No 2007 Monarch Distribution!

We will not be distributing monarchs in 2007. Many large-scale monarch distributors and researchers, including our lab, are having disease problems. Despite strict disease prevention efforts, mortality levels in our lab for the last two years were higher than acceptable. We are implementing hospital-like rearing conditions, with complete isolation of individual larvae. However, these measures will make it impossible to rear the numbers required for our fall distribution. We simply can’t justify the possible effects of releasing unhealthy monarchs into the environment, and we don’t want our customers to watch their larvae die. Additionally, the ever-growing magnitude of our distribution over the last 15 years means that we have no free time at the end of the summer, and compromises our ongoing research in August and September.

We appreciate your interest in monarchs and their environment. If you’re a teacher, we hope that you’ll find wild monarchs to rear with your students, and will continue to expose them to the wonders of this incredible insect. We are confident that you’ll be able to utilize the science teaching and learning techniques that you’ve perfected with monarchs in studies of other organisms.

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Greetings from the University of Minnesota Monarch Lab!

The focus of this year’s newsletter is finding ways to connect students with nature and the environment, getting them interested in science, and invested in creating a healthy, sustainable world!

There has been an exciting upsurge in interest about environmental issues over the past year. From the success of Al Gore’s documentary on climate change, An Inconvenient Truth, to a mention of alternative energy in the state of the union address, there is a perceivable movement toward a greater understanding of the influence humans have on the earth. We are finally taking notice that resources are finite and that there are consequences to our actions.

There is a growing hope that by making conscious decisions about the way we choose to live, we can stem or slow our impact on the environment. Sustainability has become a buzzword and making efficient use of our limited resources has become an important marketing tool for many industries, from agricultural programs to housing developments.

However, there is still a great deal of work to be done. Even if we take drastic steps today, the cumulative effects of problems like climate change mean that our children will have to contend with the consequences of our irresponsibility. Thus it is imperative that we provide them with knowledge and tools, not only to help them adapt to and remediate these problems.

As with so many things, education is the first line of defense. We need to inspire children to be a force of change. What better way to accomplish this than bringing them outside, exposing them to nature and the scientific process? This exposure will help to ensure that students come away from their education with a basic sense of the world’s environmental issues, and the will to take action to help.

We hope that this newsletter and our other programs will give you tools to take this message to your students, cultivating a crop of socially and environmentally conscious citizens ready to reshape the world.

“In the end, we will conserve only what we love; we will love only what we understand; and we will understand only what we are taught.”

Baba Dioum, 1968.

To view this newsletter in color visit www.monarchlab.org
New in 2007: Summer Ecology Institute

Boost your ecology knowledge and take away techniques and materials that translate directly to your classroom. Enroll in Schoolyard Ecology Explorations or Monarchs & More for a complete ecology experience. Institute activities will include large group presentations attended by participants in four institute courses, as well as special small group activities. You’ll choose activities most relevant to your own situation, based on the age of your students, the location and surroundings of your school, your own interests and needs, and content foci in your school. And you’ll have access to a large instructional staff that includes five college faculty and staff members, and 15 teacher mentors.

Participants who have previously taken Monarchs in the Classroom; Schoolyards, Science and Sustainability; or Insect Ecology will be able to choose activities they have not had in the past.

Monarchs & More: Insect Ecology for Elementary Teachers

Gain confidence and expertise in scientific inquiry as you learn to observe, maintain and collect insects appropriate for classroom and schoolyard study!

Elementary school teachers are invited to participate in an intensive, fun and inquiry-based study of insect ecology at the U of M. Learn basic ecological concepts, develop skills in scientific inquiry and prepare to translate these skills to the classroom as you develop new ideas to meet the requirements of standards based education. You’ll learn from expert classroom teachers as you participate in hands-on study of insects, developing experience with the process of scientific inquiry as you conduct investigations that are applicable to your own and your students’ scientific learning. Throughout the course, interdisciplinary connects and fun collegiality are emphasized. This course differs from the Insect Field Ecology course with its stronger emphasis on direct and interdisciplinary classroom applications for elementary teachers.

- Course dates and location: June 25-29 & July 23-27, UM St. Paul Campus
- Time: 8:30-3:30 Monday—Friday each week
- Target Grades: K-5
- Course capacity: 20 teachers in 1 section
- Instructors: Lead Instructors: Dr. Michele Koomen (Gustavus Adolphus College) and Laura Molenaar (elementary teacher). Teacher Mentor Instructors: Terry Vick, Mary Hedstrom, and Jane Blumer
- Compensation: All course fees, materials, lunches, per diem and 3 graduate credits will be covered by a grant from the MN Office of Higher Education.

Monarchs & More: Insect Field Ecology for Teachers

Experience the process of scientific inquiry through hands-on research with insects!

Middle and Elementary teachers are invited to participate in an intensive study of field ecology at the University of Minnesota and Eagle Bluff Environmental Learning Center. During this two-week summer workshop taught by expert elementary and middle school teachers and U of M scientists, you’ll learn field techniques for studying insects, ways to collect data, and basic insect ecology. The course blends lab activities, research and lectures that will enhance your understanding of scientific inquiry and provide new ideas to meet the requirements of standards based education. To provide more time for field study and collegial interactions, we will spend three days during week one (June 27-29) at the Eagle Bluff Environmental Learning Center. Week two will focus on techniques for transmitting these new principles to students, as you engage in activities that will be directly transferable to the classroom. This course differs from the Insect Field Ecology course with its stronger emphasis on inquiry-based research. If you’d like to enhance your own understanding of field ecology as you prepare to teach these concepts to your students, this course is for you. There will be ample time for grade-level interactions.

- Course dates and location: June 25-29 & July 23-27, UM St. Paul Campus & Eagle Bluff Environmental Learning Center
- Time: 8:30-3:30 Monday—Friday each week
- Target Grades: K-8
- Course capacity: 20 teachers in 1 section
- Instructors: Lead Instructors: Dr. Karen Oberhauser and Cindy Petersen (Middle School teacher). Teacher Mentor Instructors: Bruce Leventhal, Sarah Weaver, and Caroline Waskow (Elementary, Middle and High School teachers).
- Compensation: All course fees, materials, lunches, per diem and 3 graduate credits will be covered by a grant from the MN Office of Higher Education.

To apply for a course in the Summer Ecology Institute or other great UM summer courses for teachers, fill out a course application at www.cbs.umn.edu/hawk/2007teachercourses or contact Karen at oberh001@umn.edu. Applications received by April 14 will be given first consideration.
Unlock the research potential of your schoolyard by conducting inquiry outside with your students.

Share the thrill of discovery with your students using simple schoolyard inquiry techniques. Take two weeks this summer to train your eye to view your schoolyard as a resource for student investigations.

Expert classroom teachers and University of Minnesota scientists will teach techniques for studying plants and animals in urban, suburban and rural habitats. You’ll deepen your understanding of ecology and research during two days at the Cedar Creek Natural History Area, meeting with ecologists and touring their research sites. The inquiry focus of the course is woven into the study of ecological sustainability, with field and classroom study of the relationship between biodiversity and long-term ecosystem health.

Course activities will include instruction by expert teachers who use their schoolyards and gardens for student inquiry. Master Gardeners will be available to help you develop or enhance a schoolyard garden. Teachers will collaborate in grade-specific groups to integrate these experiences into their curriculum and to address standard requirements.

SEE for Elementary Teachers

- Course dates and locations: June 25-29 and July 23-27, St. Paul Campus and Cedar Creek Natural History Area
- Time: 8:30-3:30 Monday—Friday each week
- Course capacity: 20 teachers/section
- Instructors: Susan Barrott (University of Minnesota scientist), Lis Young-Isebrand (High School Teacher), Harmony Lewis (Elementary Teacher), Ann Mock (Elementary Teacher) and Ann Hobbie (Elementary teacher)
- Compensation: All course fees, materials, lunches, per diem and 3 graduate credits will be covered by a grant from the MN Higher Education Services Office, Improving Teacher Quality Program and the Bush Foundation.

SEE for Secondary Teachers

- Course dates and locations: June 25-29 and July 23-27, St. Paul Campus and Cedar Creek Natural History Area
- Time: 8:30-3:30 Monday—Friday each week
- Course capacity: 20 teachers/section
- Instructors: Dr. Robert Blair (U of M) and De Cansler (Rochester Middle School Teacher). Teacher Mentor Instructors: JoAnn Michet, Karen Kramer, Janet Larson (Middle and High School Teachers)
- Compensation: All course fees, materials, lunches, per diem and 3 graduate credits will be covered by a grant from the MN Higher Education Services Office, Improving Teacher Quality Program and the Bush Foundation.

To apply fill out a course application at www.cbs.umn.edu/hawk/2007teachercourses. Applications received by April 14 will be given first consideration.

Schoolyard Ecology Explorations (formerly Schoolyards, Science and Sustainability)

Schoolyard Garden Grants!

What do Willow Creek, Groveland Park, New London-Spicer and Battle Creek Schools have in common? They and 23 other Minnesota schools received NEST Schoolyard Garden Grants in 2006 and 2007! 2007 was our second year of garden grant distribution to K-12 schools. Monarchs in the Classroom, Schoolyard Ecology Explorations and the NEST Foundation have been honored to help support teachers who increase student connections to the natural world through learning opportunities in schoolyard gardens. 2008 will be the third year of distribution. We hope you will begin your schoolyard garden dreaming and apply for a grant this fall!

Grant applications will be available on-line in September at www.monarchlab.org, with a due date of December 1, 2008. Please email lis@monarchlab.org if you are interested in applying for a schoolyard garden grant in the fall of 2007. For more information see page 6 for a full page report.
We live in a society today where children have increasingly less contact with the natural world. With the invention of computers, video games and DVD's, there are a plethora of experiences to be had indoors and even the most active children are missing out on time in nature. Today, American children, ages 2-17, watch television on average almost 25 hours per week (or 3 ½ hours a day) leaving time for little else! (MediaFamily.org, 2007). Instead of biking between friends’ houses and catching frogs in ponds, they are often being shuttled from organized sporting events in minivans, surfing the internet and sometimes missing the natural world completely.

This disconnect from nature is concerning on a number of levels. Many studies have been conducted on the effect of the natural environment on children’s success. It has been demonstrated that improving the “greenness” of the home environment increases the cognitive ability in children. In his book, The Last Child in the Woods: Saving Our Children from Nature Deficit Disorder, journalist Richard Louv points to studies which indicate time playing in nature can reduce stress, increase creative problem solving and reduce the symptoms of ADHD, factors which are ever more prevalent.

As we become more disconnected from nature, the world is facing new and severe environmental challenges. From the extensive loss of biodiversity, to anthropogenic climate change, the earth is quickly being stretched beyond its ability to recover from our misuse. The consequences, from increased severe weather incidents to vast “dead zones” in our worlds oceans, are apparent, and getting worse. Although we have become increasingly adept at separating ourselves from the natural world, and are extremely careless with natural resources, we still rely on the services of a healthy ecosystem for our very survival. It is disconcerting that just as we need a generation of environmental problem solvers to put the world back together again, our children are being raised without a connection to the natural world. Although they are increasingly knowledgeable about many environmental issues, they often lack the ownership that comes with living with and learning in nature. As Louv says, “If kids are not going outside, who in the world is going to care about the spotted owl in 15 years?”

Luckily there is a way to combat this disconnect in nature; quite simply, get kids outside! And what better place for this than in school? Getting kids out into your schoolyard to plant a garden or to create a schoolyard field guide can be fun and rewarding, both for you and your students. And in these outdoor experiences there is limitless opportunity to teach lessons about ecology, science and sustainability, giving students an applied knowledge of environmental issues, a sense of responsibility to the earth, and perhaps a desire to make responsible decisions for the future. Take a few of our ideas here, or join us for a summer class (where you can spend some time outdoors yourself – see pages 2 and 3) and discover how much fun introducing kids to nature can be!
One of our favorite ways to get kids outside is to get them involved in gardening! A simple butterfly garden can provide a forum to discuss species diversity, plant and animal interactions, and the effects of pesticides and chemicals on the environment. Plus, there is nothing like the satisfaction of getting dirty on planting day, and watching the fruits of their labor grow into a beautiful living garden for getting kids invested in nature. Here is a simple garden plan and species list to get you started!

Choose a suitable spot for your garden, somewhere that is somewhat sheltered from the wind, yet receives at least six hours of sunlight per day and has water availability. It is also preferable to select flowers which will maximize blooming during the summer, providing consistent nectar for hungry butterflies. Here is a simple garden plan and species list to get you started!

Note: These species provide nectar sources for a variety of butterflies and other insects. You may also want to consider adding other larval food sources, such as parsley or other plants in the carrot family for Black Swallowtails.

- Meadow blazing star (*Liatris ligulistylus*)….Nectar
- Black-eyed Susan (*Rudbeckia fulgida*)….Nectar
- Goldenrod (*Solidago spp.*)………………..Nectar
- Columbine (*Aquilegia Canadensis*)…….Nectar
- Aster (*Aster spp.*)…………………………..Nectar
- Purple cone flower (*Echinacea spp.*)….Nectar
- Swamp Milkweed (*Asclepias incarnata*)…Nectar and larval food source for monarchs
- Cardinal flower (*Lobelia cardinalis*)…….Nectar
- Prairie Smoke (*Geum triflorum*)………..Nectar
- Switch Grass (*Panicum virgatum*)………..Erosion prevention
- Big Bluestem (*Andropogon gerardi*)…….Erosion prevention

The swamp milkweed used in the garden plan above is one of many options when attempting to attract monarch larvae to your butterfly garden. Other popular species include:

- Common Milkweed (*Asclepias syriaca*). This common plant grows quite well in disturbed soil. Its large leaves and round purple umbels are distinctive, and the tall stalk can be pruned to encourage a shorter, bushier shape.

- Tropical milkweed, *Asclepias curassavica*. This annual plant (in locations with cold winters) has beautiful red and yellow flowers that make it an attractive choice for butterfly gardens.

- Whorled Milkweed, *Asclepias verticillata*. Also known as horsetail milkweed, this plant has distinctive needle-like leaves and white flowers.

Reminder! When working with milkweed, either in your garden or as you prepare it for hungry monarch larvae, it is important to remember that its latex can be an eye irritant. This fall, Monarchs In the Classroom teacher Karen Sabatke learned this the hard way when she ended up in the ER with a painful chemical burn to her cornea after rubbing her eye while processing tropical milkweed! Always make sure that your students wash their hands after handling milkweed. Better yet, get out the class set of safety goggles when they will be handling large quantities.
Diversity is the spice of life, even in schoolyards! In the past two years Schoolyard Ecology Explorations (SEE) - formerly Schoolyards, Science and Sustainability - has supported the creation of 27 Minnesota schoolyard gardens. Through generous funding from the NEST foundation (www.nestfdn.org), teachers have been invited to apply for the NEST Garden Grants to support the creation, expansion or better use of a schoolyard garden. In the past two years, we’ve distributed over $29,000 to buy plants, mulch, gardening equipment, curricula, books and benches. All of these items help make a schoolyard rich with diverse species of plants and animals, including curious children and motivated teachers! Schoolyard gardens help SEE meet its objective of teaching about ecology and sustainability by fostering connections between students and nature.

Research has shown that students today spend far less free time enjoying and investigating nature than they did in the past, and that this can have many negative consequences (see page 4). Schools can play an important role in encouraging students to make connections to nature by incorporating outdoor learning experiences in their curriculum. NEST Garden Grants have helped hundreds of students spend time outside learning about science, art, math and more, and teachers have reported increased motivation and cooperation when students learn outside. For example, Judy Slegh of PACT Charter School wrote “This grant has made a vast difference in my student’s lives. It has brought practical skills to many students to accentuate their academic learning.”

Here are just a few of the terrific ways our 2006 NEST grant teachers have used their gardens for student learning:

- Practicing the scientific method by using garden plants and animals to make observations, generate hypotheses and conduct experiments.
- Collecting insect larvae to rear and observe.
- Teaching students about annuals, perennials, and biennials, to differentiate between monocots and dicots and understand different root types.
- Learning to identify plants using field guides.
- Teaching about systematics by creating a dichotomous key for the plants in the garden.
- Learning to plan, plant and maintain a garden.
- Using the garden as a site for creative writing.
- Creating sculptures and stepping stones and other forms of art to enhance the garden.

Even if you do not yet have a garden, most of the lessons above can be done with trees and shrubs! So, consider taking your students outside to discover what is already present in your schoolyard and ripe for learning.

We hope to have funding for a third round of NEST Garden Grant funding for the fall of 2007. Applications will be accepted between September and December 1st. Information is available at our web-site, www.monarchlab.org or by e-mail (lis@monarchlab.org).
Schoolyard Attitude is Key!

“It is not half so important to know as to feel when introducing a young child to the natural world.” Rachel Carson

Research has shown that teachers’ attitudes about the schoolyard have an impact on the attitude of students towards the plants and animals in the schoolyard. Students are naturally curious about their environment, and adults that encourage their interest have a vital impact on student’s connection to nature (Malone & Tranter, 2003). Take a moment to think about your attitude towards your schoolyard. If your students were to bring you an insect they found, how would you react? Would you ask to look more closely or scrunch up your nose? Your reaction can have a crucial impact on students’ attitudes, especially if the students come from urban environments where their contact with nature is infrequent.

So, rather than read about the patterns that exist in the natural world orgo taking students outside to discover them. There are many lessons available on the web or in our MITC and SEE curricula that utilize the schoolyard as a site to teach about numerous topics. You do not need a picture perfect garden to carry out insect sampling. Read the tips and take your students outside tomorrow!

Follow these tips with your students to encourage interest in the natural world:

1. Leave your nature phobias behind! If you run screaming across the yard at the site of a bee you’ll exacerbate the fear of nature in your students! Spend time outside to acclimate yourself to the buzz and occasional contact with insects.
2. Respect the natural hesitancy of students towards insects. Use plastic tubs that keep insects contained but visible.
3. GET EXCITED! Share in the discovery with your students, even if you have seen it 100 times.
4. Ensure that the rigor and importance of outdoor assignments match or exceed in-class assignments. Traditionally the schoolyard has been a place to play or gain physical skill, so your content rigorous assignments and attitude will have to break this barrier.
5. Increase the frequency of your outdoor assignments. After a number of important outdoor assignments students will begin to view the outdoors as an extension to the classroom and feel more comfortable outside.

Malone & Tranter (2003) School Grounds as Sites for Learning: making the most of environmental opportunities, Environmental Education Research Vol.9 No. 3

Recipe for the “Three Sisters Garden” teaching garden

The Three Sisters Garden is an agricultural technique that Native Americans utilized hundreds of years ago. This garden of corn, beans and squash embodies multiple lessons because of its folklore, the ecological interdependency of the three species and the gardening involved. A simple web search will locate numerous resources related to the Three Sisters Garden and the Iroquois legend. The ecological interdependency is relevant to nutrient cycling as well as nutrition. The beans are “nitrogen fixers” which make nitrogen available to other plants. Squash grows along the ground and the leaves cover the ground to prevent moisture loss and other plants from taking up root nearby. The corn is tall and provides support for the beans to climb upon. This interdependency of the “sisters” sustained one another.

Traditionally this garden is planted as a round mound. Use early sweet corn, scarlet runner beans and a gourd or pumpkin species. Choose a space in the garden that has at least a 6 foot diameter. In the spring when night time temperatures stay above 50 degrees F, at least mid-May in Minnesota, plant about 8 corn seeds in the center of the mound. When the corn is 4” high thin to 4 plants and plant 6 bean seeds 6” away from the corn and 6 squash seeds 12” from the beans. Thin the bean and squash plants to 4 after they emerge. Add mulch to reduce weeds until the squash can cover the ground. Keep this “garden of thanksgiving” well watered over the summer and enjoy the harvest in the fall.

Three Sisters Garden Plan

[Diagram of a round mound with corn, beans, and squash plants indicated]

Malone & Tranter (2003) School Grounds as Sites for Learning: making the most of environmental opportunities, Environmental Education Research Vol.9 No. 3
This year, monarchlab.org revived our online “Ask the Expert” feature and received a great response! Questions came in from far and wide and a few of the best have been collected here. If you and your students have monarch questions this is a great way to share them! To avoid duplicate questions we suggest that you or your class review the online question archive before formulating one great class question to submit.

Q: What is the function of the gold dots on the chrysalis? Are they really made of gold?  
(Submitted by Kathy Doyle on 6/27/2006)

A: Interestingly, the word chrysalis comes from the gold-colored spots found on some butterfly pupae, including monarchs and other milkweed butterflies (the family Danaidae). Chrysos is the ancient Greek word for gold. Milkweed butterfly pupae have an amazing array of metallic coloration.

Fred Urquhart studied the gold spots on monarch pupae in the 1970s. He concluded that they were involved in the distribution or formation of wing scale coloration. However, the experiments that lead him to think this involved cauterizing the gold spots, and it is possible that this process may have damaged the underlying tissue and affected the color patterns. A line of evidence against his hypothesis is the fact that, while many danaid butterflies have very similar wing patterns, the location and number of metallic spots on their pupae vary.

The spots are not made of metal; monarch pupae do not contain real gold. They look like gold because they reflect light like metals do. Other danaids have silver, copper, or gold spots. The reflection colors occur several hours after pupation, first as blue or greenish hues which later become gold or silver. They vanish about 24 hours before the adult emerges. Three German researchers determined how this occurs in the 1980’s. They learned that the metallic colors are caused by up to 250 pairs of dense and clear alternating layers in the endocuticle (outside layer of skin). These layers reflect and transmit light differently, and cause what is known as constructive interference of light; in essence, what happens is the layers of cuticle become very reflective, making them look like metals. The changes during pupa development happen as the cuticle layers form and decompose.

While we understand how the spots look metallic, we are not sure just why Danaids have metallic spots. Here are some hypotheses that have been suggested; perhaps you can think of others:

- **Camouflage** — they could reflect colors of the surroundings and break up the shape of the pupa; they might also look like dew droplets on a leaf.
- **Warning coloration** — because Danaids eat milkweed, they are toxic to many predators. It is possible that the metallic colors warn predators of this toxicity.
- **Protection** — The spots may filtering particular wavelengths of light which are harmful to the developing monarchs. We don’t think this is the case, because they only occur on a small portion of the monarch pupal cuticle. Some Danaids, including one named *Euploea batela*, which lives in Papua New Guinea, have metallic coloration over their entire pupa.
- They might not have any function.

Q: Why is the egg black before it hatches?  
(Submitted by Andrea Beauchamp on 10/4/2006)

A: Just before a monarch egg hatches, the dark pigmentation of the monarch’s head capsule develops. This is visible through the translucent egg shell and gives the egg its characteristic grey dot!

Q: How does [the caterpillar] stay alive in the egg if the egg is closed in? Wouldn’t they have no oxygen?  
(Submitted by Nick Peterson on 9/29/2006)

A: The egg shell (called the chorion) consists of several layers that make it resistant to damage and allow the exchange of oxygen and carbon dioxide for the developing embryo. It contains small, water-repellent pores (or holes) through which air is exchanged, and small openings called micropyles through which the sperm enter the egg to fertilize it.
# Monarchs in the Classroom Catalogue

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<th>Product Description</th>
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<tr>
<td>Curriculum Guides. 225+ page curriculum with lessons on life cycle, butterfly semantics, ecology, conservation, experiments, and migration. Separate guides for K-2, 3-6, and MS (please specify).</td>
<td>$18.00</td>
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<tr>
<td>Monarch Larval Field Guide. Spiral bound, plastic-covered field book with descriptions and drawings of larvae for use in identifying instars.</td>
<td>$7.00</td>
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<tr>
<td>A Field Guide to Invertebrates on Milkweed. 96 page, full color, field guide to invertebrates found in milkweed, with index, glossary and table of contents.</td>
<td>$9.00</td>
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<tr>
<td>The Monarch Butterfly: Uniting a Continent. An introductory book on Monarch Butterflies, available in both Spanish and English. Note desired language on order form.</td>
<td>$9.00</td>
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<tr>
<td>The Monarch Butterfly: Biology and Conservation. Research papers by dozens of monarch biologists, citizen scientists, teachers and students covering all aspects of monarch biology.</td>
<td>$40.00</td>
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<td>Monarch Come Play With Me. See description on page 11.</td>
<td>$11.00</td>
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<tr>
<td>Milkweed Visitors. See description on page 11.</td>
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<tr>
<td>The World of Monarch Butterflies CD. 31-slide powerpoint presentation with accompanying script. All stages of development, migration, overwintering and milkweed host plants are highlighted.</td>
<td>$15.00</td>
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| Classroom Slide Sets. 23-24 slides per set with script:  
  - Yearly Life Cycle. Summary of individual and migratory cycles  
  - Ecology. Interactions between monarchs and their living and non-living environment  
  - Overwintering Biology and Conservation. Migration, winter in Mexico and CA Each set: $20.00 |       |
| Butterfly King Video or DVD (please specify preference). 20 minute video highlights monarch metamorphosis. | $13.00  |
| Saving the Monarchs Video. 30 minute KSTP TV production demonstrating how students, teachers, & scientists work to promote monarch conservation. Beautiful footage of the overwintering colonies. | $10.00  |
| Monarch Life Cycle Poster. Photographs of monarch stages egg to adult. 17x22 inches, laminated. | $10.00  |
| Community Connections Poster. Highlights components of a monarch’s habitat. 24 x 36 inches. Laminated: $10.00 Unlaminated: $8.00 |       |
| Game of Monarch Life. 22”x28” color, laminated game board. Students trace the life cycle of a monarch through all stages and migration, answering challenge questions as they play. Ages 6-adult. | $17.00  |
| T-shirts. Monarch Watch: Migrating butterflies front and back. Short sleeves only: M-XXL  
  Monarchs in the Classroom: Butterfly logo on sleeve. Long or short sleeves: S-XXL  
  Start Seeing Bugs: A look at the milkweed community. Short sleeves only: S-XXL Short sleeve: $15.00 Long sleeve: $18.00 |       |
| Monarch Classroom Starter Pack. Includes: 1 Monarchs in the Classroom curriculum guide, 20 My Monarch Investigation journals, 1 Game of Monarch Life, and 1 Life Cycle poster. | $95.00  |
| My Monarch Investigation. A 32-page journal designed to be a permanent, personal record of each student’s investigation of the life cycle of the monarch butterfly. Individual: $5.00 Bulk, 20+: $4.00 each |       |
| Life Cycle Cards. A set of 16 laminated cards highlighting the metamorphosis of the monarch butterfly. Color images are backed by identifying features of all stages of the monarch life cycle. | $8.00   |
| Annual Life Cycle Cards. See description and photo on page 11. | $10.00  |
| Monarch Life Cycle Bulletin Board Figures. Set of punch-out bulletin board figures depicting the four stages of the monarch life cycle. Individually: $4.00 Set of 6: $18.00 |       |
| Pencils. Two designs: monarch larvae and monarch adults on a white background. Specify design. Individually: $0.50 Set of 30: $10.00 |       |
| Tub Cages. Translucent plastic cages with screen top. | $5.00   |
| Classroom Visits. 45-60 minutes. Travel costs extra. | $60.00/hour |
| Teacher Workshops. One hour to 3 days, before or after school, or on in-service days. Travel costs extra. | $100.00/hour |

All products can be previewed and purchased online at: www.monarchlab.org.
2007 ORDER FORM (or order online at www.monarchlab.org)

NAME AND SHIPPING ADDRESS: ________________________________
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Home Phone ___________________________
Daytime Phone _________________________
E-mail address _________________________
Grade level(s) _________________________

INSTRUCTIONAL MATERIALS (SPECIFY SIZE/TYPE/EDITION ETC):

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Shipping and handling for Instructional Materials:

| Under $16: | $2.50 |
| $16-$30:    | $4.50 |
| $31-$60:    | $6.00 |
| Over $60:   | $8.00 |

CALCULATE AND RECORD THE GRAND TOTAL BEFORE DETACHING THIS FORM AND SENDING IT WITH P.O. OR CHECK PAYMENT TO THE ADDRESS BELOW.

Payment to U of MN MONARCH FUND must be enclosed or received before pickup or mailing, with the exception of purchase orders. Send order to: Dr. Karen Oberhauser, Department of Fisheries, Wildlife & Conservation Biology, 1980 Folwell Avenue, St. Paul, MN 55108 Phone: 612 624-8706; Fax: 612 625-5299; e-mail: oberh001@umn.edu

www.monarchlab.org
ANNUAL Life Cycle Cards

Our 16-card life cycle set focuses on the individual life cycle of a developing monarch, and is still available for purchase. Our NEW, laminated, 20-card set, is more comprehensive. It covers the individual life cycle more briefly, shows side-by-side comparison photos of male/female wings and abdomens, and includes maps of the fall and spring migration and photos of predation, activities, and clustering monarchs in the Mexico. Both sets can be ordered in English or Spanish. The cost of the 20 laminated cards (3.75” by 5”) is $10.00.

Milkweed, Monarchs and More Field Guide by Ba Rea, Karen Oberhauser and Mike Quinn

Designed to help students, citizen scientists and others explore the milkweed community, this book includes over 300 full-color photos and entries on insects and spiders, which include photos of representative individuals, scientific and common names, identifying features, life cycles, and ranges. Color coded symbols are used throughout the guide to indicate the animals’ roles in the milkweed community. It also includes an overview of the unique features of the milkweed family—including photos and range and identifying features for 10 of the 110 species found in North America. The information in this 96 page guide can be easily accessed through the table of contents, index, glossary, and references. And to keep hands free in the field, it conveniently fits in your back pocket. $9 per guide.

The Monarch Butterfly: Biology and Conservation

Edited by Karen Oberhauser and Michelle Solensky, this collection of journal articles and scientific papers centers around the biology and conservation of this majestic insect. If you have ever wondered what factors affect monarch egg size, how adaptable a monarch’s migratory behavior is, or how scientists use citizen science data, this book is for you. A perfect gift for the serious monarch investigator, this volume features scholarly articles by prominent monarch biologists. $40.00.

Milkweed Visitors by Mary Holland

*Selected as a “Best Book of 2006” by the Association for Advancement of Science!*

This beautiful volume will be a priceless addition to your classroom. As your students visit the milkweed patch to obtain food for developing larvae, they will see many other creatures that inhabit the milkweed community. Mary Holland has captured those critters in clear, large, beautiful photographs, and clearly explains their roles in this fascinating, magical location. Throughout the book, many of your students’ questions will be addressed, and additionally, you and your students will be inspired to look more closely at these amazing creatures. Cost of this beautifully colored, 8” by 10” paperback, is $11.00.
Featured Teacher: Caroline Waskow

Feature teacher Caroline Waskow, from St Odilia School in Shoreview is a long time Monarchs in the Classroom teacher who will be coming onboard as a co-instructor for this summer's "Monarchs and More: Field Ecology for Teachers" course.

Caroline has a long history with monarchs. She has been using them in her classroom for the past five years, since the summer she participated in the workshop herself. "I think that monarchs make a great model," she says. "So many of the standards can be accomplished. Students can learn about life cycles, classification, ecology, anatomy, and phenology, all in one beautiful package." She has also been bringing students to the Insect Fair for the past five years, finding the positive reinforcement from other adults to be important for her students.

Caroline also works hard to get her kids outside and asking questions. "I think the most effective teaching tool is one that encourages the students to observe and ask their own questions and then try to answer them," she says. Though her schoolyard is made mostly of pavement and thin swaths of mowed grass, Caroline has been taking her students outside in some capacity since she started teaching. "I have the students practice observing, and ask them to look for evidence of something—sometimes I ask them to look for evidence of life!" she says.

"Pavement is good for sidewalk chalk and drawing for review and assessment. Unfortunately I don’t think we as a society spend enough time outside. It can be hard to develop an appreciation for the outdoors when surrounded by blacktop."

Science and getting outside come naturally to Caroline, who worked as an environmental scientist for the Metropolitan Council Environmental Services R&D group before switching to a teaching career. She also spends a lot of time outside with her family, raising a variety of animals through 4H with her kids, checking out the milkweed patch with her enthusiastic son, and spending time camping and fishing.

Caroline is also looking forward to getting outside and spending time with the teachers’ course this summer. “I am looking forward to discovering how others would use the monarchs in their classroom, and to getting a fresh perspective through the new eyes of the individuals taking the course.” She says "But mostly I am looking forward to an opportunity to learn more myself and be with motivated teachers."

We are excited to have Caroline on staff this summer and hope that you will get a chance to meet her!

Featured Student: Kaitlyn Creasy

Congratulations to Breck HS senior Kaitlyn Creasy for being selected as a semifinalist in the Intel Science Talent Search for her research paper “Tachinid Fly (Lespesia archippivora) Parasitism of Monarch Butterfly Larvae (Danaus plexipus)”. Kaitlyn was a high school researcher in the monarch lab this past summer, and while she wasn’t monitoring milkweed patches with the lab she spent a great deal of time investigating the life history strategies of the Tachinid fly monarch parasitoid. Kaitlyn was able to establish a lab population of tachinid flies, and used these to study parasitism of monarch larvae. She also collected a number of wild monarchs and raised them to determine frequency of parasitism in wild monarch populations. Among the interesting things that Kaitlyn discovered were that tachinid flies reach sexual maturity at four days old, and that female flies will hyper-parasitize a monarch larva (lay eggs on a larva that is already parasitized). Experimental larvae that died of parasitism before pupation contained up to 31 fly larvae inside!
By 9:00 am on Saturday, December 2nd 2006 the University of Minnesota’s Coffman Memorial Union was abuzz with students checking in and setting up project posters. The hundreds of K-12 students from all corners of the state had awoken early on their day off, packed up their research presentations, and headed to the University for the “Insect Fair” - a celebration of their hard work and interest in science. This event, which has been funded by the Medtronic Foundation for the past 10 years, gives students the opportunity to share their research on insects and their habitats with teachers, students and scientists from throughout Minnesota. Most teachers have attended University of Minnesota summer workshops (see page 2 and 3), and then mentored their students as they conducted research and prepared a poster summarizing their results to share with their peers at the Insect Fair.

In addition to standard science fair projects and posters, students from Galtier Magnet School and Achieve Language Academy (St. Paul), Garlough Elementary School (West St. Paul), Rossman Elementary School (Detroit Lakes), Susan Lindgren Intermediate Center (St. Louis Park), and Willow Creek Middle School (Rochester) worked on large museum type insect displays with the Bell Museum of Natural History’s education curator, Kevin Williams. An amazing variety of models, including larger-than-life caterpillar cross sections, pond edge dioramas, and towering fruit fly chromosomes, were on display.

With nearly 300 students gathered to present their projects, attend breakout sessions, and eat lasagna lunch, this year’s 10th annual Insect Fair was as fun and action packed as ever. When they weren’t eating or presenting their projects to a group of their peers and a an interviewer, students attended two breakout sessions centering on scientific and insect related topics. They chose from a variety of sessions, including Insect Bingo, Technical Drawing, and Science Surprise – a fun-filled look at science presented by MN science teacher extraordinaire Jerry Wenzel.

If attending the Insect Fair (or getting your kids interested in science, biology and the outdoors) appeals to you we would love to have you join us! Information about this year’s summer classes can be found on pages 2-3. Additional information about these classes, and about the insect fair itself, can be found at www.monarchlab.org. If you have questions, please feel free to email us (sarah@monarchlab.org).

Collecting arthropods and other animals in the schoolyard provides powerful connections between the student, the curriculum and nature in the schoolyard. The method described here is used by scientists and students alike to learn what ground-dwelling insects occur in a given area.

Lesson Summary: Students will sample the arthropod population in different habitats on their schoolyard grounds using commonly found items. Students will conduct a habitat assessment of the pit trap locations. This sampling can occur on a regular basis to sample throughout the season or it can be done once. Students of any age can conduct this study with varying degrees of adult direction. Students can design their own inquiry projects by varying this methodology.

Duration: 2-3 60 minute class periods

Materials for each group: trowel, measuring tape, 16 ounce plastic cups, tweezers, magnifying glasses, permanent marker, data sheets, schoolyard map, insect identification field guides and plastic bags.

Instructions:
1. Always discuss expectations for student behavior outside. Make sure you know where students are at all times.
2. Decide where you will place your pit traps. Use a map of the schoolyard to make preliminary decisions on the locations of the traps. Vary the habitats. For example, set some in an open field and others under a tree or other vegetation. Once you have decided on the locations, do a habitat assessment. You want to have a record of the habitat of the organisms that you will find in your trap. Record the following information for each habitat:
   - **Ground cover:** Is there gravel, grass, wood chips, dirt, pavement or something else around the trap?
   - **Vegetation over the traps:** Record the presence of shrubs or trees that are directly above the trap. Identify as deciduous or coniferous, being as specific as possible.
   - **Surrounding habitat:** For example: open lawn on the south side of the school or deciduous woods located across the playground.
3. Set the pit traps. Dig a hole in the ground with the trowel. The hole must be deep enough for the 16 oz. cup to sit at least flush to the ground. Set the traps at a minimum of 5 meters apart. Mark the locations of the traps on your map.
4. After 24-72 hours collect the animals from the pit traps. You can keep them alive and study them in plastic shoe box tubs to release later or you can put them in plastic bags and freeze them. Do not wait longer than 72 hours or the animals will all die or one will eat all of the others.
5. Count and identify the animals from each habitat.
6. Discuss and analyze results. Were there differences in the numbers or kinds of organisms you caught in different habitats? Had you seen all of the organisms before? Ask further questions and begin a new study!

Keep an Eye out for our 4th Edition Monarchs in the Classroom Curriculum Guides and NEW Schoolyard Ecology Explorations Curriculum Guides!

We are in the process of updating the next edition of our Monarch’s in the Classroom curriculum guide, and creating a brand new curriculum guide centering on Schoolyard Ecology Explorations! Out this summer, the new and improved guides will be easier to use and will contain even more useful and fun lessons to do with your kids! Watch our website (www.monarchlab.org) for updates!
Citizens and scientists are engaged in several projects that allow year to year comparisons in monarch numbers. These projects take place during the breeding, migrating and wintering stages of the monarch annual cycle. Programs focusing on the breeding and wintering stages of this cycle illustrate these comparisons and give us an idea of how the monarch population is doing.

The Monarch Larva Monitoring Project (MLMP: www.mlmp.org) is a citizen science project run by the U of M Monarch Lab. Hundreds of MLMP volunteers monitor immature monarchs on milkweed plants, assessing per milkweed plant densities of monarch eggs and larvae throughout the breeding season. There are many ways to use MLMP data to assess the health of the population; one thing we’ve done is to look at the peak egg densities during the last half of the summer, since these eggs will produce the fall migratory generation.

Researchers working with the Monarch Butterfly Biosphere Reserve and WWF-Mexico monitor the area occupied by monarchs in 22 Mexican wintering sites. Using a compass and measuring tape, and more recently GPS units, the researchers measure the perimeter of the colonies, and calculate their area in late December or early January.

Karen Oberhauser is currently synthesizing several monarch monitoring programs, including the MLMP and Mexico Reserve monitoring. She’s found that many factors are likely to affect monarch populations, and that it is difficult to say definitively how the populations are doing in the long term. However, it appears that monarchs have responded to favorable weather conditions in the past few years; note the increase in numbers on both graphs in 2006-2007. Numbers were very low in 2004, but have been about average since then. More monitoring will help us understand long-term population trends.

Most people who raise monarchs know about their relationship with *Ophryosystis elektroscirrha*, the parasite that causes dark gray spots on the pupa covering and eventually affects mortality rates. During our last two fall distributions, some teachers experienced a different type of mortality event. Their larvae seemed to be developing normally, albeit slower than expected. Almost overnight, however, their larvae turned brown and flat, sometimes hanging on the side of the cage or just on the bottom.

It is difficult to positively identify the cause of this mortality, but it is most likely a virus or bacterium. One possible culprit is nuclear polyhedrosis virus, which is common in Lepidoptera with gregarious (group-feeding) larvae. These species would be selected for resistance to a virus, as the chance of transmission is greater. For monarchs, there is little reason to divert energy that could be better used for development and predator defense to viral resistance. Female monarchs usually only lay one egg per milkweed plant, so a larva stands little chance of encountering large numbers of other individuals. In contrast, monarchs in a laboratory or classroom setting are constantly exposed to other larvae, which can lead to problems with disease. Testing by entomologists who specialize in insect diseases suggests that there may be one or more other viruses causing the widespread mortality.

We have found that even larvae that we bring in from the wild exhibit some disease, as do larvae in research and distribution facilities throughout the US. Because of these problems, we have decided to suspend our fall distribution, at least for 2007, while we see if new, “hospital-like” rearing techniques will prevent disease spread in our lab. We will continue to do research on a number of aspects of monarch biology, and will keep you posted on our progress.

2005 and 2006 Problems Lead to Decision to Cancel 2007 Monarch Distribution

![Figure 1: Biologists from WWF-Mexico have compiled data on colony size for over a decade. Notice the very low size in the winter of 2004-2005, and the average size in the last two winters.](image)

![Figure 2: Citizen volunteers in the Monarch Larva Monitoring Project measure monarch egg and larva densities in milkweed fields near their homes. This graph shows the number of eggs per milkweed in our upper Midwestern sites during the peak week for the generation that will migrate to Mexico. We use sites in this part of the US to illustrate population size because we have the most data from this region, but monitored sites all over the US help us to understand monarch population dynamics.](image)
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Schoolyard Ecology Explorations and
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