways that nitrogen applied to the field is lost. Denitrification produces two gases: dinitrogen gas, which is a major component of the atmosphere and nitrous oxide (laughing gas) that is a greenhouse gas approximately 300 times "stronger" than carbon dioxide. Scientists studied denitrification for more than a century concentrating attention on denitrification in the top soil, because topsoil is most biochemically active zone that is also easier to access. Out of ~10,000 papers on the topic only 30 are related to deeper soil processes and only a handful on agricultural soils.

My research focuses on an important question: "What portion of overall denitrification is occurring below topsoil layer and how important is it for gas emissions (carbon dioxide, nitrous oxide, and methane) from soil to the atmosphere?" Answering above question will enhance our understanding of the nitrogen cycle, improve estimates of agricultural contributions to global climate change, and assist in improving soil management practice recommendations. Previous research indicated that subsoils do not contribute a significant amount of gas to the atmosphere, despite extremely high concentrations of nitrous oxide and carbon dioxide at depth. New research at Kellogg Biological Station of Michigan State University, located in SW Michigan, indicates that high gas concentrations of the gases at depth contribute significant amounts of gas to the atmosphere. Data on soil temperature, soil moisture, soil air samples, gas flux to the atmosphere, and water percolated below root zone were repeatedly collected to help quantify what portion of the denitrification happens in the subsoil.

Microbes play important roles in all ecosystems on earth. They form the basis of many food chains, can break down decaying matter to smaller pieces usable to other organisms, and can control important nutrient cycles. For example, in lakes, bacteria break down large particles of phosphorus-containing matter into much smaller particles that can be used by other bacteria and algae. Phosphorus is an essential nutrient which is often in limited supply in lakes, and therefore plays a role in determining how much algae can grow, how many zooplankton can survive on that algae, and ultimately how many fish a lake can support. However, when phosphorus is in excess, such as in water bodies near fertilized agricultural fields, too many algae can grow, sometimes causing toxic algal blooms.

For my graduate research, I am studying how well bacteria can degrade and use a variety of phosphorus-containing particles. Studying bacterial isolates from a high-phosphorus, algae-filled lake and a low-phosphorus, clear lake, I will learn whether bacteria in each of these lake types are able to process phosphorus differently, and if so, what these differences are. This knowledge should help us better understand how excess phosphorus additions can change natural microbial cycling of phosphorus in lakes, and help determine ways to manage algal overgrowth.

Plainwell Continued

My name is Kali Bird, and I am a GK-12 Fellow in Plainwell School District. I am also a graduate student at Kellogg Biological Station in Hickory Corners (near Gull Lake). As a graduate student, I have learned highly specialized information in many courses, but most excitingly, I now conduct scientific research so that I not only receive knowledge, but produce new knowledge. I study microbial ecology, which means that I study how very small organisms interact with each other and with their environment. However, I also love teaching! As an undergraduate student, not only did I tutor students in various science and math disciplines, but I also taught high school chemistry at a local home-school co-op. Additionally, I spent a semester teaching English in Khabarovsk, Russia. These experiences have only increased my passion for sharing knowledge in exciting ways. As a GK-12 Fellow, I hope to provide innovative lessons for students so they learn how exciting discovery can be and realize that science does not have to be 'too hard.' I also hope to show them how much fun doing science is, and that scientists are not all super-smart people—they are just people who get excited about asking questions and actually get paid to find the answers!

This Fall semester, I have had the privilege of working in Plainwell High School with my teacher partner, Sandy Breitenbach, and her Biotechnology and AP Biology students. In addition to having the opportunity to share my knowledge on topics such as the fermentation process, I have been able to help students as they have learned new laboratory techniques. Perhaps most excitingly, I have been advising and supporting the AP Biology students in designing and developing their independent research projects. These students are asking interesting questions, such as, 'Does an insect change its behavior in response to the threat of predation?' and 'Do plants respond differently to fertilization when they are grown in a mixed community, rather than with plants of their same species?' One student is even isolating and identifying cellulose-degrading bacteria from the environment. Such bacteria have been targets for cultivation in order to use their unique enzymes to create biofuels from cellulosic materials such as corn cobs. The students will be presenting their research to fellow classmates and at Science Night in March, so please remember to stop by and see what they have discovered!

KBS K-12 Partnership

Vicksburg

This is Lauren Kinsman-Costello, mud scientist extraordinaire. I've had a fantastic start to the school year working with Liz Ratashak and other science teachers and students at Vicksburg Community Schools! This is my second year as a part of the Kellogg Biological Station GK-12 project and I'm in my fifth year as a Ph.D student (which means technically, I'm in the 21st grade). For my entire life, I have been fascinated with the natural world. Even while growing up in a suburb of Grand Rapids, MI behind a shopping mall, I satisfied my curiosity about nature by catching butterflies in nearby vacant lots, bringing home pet frogs, and learning the name of every wildflower in a three-block radius. I became a scientist because science allows me to satisfy this constant curiosity. I'm able to answer questions that no one knows the answer to, and sometimes questions that haven't even been asked before. Mud is my specialty. As a wetland ecosystem ecologist, I study how living things and non-living things interact in swamps, marshes, bogs…basically any place I can walk into with my waders or paddle through in a canoe. I'm interested in how chemical elements move around within an ecosystem. Through my experience teaching kids of all ages (including the grown-up ones), I've learned that everyone is curious about the world around them on some level. I look forward to giving K-12 students the opportunity to learn about science by actually *doing science*, not just reading about it.

The Vicksburg bulldogs have had a great start to the scientific school year. I have been working with partner teacher Liz Ratashak, as well as the entire science department at Vicksburg High School. I introduced myself to the high school students by demonstrating that scientists don't always wear lab coats, and that science is all about asking questions, not just about facts in their textbooks. The goals at Vicksburg for the coming year are for the students to be scientists (rather than just learning about science), and for everyone to see that science is fun. High school biology students in Mrs. Ratashak's and Mrs. Guthrie's classes started the school year learning about the process of science by manipulating the environments of organisms found in pond water. Using microscopes to count and identify microorganisms, we tested the effects of oil, darkness, fertilizer, trash, mud, and space on the amount and types of micoorganisms. While each of these experiments produced different results,they were all interesting and show how environmental changes can influence even the smallest ofpond creatures. The Vicksburg Environmental Science Club is a great new opportunity for middle school and high school students interested in doing science and helping the environment. We've already had lots of fun planting seeds in the KBS BeSt experimental plots and learning about soils, and are looking forward to future projects, including field trips to go hiking and learn about nature!

Phosphorus is an element that all living things need as a basic building block for many important cell parts including DNA, cell membranes, and molecules that store energy (ATP). Farmers, gardeners, and homeowners help plants grow by giving them fertilizer with phosphorus, but this extra phosphorus can end up in lakes, streams and wetlands, where it can be too much of a good thing. While phosphorus helps plants grow on land, in water it causes problems by causing algae to grow and forming mats of pond scum. These mats of pond scum can smell bad, look gross, cause oxygen in the water to decrease, and sometimes produce toxic substances that are harmful to pets and humans. Luckily, mud can trap and store some of this extra phosphorus at the bottom of wetlands and lakes, preventing it from causing extra algal growth. This is one reason why humans use wetlands to help filter runoff containing phosphorus from urban and agricultural areas. Sometimes, however, the phosphorus becomes "unstuck" and is released from mud. All mud types aren't created equal, and some under certain conditions are better at holding on to phosphorus than others. I study what kinds of mud characteristics and processes cause this phosphorus release into the water, as well as what kind of characteristics and conditions are good for keeping P in the mud. It's a dirty job, but someone's got to do it!

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2011 Research Experience for Teachers:

Opportunities Available at Kellogg Biological Station and The Great Lakes Bioenergy Research Center at the University of Wisconsin

Last summer, nine teachers joined researchers at KBS as a part of the Research Experiences for Teachers (RET) program. These teachers participated in cutting edge science and education research, and created related curriculum materials that they could take back to their classrooms. Host research groups in 2010 included Jen Lau's plant ecology lab, Jeff Connor's evolutionary biology and ecology lab, Elena Litchman's aquatic ecology lab, the Long-Term Ecological Research Site, the Great Lakes Bioenergy Research Center, and Andy Anderson's Math-Science Partnership Program. The RET program lasts for eight weeks and has received rave reviews from both faculty mentors and teacher participants. If you are interested in participating in the summer of 2011, please contact Sara Syswerda at parrsar1@msu.edu.

Our partners at the Great Lakes Bioenergy Research Center at the University of Wisconsin are also offering RET opportunities. Here's a note from them:

The Great Lakes Bioenergy Research Center (GLBRC) is pleased to announce the Research Experience for Teachers (RET) program for the summer of 2011, offering educators a chance to participate in research and development of educational materials around the topic of biofuels for transportation.

Teachers participating in this program will spend 7 weeks of the summer, beginning June 20, working with scientists at the University of Wisconsin-Madison involved in cutting edge research and working with colleagues to design classroom activities to contribute to the GLBRC resource library.

Teachers in the RET program in previous years created such activities as Bioprospecting for Cellulose-Degraders, Quantitative Life Cycle Assessment, and Field Investigations in Biomass Yield and Carbon Cycling.

We are looking for a few dedicated professionals for this year's program. Topics include:

Quantitative analysis of sustainability field data

Conducting a life cycle assessment of biofuel production—economics

Applications are due February 28, 2011. For a full description of the RET program and topic areas, please visit the GLBRC website: http://www.glbrc.org/education/programs

Mark Your Calendars- Happenings at KBS

February

2/5: How to participate in the Great Backyard Bird Count, Kellogg Bird Sanctuary, 1-2:30pm. Contact birdsanctuary@kbs.msu.edu for details.

March

3/1: KBS K-12 Partnership Workshop; Academic Bldg. Auditorium, 8am-4pm. RSVP to hibbsr@msu.edu or parrsar1@msu.edu

3/31: Art in Nature: Photographing Waterfowl (three part series); Kellogg Bird Sanctuary, 5:30-7:30pm. Contact birdsanctuary@kbs.msu.edu for details.

April

4/5: Soaring Birds Family Program; Kellogg Bird Sanctuary, 1-2:30pm. Contact birdsanctuary@kbs.msu.edu for details.

4/7: Art in Nature: Photographing Waterfowl Continued. Kellogg Bird Sanctuary, 5:30-7:30pm.

4/14: Art in Nature: Photographing Waterfowl Continued. Kellogg Bird Sanctuary, 5:30-7:30pm.

4/19: KBS K-12 Partnership Workshop, Academic Bldg. Auditorium, 8am-4pm. RSVP to hibbsr@msu.edu or 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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