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Teacher Connection

The Newsletter of The Wild Ones
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The Wonderful World of Insects

by Alida Madero

“The secret of success?

Grow antennae, not horns.”

James Angell, former president of the University of Michigan, when he was asked the secret of his success.

People often think an insect is any small-sized creature with lots of legs and a shell. (The shell is called the **exoskeleton**, which means a skeleton on the outside of the body). Actually insects, spiders, millipedes, and crabs all belong to a group called **arthropods**, which means “jointed legs”. All

insects are arthropods, but not all arthropods are insects.

Insects differ from other arthropods in that they have six legs, two antennae, two to four wings and three body sections: head, where they have compound eyes, mouthparts and antennae; thorax, where the legs and wings are; and abdomen that contains digestive and reproductive systems. The strong exoskeleton protects their bodies and supports their muscles in the same way that our bones support our muscles.

Insects are the largest group of animals on earth. They have lived for millions of years, much before the origin of man. Because of their long existence in the planet, insects have developed adaptative mechanisms that allow them to inhabit different ecosystems in the biosphere.

We can find insects in the most diverse environments: from lakes in cold regions under 0°C, to desert areas with temperatures as high as 50°C. Insects are present on and under soil, in plants, in the body of other animals, and even in oil wells! Just like any other animal, they have different vital functions: locomotion, reproduction, digestion, etc.

Unlike humans that have the same shape all their lives, insects change their shape at least once in their lives. Mother insects lay hundreds of **eggs** at one time, and the babies that come out from them are called **larvae**. Larvae are, in general, very different from their parents. Most larvae do

not have wings and feed in a different way from their parents. For example, adult butterflies and moths drink nectar of many flowers and other fluids, while their larvae (caterpillars) feed only from leaves of their host plant.

The larvae of many insects form **pupae**. Pupae are the larvae covered with a thick skin, or a cocoon that they make with their silk. It is in this state that larvae become **adults** through a process called **metamorphosis**.

When larvae metamorphose into adults, they shed their skin or come out of their cocoon, and fly. Adult insects usually mate only once and die after the female lays her eggs.

Here are some resources where you can find information, lessons, activities, and even songs about insects!

“The handy bug answer book” by Dr. Gilbert Waldbauer. Visible Ink Press. Detroit, New York.

<http://earthlife.net/insects/six.html>

<http://www.uky.edu/Agriculture/Entomology/ythfacts/allyr/yf807.htm>

<http://entowww.tamu.edu/academic/ucourses/ento489/insects.html>

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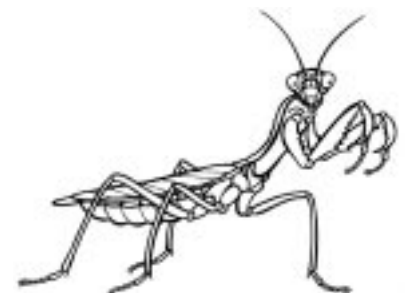
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Importance of Insects

By Mike Quinn, Invertebrate Biologist
Wildlife Diversity Branch
Texas Parks & Wildlife

As an entomologist for the state of Texas, I am often asked why insects are important. One of the most important roles insects perform is the pollination of plants. Many flowers require a visiting insect to transfer the pollen needed to fertilize and set seed. Insects pollinate three-quarters of our crop. Plants like apples, cherries, cantaloupes and peaches are almost entirely dependent on insects like honeybees. Without the insects, these crops could not be grown.

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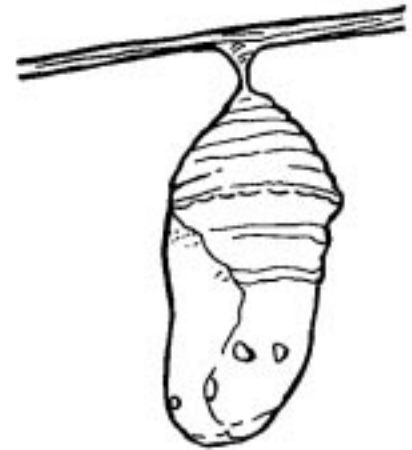
<http://www.wildlifetrust.org>

Every year the pollination activity of bees provides benefits worth tens of millions of dollars to agriculture. Bees, including the introduced or Africanized honeybee, are the best-known pollinators. However, many other insects, like flies, moths, butterflies and wasps, also can be important.



One of the most important but overlooked roles of insects is their involvement in the recycling. Many insects help break down organic matter they scavenge. Dung Beetles are perhaps the most famous insects that recycle. They bury balls of dung, in which they lay an egg. Burying the manure from cows enriches the soil. To the Egyptians, the Dung Beetles rolling a ball of dung across the land symbolized the movement of the sun across the sky. They carved the image of the "Sacred Scarab" into the walls of their pyramids.

Decay of dead animals is greatly accelerated by hide beetles and flies that feed on them. Decay of wood often is dependent on termites, carpenter ants and various beetles that tunnel through it. In addition, the tunneling of ants aerates and mixes soils, providing an essential task that earthworms provide elsewhere.



Insects are an important food source for other wildlife. Most game fish like trout, use insects as a major part of their diet. Insects are central to the diet of many songbirds, particularly at nesting time. Insects also make up a large part of the diet of many small mammals, like shrews and kangaroo rats, which in turn are prey for hawks, fox and other predators

Insects are also vital "Biological Controls" of other insects. Biological controls are predacious or parasitic insects or insects that eat other insects or lay their eggs in other insects. This essential service is largely unseen. For many pest insects, the chief factor in keeping their populations in check is predacious or parasitic insects.

Life as we know it simply could not exist without the services of the many species of insects with which we share the earth.



Insect Anatomy

by Alida Madero

The insect's body has three main parts and three pairs of legs. Adults also have wings and antennae.

Have your students find the place of the following insect body parts.

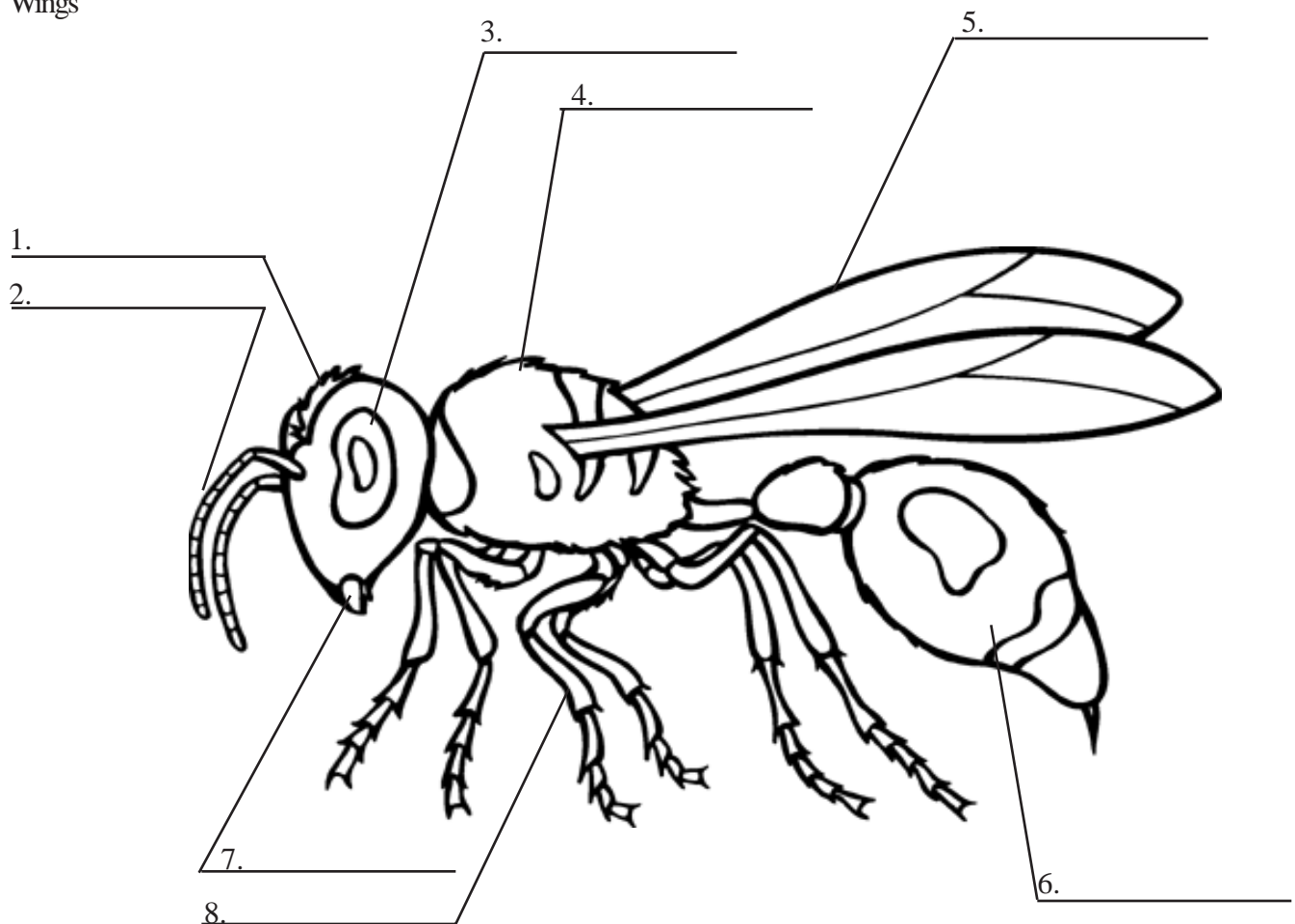
- Abdomen
- Thorax
- Head
- Legs
- Compound eye
- Antennae
- Mouth parts
- Wings

Older students can also locate where the digestive, reproductive, and respiratory systems are located.

The students could also draw an insect they have observed, and label its body parts. As a creative exercise, they could create a fantasy insect to meet a particular job, i.e. scavenger, pollinator, predator, etc. The drawing should include all the basic insect structures and appropriate labels.

The students could also write an 3-5 paragraph essay describing the design of the insect, and how it is suited to its job (niche).

Younger students can be asked to write a few sentences responding to specific directing questions.



Source: http://learningpage.com/images/clipart/insects/images/lp_i_ff_img05_wasp.gif

Answers: 1. head, 2. antennae, 3. compound eye, 4. thorax, 5. wings, 6. abdomen, 7. mouth, 8. legs

Sterile Insect Technique

by Dr. Walther Enkerlin-Hoeflich, Entomologist
International "Atomic Energy Agency-FAO

The Sterile Insect Technique (SIT) is an effective method for the control of pest insects that does not damage human health or pollute the environment, as is the case of most chemicals, or pesticides used for the purpose. This technique is a simple method of birth control for pest insects. The reproductive behavior of these insects, which is similar to that of other animals including man, is used. The diagram on page 5 describes in a simple way how insects reproduce. In this case, we show the reproduction technique of the fruit fly.

Normal Life cycle of insects (left side of diagram)

1. On the upper left side, there is a female fly, ready to look for a mate (male fly) and form a family.
2. Female decides to search for a mate and finds the male fly.
3. As a result of this, the female is ready to become a mother and lay its eggs. After some days, these eggs hatch and tiny larvae come out.
4. Eggs are laid inside sweet juicy fruits; so young larvae have enough food.
5. Larvae feed from the fruit, and as a consequence, fruits rot and fall from the tree.
6. After some time, larvae grow and mature and become adult male and female flies.
7. The steps 1 to 6 repeat over and over again. Each time a large amount of fruit is lost because it is eaten by larvae, and cannot be consumed by humans.

Insects' birth control (right side of the diagram)

1. Female fly is ready to form a family.
2. In order to protect their crops, farmers release a large amount of sterile (unable to reproduce) male flies over and around fruit trees.
3. When searching for a mate, the female finds a sterile male.
4. The female lays eggs, but eggs will not hatch.
5. As a result, the fruit remains clean, and is available for human consumption.
6. Through this insect birth control, the normal reproductive cycle of pest insects is broken, and the fruit is protected without the addition of pesticides that harm humans and the environment.

In order for this technique to work, it is necessary that the number of sterile insects released to the field is ten times higher than the number of pest insects found in crops. In this manner, it is almost sure that at least one member of each pair is sterile, and will not be able to reproduce.

When reproduction of pest insects is controlled that way over a period of time, the populations gradually decline, and their ability to damage crops becomes insignificant.

In order to apply this method of insect birth control, it is necessary to produce and sterilize millions of insects to be released over areas affected by pest insects. Massive reproduction of insects is a process that is done at industrial level, just like the production of cars, clothes, screws, etc. The difference is that insects are



Sterile Insect Factory in Tapachula,
Chiapas, Mexico

continued from page 4

living organisms and have special requirements that must be met. It is necessary to feed them a diet rich in protein and sugar; the temperature, light and humidity in the “factory” must be adequate for their optimal development. Sterilization takes place through an effective, simple and clean method that does not affect man or the environment. This method in-

cludes the exposure of insects to low doses of radiation. The type of radiation is the same used by hospitals to clean medical instruments. In fact, the amount of radiation required to sterilize insects is much lower than the amount required for those purposes mentioned above. Treated insects only suffer a small damage in their reproductive organs, enough to leave them sterile.

This method of pest control is available for about 30 different pest species that damage crops like oranges, mango, guava, apple and peach; as well as for insects that attack livestock, and those that spread diseases to humans like dengue and malaria. Worldwide there are about 50 sterile



Normal and SIT Insect Reproduction Diagram

insect “factories”. The amount of sterile insects produced per week in the world is approximately 4 thousand million that are released in affected areas of 25 countries in the world. On the American continent, there is sterile insect production in Argentina, Canada, Chile, Costa Rica, United States, Guatemala, Mexico, Panama and Peru.

The advantages of using this method to control pests are many, including:

1. An effective control of pest insects that prevents harvest losses, or damage to farm animals that produce milk, meat, or draft animals to work the land.

2. Reduction of pesticide use that pollutes the environment, including soil, water, forests.

3. Improvement of the economic status of farmers and livestock breeders that can produce more with less expenses and cleaner.

It is necessary to keep developing this technique of pest control, so it can be used for more species of crop pest insects. At the same time it is also important to continue our efforts to develop more pest control methods that are effective and environmentally friendly.

A sweet resource in danger of disappearing

by Sergio Medellin,
Pronatura Noreste, Mexico.

Honey has been sought as a food source by many animals, especially by humans for both food substance and flavor enhancer. Very important in ancient times, it was used as a preservative agent for foods (particularly meats) as well as for cadavers (as used in Babylonia and ancient Egypt). Its ability to prevent rotting has been recognized since early times when people used honey in their traditional medical treatment of wounds and open sores. Honey has an anti-microbial action, derived from the bees as well as from the plants from which they consume their nectar. These are the most common known uses for honey.

In addition to all that wonderful honey, bees provide the invaluable service of pollination. Many economically important crops, such as citrus, vegetables, macadamia nuts, pistachios, and alfalfa, depend upon bees for pollination.

The honey trade, particularly honey from the European bee *Apis mellifera*, is a major, worldwide commodity and source of employment worldwide and provides employment for many workers. Mexico is 4th in honey production, and is 2nd in volume of exportations. The area of major production is the Yucatan Peninsula, which produces over one third of the total honey of Mexico.

But...there is not need to import bees from Europe in order to produce honey. There are more than 15 native bee species in the Yucatan Peninsula. These bees are completely different from the European bees we know. These native bees have unique characteristics such as the lack of a stinger, the inability to breed with Africanized bees, the production of a very liquid and delicate-tasting honey. These native bees produce a wax called "Campeche wax", which was widely used in the process of grafting plants. The production of this wax was intensively commercialized during the Mexican colonial times (16th-18th centuries).

Most of these bees have the potential to be domesticated, however, the only sting-less species that has actually been domesticated since ancient times is the xunan kab or kolil kab (in the Mayan language), or *Melipona beecheii* Benneth. These bees are still being farmed by traditional methods in rural areas. They are maintained in artificial beehives, locally known as "jobon", imitate natural hollow tree trunks in the forest.

This species was economically important in the past. The honey they produced provided the ancient Mayans with food energy, and the beeswax was used to make products for everyday life. Honey was also the main ingredient in the preparation of ceremonial alcoholic drinks and was considered an important element in traditional medicine for its therapeutic properties.

The economic importance of honey was so significant that it is typically listed as a main commerce during prehispanic times. Honey decreased in popularity and use when sugar cane was introduced to Mexico, and people started using sugar instead of honey.

The introduction of the European bee *Apis mellifera* to the Yucatan greatly changed the production of honey in Mexico. People started rearing the *Apis* bees for honey, replacing the practice of raising xunan kab in their backyards

with traditional methods.

Honey production from xunan kab was reduced to low critical levels. In addition, ecological (deforestation), economic (production and numbers of producers is low), and social changes (the production of xunan kab was done by elders in a traditional way, and was being undervalued by younger generations) did not favor raising the Mayan bees. However, xunan kab honey has kept its place in traditional medicine.

This picture changed with the arrival of Africanized bees from South America. These bees constitute a serious threat to almost one third of European beehives, which are located in backyards. With the arrival of Africanized bees, their negative effect on European bees, and the need to relocate European beehives from backyards and homes, came the chance for xunan kab to reclaim its place in history.

But... could the practice of raising xunan kab be rescued and the value of traditional technology recover? How could this be achieved?

Several years ago, organized groups of interested individuals from varied backgrounds created an organization called Yik'el Kab ("insect that produces honey"). Among them were: traditional producers, ethno ecologists, researchers, technicians, teachers, and communication experts. They have joined efforts to rescue, promote, finance, and support research and training in sting-less bee husbandry, particularly in the Maya Zone of the Yucatan Peninsula. By uniting efforts with governmental and research agencies, this organization is achieving the conservation of this resource and also improving the economy of the mayan-yucateco communities.

Ant Safari

by Michael Wilkinson

Preparation

Construct maps of the study area. Simple line maps that can be photocopied will be sufficient. Older students may be able to help with this.

Gather field kits for each group. Each kit should include notebooks, drawing paper, pencils, colored pencils, measuring equipment, hand lenses, and small specimen containers. The kits can be put together in any sturdy container that will be easy for the children to carry.

Divide students into research teams of 2 to 4 children. This will help facilitate increased participation and communication within each group, and provide for the opportunity to share observations, questions, and hypotheses between groups.

Brainstorm questions to which students will attempt to find answers. In science, there are always more questions than answers, so this list will most certainly grow as students get involved in this study.

To get your students started, you might pose some of the following questions:

- What new things have you noticed about the way ants act or look?
- How frequently do ants enter or leave the nest?
- How far do ants travel from the nest?
- Do all the ants do the same job, or do they have different jobs?
- What is the average speed of an ant?
 - Does the average speed of an ant vary based on species, air temperature, or other factors?

Field Work

Explore the schoolyard to find good observation stations. If possible, mark each station with a flag or stake. If safety concerns prohibit this, have students mark their station only on a map of the schoolyard.

Once observation stations are identified, begin collecting data. A dialectic notebook is a helpful structure for older children to organize their thinking. To set up a dialectic notebook, divide your notebook page into two columns. Label one column "Observations," and the other column "Hypotheses and Questions."

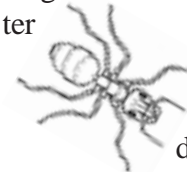
In the Classroom

Bring ants into your classroom for your students to observe. The traditional ant farm provides a convenient way to observe ants'



subterranean activities. To populate your ant farm, ants can be purchased from most supply houses, or dig up part of an ant hill

from your study site. A clear, 2-liter soda bottle makes an inexpensive container to hold your ant farm. Be sure to cover the bottle with an opaque paper when observations are not being made. This will encourage the ants to tunnel near the edge of the bottle, where they can more easily be observed. A ring of Vaseline around the opening of the ant farm, and placing the ant farm in a pan of water will help prevent ants



from escaping.

Have your students prepare graphs, charts, and diagrams to share their data with each other, and publish their work on The Wild Ones web site. When students have questions about their study that they cannot answer through observation or books, have them send us an e-mail through our web site.



Final Thoughts

Analyzing Ants provides your students an opportunity to engage in original research, and takes them through all steps of doing science: questioning, observing, analyzing, hypothesizing, testing, concluding, and publishing.



Doing Science

by Michael Wilkinson

What is the difference between a science class and “doing science?” It can be a great deal. To really “do science,” your students must be engaged in the process of inquiry. Science is all about asking questions and then going about trying to find the answers.

This means results can be unpredictable, inconclusive, and always lead to more questions. While this may sound difficult to manage in the classroom, consider this: in doing science, student individualization and comprehension is exponentially increased.

Now, don't get me wrong. There is value in science class and “cook-book” labs. These provide students with the skills to do science. In these controlled situations, specific concepts can be demonstrated. However, students must be given the opportunity to investigate and experiment on their own terms to fully internalize the information presented in class. They need the opportunity to translate that information into their own cognitive construct in a meaningful and lasting manner.

An added advantage that many teachers have found in doing science is that it is often less expensive than they expected it to be. In science, one must construct experiments and apparatus. Materials can be recovered from the rubbish bin and recycled, donated from a local vendor, or purchased inexpensively in a local market. What remains to be procured can generally be ordered from a supply house. Think about how many ways a two-liter soda bottle can be used. What about film canisters? Even the

plastic soup containers from your local Chinese take-out establishment, or the rectangular baby wipes boxes can be used in a variety of ways.

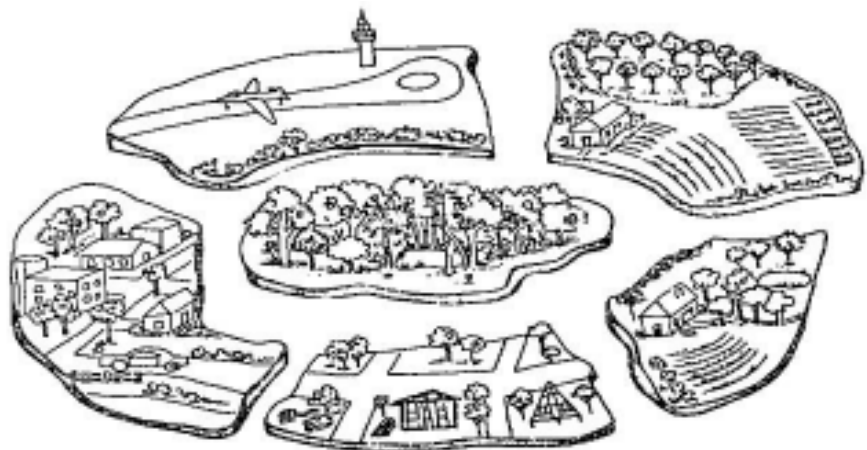
Most of the projects we suggest in The Wild Ones fall within the category of doing science. Children are asked to pose questions and actively participate in the pursuit of answers. Try out the projects and activities suggested in the Teacher Connection On-line.

In Our Next Issue...

The term “Bioscape” describes an approach to conservation that uses a landscape level of analysis and priority setting. Bioscapes are human/wildlife landscape mosaics, geographically defined by a common sphere of human influence. Through Bioscapes, conservationists link the physical environment, conservation science, and the human dimensions of politics and culture in areas where human population pressures have placed wildlife species at great risk.

For a sneak preview of a Wildlife Trust Bioscape Project, visit <http://www.wildlifetrust.org/hhome2.htm>

In the Spring edition of The Wild Times we will explore “Bioscapes”.



Elements of a bioscape

Insect project

by Charissa Sgouros,
Bank Street School for Children

Insects are so small, and yet they out-populate humans by quite a large number. They are crucial to our existence. By studying them, children can learn to appreciate these “unhuggable” creatures.

Have your student each chose their own insect to study. They are then responsible for finding out as much information as possible, using a variety of resources, such as homework readings, on-line computer information, science books, library, etc.

This information is first translated into sketches, which it is later used for their papier-mâché models, and finally, creative writing pieces. Each child has a choice of how to express the information discovered creatively by way of short story, song, poem, letter, or diary entry. Whatever method is used, it is to be a vehicle for relating information about their individual insect.

The written pieces and models which are part of the culmination of the classes insect research project can be submitted to The Wild Ones to be uploaded to the website.