Monarchs in the Classroom (MITC) provides hands-on, inquiry-based science opportunities for K-12 teachers and students, and the public. Using the monarch butterfly as a focal organism, we create connections between humans and the natural world, fostering environmental concern and caring. We hope that you’ll find the enclosed news, opportunities, and education ideas useful. We encourage you to visit our website, www.monarchlab.umn.edu, for frequent monarch news.

We've chosen Monarchs and the Environment as a theme for this issue. You'll read how monarchs' natural environment has been both a positive and negative force over the past year, and about concerns regarding impacts humans have on monarchs and their habitat. These issues were thrust into the international limelight after the catastrophic storm in the Mexican overwintering sites in January 2002, and we've tried to put this event into perspective in the article on page 14. You'll also learn how students, teachers, citizens and scientists are working to understand how monarchs interact with their environment, and get tips on how you can help in these efforts.

The MITC family is an amazing group, and this newsletter highlights some of your work. By recognizing a few, we celebrate the work of many, and hope to provide examples that are useful to those of you working with children and others in schools, communities and nature centers. We've included information on exciting learning opportunities, including a new course: "Monarchs and More: Insect Ecology for Teachers." We're also excited about the Larva Monitoring workshops being offered throughout the US over the next three years, thanks to generous funding from the National Science Foundation and the hard work of a corps of volunteers, scientists and naturalists.

As always, please stay in touch. We wish you all the best for a great year!

Citizen Involvement is Key to the MLMP! (www.mlmp.org)

The Monarch Larva Monitoring Project (MLMP) invites you to become a Citizen Scientists involved in monarch conservation! The MLMP, currently in its 5th year, includes over 200 volunteers who collect data on the distribution and abundance of monarch larvae. The help of these citizens from across the continent gives scientists and policy makers a more accurate picture of the health of the monarch population, and factors that influence monarch numbers.

Currently about half of all volunteers monitor with others, especially children ages 17 and younger. The MLMP is a terrific way to introduce young adults to field science and the love of nature.

The MLMP is greatly expanding its efforts to create links between K-12 educators, informational science education institutions, and citizens. One effort to connect the citizens is through the new web-site (www.mlmp.org). This web-site is user friendly and includes training information, all the forms and protocols for monitoring, data entry forms, access to volunteers’ results, links and more. The MLMP is also partnering with Nature Centers across the country. These outdoor and environmental education centers will become sites of expertise as naturalists are trained to train volunteers and aid in the monitoring process. These expanded efforts will result in a larger, more informed volunteer base. Visit our website for more information, or contact karen@mlmp.org.
ESPECIALLY FOR TEACHERS: www.monarchlab.umn.edu/Teachers/teachers.htm

Courses and Workshops

New Course!! "More Than Monarchs"

Are you looking for more hands-on, classroom-friendly, and inquiry-based lessons for your students? Read on! Our new summer course has something for everyone: seasoned monarch teachers, teachers who don’t bat an eye when handling strange insects, and teachers who would rather scrub the kitchen floor than pick up a pillbug! After six years, our Monarchs in the Classroom summer course for teachers is changing. We’re expanding the syllabus to include other classroom-friendly arthropods*! While our monarch course provided a popular and focused curriculum for almost 300 teachers, we decided to use a similar inquiry-based approach to a broader topic for 2002.

Last summer, nine expert primary, intermediate and middle school teachers met with MITC personnel to develop a syllabus for this course, and we’re excited about what evolved over six days of idea sharing (see sidebar for members of the “M&M Design Team”). We’ll offer separate courses for middle school and elementary teachers, with the two groups meeting together during the second week of the course to allow participants to experience the scope and sequence of overlapping topics. Each group will study "insect systems of the day" during week 1. Middle school teachers will meet at Wilder Forest during week 1, immersing themselves in key ecological topics by conducting a series of research projects, and discussing the results and implications of these projects in an informal setting each evening. Elementary teachers will meet at the U of M St. Paul campus. All participants will conduct an independent research project on an insect system of their choice, with mentoring from U of M scientists and classroom teachers.

The focus of week 2, when both groups will meet in St. Paul, will be incorporating the concepts and processes from week 1 into interdisciplinary, inquiry-based classroom projects. We’ll practice teaching lessons, share classroom tips, and learn how to assess inquiry-based student projects.

Throughout the course, participants will work with teacher-mentors, U of M scientists, and each other. The connections formed during the course will be maintained as the lessons move from campus to the classroom.

A course announcement is on page 6, with an application on pages 11-12. You may also download an application from www.monarchlab.umn.edu or call us to request a faxed application.

*Arthropods are animals with a segmented exoskeleton and jointed limbs. Some of the arthropods we'll be studying include milkweed bugs, monarchs, ladybugs, aphids, ants, aquatic insects and pillbugs.

District Workshops

The summer course is just one way to learn how to use monarchs and other insects in your classroom. We also conduct workshops for individual schools and districts. Workshops can take place after school, on weekends, in the summer or on in-service days. The location is also up to you! MITC can come to you or the workshop can be held at the University of Minnesota. The length is tailored to your needs: as brief as two hours or up to three days. The more time you have, the more depth and hands-on experiences we can provide.

Workshop content components include hands-on stations, where teachers become comfortable handling and caring for monarchs; monarch biology, which is taught in an open format; website connections, which expand the horizons of the unit far beyond the classroom; and practice using the MITC curriculum with experienced teachers. All workshops are conducted by a proven blend of scientists and expert classroom teachers.

Our curriculum offers a unique opportunity to team teachers in schools with monarch experience with teachers who have little or no monarch experience. Teams can be made up of specific grades or multi-grade levels. MITC will show any size group how to make science more accessible and exciting for teachers and students.

To set up a workshop or receive a workshop brochure, call us at 612 624-8706.

“Monarchs and More” Design Team

Ann Mock: Maple Grove
Laura Molenaar: New London/Spicer
Laura Richter: Mazomanie, WI
Kilee Lange: Minneapolis
Jerry Wenzel: East Grand Forks
Lori Funderburk: Brooklyn Park
Dale Pulis: Sauk Rapids
Rick Sowada: Richfield
Terry Vick: Minneapolis
Liz Goehring: Penn State University
Beth Lavoie: University of MN
Catherine Reed: University of MN
Karen Oberhauser: University of MN
Tips for Teaching with Monarchs

Back by popular demand, we have more tips for teaching with monarchs. Our thanks goes out to our expert teachers Terry Vick and Cindy Petersen for contributing such great ideas!

1. **Butterfly/Roosting Tree** Bring the overwintering grounds to your classroom by making your very own roosting tree. The tree can easily be constructed out of paper towel/cardboard roles and wrapping paper. Then have each student make a butterfly which could represent the one they reared that year. When your students release their live butterflies have them tape their paper butterflies to the tree. The butterflies will stay on the tree until the following spring when the monarchs leave the overwintering grounds in Mexico.

2. **Ziplock Tub Cages** Looking for a smaller size container to house your monarchs from egg to adulthood? Ziplock “disposable” tubs are easy to work with and inexpensive. The lids can easily be removed and replaced with mesh screening secured with rubber bands. Or try altering the lid by cutting out the middle and adhere the screening with a heat gun or glue.

3. **Get Outside!!** This is where it all happens. Go out as a class in the fall and spring to look for eggs. In the fall, Cindy Petersen’s 8th graders model the monitoring that they did during the summer for the 7th grade students who are learning about monarch biology for the first time.

4. **Experiment** Never underestimate the powerful learning that takes place when students ask their own questions and collect data to help answer them. Experimenting can be pretty chaotic in a classroom, but after you do it a few times and see the benefits, it’s worth every crazy moment.

5. **Monarch Ranch** Although many students may take home their larvae in cages, keep a “monarch ranch” going in the classroom by having plenty of classroom monarchs. Have monarch larvae of all instars developing as well as adults to observe and marvel over. You can use these classroom monarchs to talk about a range of topics. Students love to love to show off their classroom to parents, siblings and other students. The “ranch” becomes a great conversation starter for just about anyone.

6. **Question, Question, Question** Keep paper up around the room so that every time anyone asks a question, they have a place to write it down. After a few days, students start to ask the question, stop, and just go write it down on the sheet of paper. Take it a step further and have informal “contests” that develop from class to class on who can ask the most and the best questions. These are great sources for developing experiments later down the road.

### 2001 Monarch Fair

The fifth annual Monarch Fair took place on December 8, 2001 at the Bell Museum. We had sixty-six excellent student research projects and three incredible permanent displays. All of the participants worked hard to answer a question of their choosing about different aspects of the monarch butterfly.

The permanent displays focused on the monarch life cycle, ecology, conservation, migration or rearing techniques. Ordean Middle School’s display was *The Big Book of the Monarch Life Cycle*, South High School’s display was *Late Night with Danaus Plexippus from South High*, and Lake Junior High School’s display was *Monarchs of Woodbury*. All of these displays were designed and constructed by the teachers and students working with Kevin Williams from the Bell Museum and Karen Oberhauser.

Awards were given to projects (see side bar) for different parts of the research process. The students also enjoyed getting t-shirts. The day ended with a banquet with plenty of time for socializing. This year’s fair showed the excellent quality of research that is being done by students and their teachers. We applaud everyone for their hard work and dedication to monarchs and look forward to learning more with our fellow researchers!

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**Outstanding Projects**

- Ali Maeser, St. Hubert MS, Chanhassen: Decisions, Decisions
- Laura Nickolay, St. Hubert MS, Chanhassen: Totally Tachinid

**Outstanding Questions**

- Laura Nickolay, St. Hubert MS, Chanhassen: Totally Tachinid
- Carissa Morfitt, Amery Middle School, Amery: The Effect of Light and Temperature on Gonad Development in Male Monarchs
- Karl Kraft, Kenyon Wanamingo MS, Kenyon: Will the Catepillar Choose Green Paper or Milkweed?
- Leah Meyer, Winona Middle School, Winona: Grow Like a Weed
- Alyssa Kne, St. Francis Intermediate, St. Francis: Can Larvae Learn?
- Beck Decaigny, Cloquet Middle School, Cloquet: Is There a Relationship Between Male and Female Monarch Butterfly Proboscis Length and Wing Length?

**Outstanding Design**

- Alyssa Kne, St. Francis Intermediate, St. Francis: Can Larvae Learn?
- Stephanie Mock and Kristin Morris, Rush Creek Elementary, Osseo: Monarch, What’s Your Groove?
- Alison Keleher, Alice Metz, Grace Wilkinson, Katie Guzik, Dan Ayd and Justin Woodruff, Sunrise Middle School, White Bear Lake: How Will Monarch Larvae Grow When Fed Hoya or Common Milkweed?
TEACHERS IN THE SPOTLIGHT: Rhoda Stroud and Christelle Kohler

Webster Magnet-St. Paul, MN: While using monarchs in their classrooms Rhoda Stroud and Christelle Kohler have faced challenges unique to their urban setting—such as finding healthy milkweed. Nonetheless, they have found that the beauty and intrigue of the monarch has no boundaries in their culturally diverse school. We are thrilled to highlight the work of these veteran teachers who successfully bring the natural world to many who otherwise have limited exposure to monarch habitat! Many thanks to Rhoda Stroud for contributing this article.

After I saw an adult emerge from a pupa in my co-worker’s classroom, I was hooked! I had to learn more! Attending the University of Minnesota’s Monarchs in the Classroom summer course provided me with an experience beyond my imagination. For example, I was thrilled to be in the workshop until I learned that I had to take larvae home to rear on my own. On my own?? Yuck! I then began an incredible journey.

I am not an outdoors person so traipsing through fields and wooded areas to find milkweed was a true adventure for me. One thing I learned very quickly was that milkweed is not plentiful in my inner city neighborhood. Whenever I found a stalk growing nearby, I did a victory dance. Rearing the monarchs from larval stage to adulthood was truly rewarding and emotional. Although I felt sad upon their release into the wild, I couldn’t wait to begin school the following September to work with monarchs in my classroom.

Webster Magnet is a large inner city school that resembles the United Nations. My classroom is full of students from many cultures: Hmong, African-American, European-American, Latino, and Native American. My room also has a wide range of abilities in all areas of study. Every year that Mrs. Kohler and I teach this unit, we never fail to marvel at how the students adapt to everything about the monarch. Many students have never had this type of hands-on class before, nor have they kept a daily scientific observation journal. Together, Mrs. Kohler and I made up a booklet for the students to record observations and keep a daily diary/log describing their feelings. It is wonderful to see reluctant readers doing just that in order to learn more about their larva.

Students are genuinely interested in participating with the monarch unit. Our tests show that the students learn the material, and former students who return to visit refer to the monarch unit and how much fun it was. Our classrooms generate so much interest that students from other classes often come in to see what our larvae are doing!

Furthermore, students go home and actually talk to their parents about what they are learning in school! Students’ enthusiasm often convinces family members come to class just to see the unit “happenings.” Parents are thrilled about the monarchs and they love the communication this unit fosters at home about school, ultimately laying the groundwork for communications in other areas of study.

At Webster Open School, using monarchs in our classrooms has proven to be a positive learning experience for students, teachers and parents alike.

MITC Larval Distribution 2001

Every year the MITC monarch distribution grows, and 2001 was no exception. Over 50,000 monarch eggs and larvae made their way into MN and WI classrooms last fall, 12,000 more than in 2000. Most of these monarchs were distributed as eggs (about 35,000). In past years we were concerned as to whether we would be able to fill all the orders due to a shortage of eggs and larvae. Not so in 2001! As many of you who took extra larvae know, we were up to our elbows in monarchs. This year, there was no need for soft music and candlelight to encourage the adults to mate and lay eggs! We hope the extra larvae enabled you and your students to do more research and observations.

We distributed first and second instars in petri dishes this fall, and this seemed to help people keep track of these tiny larvae. This year fewer teachers called to report missing larvae.

We look forward to the 2002 distribution, and to seeing many of you in our lab. We’re continuing to work on finding ways to improve the distribution process and the health of our eggs and larvae, and welcome comments or suggestions.

MONARCHS
Monarchs can fly fast and far
Only eat milkweed
Nature is their life
At last they fly south
Reaching Mexico
Can they make it back?
No!
However, they sleep on the mountain
Someday their children will come back

By Sean, grade 3
Summer Work with Monarchs and Kids

Many MITC teachers have expanded their programs to include working with students in the summer. The Monarch Larva Monitoring Project (see page 1) is an excellent spring board into field research. The structure of the MLMP and the relaxed pace of summer is a terrific combination to teach about field work, discover the natural world and investigate. Many thanks to Jane Borland, Donna Kemp and Cindy Peterson for their contributions to this page!

Cindy Peterson & Jane Borland are Outstanding and Researching in the Field!

For the past three years Cindy Peterson of St. Hubert Middle School in Chanhassen Minnesota has worked with students over the summer. She begins teaching students about field research by using the MLMP protocol, which involves data collection techniques, observation skills and data entry. While students collect their data Cindy helps them develop scientific questions inspired by the field work. Questions developed by the students become their research topics. Throughout the remainder of the summer students continue to monitor as well as collect data to answer their own questions.

Cindy’s students use the projects they develop for the school science fair, monarch fair (see page 3), regional fair and state fair. The venues are important, giving students a place to communicate their work and results. Cindy highly encourages other middle school teachers to conduct summer research. She believes that middle school students are an “untapped resource,” capable of conducting excellent science without many of the distractions older students face.

Jane Borland conducts exciting research with high school students, despite the distractions faced by this age group! For the past 4 years, her Lamar High School Monarch Research Team in Arlington Texas has used the MLMP protocol to conduct field research as a team. The team gets an early start on monitoring in Texas; milkweed comes up at the end of March, when Cindy Petersen’s neighborhood is still buried under snow! During the school year, students meet on Wednesday afternoons to monitor. In the summer, they meet early in the morning to avoid the Texas summer heat. Jane and her students have documented that many fall migrants are reproductively active. The team consistently finds mated females and the highest egg production in the fall, contrary to popular belief! As students brave the heat they learn not only about monarchs but scientific research as well.

Monitoring in Texas during June, July, and August is bleak as the team seldom finds eggs or larvae. This lack of data makes it tempting to throw in the towel, but the students soon realize that they need data to prove that there is no monarch activity in the summer.

Cindy, Jane and many other teachers can testify to the unlimited benefits of working with students in the summer. So, grab your sunscreen and stand out in your field with your students this summer. You’ll all have fun as you learn!

High School Students Eager to Help! By Donna Kemp

Kylee Crooks and Carlee Kemp, juniors at Sparta High School, have both spent many hours during the summer monitoring milkweed and monarchs. Carlee has participated in the project for the past three summers and Kylee has joined us for the last two summers. I asked both participants why they give up their free time in the summer to help monitor. “I like butterflies and the Monarch population is important to me”, Kylee responded. Carlee added, “I agree with Kylee, and it makes me feel good to know I’m helping”.

I don’t know if either student will pursue a career in science, but both students will always remember the hours of work and the laughs we’ve had together in the field. As a teacher and a parent I enjoy the time I get to spend with my daughter and getting to know students outside of the classroom. It’s fun to experience each other in such a unique setting. After the disastrous storm in Mexico this past winter we are anxious to see how the Monarch population in our area will be affected. We are looking forward to getting out to our site and begin another summer of monitoring.
2002 COURSE ANNOUNCEMENT

Monarchs and More: Insect Ecology
FOR ELEMENTARY & MIDDLE SCHOOL TEACHERS

WHAT: An intensive summer workshop in which you will:

• learn basic biological and ecological principles using insects as a focus
• practice transmitting these principles to your students
• learn insect rearing and observation techniques appropriate to your classroom
• observe and practice scientific inquiry methods
• receive materials to use in your classroom
• join a nationwide science partnership between educators, researchers and students

Funds for this project were provided by a grant from the federal Eisenhower Professional Development Program administered by the Minnesota Higher Education Services Offices. All participant costs, including a $200 stipend and 3 graduate credits, are covered.

WHEN: The class consists of two separate weeks, with time required in the interim; all participants must attend BOTH weeks. Interim work requires a time commitment, and participants should plan to be home for at least a week between the two in-class weeks.

• ELEMENTARY: July 15-19 and August 5-9 from 8:30 a.m. to 3:30 p.m. each day.
• MIDDLE SCHOOL: June 23-28 and August 5-9 from 8:30 a.m. to 3:30 p.m.

WHERE:

• ELEMENTARY: University of Minnesota, St. Paul Campus, both weeks.
• MIDDLE SCHOOL: June 23-28 at Wilder Forest (staying overnight) and August 5-9 from 8:30 a.m. to 3:30 p.m. at the University of Minnesota.

ELEMENTARY INSTRUCTORS: Dr. Karen Oberhauser and Beth Lavoie, University of Minnesota; Terry Vick, Ericsson Elementary School, Minneapolis; Laura Molenaar, Prairie Woods Elementary, New London-Spicer; Ann Mock, Rush Creek Elementary, Osseo.

MIDDLE SCHOOL INSTRUCTORS: Dr. Karen Oberhauser and Michelle Solensky, University of Minnesota; Jerry Wenzel, East Grand Forks Middle School; Cindy Petersen, St. Hubert Middle School, Chanhassen.

PARTICIPANTS: 20 Minnesota teachers in each course, with some preference given to teachers from districts with a high proportion of low-income students, or who apply in teams. Teams can consist of two teachers from the same school or district, and do not have to teach the same grade. We rarely accept more than two teachers from a single school, and seek a mix of metro-area and out-state, public and private school teachers. Some teachers who have taken Monarchs in the Classroom will be accepted into the course.

HOW TO APPLY: The application is included on pages 11 & 12 of this newsletter. Applications must be postmarked or faxed by April 17, 2002, and participants will be notified by May 3rd.

COURSE SYNOPSIS: The course consists of three parts: 1) a week of field and laboratory work during which participants are introduced to five different insect systems and related ecology topics, 2) an interim period, during which participants conduct mini-research projects on an insect of their choice (with expert mentoring from project staff), and 3) a week in which teachers work in grade-level groups to translate their knowledge of insects into inquiry-based classroom activities and projects. Group meetings and regular contact with a mentor/instructor follow the summer program. The systems on which we will focus in 2002 include the “milkweed community” of monarchs and other insects.
The Monarch Classroom Starter Pack provides fourth through sixth grade teachers with materials that will help them get started using the monarch butterfly life cycle as a dynamic, inquiry-based science unit. Each starter pack features a copy of Monarchs in the Classroom Grade 3-6 Curriculum Guide and 20 copies of My Monarch Investigation. The Curriculum Guide provides a wealth of monarch information and lesson plans across the curriculum. My Monarch Investigation is a journal designed to encourage students to form their own questions and think like scientists as they record their observations of the monarch life cycle. The journals provide a permanent, personal record of each students’ monarch experience. (Additional journals for larger class sizes can be purchased for classroom use at a substantial discount off of retail cost.) Each Starter Pack also includes a colorful laminated monarch life cycle poster and a copy of the Monarch Life Cycle board game, which invites students to have fun as they share their monarch knowledge.

Monarchs in the Classroom, directed by Dr. Karen Oberhauser at the University of Minnesota, is a partnership between scientists and teachers promoting classroom practices in which students learn science in ways that reflect the inquiry methods used by scientists to understand the natural world. Lifestrands, Inc. was created by Leah Spink, an elementary teacher with years of experience making science come alive in the classroom and illustrator, naturalist and long time monarch enthusiast, Ba Rea, to develop products to help elementary school teachers provide their students with authentic life science experiences.

<table>
<thead>
<tr>
<th>Monarch Classroom Starter Pack</th>
<th>$95.00 each</th>
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<tr>
<td>includes: 1 Monarchs in the Classroom Curriculum guide, 20 My Monarch Investigation journals, 1 Monarch Life Cycle Game, and 1 Monarch Life Cycle poster</td>
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<table>
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<tr>
<th>My Monarch Investigation</th>
<th>Monarchs in the Classroom</th>
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<tr>
<td>1-19 copies</td>
<td>Curriculum Guides K-2, 3-6</td>
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<td>Classroom set of 20</td>
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<td>$ 5.00 each</td>
<td>Monarch Life Cycle Game</td>
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<td>Monarch Life Cycle Poster</td>
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My Monarch Investigation

*My Monarch Investigation*, created by Lifestrands, inc., is a 32 page journal designed to guide students through an investigation of the life cycle of monarch butterflies. It has eight full color pages of illustrations and photographs covering caterpillar anatomy, habitat and community, life cycle, chrysalis development, butterfly emergence, and migration.

The text, written for students in 4th through 6th grades, describes what we know about monarch butterflies and what scientists are doing to learn more. By asking students to craft testable questions, make consistent measurements and consider ways to graph their data, *My Monarch Investigation* encourages them to act as scientists and follow their own inquiry. Teachers can use that experience to guide students’ observation of monarch caterpillars in the classroom and to promote original investigation into the monarch’s life and habits.

Between informational pages, *My Monarch Investigation* has journal pages with space for making daily notes, recording quantitative observations, and logging testable questions inspired by observing the caterpillar, chrysalis and butterfly stages of the monarch. Marlo, a cartoon monarch, adds a touch of humor, prompting observers to look for some specific phenomena and think about them from a monarch’s point of view.

*My Monarch Investigation* $4.99 each or classroom sets of 20 or more for $3.00 each.

For more information visit http://www.lifestrands.org

Monarchs in the Classroom

Inquiry Based Curricula

Monarchs in the Classroom is a K-8 curriculum (three separate volumes for K-2, 3-6, and middle school) designed to be an interdisciplinary, inquiry-based supplement to classroom science instruction. With its foundation in life science, the curriculum incorporates concepts and skills in math, reading, writing, art, and social studies. Lessons are congruent with K-8 concept and process standards as outlined in the National Academy of Science’s National Science Education Standards (1996) Through this series of lessons related to the life cycle and ecology of monarch butterflies, students engage in inquiry processes which help them ask questions, plan and conduct investigations, use appropriate tools and techniques to gather data, think critically and logically about relationships between evidence and explanations, construct and analyze alternative theories, and communicate scientific ideas. The curriculum includes extensive background information on monarchs, their host plants and predators, and rearing techniques.

*Monarchs in the Classroom Curriculum Guides* $17.50 each

For more information visit http://www.monarchlab.umn.edu
LIVE ORGANISMS AVAILABLE FOR MINNESOTA AND WISCONSIN CUSTOMERS ONLY!!

LARVAE. 5-10/classroom recommended. Instructions for rearing and observing included. We cannot replace larvae that die after leaving our lab or fail to develop into adults.

EGGS. Approx. 30 eggs on potted milkweed plant or on milkweed leaves packed in a petri dish. Plants CANNOT be mailed. We cannot replace eggs that fail to hatch or that do not develop into adults.

OVERNIGHT SHIPPING AND HANDLING FOR LARVAE OR EGGS. (We only ship larvae or eggs on milkweed leaves in petri dishes. We no longer ship plants with eggs on them, or larvae in cages. Mortality in shipping sometimes occurs, and we encourage teachers to pick up larvae from our lab if possible.

INSTRUCTIONAL MATERIALS

TUB CAGES. Translucent plastic cages with screen top. $5.00

THIRD EDITION CURRICULUM GUIDES. 225+ page curriculum with lessons on life cycle, butterfly systematics, ecology, conservation, experiments, and migration. Separate guides for K-2, 3-6, and Middle School. $17.00

MONARCH LARVAL FIELD GUIDE. A spiral bound, plastic-covered field book with descriptions and drawings of larvae for use in identifying instars. $7.00

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

MONARCH LIFE CYCLE POSTER. Produced by the Midwest Monarch Project, includes photographs of monarch stages from egg to adult. 17x22 inches, laminated. $9.00

MONARCH LIFE BOARD GAME. 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

BUTTERFLY KING VIDEO. 20 minute video on the development of two monarchs during the summer. Story highlights natural and human-caused risks faced by monarch larvae, and has excellent footage of all stages. $13.00

SAVING THE MONARCHS VIDEO. 30 minute video produced by KSTP TV describes how students, teachers, and scientists are working together to promote monarch conservation. Beautiful footage of the overwintering colonies. $10.00

T-SHIRTS.
• Monarch Watch. Migrating butterflies front and back. Short sleeves only. Short sleeve: $15.00
• Monarchs in the Classroom. Long or short sleeves, butterfly logo on sleeve. Long sleeve: $18.00

CLASSROOM VISITS. 45-60 minutes. Travel costs extra $60.00

TEACHER WORKSHOPS. One hour to one day, before or after school, or on inservice days. Travel costs extra; we will provide curriculum guides plus 10 larvae/teacher for $20.00 per teacher if 10 or more teachers attend. Contact us for details! $100/hour

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. In addition to journal pages, the book includes eight full color pages of illustrations and photographs covering caterpillar anatomy, habitat and community, life cycle, chrysalis development, butterfly emergence, and migration. Individual journals $5.00
Classroom set of 20 $60.00
Additional (over 20) $3.00

MONARCH CLASSROOM STARTER PACK. Use the life cycle of the monarch butterfly to teach the principles of science. Recommended age range 4th grade up. includes: 1 Monarchs in the Classroom Curriculum guide, 20 My Monarch Investigation journals, 1 Monarch Life Cycle Game, and 1 Monarch Life Cycle poster $95.00

CD ROM: FLYING WITH THE MONARCHS. An interactive CD ROM to use at home or in your classroom. Topics cover ecology, life cycle, conservation and migration through animation and beautiful visual images. Includes multiple quizzes, audio narration, video clips and more. Appropriate for all ages. Will be ready in May 2002. $25.00

*NEW ITEMS
### PART 2. INSTRUCTIONAL MATERIALS

**MONARCHS IN THE CLASSROOM 2002 ORDER FORM**

#### NAME AND SHIPPING ADDRESS

<table>
<thead>
<tr>
<th>Home Phone #</th>
<th>Daytime Phone #</th>
<th>Grade level(s)</th>
<th>E-mail address</th>
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#### PART 1. LIVE ORGANISMS

**MINNESOTA AND WISCONSIN CUSTOMERS ONLY!!**

Please place fall orders by August 15. We will fill late orders only if we have extras. Contact us for availability if you are ordering larvae in the spring. If you would like pupae or adults, please contact us.

<table>
<thead>
<tr>
<th>QUANTITY COST/ITEM TOTALS</th>
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<tr>
<td>Larvae (see price list for ordering instructions):</td>
</tr>
<tr>
<td>summer and fall x $1.00</td>
</tr>
<tr>
<td>spring (before 6/21) x $1.50</td>
</tr>
<tr>
<td>30 Eggs on milkweed leaves in petri dish x $5.00</td>
</tr>
<tr>
<td>30 Eggs on potted milkweed plant (Cannot be mailed) x $13.00</td>
</tr>
</tbody>
</table>

- **Express shipping of live organisms (larvae or eggs)**: $13.00

**NEW ITEMS**

#### PART 2. INSTRUCTIONAL MATERIALS

<table>
<thead>
<tr>
<th>QUANTITY COST/ITEM TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monarchs in the Classroom</td>
</tr>
<tr>
<td>Curriculum, 3rd edition</td>
</tr>
<tr>
<td>K-2 x $17.00</td>
</tr>
<tr>
<td>3-6 x $17.00</td>
</tr>
<tr>
<td>Middle School x $17.00</td>
</tr>
<tr>
<td>A Field Guide to Monarch Caterpillars x $7.00</td>
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<tr>
<td>Classroom slide set with script</td>
</tr>
<tr>
<td>• Yearly Life Cycle x $20.00</td>
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<tr>
<td>• Overwintering Biology and Conservation x $20.00</td>
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<td>• Ecology x $20.00</td>
</tr>
<tr>
<td>Monarch Life Cycle poster x $9.00</td>
</tr>
<tr>
<td>*Monarch Classroom Starter Pack x $95.00</td>
</tr>
<tr>
<td>*My Monarch Investigation Individual Journal x $5.00</td>
</tr>
<tr>
<td>Classroom set of 20 x $60.00</td>
</tr>
<tr>
<td>Additional Journals (over 20) x $3.00</td>
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**NEW ITEMS**

<table>
<thead>
<tr>
<th>QUANTITY COST/ITEM TOTALS</th>
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</thead>
<tbody>
<tr>
<td>The Game of Monarch Life x $17.00</td>
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<tr>
<td>Butterfly King Video x $13.00</td>
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<tr>
<td>*Monarchs in the Classroom t-shirts</td>
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<tr>
<td>Long-sleeved:</td>
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<tr>
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<tr>
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<tr>
<td>Short-sleeved:</td>
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<tr>
<td>QTY EA: M L XL</td>
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<tr>
<td>Total qty: x $18.00</td>
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<tr>
<td>Monarch Watch T-Shirts</td>
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<tr>
<td>QTY EA: M L XL</td>
</tr>
<tr>
<td>Total qty: x $15.00</td>
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<tr>
<td>Plastic Tub Cages</td>
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<tr>
<td>Total qty: x $5.00</td>
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#### SHIPPING for Instructional Materials: ____________

**TOTAL: ____________**

**NEW ITEMS**

**PAYMENT** to UNIVERSITY OF MINNESOTA MONARCH FUND must be enclosed or received before pickup or mailing. We will invoice or accept Purchase Orders for orders over $50.00 only.

Send order to: Dr. Karen Oberhauser, Department of Ecology, University of Minnesota, 1987 Upper Buford Circle, St. Paul MN 55108, Fax 612-624-6777, Phone: 612-624-8706, e-mail oberh001@tc.umn.edu.

Order recd _______ Date pd _______ Amt recd _______ Date mailed _______ PO#__________ Inv amt__________
# MONARCHS and MORE: INSECT ECOLOGY
## FOR ELEMENTARY AND MIDDLE SCHOOL TEACHERS
### 2002 Course Application

Please fill out both sides of this application and return by April 17 to Dr. Karen Oberhauser at the address on the back. Contact Karen if you have questions about the application or the workshop.

<table>
<thead>
<tr>
<th>Name</th>
<th>School name</th>
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<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Home Mailing Address</td>
<td>School mailing address</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Home Phone</td>
<td>School Phone</td>
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</tr>
<tr>
<td>e-mail</td>
<td>School type (circle one) (circle one)</td>
</tr>
<tr>
<td></td>
<td>Elem       MS</td>
</tr>
<tr>
<td>Grade level(s)</td>
<td>Private     Public</td>
</tr>
<tr>
<td>that you now teach</td>
<td>Location (circle one) urban   suburban rural</td>
</tr>
<tr>
<td># of years teaching</td>
<td>% of students in your school that qualify for free lunch</td>
</tr>
<tr>
<td>experience</td>
<td></td>
</tr>
<tr>
<td>Highest degree</td>
<td>If you are applying in a team with another teacher from your school or district, please indicate his or her name here, and send your applications together. Each team member must complete a full application.</td>
</tr>
<tr>
<td>earned (with year)</td>
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<tr>
<td># of credits beyond</td>
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<td>degree</td>
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<tr>
<td># of college science</td>
<td></td>
</tr>
<tr>
<td>courses completed</td>
<td></td>
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</table>

### IMPORTANT: PLEASE READ AND SIGN THE FOLLOWING

I am applying for the (circle one) MIDDLE SCHOOL ELEMENTARY course.

I understand that this course meets June 23-28 (Middle School), July 15-19 (Elementary) and August 5-9 (Elementary and Middle School) from 8:30 a.m. to 3:30 p.m. each day. As far as I know now, I am available for all of these days and times, and plan to attend the course every day if I am accepted.

Signed ___________________________ Date: ______________

If you are applying in a team with another teacher from your school or district, please indicate his or her name here, and send your applications together. Each team member must complete a full application.
Please answer the following 4 multiple choice and 5 essay questions. We are asking these questions to allow us to choose participants with a mixture of backgrounds and expertise—there are no “correct” answers! All answers will be confidential.

1. I incorporate activities or lessons that take place outside into my classes:
   a) never
   b) rarely (once or twice a year)
   c) once in a while (three to five times a year)
   d) often (more than five times a year)

2. Compared to the amount of time I should spend teaching science, I spend:
   a) much less
   b) slightly less
   c) the right amount
   d) slightly more
   e) much more

3. My science instruction is spent in:
   a) textbook-based presentation only
   b) mostly textbook-based presentation
   c) equal amounts of textbook- and activity-based instruction
   d) mostly activity-based instruction

4. Please rate your effectiveness as a teacher of elementary or middle school science:
   a) superior: one of the best in my building
   b) above average
   c) average
   d) below average
   e) low: in need of professional improvement

Please use a separate piece of paper to answer the following questions, typing your answers if possible and limiting them to about 1/3 page or less per question (you don’t need a separate page for each question, just don’t answer them on this sheet of paper). Please staple the questions to the rest of your application.

1. Do you ever use living organisms in your classroom? If so, what organisms, and how? If not, why not?
2. How do students best learn science?
3. What makes your own science instruction successful or unsuccessful?
4. Please describe your best science teaching experience.
5. (Optional) Is there anything else you would like us to know?

Completed applications should be postmarked or faxed by April 17 to the address below. If possible, please mail both applications together if you are applying as a team.

Dr. Karen Oberhauser
University of Minnesota
Department of Ecology
1987 Upper Buford Circle
St. Paul MN  55108
fax: 612 624-6777
phone: 612 624-8706
e-mail: oberh001@tc.umn.edu
Monarchs and the Environment

“Please keep the environment safe for them.” ~ 7 year old student, Connor Keech

Last fall, a suite of papers published in the Proceedings of the National Academy of Science (PNAS) documented several studies on the impact of transgenic Bt corn on monarchs. Bt corn, one of a growing number of genetically modified plant pesticides, produces a protein that is toxic to Lepidoptera (butterflies and moths). This genetically modified crop was developed to protect corn plants against corn borers, larvae of a small, inconspicuous moth that cause extensive damage in some years.

The PNAS papers, authored by scientists from IA, Ontario, MN, NY, NE and MD reported on many factors that affect risks to monarchs from Bt corn. The bottom line of these studies is a mixture of good and bad news, with unanswered questions still remaining. The Bt corn lines that have received regulatory approval express relatively low levels of toxin in their pollen, and it is unlikely that enough pollen falls on milkweed plants in cornfields to kill many monarchs. However, many scientists and conservationists are not completely satisfied about the conclusion that there is no risk to monarchs from Bt corn. The above studies didn’t consider the effects of anthers on monarchs. Anthers, the plant organs that produce pollen, are shed from corn plants. They contain high levels of Bt toxin. Second, the cornfield studies had sample sizes that may have been too small to detect a difference between survival in Bt fields and non-Bt fields. Finally, the studies did not adequately consider potential sublethal effects on monarchs that consume Bt toxin as larvae. We don’t know the effects of this on their ability to reproduce, migrate and survive.

One of the most surprising results of the research was the number of monarchs and milkweed found in cornfields. Karen Oberhauser and Michelle Prysby coordinated a study of field sites in Minnesota, Wisconsin, Iowa, Maryland and Ontario. We measured per plant densities of monarchs on cornfield milkweed, then estimated the density of milkweed in these fields. By comparing these densities to values from other habitats, we learned that most monarchs in the upper Midwest probably grow up in either corn or soybean fields. This is both good and bad. It means that monarchs can share land with human cropping systems; since common milkweed grows well in disturbed habitats, human presence may actually have benefited monarchs. However, monarchs could be very susceptible to changes in agricultural practices, especially weed and insect control practices.

We are particularly concerned about the potential impact of herbicide-tolerant plants. These crops have been genetically modified to withstand herbicide applications, allowing farmers to spray their fields after the crops have come up. Later spraying could have a significant effect on the amount of milkweed available to female monarchs looking for plants on which to lay their eggs. We still need to study the impact of herbicide-tolerant plants; the decrease in milkweed availability that could inevitably result from herbicide-tolerant plants will have a significant impact on monarch numbers.

Bt crops are touted as environmentally-friendly, since they can potentially decrease the amount of pesticides applied. An irony in this selling point is that few farmers use insecticides to control corn borers, simply because they don’t lose enough corn to this pest to make it cost-effective. A second irony is that herbicide tolerant crops, produced by many of the same companies, allows an increase in the amount of herbicides applied to fields, thus increasing the environmentally-harmful effects of agriculture on natural systems.

Our cornfield research showed that monarchs, and other organisms, can coexist with agricultural systems. One of our goals is to learn how best to foster this coexistence, in a way that minimizes costs to farmers, society, and the natural environment.
Winter Storm in Mexico Kills Millions of Monarchs

The 2001-2002 monarch overwintering generation has experienced population extremes. The Monarch Larva Monitoring Project provided data that proved what many observers noted: the summer of 2001 was a good one for monarchs. Millions were produced all across the breeding range; as these monarchs moved southward toward their winter home in Mexico, Monarch Watch (www.monarchwatch.org) participants made similar observations of large numbers compared to earlier years. Eligio Garcia, biologist in the Monarch Butterfly Biosphere Reserve, used a standardized protocol to measure the number of hectares occupied by the butterflies after they reached Mexico. He reported that the number of hectares occupied by monarchs this winter in the Rosario and Chincua colonies (see Journey North www.learner.org) was as high as had been recorded any year since 1996, good news for monarch fans everywhere.

However, January brought a rare and deadly combination of weather to the Transvolcanic mountains of central Mexico. While monarchs enjoy the bounties of abundant milkweed and space during the summer in the northern US and southern Canada, they are essentially a tropical insect, and must leave these areas every winter if they are to survive. Unlike most temperate insects that can hibernate through cold winters, monarchs die in temperatures that are much below freezing. On January 12-13, 2002, in the middle of what is generally the dry season, a deluge of rain swept into the region, bringing up to 10 cm of rain to Angangueo, the town nearest the Sierra Chincua colony. The rain soon turned to snow, and many butterflies were knocked to the ground. This has happened several times before, but this year the rain and snow were followed by sub-freezing temperatures. The combination of wet and cold killed millions of butterflies. Monarchs can withstand colder temperatures if they’re dry; likewise they can stand being wet if they’re not cold. However, the combination is deadly. Samples of dead butterflies have led to estimates that up to 80% of the population died in the storm’s aftermath.

The effects of this storm may have been exacerbated by logging. We know that an open forest is more subject to weather extremes of cold, wetting and wind. This has been called the “umbrella and blanket” effect by Lincoln Brower; an intact forest protects the butterflies by acting as an umbrella to lessen the impacts of rain and snow, and as a blanket to lessen the impacts of cold. A few degrees can mean the difference between freezing to death and surviving, and higher wind velocities may have knocked more butterflies out of the trees. It is also possible that a more dense forest would have provided protection from the snow. Whatever the relationship between human activities and the effects of the storm, the Eastern migratory population, at least as measured in the two major colonies of Rosario and Chincua, may be smaller than has ever been recorded, and thus more vulnerable to any environmental perturbation, anthropogenic or natural.

We also know that the population can recover. If 2002, like 2001, is another banner summer for monarchs, we may see as many monarchs next fall as in a relatively low but still “normal” year. However, if 2002 is hot and dry, or cold and wet, it may take much longer for monarch numbers to return to what we would consider normal. We’ll all keep our fingers crossed, but there is more that can be done. Like all organisms, monarchs have specific habitat requirements; we need to make sure that these habitats are available. Many monitoring programs (see page 15) will provide data needed to quantify long-term impacts of the 2002 storm, and citizens throughout the monarchs’ range can help these programs. Finally, we can educate others about the natural world. These kinds of active involvement are much more likely to make a difference than crossing our fingers!

A version of this article is printed in the Monarch Butterfly Sanctuary Foundation 2002 newsletter. By Karen Oberhauser and Lincoln Brower.

Answers to the Quiz:
Anywhere milkweed and flowers are growing is good monarch habitat.; Warning coloration; Both positive and negative, caterpillars eat the plant and adults pollinate plants; Non-living things such as temperature and daylength.
Monarch Population Dynamics Meeting

Teacher and Student Presenters at Monarch Population Dynamics Meeting

Mary Bishop Kennedy and Kristin Duncan: Texas Military Institute, San Antonio TX. Are all migrating monarchs in reproductive diapause?
Mary Bishop Kennedy, Stephanie Spurgat and Bethany Leach: Texas Military Institute, San Antonio TX. Do monarch larvae use visual or chemical stimuli to find milkweed?
Jane Borland, Tiffany Watkins, Trey Crumpton: Lamar HS, Arlington TX and Carol Johnson, Brenda Montes, and James Tovar: John Jay HS, San Antonio TX. Characteristics of fall migratory monarch butterflies
Cindy Petersen and Jill Clancy: St. Hubert’s MS, Chanhassen MN. A silent killer
Cindy Petersen and Sarah Peterson: St. Hubert’s MS, Chanhassen MN. Danger: Weevils
Annette Strom, Jenna Proctor and Britteny Saline: Ordean MS, Duluth MN. Effects of common garden chemicals on invertebrates
Annette Strom, Jenna Proctor and Britteny Saline: Ordean MS, Duluth MN. Monarch population fluctuations

Monarchs have received a great deal of attention in Mexico, the US and Canada, from research, conservation and education perspectives. This attention results from many features of their biology, including a spectacular and unique (among insects) migration, during which a single individual can traverse all three countries; their popularity and recognition among the public; and potential impacts of human activities, such as habitat destruction and pesticide use, on monarch populations. The Monarch Population Dynamics Meeting, held 20-23 May 2001 in Lawrence Kansas addressed all of these factors, and more.

The Monarch Meeting, hosted by Monarch Watch in collaboration with Monarchs in the Classroom, was organized by Chip Taylor and Karen Oberhauser. Scientific presentations were followed by discussions of key parameters necessary for an understanding of monarch population dynamics. These discussions and presentations have formed the start of a unique project, an attempt to understand the annual dynamics of a migratory insect with a continental distribution. During the meeting, participants worked to synthesize existing data on monarch population dynamics during all stages of the annual cycle, identify future research priorities, and make policy recommendations.

We are especially proud of the Middle and High School teachers and students who participated in this meeting, both as presenters and as important contributors to the discussions that followed the scientific presentations (see side bar). These teachers and students conducted independent research projects after taking part in Monarchs in the Classroom workshops, and their participation was funded by a grant from the National Science Foundation.

Many of the papers presented at the meeting will be available in a forthcoming book to be published by Cornell University Press. Working group summaries and policy recommendations are available from Karen Oberhauser or on the MonarchLab website (www.monarchlab.umn.edu). Financial support for the meeting came from Monarch Watch, MITC, Monarch Butterfly Sanctuary Foundation, the United States Fish and Wildlife Service, the National Fish and Wildlife Foundation, and the University of Kansas.

How Can You Help Monarchs?

If you’d like to help learn more about monarchs, or ensure that they survive for future generations to enjoy, here are some ideas.

1. Monitor Monarchs! The Monarch Larva Monitoring Project (MLMP, www.mlmp.org), an MITC project, is fully described on page 1. The Journey North program (wwwlearner.org/north) gives students, teachers and others a forum in which to report their first sighting of monarchs. These first sightings track the monarchs’ return from their overwintering sites in Mexico, and their offspring as they recolonize the entire northern breeding range. The Monarch Watch program (www.monarchwatch.org) is focused on the fall migration. In this program, volunteers throughout the monarchs’ North American range tag and observe monarchs as they move south towards the overwintering sites in Mexico. The North American Butterfly Association (www.naba.org) conducts an annual butterfly count in July, and have many years of data on the abundance of dozens of butterfly species, including monarchs.

2. Donate money to organizations that preserve habitat. Some of these are specific to monarchs (e.g. the Monarch Butterfly Sanctuary Foundation, www.mbsf.org, and the Michoacan Reforestation Fund, www.michoacanmonarchs.com), but many other organizations are preserving habitat that will benefit monarchs (e.g. The Nature Conservancy and the World Wildlife Fund).

3. Preserve and create habitat. Plant native milkweed in your gardens, yards and fields; and do what you can to preserve habitat in which monarchs can breed, grow and migrate.

4. Teach others about monarchs and conservation. Let us know what you’re doing!
2002 *Monarchs in the Classroom* Summer Course

Application and Ordering Materials Inside!