

## **Ecologists, Educators, and Schools: becoming mentors, teachers, and colleagues through the Montana GK-12 Program**

Ten PhD candidates in the University of Montana ECOS (Ecologists, Educators, and Schools) GK-12 program are showing school children and their teachers how to use an ecological lens for viewing their schoolyard. Instead of a playground and weed patch, they see a laboratory filled with organisms with interesting adaptations and interactions, gradients and microhabitats, dynamic populations, patterns of disturbance, and successional changes. The fellows are modeling what ecologists do by immersing themselves and their student and teacher collaborators in ecological investigations in schoolyard and classroom laboratories. In each of the partner schools, fellows are creating demonstration projects for learning about ecology. At several schools ECOS teams, comprised of fellows, teachers and their students, are restoring habitats by removing invasive weeds and replacing them with native plants, or starting school-wide composting projects to better understand nutrient cycling.



*Sharen Kickingwoman and Alyssa Bashor eliminate invasive weeds in the Target Range School Restoration Garden and Outdoor Ecology Laboratory.*

At one school, students are conducting an experiment to examine the influence of fire on biodiversity; a controlled burn in the school's experimental plots is set for April. But the fellows report that this is not a one-way flow of expertise. The fellows are learning how to teach from great mentors - both the children and teachers with whom they work! All of the fellows report that this teaching experience has improved their ability to communicate about their work with non-scientist audiences such as parents and the public, and will

help them be better teachers as they move into academic positions. One fellow reported that, " I believe that [ECOS] experiences, beyond just changing the ways I can work, have changed the ways I want to work." Furthermore, by getting involved in the ecological education of young children, the ECOS Fellows are fostering learning that provides a strong sense of place and connection to local environments, and an understanding of ecological processes and relationships in these environments and beyond. One fellow summed this impact up this way. " To get across my message I need to be creative, stay away from scientific jargon and put my message into a context that the kids know intimately. We do not talk about environmental pollution in general, but rather the problems with litter in the schoolyard. Instead of solid waste management as a global or national issue, we are beginning a school-wide composting project to re-use lunchroom waste. Perhaps the most valuable part of our lessons is that the kids take part in making a change to something they really care about. As a conservation biologist in an underdeveloped country, I am constantly struggling for ways to get across the value of environment and the importance of environmental conservation. Next time I am overseas, I will be more effective in speaking with local communities about conservation ."



*Students from Big Sky High School learn how to make population estimates of fish populations in the Bitterroot River, Montana.*

The Montana GK-12 program has just completed its first year, and the first cohort of fellows just finished their first semester in local schools in western Montana. Already they have commented that their experience has helped them learn to communicate about their research more effectively, become better teachers, and to influence what children know about the environment through teaching and mentoring.

### **Learning to Communicate About Science and Impact on Fellows Future Careers**

One student reflected that, " As a PhD student involved in the ECOS GK12 program, my experiences and contributions provide direct benefit to my program of study and my career potential. Participation in the ECOS program has given me exposure to and forged connections with students and researchers in related disciplines, which has increased the scope and breadth of my scientific knowledge. I have been called upon to present my research to various audiences from the GK12 to university level, which has strengthened my understanding of my work and its real-world implications." Another fellow wrote, " the community-building this program promotes has helped dispel fears of ecologists as threats to local jobs (i.e. logging). Through this increased communication between teachers, students, parents, and ecologists, the community comes to perceive ecologists as everyday people and less threatening. This ultimately will benefit my career as a scientist, because a population that is aware of what ecologists actually do may prevent conflicts and promote cooperation when conducting research on public lands ." These experiences already are having an impact. " A large part of my research is applied in nature. It is very important that I be able to communicate to my peers, to government scientists, and to the public. My experiences with ECOS thus far have improved my ability to communicate at all of these levels ."

### **Maturing as Teachers**

Fellows report that the teaching experience offered through the Montana GK-12 program has been especially valuable in their career development. For example, " in developing and presenting science-based curricula in the GK12 setting I have improved my skills as a teacher, and learned to listen to students in order to facilitate better learning. I have learned that teaching and learning do not necessarily occur in a linear fashion, so that by allowing flexibility in exploring new topics students gain more thorough understanding and a greater love of learning. I believe these experiences will benefit my skills as a teacher at all levels, from GK12 through university." Another fellow who had not had extensive prior teaching experience reported that " over the last four months, I think the 4th and 5th graders at Sussex have taught me more than I have taught them; being a good teacher requires not only technical knowledge in a particular subject, but also great interpersonal skills. I have to get to know them and their educational background. I have to be fun yet authoritative. I have to learn how to communicate scientific information to kids in a way that is easy for them to understand but also conveys respect for their intellect. I have to challenge them enough to get them thinking but not so much that they become frustrated. Now that they have taught me all of this, perhaps next semester I can teach them something equally important ." Another fellow reports " A gap in my graduate education prior to ECOS was the knowledge of how to be a good teacher. I have been inspired by the quality of educators we work with and have learned more about effective teaching by working directly with our teachers in the classroom setting than I had hoped ." A fellow with significant teaching experience prior to becoming a GK-12 fellow recounted that " working with ECOS has rekindled my teaching ambitions. I have started working on a chapter of my doctoral dissertation that will focus on entirely on development of ecologically-based lesson plans for middle/high school science classes. And, I have started thinking seriously about focusing my career on improving biology education. In particular, I am interested in becoming involved in teacher training,

curricula and program development, and, eventually, assessment and continued development of academic standards ." The GK-12 experience is richer than the typical college lab teaching assignment, according to one fellow: " Since my time in the ECOS program I have been able to watch master teachers educate their students, develop lesson plans, and instruct various students. Prior to this experience the only teaching instruction I have received was teaching entry level biology labs at UM. This normally entailed providing lectures and lesson plans that were developed by another instructor. Involvement in this program has strengthened my career path, by placing me in a situation where I could receive training to be a teacher, develop lesson plans, and work with a vast assortment of students that would challenge my skills as an educator. The opportunity to do this has provided me with ample feedback in order to hone my skills as an educator ." And the fellows also are pragmatic about the value of the experience. " The ECOS experience will also (hopefully) make me a more competitive candidate for academic positions and strengthen my teaching credentials when I apply for jobs. "

### **Influencing Children through Teaching and Mentoring**

All of the ECOS fellows have reported many experiences that testify to the impact they are having on students' knowledge and interest in science. For example, a fellow in a rural K-12 school relayed this reflection on her experience. " There are several girls in fifth grade who are adamant about becoming scientists and 'getting their hands dirty'. Several students collect information on the web or from the library during the week so we can talk more on a topic after discussion the previous week and often, unanswered questions from several sessions past come up again. A lot of the students didn't realize how many ways a person can 'do' science and feel more comfortable with the process of asking, then answering questions. It is a thrill ." GK-12 fellows enrich the classroom atmosphere. According to one fellow, " the greatest benefits of this GK-12 program will be to the students in class that participate. These students benefit from [having] more teachers in the classroom, which allows for greater personal attention and mentorship. Students who have difficulty with science will receive greater attention and ultimately learn more. This increased mentorship could translate to more students entering the sciences ." The children look up to the fellows and look forward to their classroom visits. A fellow in a rural school relates these observations: " I have experienced a level of fulfillment in teaching ecology to elementary school children that I never realized in teaching at the college level. For example, I have watched 1 st graders figure out all by themselves why the earth has seasons. I've watched them come to the realization that individual earthworms are both boys and girls. I've caught them as they dropped from limbs of trees when they suddenly become too scared to descend. I've watched them learn that being quiet in the woods can be much more rewarding than being loud. And, in working with kids, I have learned that darned near every moment in a young person's life can be meaningful . "

In every classroom, every day, ECOS fellows are mentors. By example, and through their passion for science and learning, they are demonstrating that careers in science are not only possible, but also that these careers are exciting and important. A fellow in a local high school offered that "one of the most important influences we have had is to simply



show these students what scientists are really like and what they really do. I do not think many of the students we interact with would give much consideration to scientific careers. I hope we are making some students realize that such a career is a possibility. During one interaction I had with a student while we were sampling fishes, I realized that we are having this effect. A generally quiet student said to me, "You have a great job", with incredible earnestness in his voice. Students eagerly await our return to their classroom and I think we have successfully made the students enjoy the times we are in their classroom, which was a major goal of ours from the beginning ." Another fellow has seen her view of her role as a mentor expand through her GK-12 fellowship. She says, " As a woman and a scientist I entered into the ECOS program with a goal of mentoring girls in the study of science. As the year has progressed I have tried to fulfill that goal, but have expanded it to include both girls and boys, at all levels of intellectual development and scientific understanding. One of the great benefits of the ECOS program for GK12 students is that we are given the time and context to teach to small groups or single students, so that all students receive individualized attention. Some of my most rewarding teaching moments have been spent focused on one or two students as they, with open minds, explore the world around them - happy that they are given the opportunity to ask questions, and confident that their ECOS mentors will have all the answers. " But perhaps the most telling influence is summarized by this fellow: " By teaching science through ecology in an outdoor setting, we have reached students that self-admittedly are not interested in science. Over [the semester] break, our students have continually asked our partner teachers when we will return to the classroom; this is the best reward a person could hope for! I truly believe this will be an experience some students will remember the rest of their life and may influence their career path ."



