

KBS K-12 Partnership

Spring Newsletter

Issue 11 Ecological Literacy in K-12 Classrooms May 2012



Dear KBS K-12 Partners,

We hope this newsletter finds you all well as the school year comes to a close. 2011-2012 brought new challenges and experiences to the K-12 Partnership. We were pleased to successfully complete our first year of data collection on the GK-12 BEST Plots Research Network. In each participating district, students and teachers collaborated with GK-12 Fellows to collect data on soils, plant and invertebrate diversity, and landscapes surrounding the schoolyard plots. It was a huge job and we hope the students learned a lot in the process. The MSP team also continued conducting interviews with K-12 students to learn more about the ways in which they reason through scientific information. On the following pages, you'll find more detailed district updates- they'll fill you in on the exciting things happening in the classroom, the schoolyard, and here at KBS. As always, we would love to hear from you. Have a fabulous summer.

Until next time,

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

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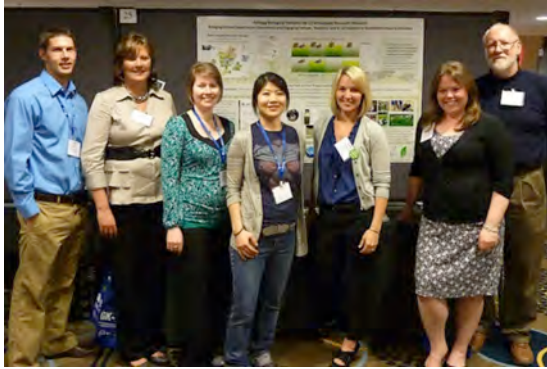


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In March, several GK-12 Fellows, Tom, Robin, and teacher in residence Liz attended the Annual GK-12 Meeting in Washington D.C. Here's their report on all the fun!



From Tom: Nick, Marcia, Alycia, Tomomi, Robin and Liz presented and represented our GK-12 Project at the 2012 Annual Meeting for GK-12 Project Teams, held at the Hyatt Regency on Capitol Hill, March 16-18. I cheered them on, took pictures and took great pride in they way they represented all of us. Nick's roundtable discussions about fostering quantitative reasoning skills were well-attended and well-received. Our BEST Team presentation on Building Long-Term Research Projects and Collaborations was a big hit, even though it was at the worst possible time (early Sunday morning) and location (a room hidden behind the bar). Participants were very enthusiastic about our presentation and activities and full of questions.

It was especially gratifying to learn that other projects are studying our website and adopting some of our innovations. There were 103 projects represented at the meeting and many of them are doing very interesting things, but I liked ours the BEST!

Report from Nick: Attending my first GK-12 conference was both exciting and encouraging. I was fortunate to interact with numerous partner teachers and fellows who were bubbling over with enthusiasm and motivation to improve science education. This was especially true at my roundtable discussions on fostering critical thinking and at our BEST team presentation. During my roundtable discussions I explained a lesson structure that I have created that focuses on developing the core critical thinking skills required to perform many essential tasks in science, such as engaging in argument from evidence and making claims and supporting them with evidence. My audience engaged me in fruitful discussion and provided me with ample positive feedback and insightful suggestions throughout, which left me feeling that my presentations were a success. Despite The BEST team's



presentation time and room placement, we attracted an audience that was so engaged with our presentation on building long-term research projects that we ran out of time while trying to address all of the positive comments and feedback we received. It seemed that each time that we transitioned from one speaker to another, a group discussion would spontaneously occur where several audience members would ask questions and praise our work. In fact, we had several participants stay behind after our presentation ended to continue to discuss our project further with us, which to me is always a sure sign of genuine interest in a presentation.

Report from Robin: This year I attended my third GK-12 Annual Meeting. This was the second time our project has been chosen to present a workshop for PIs, Fellows, and K-12 Partner Teachers in attendance. I was honored to share our experiences, and your hard work over the last two years, building the BEST Research Network, and I truly enjoyed watching our Fellows shine as they described their own research and how they bring their work to the BEST Research Network and K-12 classrooms throughout SW Michigan. They are amazing! But, you all know that already. There is definitely a lot of enthusiasm in the GK-12 community about the work we are doing and the opportunities that long-term research networks offer for doing open-ended inquiry in K-12 schools. Keep up the great work, everyone. It's an honor to represent you!

Marcia and I attended a fun workshop to learn about using 1 minute videos to quickly introduce teachers to the content included in lessons that GK-12 projects post on their website - the idea is that short videos are not only engaging, but save teachers the hassle of reading through paragraphs to text to figure out whether they want to use a particular lesson. We think this would be a great way to introduce our BEST plots protocols, so be on the look out for quick videos that introduce the Biomass and Biodiversity, Soils, and Landscape-level protocols this summer. We'll keep you posted...

Report from Liz: I feel very lucky to have been able to attend the final GK-12 conference – I know our project has accomplished great things so far, and it was great to learn about the amazing work others are doing as well. It was clear everyone had ample enthusiasm for their work and that the connection between the universities and K-12 classes will continue long after funding runs out for this program.

During our presentation, it was easy for me to share the ways in which being a GK-12 fellow has helped me in my graduate career. Not only has my time as a fellow given me more confidence as a public speaker and educator, but also more clarity in the main ideas behind my dissertation research. It was a lot of fun to present my Invasive Species Game with the audience, and to share how it related to my research and basic ecology principles that teachers are discussing in their classrooms. I received many great suggestions of ways to expand the reach of my Invasive Species Game, and I can't wait to try them out!



Report from Alycia: Our presentation went amazingly well! Some participants said it was the best workshop they attended all weekend! Another GK-12 project is eager for us to publish the Data Nuggets because they use them for their project. Everyone also loved the invasive species game Liz presented. Definitely a success! I attended one session about skipping lecture and using active learning techniques in the classroom. It was great to see familiar and new techniques in action. One useful tool was constructivism – having students construct their understanding instead of having information given to them. The presenter used an example with significant figures where she provides her students with a series of examples and gets them to construct the rules for determining the number of significant figures. I also attended a session on evaluating GK-12 projects. It was great to interact with everyone at this conference that was so enthusiastic about improving science education. It makes me feel good about the work we do in the classroom. I can also see the benefits of our professional development and how that will prepare us for careers in science.

Report from Tomomi: This was my first time participating in the GK-12 conference and I had a lot of fun sharing our GK-12 project with an enthusiastic audience. During our 75 minute presentation, six of us each spoke a little bit about our project. Alycia and I talked about how we practice inquiry at all stages of the scientific process in the classroom using the BEST plots. Then I summarized the benefits and challenges of our GK-12 project. While we had some logistical challenges (e.g. low germination, weedy plots and data management), it was a really great experience for all of the fellows to exercise inquiry-based science with students at different levels. We also feel more confident as scientists and educators, and comfortable talking about our research to a wide audience. Overall, our presentation was pretty well received – participants had a lot of constructive comments and suggestions. I'm happy to report that we represented everyone's hard work well and that the people were really interested in our project! I feel very lucky to be part of the KBS GK-12 project. Next year, I will continue to be involved in the GK-12 program at KBS, so I look forward to keeping the momentum going!

Report from Marcia: Having the opportunity to attend my first GK-12 Conference was both amazing and bitter/sweet. I was so proud of our BEST team and their dedication to the things we do here at KBS. The commitment to the program and enthusiasm for science and science education K-12 was certainly apparent. Science teaching strategies, STEM topics in K-12, mini-grants, and watershed games were some of the topics I paid attention to during other workshops. I thought our poster was one of the BEST at the conference, but enjoyed reading many others and often took pictures of ideas or concepts. When the author of Life in the Treetops, Dr. Margaret Lowman spoke during lunch on Saturday I was totally enthralled. Having traveled to Central and South American rainforests myself I found her stories extremely entertaining. Studying the diversity of life by swabbing belly buttons is certainly something I never thought of! The GK-12 program is strong and has certainly touched more lives of teachers and students than I ever imagined. I spoke from the heart when I said at the conference that our Fellows make a difference in our classrooms and with the teachers they work with. May these relationships continue for years to come, officially or not.



I have worked on the Kalamazoo River for many years. Like most US rivers, the Kalamazoo River has undergone many changes during the

last century. Dams were built in the early part of the 20th century to generate electricity. The river was channelized for flood control. As industry became important, waste was dumped into the river, and at one time, the river was so polluted that it would run white from paper mill waste. These paper mill wastes included PCBs, a very stable and harmful chemical that is slow to degrade in the environment. In recent years, however, many positive changes have occurred. Regulations have been put into place to prevent PCB's and other toxins from being dumped into the river, and dams are being removed to restore the river to its more natural state. Removing the dams should create high quality habitat for fish. Despite a legacy of past abuse, my research on the Kalamazoo River shows an amazing diversity of aquatic life. My specific research goal is to understand how the remaining dams on the Kalamazoo River impact the downstream food webs. By collecting insects and materials that flow in the water, I am learning how dams change potential food sources for stream insects. In addition, a burst oil pipeline and massive oil spill into the Kalamazoo River in 2010 dramatically altered my research focus. Although oil spills have occurred on rivers before, this spill is different because it involves oil obtained from oil sands from Canada. The oil has components that are heavier than water and sink to the bottom. It is likely that there is oil on the bottom of the river, especially in Ceresco Dam and Morrow Lake. The clean-up of this remaining oil is challenging. My lab and others are investigating if this submerged oil is harmful to the organisms living there and how long this oil will take to degrade. I'm now actively looking at the effect of the oil on the stream insects.

Gobles and Galesburg-Augusta

By GK-12 Fellow Leila Desotelle

Unfortunately, my time as a GK-12 fellow at Gobles Middle School is soon ending. Becky Drayton and I have done a lot over the season. I brought in soils from different KBS K-12 partnership districts to look at the different minerals. Becky's class used vinegar to test for bits of limestone in the soil. Limestone reacts with vinegar and hisses like rice cereal. Some soil reacted and some didn't. The students loved to hear the reaction! Following the activity, I showed Becky's class a picture of me on a limestone cliff in Wisconsin. Did you know that there was a shallow sea over Wisconsin millions of years ago? I also brought in a Charlevoix stone, which is fossilized coral.

Related to the bioenergy plots, I discussed with Becky's 8th grade students how much energy Michigan needs. We looked at how much energy I use per month and looked at how much energy is produced from coal fired plants and hydroelectric dams.



I also visited Terry Blake's classroom in Galesburg Augusta where I spoke about the insects in the Kalamazoo River and talked with the students about the oil spill. Now that summer is here, I am sad that my time is finished, but am looking forward to working hard on my research.

Gull Lake

By GK-12 Fellow Tyler Bassett

My name is Tyler Bassett, the GK-12 Fellow for Gull Lake. I have been busy as ever in Kim Clancy's 6th grade and Jennifer Boyle's 8th grade science classes since the last newsletter. Primarily, I have been following their curriculum, always looking for a unique lesson, or a fresh take on an old theme.

I am always looking for a tie-in with my research, which I did in Kim's class when wrapping up a long section on geology. We had discussed the bedrock of Michigan, applying the student's knowledge of rocks and finding out what was underneath their feet. To connect that to the aboveground world, we ventured outdoors and examined the plants found in two different soil types: the BEST Plots (loamy), and the Outdoor Classroom (sandy). We found that the BEST Plots were dominated by white clover and had lower diversity, while the Outdoor Classroom was characterized by more variety. We discussed differences between the sites, and compared them to soil profiles from each site.

Another fun activity I led with the 6th graders is worth mentioning. During a section on plate tectonics, I invented a game called "Return to Pangaea," complete with a game board. The player is a scientist looking for fossil evidence to explain the theory that all of the planet's continents were joined as one. The objective is to try to collect cards that depict the fossils . . . or lose a turn because the scientific establishment has prevented publication of your controversial theory!

In Jennifer's class, one activity that stands out, because we confirmed the assumption that any lesson that involves burning stuff is bound to be a success. The students were learning about organic compounds, and we specifically investigated biochemical compounds: carbohydrates, fats, and proteins. To measure the amount of calories in foods, we burned three different snacks under a beaker of water and measured the temperature change in each food. The students made predictions based on the proportion of each biochemical compound in roasted peanuts, Trix cereal, and Triscuits crackers.

Finally, I will be wrapping up the year with the 8th graders leading an inquiry-based project for their life sciences section. Making use of the Outdoor Classroom, groups of 2-3 students in each class will develop a question. I will be guiding them on forming hypotheses, doing experiments, and interpreting data. Just in time for spring!



Winter is not the ideal time for a plant ecologist to do research, but there is plenty else to do. A typical winter is spent writing grants and manuscripts, and analyzing data from the prior year. This winter was no exception for me. In particular, I looked at data from several prairie restorations I studied in summer 2011. I wanted to see if sowing more species created a more productive ecosystem. Several other researchers have shown that increasing species diversity increases biomass productivity, which is considered the basis of the prairie food web. Previous studies have been

conducted in controlled, weeded plots. Restorations, on the other hand, proceed through succession, except for occasional prescribed burns.

Contrary to the predictions, I found that there was no relationship between the number of species sown and productivity, suggesting that there are other factors responsible for differences in productivity. This upcoming summer, I will be establishing an experiment that will explore what some of those factors are. Is it the way prairies are managed? Is it soil fertility? Is it simply controlled by which species are planted and not the number of species? Stay tuned for answers to these exciting questions . . .





My research focuses on cows and how they decide when to graze, where to graze, and which grasses to eat. Last summer, I studied how environmental factors such as grass species and traveling distance to pastures influenced cow grazing behavior. I wanted to see if pastures that were farther away (and thus more energetically costly to visit) caused a drop in milk production or in the number of visits cows made to those pastures. I also wanted to see if offering novel grasses in certain pastures makes cows more willing to spend time and energy searching for their favorite grasses. Using GPS collars to track their movements, I found that cows didn't spend more time searching for specific grasses. However, when they had to walk farther to the pasture, the cows produced less milk, showing an energetic trade-off in pasture systems.

Cow behavior is not only an interesting topic for biologists, but it is also an important factor for farmers to consider when managing their herds for health and efficiency. Understanding how animals make decisions can inform our own decisions about when and how we should manage animals, particularly those animals that produce food for us.



Hastings

By GK-12 Fellow Kate Steensma

I had a lot of fun using games to communicate scientific concepts at Hastings High School this spring. Games are a useful tool for teaching inquiry skills, since students have the opportunity to predict game outcomes, and test their predictions by playing. Once a game is complete, students can graph the outcome and compare it to their initial hypotheses. I find that interactive learning often improves my own understanding of a topic, and it is a great way to get students engaged and excited about science.

For our evolution unit, we played a few different games to model natural selection and evolution. The first of these games, "Survivor" showed how beneficial mutations might change a population's characteristics over many generations. Students pretended to be a made-up species that hops around like kangaroos, competing for limited resources. After a beneficial mutation was introduced into the population, a few of the students acquired the ability to run, and over several generations, they were more successful at surviving and reproducing than their hopping ancestors, who were nearly extinct.

Next, we played another evolution-themed game, "The Hunger Games," which shows evolution of predator and prey strategies. Students compete once again for prey (plastic eggs filled with candy), but this time, some of the prey ward off their predators by resembling a toxic species (orange eggs filled with rocks). Students change their foraging strategies depending on the ratio of benign mimic eggs to toxic eggs, just as a predator species in nature adopts different hunting strategies in response to different escape strategies used by its prey.

Hastings 9th and 10th graders had an exciting opportunity to venture outside the classroom for a "Nature Day" in March. Students took field trips to Pierce Cedar Creek, Kellogg Biological Station, and the Kalamazoo Nature Center. I really enjoyed sharing my research with the group that visited KBS, and was pleasantly surprised at how many students bravely



volunteered to feel the not-so-pleasant inside of a cow's stomach! It has been a privilege to work with Mr. Buehler and his colleagues this year. I had a lot of fun learning the ups and downs of teaching, and I appreciate their encouragement and advice. After my experience as a GK-12 fellow, I feel that I can think about and communicate science more clearly and more confidently, and I look forward to sharing scientific ideas with a variety of audiences in the future.

Harper Creek and Parchment

By GK-12 Fellow Leilei Ruan

This semester, I have been working at Harper Creek high school with my partner teacher Mrs. Sandra Erwin for her Chemistry II class. The students would like to start a science project and both Mrs. Erwin and her class showed a big interest in the Kalamazoo river oil spill incident. One student from the class said, "Chemistry is cool but it would be awesome to connect our newly learned knowledge with real environmental issues." Generally, our class projects are looking at the impacts from the oil spill on plant growth and germination, and how to remove the oil from contaminated soils using some bioremediation methods such as adding nutrients to activate microbes to help degrade oil. We also invited an expert scientist, Dr. Stephen Hamilton, to give the class a lecture on the Kalamazoo river oil spill and he also gave us a field tour to a part of contaminated river at Marshall. As the saying goes, interest is the best teacher! Not only will students be more enthusiastically involved with their projects, but also they can learn how to design and interpret a science experiment.

I also have been working with Mr. Stephen Barry at Harper Creek high school to train his independent study class to carry out the soil protocols for our BEST plots. I gave an introduction about biofuels and then we practiced soil protocols such as soil moisture, texture, pH and inorganic nitrogen. I also helped Mrs. Jodie McManus at Parchment High School with her Biology class. We conducted landscape and soil protocols at their plots. The kids were friendly and they were curious about the BEST plots. They had many interesting questions. Mrs. McManus and her class made me feel quite welcome. When we have a few minutes left at the end of class, kids also like to ask me questions about myself and science. It has been a good time working with them.

I will finish my GK-12 fellow work by the middle of May. This year, I learned a lot from my partner teachers, especially from Mrs. Erwin. Her hard working attitude towards her class, her enthusiasm for science and her patience with students have been excellent examples to follow in my future career. I appreciate that GK-12 gave me such a great opportunity to enhance my communication skills, amplify understanding in my study area, bring my research to the public audience and build friendships with kids and teachers. As I said last time, I feel there have been some connections between teachers, kids, and me, which will have a lasting impact on me.



In the past half year, I focused on both field and lab work. In the field, I was studying the impacts of changes in snowfall on greenhouse gas emissions from soil. With increasing global surface temperature, snow cover has decreased in most regions. Additionally, snow is an effective insulator, so the frequency of freeze-thaw cycles is likely to increase due to reduction in snowpack thickness. Freeze and thaw cycles can strongly impact soil carbon and nitrogen dynamics due to the release of aggregate-protected organic carbon by soil aggregate destruction, with the death of microorganisms and roots increasing the availability of substrate and consequently stimulating the activity of microorganisms such as denitrifiers in soils and then greenhouse gas emissions (CO_2 , CH_4 and N_2O). I went out every time after it snowed and added or removed snow for some of the experimental plots. Automated chambers were used to monitor greenhouse gas emissions throughout the winter. In the lab, I spent considerable time analyzing data from last field season and prepared my dissertation manuscript.

This summer, I am planning to sample across 6 different sites of the GLBRC extensive sites for gases. Also, I will continue to analyze my data to prepare for my PhD dissertation defense.





I am about a year from finishing my Ph.D. degree! I have a lot of writing and data

analysis in my future, and so far it's been really rewarding to organize all of my data and ideas for publication. My research helps us understand a fundamental biological process - how species form - and has important applications to conservation. I study two species of stickleback fish that live in multiple lakes in British Columbia, Canada.

This summer I will attend an evolution conference in Ottawa, Canada. It should be a big conference this year with around 1800 attendees. I will give a talk on my latest project where I tested whether presence of distinct habitats is important for female mate choice between males of two different species. I found that habitat

is most important for female mate choice when populations are first diverging into species or when species are breaking down due to increased mating between species. However, once two species are distinct, female preferences for their own species are strong regardless of habitats. This work is particularly relevant as humans continually change environments around them. By changing habitats, we may keep species from forming or we may speed up the loss of species.



Harper Creek

By GK-12 Fellow Alycia Lackey

This spring I've brought multiple inquiry lessons into Harper Creek's elementary classrooms. It's been fun visiting different classes at each school, and I love seeing the students light up about science activities. Not only have students improved their understanding of science content, but they have also gotten great practice with science inquiry skills.

One of these lessons is called "Incredible Invertebrates," which I developed with GK-12 fellow, Kate Steensma. I presented this lesson to fourth graders with Jim Eckert at Wattles Park, Jim Remus at Sonoma, and Sue Swaton at Beadle Lake. In this lesson, students learn to distinguish different types of invertebrates based on their physical characteristics. Students hypothesize why certain physical characteristics might be helpful or harmful to an invertebrate's survival and get to test their hypotheses using field guides. This lesson is great for familiarizing students with invertebrates they can find in our BEST plots and backyards.

Another lesson covered how seeds disperse, which I developed with GK-12 fellow, Liz Schultheis. Students learn about how seeds have different physical characteristics that help them disperse in particular ways, such as by wind, water, or animal fur. Students describe three types of seeds and hypothesize how they will disperse based on the seeds' physical characteristics. Then students test their hypotheses for each of the three seed types. This lesson is really fun and hands-on. Students had a great time testing out all of the seeds with the different modes of dispersal. The "fluffy" seeds were a sure favorite, but we had a hard time keeping them from floating all over the room! I did this lesson at Wattles Park with Maria Farkas' and Joene Joostberns' third grade classes.

During my two years as a GK-12 fellow, I have truly enjoyed learning how to communicate science across the grade levels. I strongly believe that if I can communicate my research to a third grader, then I can communicate my research to anyone. Working with Harper Creek teachers and students has been great training for me as a scientist. I am very grateful to all of my teacher role models for teaching me how to get my points across clearly and succinctly. I am also continually buoyed by the enthusiasm elementary students have for science, new ideas, hands-on activities, and asking questions. These students and teachers have greatly bolstered my confidence as a science communicator and educator. Thank you!!



Lawton

By GK-12 Fellow Liz Schultheis

Hi! My name is Liz Schultheis and working with my partner teachers, Dave Williams and Holly Visich, I developed many fun lessons this spring trimester at Lawton. My favorite activity has been working with both classes to create and conduct experiments with "Living Machines", or mini ecosystems of interconnecting terrestrial, wetland, and lake habitats. These machines are



created from items available from hardware stores, and out in nature: 5-gallon water bottles, plastic tubing, and plants from lakes and land. To decide what research questions to address with the Living Machines, students researched and presented information about

human effects on the environment. The students decided to test the effects of over-fertilization because it is an issue important to Lawton and the Great Lakes. Using the 6 machines at the High School, students set up 2 control systems, 2 systems with low fertilization, and 2 with high fertilization. The students will monitor the machines for the remainder of the school year (and hopefully next year as well!) to see how fertilization affects the land plants, algae, aquatic plants, and even fish in the machines. As a class, we predicted that the machines will show signs of eutrophication – algae will bloom and water oxygen levels will drop.



Another great lesson we did in Dave William's class was to create a water budget for the entire high school. This lesson taught students not only about the water falling onto the school, but also where that water ends up. While walking around the grounds of Lawton HS, students mapped all the features of the schoolyard and recorded changes in slope to monitor where the water flows after it rains. They also recorded how fast water infiltrates into different ground covers, like grass and gravel, demonstrating how much of the rain makes it back into our ground water and how much runs off into streams. We put plastic bags over tree leaves to collect transpired water during photosynthesis, and students were shocked by the amount of water lost from plant leaves, even this early in the growing season!



The number of invasive species is growing year-by-year, as plants,

animals, and microbes are introduced (generally by accident) into habitats where they did not historically occur. Invasive species are often destructive, causing over \$137 billion in damages to native ecosystems and human interests around the world annually. Yet, despite all the problems they cause, we still do not know what causes some species to be invasive and not others. My research addresses this question by testing whether invasive species are successful because they are not strongly controlled by competitors, predators, and herbivores in their introduced range.

This summer, I am testing this hypothesis by growing three categories of plants together in a field experiment with and without natural enemies: native plant species, introduced plant species that are not invasive, and invasive introduced plant species. Native are those naturally occurring in Michigan, while introduced and invasive species are brought to Michigan by humans. While introduced species mix with native plants and have little effect, invasive plants have the potential to aggressively colonize natural areas and decrease biodiversity. In my experiment I will measure plant growth, survival, and reproduction in the presence and absence of herbivores and disease. I predict that removing natural enemies will have a greater benefit to native and introduced species than to invasive species because enemies have relatively little impact on invasive species. My research will help determine what factors contribute to invasion success and can, therefore, help predict and prevent future invasions.



Apart from my time spent as a GK-12 fellow, I have continued to make progress on my research project on

the effects of fishing on largemouth bass. In 2009 and

2010, I obtained results that show that largemouth bass consistently differ in their behaviors and that the catchability of



an individual bass depends on how aggressive it is. During 2011 and 2012, I have added to my findings by showing that male bass that are more aggressive get more eggs laid in their nests and more aggressively guard their nests from potential nest predators like bluegill. When all the results are examined together, they indicate that when people fish they selectively remove the easier to catch, aggressive individuals, while leaving the docile ones behind to do the majority of the reproducing. This means that over-fishing could lead to fish populations full of docile fish that won't take the bait. This upcoming summer, I will be investigating if bass inherit their level of aggression from their parents. This is important because if docile parents produce docile babies, then a population that becomes full of docile fish will likely stay that way for a long time, even if fishing pressure is reduced.

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. Over the past few months, I have worked with several teachers in Olivet. In Mr. Stolberg's 8th grade earth science class, one of the lessons I taught was on volcanoes and how they can impact the earth's climate. As part of the lesson, students analyzed real data from 5 of the biggest volcanic explosions over the last 100 years. They used the data to draw their own conclusions about how volcanoes can impact the earth's climate and then we discussed mechanisms that could explain why volcanoes have the

effect that they do. Additionally, I am currently working with Mr. Stolberg to put together a field trip to KBS for the Olivet 8th grade again this year. Last year, we took the 8th grade to KBS on a beautiful day in May. I was able to show students my research with largemouth bass and they were also able to tour the KBS bird sanctuary and the KBS dairy farm. This year, we plan to add an additional stop to the LTER site where studies on the ecology of intensive field crop ecosystems like corn and soybeans are conducted.

The 4th and 5th grades also had their annual science fair recently and it was a huge success! As part of the lead up to the fair, I gave an assembly to each grade about how I went through the scientific process to answer my research questions on chimpanzee intelligence and the effects of fishing on largemouth bass. The students seemed to really enjoy the videos of my chimpanzee research and liked to see how I used the same process to answer my research questions as they used to answer their science fair questions. On the day of the science fair, I was able to view many of the students' science fair projects and talk with them about their questions, the issues they faced as they tried to answer those questions, and how they were able to overcome those issues. I can hardly believe that my 2 years as a GK-12 fellow will soon be over. I will miss my weekly trips into Olivet but I am grateful for the many great connections that I made with teachers and students alike during my time as a GK-12 fellow.



Plainwell

By GK-12 Fellow Tomomi Suwa

On April 18th, more than 250 students and parents attended the 5th annual, district-wide Science Night at Plainwell Middle School. Students presented their science projects and the Parent-Teacher Association graciously donated snacks for the event. In addition, eighteen local and community groups participated by setting up informational booths and interactive activities for students of all ages. For example, Great Lakes GeoScience brought exciting fossils and mineral rocks, the Western Michigan Solar Car Team brought an impressive student-built solar car. Kalamazoo Astronomical Society came with their high powered telescopes, and Julie Doll from MSU's Long Term Ecological Research Project had a station where

students learn how to take a soil core samples. One of the projects that caught everyone's attention was a huge periodic table (as big as a truck!), created by middle school students in Mrs. McGregor's class. Each student described an element with a picture and they assembled all of the elements into a big table. Our GK-12 fellows, Michael and Leila also brought the organisms they study (frogs and crayfish) and talked to students about their research. Tyler represented the Michigan Botanical Club and showed students how to identify plants using a field guide. Thanks to many volunteers, teachers, and students for another successful Science Night!



One of the most exciting parts about the event for me was to see each of the AP Biology students present their posters about their independent projects. Since last September, I've been working closely with them to go through the entire process of science including picking interesting questions, designing an experiment and analyzing the data. Students picked diverse topics ranging from the effects of temperature on fruit fly reproduction to the impacts of road salt on duckweed survival. I must say that I have been pretty impressed by their dedication and enthusiasm. It has been a very rewarding experience for me to work with them and I am very proud to see them complete their independent project. Mrs. Sandy Breteinbach and I also took 14 students to present their work at the Math and Science Symposium at Grand Valley State University in April (see page 14 for a report on the event).



My research focuses on how soil bacteria make it possible for plants to live in different habitats. Soil bacteria,

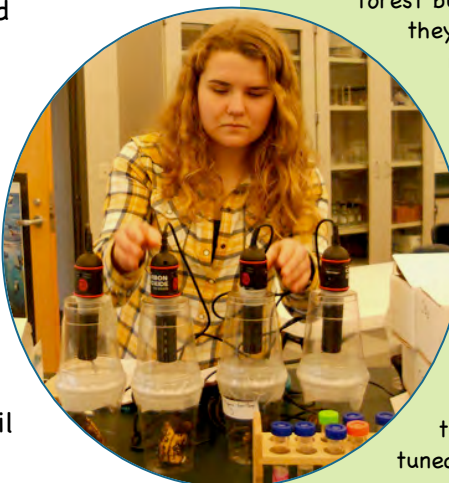
called rhizobia, live inside the roots of some plants - legumes (members of the pea family) - and act like natural fertilizer. Rhizobia convert nitrogen that comes from the atmosphere into a form that legumes can use. In turn, legumes may provide photosynthetic carbon to the rhizobia. This beneficial interaction is called a mutualism. As you can imagine, rhizobia can help plants grow in areas where they might not live otherwise. But rhizobia are not always helpful to plants, or may not be even available. For example, rhizobia may not survive or convert nitrogen effectively in certain environmental conditions, like dry soil or low pH. Using native legume called hog peanut, I am studying how climate change affects the interactions between legumes and rhizobia.

Last summer, I documented some of the key environmental conditions that may determine where these legumes grow in southwest Michigan and isolated rhizobia from seven sites. Hog peanuts tend to grow in small patches in the

forest but it's unclear why they grow in a certain

microhabitat. Is it because rhizobia are distributed in a patchy way or are abiotic factors simply driving this pattern? This summer, I am going to conduct a series of field and greenhouse

experiments to test this hypothesis. So stay tuned!



With summer fast approaching the nights will soon be filled with the sounds of frogs and toads. Male frogs and toads call to attract females, and my research focuses on studying this calling behavior. I am interested in determining whether males that are near the end of their lives alter their calling behavior. Much of this research involves making audio recordings of males calling in their natural habitat during the breeding season. During the past fall and winter I worked in a histology lab examining the toe bones of the males I have recorded. Frogs and toads develop growth rings on their toe bones, and by counting these rings I can determine the age of individuals. The analysis of these bones is ongoing, but I hope to have age estimates very soon.

Currently I am preparing for the coming breeding season. This year I will be initiating an experiment examining how males of different age respond to the presence of a potential predator. To do this, I plan to measure how long males take to resume calling after being exposed to the sound of a predator. My prediction is that older males who are closer to the end of their life will behave riskier by resuming calling more rapidly than younger males.



Plainwell

By GK-12 Fellow Michael Kuczynski

Hello, my name is Michael Kuczynski, I am the GK-12 fellow at Plainwell Middle School. Over the past year I have had the opportunity to work in a number of different classrooms covering a variety of subjects for grades 6, 7, and 8. In Marty Green's classes, I designed and presented several different lessons covering a variety of earth science topics. In one activity, students got the chance to search for evidence of continental drift. Another activity had students playing a game about different types of storms and the damage they can cause. In Bob Farris' and Maggie McGreggor's classes I was able to present lessons teaching life science concepts. Students played a card game that had them play the part of a landowner or farmer to demonstrate the importance of biodiversity. In a different activity students got to step into the role of birds foraging in different environments with different beak shapes to learn about how genes and the environment play a role in determine an organism's phenotype. By engaging students with these activities I hope to make science more approachable to the students. Many of the activities I have developed are games or

have game-like qualities. This is my attempt to make learning more enjoyable for the students. I believe that if a student generally enjoys being in a class then he/she is going to be more likely to care about the material, put forth a greater effort to succeed in the class, and retain more of the information presented.

Furthermore, if a student enjoys going to science class they may be more likely to consider science as a potential future career.

In Plainwell we successfully completed the district's annual Science Night. Science Night is a great opportunity for kids and their families to learn about science taking place in the local community, and for students to show off their own work. A variety of local community organizations set up tables with demonstrations or informational activities in the middle school. Additionally, students from the high school and elementary schools presented science projects to their peers. This year we had groups such as the Kalamazoo Bee Club, Great Lakes Geoscience, WMU chemistry club, SPM Wind Power, several KBS graduate students (I talked about frogs and toads), and many others. Science Night exposed students to a wide variety of science from many different fields, and hopefully inspired some to pursue science in their future education.



Vicksburg

By GK-12 Fellow Christine Nieman

The Vicksburg Community School District continues to increase their science knowledge in the classroom! Over the winter I have done several lessons that have helped the students better understand graphs and general science concepts. For one lesson, I put together a worksheet that incorporated my research. The students were given information about the amount of feed offered to cows and the amount of milk they produced. Students made scatter plots showing a positive correlation between feed offered and milk produced. Learning how to read graphs is an important skill that I have tried to incorporate into my lessons. Recently, we played a game called "Michigan Monsters", which focuses on the spread invasive species in Michigan. The game taught the students what an invasive species was, how scientists try to control it, and how the invasive tries to survive. This was a great interactive game for the students. I followed up the game with another lesson, in which, I described several invasive species in Michigan; where they came from, how they got here, and how they are affecting the ecosystem. The students were eager to share their stories about encounters with invasive species, particularly zebra mussels and mute swans.

The Environmental Club at Vicksburg is still very active. During the winter, the club took a field trip out to the KBS dairy and bird sanctuary. I was able to show them my research subjects, the cows, and also the robotic milking machines. The students had the opportunity to



get the full research experience and put their hands into a rumen-cannulated cow. We took rumen fluid samples from the cows and later brought the samples to the lab and tested the pH. The students seemed very interested in learning about how the KBS cows volunteer to be milked in the robot. Our second stop of the field trip was at the bird sanctuary where we identified birds in preparation for the Backyard Bird Count. We also took a tour of the bird sanctuary and got to feed the swans and ducks. It was one of the coldest days of the year, but the students really enjoyed their experience at KBS! Our next trip is to the Critchlow Alligator Sanctuary in Athens. We are all very excited to see the alligators and learn more about them and their habitats!

We all know that the cows at the KBS dairy eat grass as the main component of their diet, but did you know that



the amount of milk cows can produce may be related to the quality of grass in the pasture? Part of my research focuses on how pasture quality and milk production changes over the grazing season as a result of management decisions. The fiber content of a forage increases as it reaches its maximum height, so if a pasture is grazed more often it should have lower fiber content and, therefore, be of higher quality. Cows also prefer eating higher quality pastures because the leaves are more easily digestible, which should result in higher intakes. In order to assess fiber content, I took hundreds of fresh pasture clippings and dried them in an oven. Over the course of the winter I have been analyzing those samples. I have seen big differences in pasture quality between the different pasture species at KBS, this is because legume based pastures are generally more digestible due to their high protein content. I am predicting that milk production will

be higher on the high quality legume based pastures.



Plainwell AP Biology Students share their science at the Michigan High School Math and Science Symposium

By GK-12 Fellow Tomomi Suwa

April 25th was a big science day for 14 students from Plainwell high school. They each presented a poster on their independent project at the Michigan High School Math and Science Symposium at Grand Valley State University. Among 40 other presenters from Southwest

Michigan schools, the students from Plainwell represented their school very well.



These students are from Mrs. Sandy Breiteinbach's AP Biology class and since last September, I've been working closely with them to go through the entire process of science including picking interesting questions, designing an experiment and

analyzing the data. They each came up with creative projects such as the effects of spotted knapweed on native plant species, differences in decomposing rates between organic and conventional fruits, and the potential effects of watermill pollution on invertebrate organisms in the Kalamazoo River.

At first, they looked nervous about presenting their work in front of other high school students and teachers. But they quickly warmed up and seemed to enjoy the experience. I was very proud to see them complete their independent project and to share their findings to their peers. I think the Math and Science Symposium brought the year of independent projects to a successful close. Congratulations!





Mark Your Calendars- Happenings at KBS

May

24th: GK-12 Fellow and Partner Teacher Orientation. Terrace Room. Email Robin with questions (hibbsr@msu.edu)

26th: Nests! Join the folks at the Bird Sanctuary as they go out in search of nests and baby birds – it's that time of year! Contact birdsantuary@kbs.msu.edu with questions. A Family Event!

June

25-29th: KBS K-12 Partnership Summer Science Institute. RSVP to Sara at parrsar1@msu.edu. You can see our evolving agenda at <http://www.kbs.msu.edu/education/k-12-partnership/workshops/601-kbs-k-12-partnership-summer-institute-2012>. New teachers are always welcome and administrators are invited to join us on Monday, June 25th. See you then!





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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