PARPARIM

Butterfly Migration in the Middle East: Beyond the Boundaries

Dear Educator,

Welcome to ***Parparim,*** **Butterfly Migration in the Middle East: Beyond the Boundaries**. A five-part modular curriculum for students in grades four through six, ***Parparim*** (Hebrew for butterflies) includes a webinar by Israeli butterfly expert Dr. Guy Pe'er, scheduled for April, where students can see the flora and fauna of Israel and have their questions answered by a butterfly expert in real time.

Parparim was created by Jewish National Fund in partnership with the US Forest Service, and with the guidance of Dr. Guy Pe'er. Throughout the last century, JNF has been known as a global environmental leader, greening the land of Israel by planting 240 million trees. Together with the US Forest Service, JNF provides environmental education in the fall, through World Water Monitoring Day, and has added this new spring program, ***Parparim***.

Parparim was designed for use in many school settings. Educators can choose and implement the lessons that fit into their schedules. Some highlights of the program are:

- **Unit One:** Students create hand-made butterflies which will become part of an exhibit at the Holocaust Museum in Houston, TX.
- **Unit Two:** Students work together on a mural, mapping butterfly migration and dispersal on a large climatic map of the Middle East.
- **Unit Three:** Classes plan and implement social action projects to improve the environment.
- **Unit Four:** Students explore diversity through biodiversity. Working in groups, they will present a multi-faceted report about how biodiversity strengthens an ecosystem and how diversity strengthens our society.

Continued

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MODULES AND TIME FRAMES

Lessons and Time Allotted

Unit One		Time Allotted
Introduction to Butterflies	Page 5	15 to 30 minutes
Butterfly Life Cycle	Page 6	10 to 20 minutes
Eggs	Page 6	10 to 15 minutes
Larva (caterpillars)	Page 7	10 to 15 minutes
Pupa (chrysalis)	Page 8	10 to 15 minutes
Adult	Page 8	10 to 15 minutes
The Butterfly Project (Background)	Page 9	20 to 30 minutes
Project (create butterflies)	Page 11	20 to 30 minutes
Conclusion	Page 12	5 to 10 minutes
Unit Two		**Time Allotted**
Butterfly Behavior	Page 20	5 to 10 minutes
Survival Strategy	Page 21	5 to 10 minutes
Hilltopping	Page 21	5 to 10 minutes
Dispersal and Migration	Page 22	10 to 20 minutes
Think Like A Butterfly	Page 24	10 to 20 minutes
Map Mural	Page 25	20 to 30 minutes
Unit Three		**Time Allotted**
Bioindicators	Page 29	10 to 20 minutes
Make a Difference	Page 32	15 to 20 minutes planning, ongoing activity
Unit Four		**Time Allotted**
Pollination and Biodiversity	Page 36	5 to 10 minutes
Group Research Project	Page 37	30 to 60 minutes, or as homework
Year of Biodiversity (Alternate Project)	Page 39	30 to 60 minutes, or as homework
Presentations		5 to 10 minutes per group

Continued

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Parparim encourages critical thinking as students find relationships between several curricular areas: science, social studies, literature, and art.

SCOPE AND SEQUENCE

Curricular Areas and Themes by Unit

	Unit One	Unit Two	Webinar	Unit Three	Unit Four
CURRICULAR AREAS					
Science	✓	✓	✓	✓	✓
Social Studies	✓	✓	✓	✓	✓
Literature	✓				
Judaic Studies	✓				
Art/Writing	✓	✓		✓	✓
THEMES					
History	✓		✓		
Survival Strategy	✓	✓			
Geography		✓	✓	✓	✓
Climate		✓	✓	✓	✓
Social Action			✓	✓	
Conservation	✓	✓	✓	✓	✓
Cooperation	✓	✓		✓	✓
Diversity	✓	✓	✓	✓	✓

***Parparim,* Butterfly Migration in the Middle East: Beyond the Boundaries** was designed to engage, educate and energize your students towards *tikkun olam*, care and repair of the earth. Please share your thoughts and experiences with us at *education@jnf.org*.

Thank you,

Nina Woldin
Coauthor, Parparim
Jewish National Fund

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UNIT ONE:
Butterflies are Transformers!

Key Concept:

The metamorphosis of the butterfly is a symbol of transformation.

Skills:

- Observation
- Diagramming
- Critical thinking
- Creative self-expression

Materials:

- Butterfly life cycle printout on page 13 (one for each student)
- Butterfly eggs photo printout on page 14 (one for every 5 students)
- Butterfly larvae photos printout on page 15 (one for every 5 students)
- Butterfly pupae photos printout on page 16 (one for every 5 students)
- Adult butterfly photos printout on page 17 (one for every 5 students)
- Annotated butterfly drawing printout on page 18 (one for each student)
- Butterfly Notebook (either lined or unlined paper) and pencil for each student
- Collage materials, scissors, glue, felt-tipped pens
- Optional: Butterfly garden or live butterfly kit (kits are available on-line for approximately $25)

Vocabulary:

transform – (v) change completely
metamorphosis – (n) a complete change in form from one stage to the next in the life history of an organism, for example, from the caterpillar to the pupa and from the pupa to the adult butterfly
larva (plural larvae) – (n) immature form of an insect, especially one that is very different from the adult
exoskeleton – (n) a hard outer structure, such as the shell of an insect, that provides protection or support
molt – (v) to shed outer layer, such as feathers or skin, in the process of renewal
predator – (n) an animal that lives from hunting or preying on other animals for food
prey – (n) the animal which is being hunted or being eaten
pupa (plural pupae) – (n) an insect in the nonfeeding, immobile, transformation stage between the larva and the adult
chrysalis (plural chrysalises) – (n) same as pupa
dormant – (adj) having normal physical functions suspended or slowed down for a period of time
diapause – (n) a period during which growth or development is suspended and physiological activity is diminished, as in certain insects in response to adverse environmental conditions **OR** a period of suspended development and growth accompanied by decreased metabolism in insects and some other animals, correlated with seasonal changes
species – (n) a group of organisms that resemble one another in appearance, behavior, environmental needs, and other characteristics; and can interbreed with one another and produce fertile offspring
family– (n) a group of species which share relatively common characteristics, and are assumed to have evolved from the same ancestors (There are 7 butterfly families in Israel. We will meet four of them.)
migrate – (v) to pass, usually seasonally, from one region or climate to another, taking a directional path (For birds, the start and end points are fixed and pre-determined. For butterflies, usually the migration is abrupt and the movement is directional, but the destiny is usually not known.)

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migration - (n) the periodic (seasonal) passage of groups of animals from one region to another for feeding or breeding (The Latin word means "to go from one place to another." Note, migratory butterflies ARE migrating, but it's a different type of migration from birds.)

Objectives:

- To learn about the life cycle and physical makeup of butterflies through observation and diagramming.
- To discover the symbolism related to the butterfly: transformation, hope, faith and religious freedom, and to apply those concepts as social and political themes.
- To learn the fascinating details of butterfly biology and through them understand their significance to nature and to us.

Background:

Butterflies go through a life cycle comprised of 4 stages: egg, larva, pupa and adult. This is considered to be complete metamorphosis. Depending on the type of butterfly, the life cycle may take anywhere from one month to a year or more. The butterfly's physical characteristics have caused it to become a symbol of transformation, hope, faith and religious freedom.

The Butterfly Project. (Based on the poem, "The Butterfly" by Pavel Friedman, a young man who perished in a concentration camp during World War II) is an exhibit of the Holocaust Museum in Houston. In an effort to remember the 1.5 million children who perished in the Holocaust, the Museum is collecting 1.5 million handmade butterflies. The butterflies will eventually comprise an exhibition, currently scheduled for spring 2012.

Procedure:

The following can be done in conjunction with raising live butterflies in the classroom, or as an independent unit.

Activities:

2 – 5 class periods

INTRODUCTION (15 - 30 minutes)

Begin this way: Close your eyes. Think of a time you saw a butterfly. Where were you? What were you doing? What do you remember about how the butterfly looked and what it was doing? How did you feel? *Have students draw a picture of their experiences or write about them on page one of their Butterfly Notebooks. Encourage them to share their drawings or writing with the rest of the class.*

Explain: Butterflies have become symbols of transformation, hope and faith; reminders that things can change for the better. They also symbolize freedom, especially religious freedom. Keep this in mind as we learn about the life cycle of butterflies, and see if you can figure out why this is so.

Write the following words on the chalkboard, and have the students copy them on page two of their Butterfly Notebooks, leaving enough space under each word to write a few lines:
Transformation
Faith
Freedom
Hope

Tell students: We will discuss these words as we learn about butterflies.

THE BUTTERFLY LIFE CYCLE: (10 - 20 minutes)

Explain: Butterflies go through a life cycle which is made up of 4 stages: egg, larva (or "caterpillar"), pupa (or "chrysalis"), and adult. While in the chrysalis, the organs and body parts of the larvae dissolve and re-form into the organs, tissues, limbs and wings of the adult butterfly. They go through a complete transformation. *See whether anyone suggests that this physical transformation might be the reason butterflies symbolize transformation. If no one does, ask,* What does the word transformation mean? They may be familiar with cartoon "Transformers," robots who change into vehicles, animals and other objects. *Say,* Transformation means change. The change can be physical, like the robot Transformers, or the butterfly. (And just like the robot Transformers, the change involves a change not only in looks but also in function.) It can also be a change in the way someone understands the world, and because of this new understanding, a change in the way the person acts. Let's look at the butterfly life cycle and see how it relates to transformation.

Go back to the words the students copied on page two of their Butterfly Notebooks. Ask students to suggest phrases about what happens to the butterflies, to write under the word "Transformation." They will probably suggest "grow wings" or "change in chrysalis" or even "body parts dissolve and re-form." *Once these phrases have been written, ask students to suggest other examples of transformation, either in nature, or in their lives.* For example, the landscape transforms as the seasons change; people sometimes transform landscapes from nature into urban or agriculture. Caring for people or for the environment may transform their world from a cold, hostile place to one that is safer and more secure.

EGGS: (10 - 15 minutes)

Explain: A butterfly starts its life as a very small egg. The egg shape may differ between butterfly families or species: it can be round as a ball, oval, conic (cone shaped), or cylindrical. Most often, each family of butterflies has a typical shape of eggs: Swallowtails' eggs are usually round and simple in structure; the eggs of Blues are usually flat and have complex structures on them; Whites have conic eggs, and Fritillaries have barrel-shape eggs. If you look closely enough, in some eggs you can even see signs of the tiny caterpillar developing inside of it – the color changes with the days, the top turning dark before the larva hatches. Butterfly eggs are usually laid on the plants on which the larvae will later feed – on the leaves, flowers, on branches, or sometimes hidden on the lower parts of the plant or under it. *Ask,* Why do they need to hide? (Because the eggs cannot escape predators). You need to take your time and look very carefully to find these tiny eggs. Sometimes they are laid together, but most often each egg is laid alone, one in each place. *Ask,* Why should the mother spend so much time to select a place for each egg separately? (Answer: Because this way they are better protected. If one is eaten, or the plant dies, others will survive. Also, if the larva lives inside a small flower, there is only enough room for one at a time). *Continue,* A single female butterfly can lay one hundred to two hundred eggs!

If possible, give students the opportunity to find butterfly eggs in a butterfly garden (you may need to ask the owners for help to find the host-plants). If this is not possible, students can work in small groups with a printout of the photographs of butterfly eggs that can be found on page 14.

Challenge students to write a description of each egg they observe in the printout on page three of their Butterfly Notebooks, label each kind of butterfly egg and its host plant. Next have them answer these questions: What is the shape of the egg? Color? How are butterfly eggs similar to bird eggs? In what ways are they different?

LARVA:
(10 - 15 minutes

Explain: When the egg hatches, it is not a butterfly with wings that comes out, because a butterfly's life cycle has four stages. The second stage is the larva. Butterfly larvae are also called caterpillars. When the eggs hatch, the caterpillars begin eating the host plant they were laid on – some eat the leaves, others live on the flowers or the seeds. The mother butterfly is careful to lay her eggs on the species of plant that the caterpillar will need to eat because the caterpillars are too small to travel to new plants, especially when they just hatch. Each larva of a certain butterfly species usually can usually only eat one, or sometimes a few, species of plants. The reason for this is that the host plant doesn't actually "want" the larvae to feed on it, since that causes damage to the plant. So plants have developed poisons in reaction to this. (These are often the spices we use! They have a strong smell, and in fact they are poisonous for most insects.). But the butterflies must eat something – so they have evolved resistance to the specific chemical, or poison, made by their host plant. Since every plant makes different poison, and the butterfly cannot develop resistance to all poisons, they become specific only to one kind, or a small group, of host plant. For this reason the butterflies have to lay eggs on the right species of plant they have adapted to. The hatching larvae are extremely small: usually, 1mm in length or less! But once they start eating, they grow very quickly. A caterpillar's skin does not stretch or grow, so it must molt (shed the outgrown skin) as it grows. Caterpillars do this four times. In the last molt (the fifth one), the larva will take a different, stronger skin and a new structure, and will turn into a pupa.

If you are raising butterflies in your classroom, have the students observe the caterpillars for a short time each day. When do they eat? What do they do before they molt? Has their color changed? (They often change colors each time they molt. Before molting, they usually stop their activity for almost a day).

Continue: Butterflies are at the bottom of the food chain, right above plants. That means that they are "prey" to many animals (many animals eat them). Birds, lizards, spiders and preying mantises are among the predators who eat butterflies. But the worst enemies of all are tiny parasites, which lay their eggs into the eggs or larvae of the butterflies and eat them. In order to protect themselves from predators and parasites, caterpillars use different strategies. Some are poisonous to predators. These caterpillars get their poison from the plants they eat. Usually, the brightly colored larvae are poisonous; their color warns predators to stay away. Some caterpillars use camouflage: they blend into their surroundings to hide from predators. For example, they may be a shade of green that matches their host plant. Others look like inedible objects such as bird droppings. And others simply live in groups: if a parasite or predator attacks a group of 100 larvae, it might miss a few.

Distribute the photographs of caterpillars on page 15. Have students study them and answer the questions below on page four of their Butterfly Notebooks, based on the photographs.
1. Which caterpillar looks poisonous? What color is it?
2. Which caterpillar uses camouflage as protection from predators?
3. Find the baby pictures! Match each caterpillar to the eggs you studied.

PUPA:
(10 - 15 minutes)

Explain: When a caterpillar has finished growing, it stops eating and travels in search of a hidden place where it hangs or hides. It then performs the last molt and this time grows a thick shell and a new structure: a pupa. A butterfly pupa is also called a "chrysalis." Inside the chrysalis, every part of the caterpillar is transforming. The scientific name for this change is metamorphosis. The caterpillar's body parts simply dissolve – turning into a completely unformed, mass of gooey fluid - and then re-form into the organs, tissues, limbs and wings of the adult butterfly. The entire process usually takes only about one week!

Continue: Because the pupa cannot move, it must be well camouflaged, hidden on branches or under the ground. It often also has a very hard skin, to protect it from the environment. The pupa is in fact the most well-defended stage of the butterfly's life cycle. In this stage, many butterflies can stay and wait for the right conditions before they emerge from the chrysalis. They can stay for months or an entire year and in desert places, if there is no rainfall, they can remain dormant for several years until there is finally a good year with enough rain – and only then the adults will emerge. This kind of "waiting" is called "diapause."

What will cause the butterfly to emerge? Some will emerge immediately when the adult is "ready" – within a week to 10 days. Others have an internal clock, or they respond to the length of the day or the temperature (waiting for the days to get long enough or the temperatures high enough, as signs that winter is over). But many butterflies, especially in the desert, respond to the amount of rain. Some desert butterflies in Israel can stay dormant for as long as 15 years!

If you are raising butterflies in your classroom, have the students observe the chrysalises for a short time each day.

If you are not raising butterflies in your classroom, have the students observe the pupae photographs, and answer the following question on page five of their Butterfly Notebooks:

1. Can you see inside of the chrysalis? If so, what do you see? One day before the hatching, the pupa usually changes color and turns dark. Very often, the marks of the wings can even be seen through the thin skin of the pupa. Do any of the butterflies in the photograph look as if they are ready to hatch?
2. How is each chrysalis different? How are they the same?

ADULT:
(10 - 15 minutes)

Tell students: When the butterfly has finished forming inside the pupa, the adult emerges out of the skin. At first, its wings are small, soft, and folded up against its body. This is because the butterfly had to fit inside of the chrysalis. The butterfly rests for a short time after coming out of the chrysalis, but then it must move its wings, flip them and pump blood into them in order to expand the wings to their final size. It then has to wait for the wings to dry and harden. After some hours, the wings finally finish drying and strengthening – and the butterfly is ready to take off.

Distribute the annotated butterfly drawing on page 18, and the adult butterfly photos from page 17. Students should tape the annotated butterfly drawing to page six in their Butterfly Notebooks. Challenge students to find and identify all of the body parts from the annotated drawing on the photos of the adult butterflies.

If you are raising butterflies in your classroom, have the students observe them. Compare the live butterflies to the annotated drawing. Can students find the 10 body parts? Plan a special ceremony as you set the butterflies free. Each student can say one thing that s/he has learned from the experience of raising butterflies.

Have students go back to page two of their Butterfly Notebooks. Ask for suggestions for phrases to write under the word "faith." Remind students that when butterflies first emerge from the chrysalis, it is difficult for them to fly. They must pump blood into their wings. Then students may suggest phrases such as "keep trying until you succeed," or "believe that you will be able to fly."

THE BUTTERFLY PROJECT

BACKGROUND INFORMATION: (20 - 30 minutes)

Students will create butterflies, which will be sent to the Holocaust Museum in Houston, Texas. These butterflies will become part of the exhibition containing 1.5 million hand-made butterflies as a reminder of the 1.5 million children who perished in the Holocaust.

At this point, the students need to learn about the Holocaust in an age-appropriate way. The background information you present about the Holocaust will depend upon the experience of your students. In some communities students may already know a great deal, while in others the subject may be very unfamiliar to them.

An excellent resource is the book *I Never Saw Another Butterfly… Children's Drawings and Poems from Terezin Concentration Camp, 1942-1944,* edited by Hana Volavkova, available in most libraries.

The book contains children's drawings and poems from Terezin Concentration Camp, where the prisoners, Jewish people, lived in unsanitary conditions and were only poorly fed. Many of them died of hunger, disease and cold. Others were executed by the Nazis. Nonetheless, the children often had optimism, hopes, dreams and faith in the future. The ghetto of Terezin, located in the hills outside of Prague, was an unusual concentration camp in that it was created to cover up the Nazi genocide of the Jews. Billed as the "Führer's gift to the Jews," this "model ghetto" was the site of a Red Cross inspection visit in 1944. With its high proportion of artists and intellectuals, culture flourished in the ghetto – alongside starvation, disease, and constant dread of transports to the death camps of the east. Your class should know that a total of 15,000 children under the age of fifteen passed through the Terezin Concentration Camp between the years 1942-1944. Less than 100 survived. That means that almost every one of its inhabitants was condemned in advance to die.[1]

After you have discussed the Holocaust, read the poem, "The Butterfly" by Pavel Friedman, a young man who perished in a concentration camp during World War II. He was a resident of Terezin.

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[1] Hana Volavkova, ed., I Never Saw Another Butterfly (New York: Schocken Books, 1993).

THE BUTTERFLY
By Pavel Friedman

The last, the very last,
So richly, brightly, dazzlingly yellow.
Perhaps if the sun's tears would sing
against a white stone…
Such, such a yellow
is carried lightly 'way up high.
It went away I'm sure because it wished to
kiss the world good-bye.
For seven weeks I've lived in here,
penned up inside this ghetto.
But I have found what I love here.
The dandelions call to me
and the white chestnut branches in the court.
Only I never saw another butterfly.
That butterfly was the last one.
Butterflies don't live in here,
in the ghetto.

The butterfly described in the poem is probably the Brimstone (Gonepteryx rhamni), a common butterfly in Europe. Would it fly into a place with no trees, no plants, no flowers?

Discuss the poem. Ask: What words in the poem tell you how Pavel Friedman felt? Students may answer, "I've lived in here, penned up inside this ghetto" or "I have found what I love here." Do these two statements contradict each other? Why or why not? *Encourage open discussion.*

Discuss the symbolism of the butterfly in this poem. As part of this discussion, have students go back to page two of their Butterfly Notebooks. Ask for suggestions of phrases to write under the word "freedom." Students may suggest that butterflies can fly, and therefore are symbols of freedom. Jews confined to the ghetto were not free; they were forbidden to leave. Perhaps that is why Pavel said, "…carried lightly 'way up high. It went away I'm sure because it wished to kiss the world good-bye." Students may also remember that butterflies seem confined inside the chrysalis. When they are ready to fly, they free themselves from that confined space, transforming from confinement to freedom.

Ask for suggestions for phrases to write under the word "hope." Students may suggest that butterflies are symbols of hope because butterflies change completely and people can change their outlooks and their lives. *Ask students, What do you think Pavel Friedman meant when he wrote, "Butterflies don't live in here, in the ghetto.?"* One answer might be, "The Jews living in the ghetto did not have hope that their situations would improve."

PROJECT:
(20- 30 minutes)

Explain to the students that they will create model butterflies, which will be sent to the Holocaust Museum in Houston, Texas. These butterflies will become part of the exhibition containing 1.5 million hand-made butterflies as a reminder of the 1.5 million children who perished in the Holocaust.

For inspiration, students might refer back to page one of their Butterfly Notebooks, to remember personal experiences with butterflies. Encourage them to make their butterflies individuals with personalities and names. What colors and shapes will they use to express the individual qualities of their butterflies? Will they look realistic, or will they be imaginative? Students should study and use the annotated butterfly drawing for reference as they construct their own butterflies, even if they don't make realistic models. You can use materials of your choice, such as construction paper, paper mache, collage from magazines, wallpaper samples, origami paper, recycled newspaper or any other material that inspires you. For some samples of butterflies that other students have made, visit ***http://www.hmh.org/ed_butterfly11.shtml***

Below are guidelines for butterflies to be submitted to the Holocaust Museum exhibit.

- Butterflies should be no larger than 8 inches by 10 inches.
- Butterflies may be of any medium the artist chooses, but two-dimensional submissions are preferred.
- Glitter should not be used.
- Food products (cereal, macaroni, candy, marshmallows or other perishables) also should not be used.
- If possible, e-mail a photograph of your butterflies to ***butterflyproject@hmh.org***.

Send or bring your butterflies to the Museum by June 30, 2012, with the following information included:

- Your name,
- Your organization or school,
- Your address,
- Your e-mail address, and
- The total number of butterflies sent.

Mail or bring your butterflies to:
Holocaust Museum Houston
Butterfly Project
Education Department
5401 Caroline St.
Houston, TX 77004

Before you send the butterflies to the Holocaust Museum in Houston, Texas, have an exhibit in your school to share what your class has learned about butterflies and their symbolism. Include the name of each butterfly in the exhibit, and have the students introduce their butterflies, telling a little bit about each one's imaginary personality.

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After the class exhibit: Have each student write the name of the butterfly s/he created on a small piece of paper, and put the papers into a bowl. Pick a butterfly's name out of the bowl and read it out loud. The student who created the butterfly whose name was read must take the butterfly out of the exhibit. Repeat this step until 90 per cent of the butterflies have been taken out of the exhibit.

CONCLUSION:
(5- 10 minutes)

Explain to students: The butterflies which were taken out of the exhibit were not the smallest or the weakest. They weren't the largest, or the brightest, either. They were chosen randomly out of a bowl, and taken out of the exhibit only because their names were chosen. This is what happened at Terezin. People were chosen for transport to the death camps without reason. Of course, your butterflies are not taken out of the exhibit, it was only to demonstre the feeling of fear and hope that prevailed in the Ghetto.

The butterflies you send to the Holocaust Museum will represent transformation, freedom, hope and faith for the new generation. It is important to remember what happened and to speak out against prejudice – to build a fair world – one where this will not happen ever again.

BUTTERFLY LIFE CYCLE

1. eggs

2. larva
(caterpillar)

4. adult

3. pupa
(chrysalis)

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BUTTERFLY EGGS

Large Salmon Arab

Large Salmon Arab feeds on Caper plants

Pea Blue

Pea Blue: mostly feeds on the flowers and fruits of plants in the family Fabaceae: including pea, alfalfa, clover, lotus and broom

African Monarch

African Monarch: feeds on plants of the Asclepiadaceae family – a highly poisonous family of plants, originating mostly in Africa. For example Sodom's apple, a typical plant of the very hot Rift Valley

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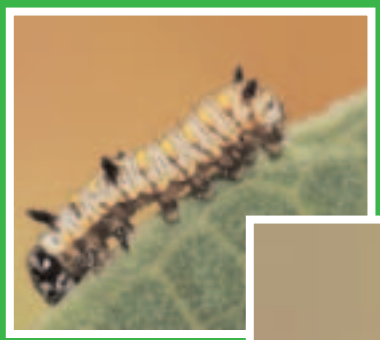
BUTTERFLY LARVAE

Large Salmon Arab

Pea Blue

African Monarch



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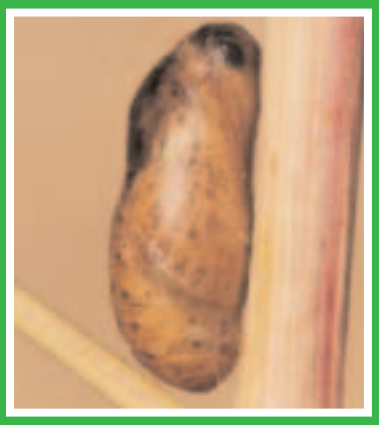
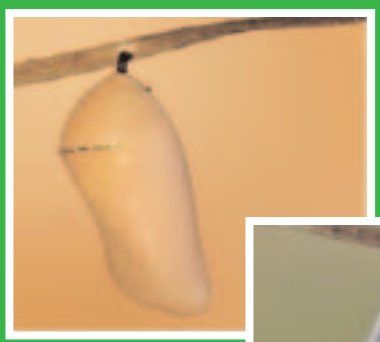
BUTTERFLY PUPAE

Large Salmon Arab

Pea Blue



African Monarch



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ADULT BUTTERFLIES

distribution

location

Large Salmon Arab

distribution

location

Pea blue

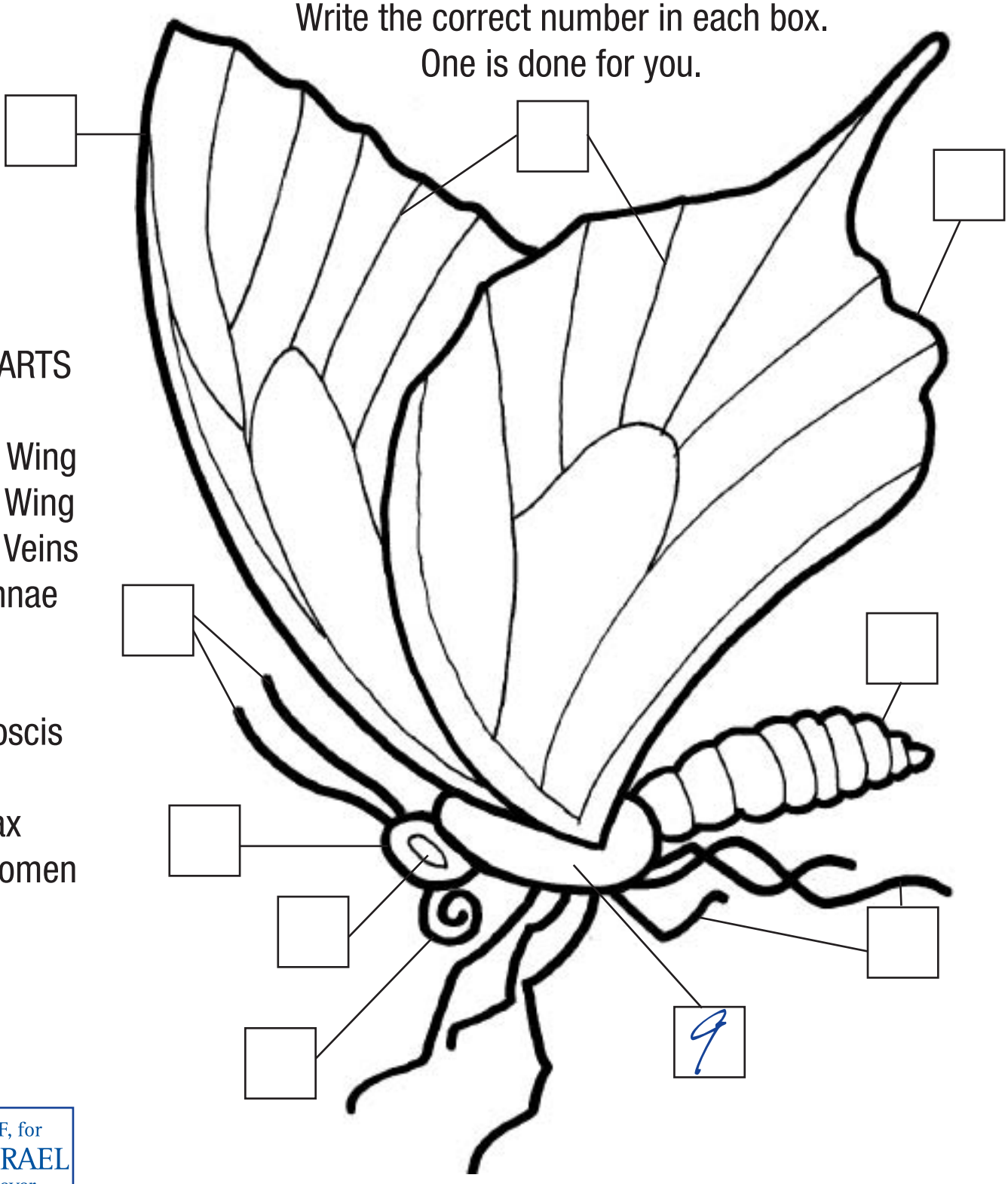
distribution

location

African Monarch

ADULT BUTTERFLY

Write the correct number in each box.
One is done for you.



BODY PARTS

1. Front Wing
2. Back Wing
3. Wing Veins
4. Antennae
5. Eye
6. Head
7. Proboscis
8. Legs
9. Thorax
10. Abdomen

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UNIT TWO:
Butterflies Move!

Key Concept:

Israel is a meeting point between continents. It also has diverse climate and geography, and therefore it serves as a meeting point for the populations of animals from different geographic origins, and a crossroad for migration. Butterflies go beyond the borders that humans create.

Skills:

- Critical thinking
- Mapping

Materials:

- Butterfly Notebooks
- Annotated butterfly drawing printout from page 18 (now on page six of Butterfly Notebooks)
- Photo of Pea Blue with eyespot (in supplementary material)
- Butterfly Origins Chart printout on page 27 (one for each student)
- Climate map of the Middle East on page 28 (for teacher reference)
- Large roll of paper for climate map mural (You can make this by projecting the climate map on page 28 onto the paper and tracing it. Include the names of countries on the map in their locations, but not the borders. This is a butterfly's-eye view of the world, with the names of the countries just to give perspective to the people viewing it. Be sure to include the key at the bottom of the map. You can also send the climate map to a copy center to be printed out large enough for the Butterfly Migration mural.)
- Markers of many colors, enough for all of the students to use in the Butterfly Migration mural

Vocabulary:

- **nectaring** – (v) absorbing the sugary fluid secreted by plants
- **puddling** – (v) absorbing nutrients (salt and minerals) found in puddles or mud
- **hilltopping** – (n) a behavioral phenomenon in many butterfly species, in which butterflies ascend to mountain summits in order to find mates – the summit serving as an easily-recognized meeting point
- **overwinter** – (v) spend the winter in a specific location
- **mimicry** – (n) protective resemblance, where certain animals look like other animals or plants or like objects in the natural surrounding around them, usually in order to protect themselves against enemies
- **dispersal** – (n) the process of moving from one point to another (without a pre-designated destination), in the process animals may occupy a new area
- **migration** – large distance movements, sometimes in groups (Migration is usually directional. In birds, the destination is relatively fixed and the individuals return to the same spot. In butterflies this is rarely the case.)
- **proboscis** – (n) in insects, a long mouthpart that is usually tubular and flexible
- **diapause** – in an insect: (n) a period of suspended development; or (v) to undergo a period of suspended development
- **temperate** - (adj) climate where winters are roughly equally long to summers, and the temperatures do not reach the extremes
- **mediterranean** – a relatively unique type of (subtropical) climate, where winters are cool and rainy but not cold - snows are rare, and summers are warm and dry, often with no rain at all for several months (Such climate occurs only in 5 areas in the world: around the Mediterranean Sea (hence the name), California, central Chile, South Africa and South-West Australia.)

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Objectives:

- To learn about two different types of butterfly migration: large-distance and directional vs. local dispersal
- To discover the geography of the Middle East: the crossroads between Europe, Asia and Africa, and to apply the concept of crossroads to social and political themes
- To explore the diverse climate of the Middle East and its impact on life in the region

Background:

The interesting activities of adult butterflies serve as a framework to learn about the geography, climate, and environment of the Middle East. The combination of Israel's geographic location, the specific topography of Israel, and the variety of climates available – with specific focus on the Rift Valley as a convenient migratory route and a climatically-convenient source for tropical migratory butterflies – can serve in explaining the factors that activate animal movement (dispersal and migration). Seasonal changes in temperature, climatic fluctuations and food availability are some of the factors that affect the expansion of butterflies in spring and summer and then their disappearance in winter. The relations between butterfly migration and geography/topography can then be used to depict the idea that butterflies go beyond the borders that humans create.

Procedure:
Activities:

The following activities are modular. Choose the ones that fit into your schedule.

1 – 3 class periods; if desired, some of the activities can be assigned as homework.

BUTTERFLY BEHAVIOR
(5 - 10 minutes)

Have students open their Butterfly Notebooks and look at the annotated butterfly drawing they have taped on page six. Review: We have learned that butterflies go through a life cycle comprised of 4 stages: egg, larva, pupa and adult. This type of life cycle is considered "complete metamorphosis."

People often ask, "How long does a butterfly live?" This question can be confusing because most people, when asking this question, actually mean "How long does the ADULT butterfly live?" A butterfly is actually the entire cycle, from egg to adult, and the process can take a month, a year, or even many years in the case of desert butterflies that can remain dormant if conditions are not favorable to them. *Ask,* What kinds of conditions might be unfavorable to desert butterflies? (not enough rain, or rains come too late in the season, or temperature is cold). Under adverse conditions, butterflies may remain in a dormant state, waiting for more favorable circumstances. This dormancy is called "diapause." Diapause can occur at any of the stages of metamorphosis, but most often, especially for desert butterflies, diapause will occur at the stage of the pupa. *Ask,* Why do you think this is so? (the adult is "ready" and can hatch quickly from it if the conditions are right) *Explain:* The answer also depends on the species – some adults live only 3 days or so, many live a week or several weeks – but other butterflies live, as adults, several months or even years. Some butterflies even perform their dormancy at the adult stage – going through winter for instance and simply "waking up" when the temperature is high enough. Monarch butterflies, for example, overwinter as adults.

Let's go back to where we were at the end of the last session. After a long time in the pupa stage, what is the first thing to do? Eat, of course! The adult butterflies do not feed on the same food as the larvae – instead, they have a proboscis to suck on nectar – sugar solution provided by flowers. The action itself is called "nectaring." Butterflies are also attracted to mud next to puddles or rivers, to rotting fruits or even to our skin

(sucking on our sweat). This behavior is called “puddling” (after the word puddle). *Ask,* Why do you think they do it? (Because this way they can collect nutrients – like salt – that are important for them.) *Continue:* You might wonder why adult butterflies feed mostly on sugar solution, while our parents tell us that sugar and candies are not good food. Adult butterflies hatch in their final size, and do not grow or change anymore, so they do not need to build their bodies – they only need energy to maintain their activity. The ‘real food’ to build their bodies came from the larvae, who fed on the plants before.

Challenge students to find and circle the proboscis on the annotated butterfly drawing.

SURVIVAL STRATEGY (5 - 10 minutes)

Continue: Adult butterflies need to protect themselves. Like caterpillars, some have warning colors, others are camouflaged – but also, some adult butterflies have more sophisticated methods to protect themselves. Eyespots (a circular, eye-like marking) make them look like a bigger, more dangerous animal. They can hide the eyespots and show them – surprisingly - only at a time of danger. This may scare away some predators. Other butterflies try to confuse the predators and cause them to attack the wrong eyes! For instance, the Pea Blue has a small eye at the back of the wing, along with a small “tail” that looks like the butterfly antenna – a perfect mimic of the head – at the opposite end. When sitting, Blues even rub the wings to make it look as if it's the head (like flies do when sitting). If a lizard or a bird would bite on the eyes are at the end of the wings, it wouldn't kill the butterfly and instead the Pea Blue would fly away – slightly harmed, but alive. This type of protection is called “mimicry.”

Show students the photo of the adult Pea Blue with eyespots (found in supplemental photos) and have them draw and label an eyespot on their annotated butterfly drawings.

MOVING TO MEET: HILLTOPPING (5 to 10 minutes)

Continue: In order to complete the cycle, the adults must mate. To find each other, butterflies can fly around their habitat (for instance next to their host plants). Many male butterflies select a place of high quality, for example a tree next to a good patch of host plants, or maybe on top of some host plants, and make it into their territory. Then they defend their territory against all other males. For the females, this behavior is perfect because it allows them to choose the best males: those that could find a good spot and protect it against all others. Have you seen butterflies spiraling together higher-and-higher up, until one of them returns to the same spot as it was before – usually a high branch or a tree? This is a typical territorial behavior, a fight between males.

But what happens if a butterfly hatches as an adult and finds itself alone? This can happen if the butterflies are spread over large areas, or if they don’t hatch at the same time. The butterfly can sit and wait for others, but many butterflies have found a better solution: hilltopping! If they do not see any other butterflies in the vicinity, they simply go up a nearby hill or mountain, to its summit (top). Summits are easy to navigate to (you only need to go up!) so they are an easy-to-find meeting place for the butterflies! After mating, the females leave the summits to start searching for places where their host-plant grows, to lay their eggs on them and restart the life cycle.

Ask, Now that you have learned about hilltopping, where would you go to find butterflies? (up to mountain summits on sunny days) The higher the summit, and the more isolated, the more butterflies you may find.

MOVING TO SEARCH FOR FOOD: DISPERSAL AND MIGRATION (10 to 20 minutes)

Ask, Do you know what migration means? (Students probably know that birds fly south for the winter.) *Explain:* Birds are famous for their migration: storks, cranes, swallows, and many raptors migrate from Europe to Africa, or from North America to South America and back every year. Winter in Europe or in Canada is too harsh, so they fly to Africa or South America where it is warmer and there is more food. But why do they return? Because in spring and summer, everything turns green, there is plenty of food and the days are very long – giving them the opportunity to find plenty of food and plenty of time to feed their chicks.

Some butterflies do the same. The Monarch is the most famous: the adult butterflies overwinter in Mexico or in the south of the United States, and then, when spring comes they migrate over the entire US and up to Canada. But unlike birds, they actually do not fly all the way without stopping: the females stop wherever they spot a host-plant, then they lay some eggs and continue on. In the next generation, then, butterflies hatch all over North America. In the next autumn, the next generation will migrate to the south and the same individuals that migrated south will be the ones that will migrate again to the north the next spring.

But the Monarch is an exception. Most butterflies do not make such "routine trips" - they simply migrate in response to some changes in the environment.

Write the following words on the chalkboard and have students copy them on page seven of their Butterfly Notebooks, leaving enough space under each word to write a few lines:
Dispersal
Migration

Tell students, Think about these words as we discuss butterfly movement.

What do you think a female butterfly can do if there are too many adult butterflies already at the same spot, other females have already used the plants, and she can't find a place to lay her eggs? (leave the place) Or, what happens if so many larvae have developed that they have eaten all the plants in the previous generation? Or, if the plants died because of drought? (again, the adults can just leave the place)

Explain: Dispersal and migration often occur when butterflies hatch in a certain spot and do not find sufficient host plants in the vicinity. Dispersal is the name we give to those cases where a butterfly simply leaves the place – perhaps alone – and searches for another place. There is no clear destination, and the butterfly may not even find a new spot. But if they do, they can occupy the new spot.

Ask students for phrases to write under the word "dispersal" that will explain what it means for butterflies. They may suggest, "fly off to find better conditions." It is important that they also include, "sometimes alone," and "no clear destination."

Migration, however, will often happen after a GOOD period of rain and a good growth season. How come? Because if there is plenty of food, many larvae will develop into adults, the adults will lay many eggs which will develop into even more adults (each female can lay 100 to 200 eggs!) – and within a generation or two the population will "explode." There will

be simply too many butterflies, and not enough food because the larvae consume all the host-plants. In such conditions, the adults will start moving together and search for new places. This mass movement, which is often directional, is called migration.

Continue: But it is not the same as bird migration. First, the butterflies do not have a clear destination: they just move in search of a new place, and lay their eggs everywhere along the way. But since they respond to topography and climate, they often migrate along the same routes as birds. Second, butterfly migration is often seasonal but not for the same reasons as bird migration: it simply happens after a good rainy season, and in fact, very often butterfly migration will begin later than birds. They will migrate only in late spring and summer, after the host-plants that supported the larvae have started to dry or have been eaten by the larvae. Other differences between butterfly migration and bird migration are that butterflies don't necessarily migrate every year, and they will almost never return from the migration. Birds always fly back and forth. The African Monarch and the Painted Lady are typical examples of migratory butterflies: their migration is quite seasonal, they travel great distances, and they often travel in large groups – up to millions of butterflies.

Continue: When autumn comes, sometimes we will see migration of butterflies south, back to warmer regions the way the birds do. But most often, the butterflies will simply die in the cold winter, and we will not see them again until the next time that migratory butterflies arrive from Africa or from the oases in the Sahara or along the Dead Sea.

Ask students for phrases to write under the word "migration" that will explain what it means for butterflies. They may again suggest, "fly off to find better conditions." However this time they should also include, "mass movement," or "in groups," and "directional."

Explain: Butterflies that "disperse" very often, and travel large distances, are still called "migratory" butterflies. This is because, with the yearly seasons, their movement from one place to another SEEMS directional.

Distribute the Butterfly Origins Chart printout from page 27. Instruct students to raise their hands when they have information to fill in the missing spaces.

Direct students to look at the large climate map of the Middle East that you have prepared. Help them to find Israel.

Explain: Because it is a country at the meeting point between continents, and especially with its diverse climate and geography, many kinds of animals live in Israel, and many different kinds of butterflies pass through.

Point out the different areas on the map as you speak. Butterflies of general **Eurasian** origins (Europe + Asia) usually need more temperate climate, and are most comfortable in the north of Israel – the Mediterranean area in particular. *Ask,* What should be filled in the climate space for "Butterflies of Eurasian origin?" (temperate) What should be filled in the "locations" space? (north of Israel, Mediterranean area)

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Continue. Some butterflies are typical to the dry and cold mountains of central Asia, for example the mountains in Iran. Such species are called **Irano-Turanian**. These butterflies are most comfortable in places like Mt. Hermon where it snows heavily in winter and is dry and hot in summer. Other areas where one can find Irano-Turanian species in Israel are east of Jerusalem and the mountains of the Negev desert (where it could even snow in winter!). *Ask,* What should be filled in the "climate" space for butterflies of Irano-Turanian origin? (Cold Desert Climate: cold winters and very dry summers, often mountains) What should be filled in for "locations?" (Mt. Hermon, Negev highlands)

Do the same for Saharan species of butterfly. Then there is the Saharan or **Saharo-Arabian** species of butterfly. They would be most comfortable in the desert, especially in the Negev which is even geographically part of the Sahara. Saharo-Arabian species are often very good in long-term diapause. Since the desert climate is often unpredictable, many of them also tend to disperse large distances but it's not often that they really "migrate" since they cannot expand out of the desert. *Ask,* What should be filled in the "climate" space for butterflies of Saharo-Arabian origin? (warm desert climate) What should be filled in for "locations?" (Negev, Sahara deserts)

Trace the route you describe as you speak: The fourth region is the Rift Valley, which is low and warm, and has an arid climate but many small oases. This area has a lot of plants and animals that seem not to belong in this area – their origin is in the dry parts of East Africa, and therefore they are called **Sudani**. Animals in the Rift Valley include hyraxes (a small mammal related to the elephant) and ibexes. And of course, many unique butterflies. Sudani plants and animals need the combination of heat and water. Sudani butterflies are often migratory – species fly from Africa along the Rift Valley, settle in the Dead Sea area, and during summer they can spread to the rest of Israel.

Fill in the information for Sudani butterflies. (Climate: Semi-Arid, Mediterranean and Warm Desert; Location: Rift Valley)

Sum it up: As you can see, butterflies travel from Africa, through the Rift Valley, onward to Turkey, West Asia and Europe. They are not affected by man-made borders. Even the Rift Valley itself belongs both to Israel from the West and Jordan from the East. Butterflies will of course fly on both sides. To understand migration, scientists throughout the world try to bridge the borders and work together when they study nature.

Divide the class into 3 groups. Assign each group a species of butterfly with which they are familiar from Unit One:
- African Monarch (Danaus chrysippus)
- Large Salmon Arab (Madais fausta)
- Pea Blue (or Bean Butterfly, Lampides boeticus)

Give each group all four butterfly lifecycle photos, and remind them to look on their Butterfly Origins Charts to find the answers to the following questions:
1. What is the distribution of your butterfly? (on which continent(s)?
2. What kind of climate is most hospitable to your butterfly?
3. What does your butterfly eat?

Have the students write the name of the butterfly and the answers to the questions on page eight of their Butterfly Notebooks.

THINK LIKE A BUTTERFLY:
(10 - 20 minutes)

Work with students to try to determine how the butterflies disperse through the year. Where would we find the butterfly in winter? Where would it be in summer? When should the butterfly start dispersing? HINT: Think of the relationship, a cycle, between the butterflies and the plants. If the host plant likes heat – like Capers, the main food of the Salmon Arab, then the butterflies would start moving up north only when Capers are plentiful, and after they have completed at least one good cycle in spring – so the expansion happens mostly during June and July. Similarly, if the butterflies come from Africa (example, the African Monarch) instead of the Rift Valley (a convenient migration route), they first need to pass spring in Africa, and then expand. They may come only in July and August – and in some years may not arrive at all!

Hand out the Silk Road and Incense Road map printout on page 26. Have the students tape it to page nine in their Butterfly Notebooks. As students study it, point out that these ancient trade routes caused people from Europe, Asia and Africa to travel through Israel. Explain that because of its central location, Israel is also a center for bird migration, and that, of course, butterflies also migrate through Israel.

MAP MURAL
(20 - 45 minutes)

Introduce the Map Mural activity: This is a map of the Middle East from a butterfly's viewpoint. The map shows the climate of each region, which is most important for plants and butterflies. The countries are marked on the map to give you perspective. Butterflies migrate beyond the man-made boundaries.

Have students work together, drawing the butterfly their group has been assigned in the continent of origin, and showing a path they would migrate to find better seasonal conditions.

CONCLUSION

When the mural is complete, display it on the bulletin board. Discuss:

1. How has the geography of the Middle East affected the movement of people and animals, including birds and butterflies, through Israel? (Israel's central location is the crossroads between Europe, Africa and Asia.)
2. How does the climate affect the movement of people and animals? The climate is varied. People and animals don't stay in the desert where it is too hot or dry, they live mostly in the more hospitable areas – the Mediterranean area. But butterflies are mobile, they can change seasonally like the nomads did for thousands of years).
3. Butterflies don't see man-made boundaries. What are some ways that butterflies might help people to get along better? (scientists work together to study migration).

Introduce a concept which leads to the next lesson: Butterflies are bioindicators. This means that studying butterflies is a good way to see whether the environment is healthy. People must work together to make sure the environment is healthy to sustain all living creatures. That is another way that butterflies can help us get along better - they help us to focus on what is important. We will learn more about bioindicators next time.

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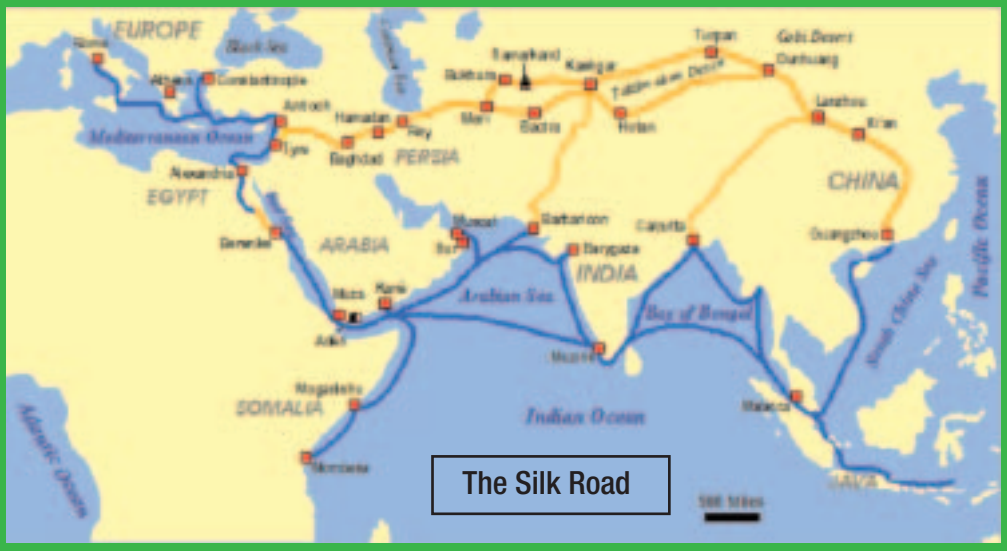
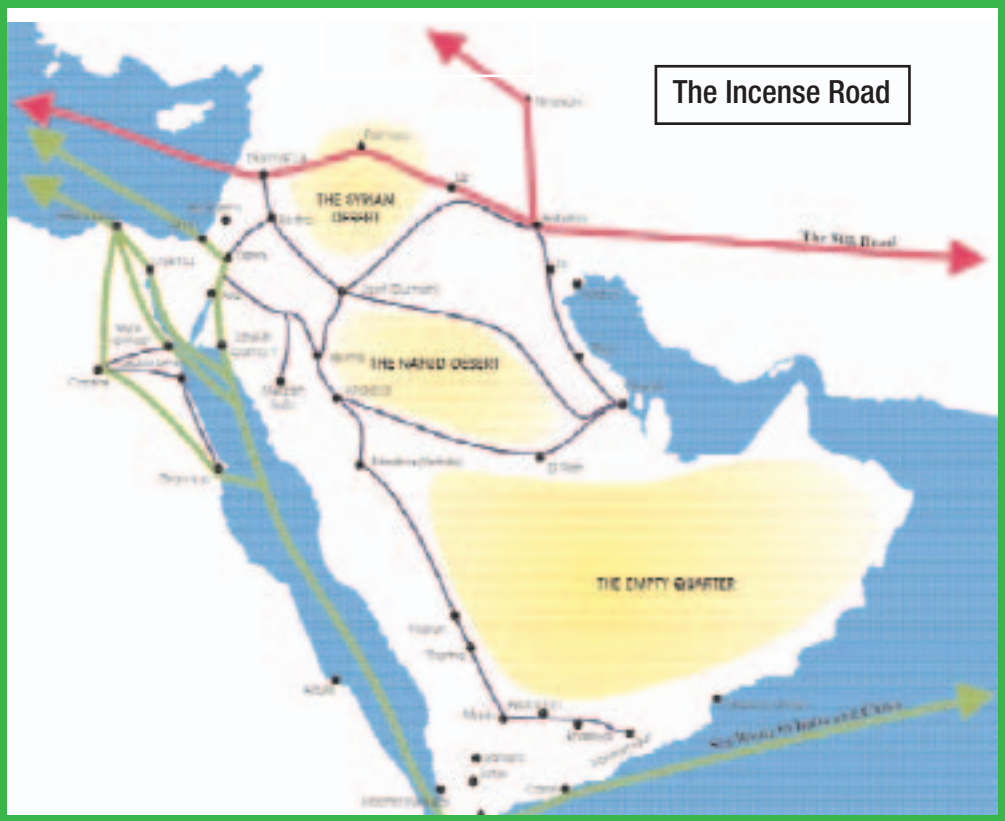
TRADE ROUTES





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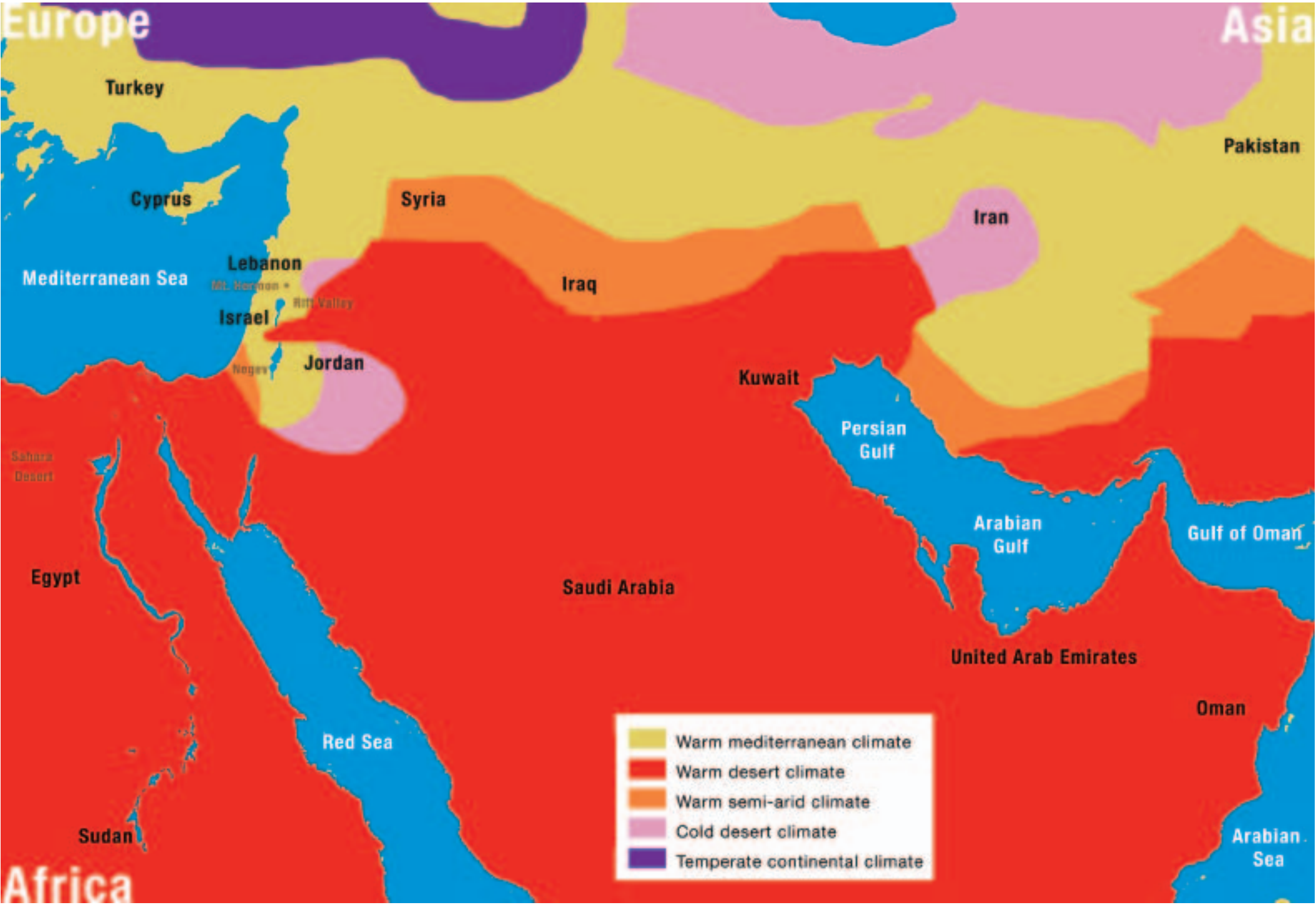
BUTTERFLY ORIGINS

ORIGIN	CLIMATE	LOCATIONS
Eurasian (European + Asian)		
Irano-Turanian		
Saharan-Arabian		
Sudani		


Europe
Asia
Turkey
Pakistan
Cyprus
Syria
Iran
Lebanon
Mediterranean Sea
Iraq
Israel
Jordan
Kuwait
Persian Gulf
Arabian Gulf
Gulf of Oman
Egypt
Saudi Arabia
United Arab Emirates
Oman
Red Sea
Sudan
Arabian Sea
Africa
Warm mediterranean climate
Warm desert climate
Warm semi-arid climate
Cold desert climate
Temperate continental climate

UNIT THREE:
We Can Learn from Butterflies

Key Concept:

Butterflies are bioindicators for identifying environmental trends, such as the loss of natural habitats, pollution, desertification and climate change - all of which affect not only butterflies (and butterfly migration) but also other species and ecosystems – including us, the humans.

Skills:

- Critical thinking
- Observation
- Social action: care for the environment

Materials:

- Butterfly Notebooks
- Press Release Template on page 33

Vocabulary:

bioindicator – (n) an organism whose well-being describes the quality of the ecosystem in which it lives
monitoring – (v) observing, checking, and keeping a record
desertification - (n) the process by which a fertile land becomes desert (usually due to drought, deforestation or inappropriate agriculture)
conservation - (n) preservation, protection, or restoration of the natural environment
habitat - (n) the area or environment in which an organism (or a group of organisms) lives; along with the conditions that define this place.
ecosystem – (n) all organisms in a particular region, along with the environment in which they live; elements of an ecosystem interact with each other and depend on each other directly or indirectly

Background:

Butterflies serve as important means to identify environmental trends and to enhance our awareness of the potential consequences on nature and on humans. This is the essence of the use of specific species as "bioindicators." In particular, dispersal, migration and distribution shifts serve as an excellent way to notice such environmental changes. At the same time, the beauty and charisma of butterflies invokes public sympathy and therefore helps raise awareness of our impacts on our surroundings, and facilitates the willingness to act toward changing this situation.

Procedure:

The following activities are modular. Choose the ones that fit into your schedule

Activities:

1 – 3 class periods

BIOINDICATORS (10 - 15 minutes)

Introduce the term bioindicator: Have you ever heard the word bioindicator? *Give students a chance to guess what it means. They will probably notice that "bio" refers to biology, and indicator means that it points out something. Explain:* A bioindicator is an organism whose condition can help us evaluate the status of a system. The classic example is the "canary in the coal mine." People used to put a canary in a cage inside the underground coal-mines to detect toxic gases. If the canary died, they knew that the level of toxic fumes was rising and they must leave before they would be poisoned.

Butterflies describe the quality of the ecosystem in which they live. The disappearance of populations or species of butterflies from a certain place can indicate that the environment has changed. We can also use changes in behavior – such as migration – to detect environmental changes.

Elicit suggestions of what would make an animal a good bioindicator.
(Answers below)
- easy to observe
- live in specific habitats or depend upon specific plant to live – so that we can link them to a specific place, habitat or a group of species that may be affected as well
- particularly sensitive to the environment, and more sensitive than other species (so that they are the first to respond!)
- effects of the environment on the organism are well-understood (If we don't know why a butterfly has disappeared, we don't know what it's warning us about)
- have short generations so that changes in the environment that affect their offspring can be seen within a short period of time (Otherwise, by the time it responds it may be too late. Would mammals be a good indicator? Why or why not?)
- relate to many ecological processes and species, for example many animals depend on them as a source of food, or they pollinate or affect plants
- hopefully, changes are reversible – so that we do not "sacrifice" them

Write a list of animals on the chalkboard:
Big mammals (bears, cougars)
Bats
Butterflies
Flies
Earth-worms
Birds

Ask students to vote – which ones are good bioindicator? (Note: birds are often used as such, but they are not as specific as butterflies because they are usually affected more by habitat structure and less by the specific contents, for example, which plants live in the habitat.)

Ask students to help you list the butterfly behaviors they have learned about. Write them on the chalkboard:
Eating
Hilltopping (mating)
Migrating (dispersing)
Laying eggs
Hatching (from eggs and from chrysalis)

Discuss: How do environmental conditions affect each of these activities? (Eating is affected by supply of host plants, or for the adults, supply of nectar plants; Hilltopping [mating] is affected by size of butterfly population; Migrating [dispersing] is affected by butterfly population, supply of plants, and weather conditions; Hatching time is affected by weather conditions: temperature and rainfall)

Explain: So by observing butterflies, it is possible to learn about the environment in which they live.

MONITORING
(10 - 20 minutes)

Continue: There is a specific way to observe and learn from the butterflies. It's called Butterfly Monitoring. In order to monitor butterflies, people walk through butterfly habitats. They observe their behavior and count the butterflies. The recorders can be scientists, or anyone who is interested in butterflies.

Continue: Israel is a good place to look at butterflies because it is a location with diverse climate and varied geography, and an important route of migration between Europe and Asia in the north, and Africa and Saudi Arabia in the south. For these reasons, it's interesting to see what we can learn from butterflies in general, and especially butterfly migration in Israel.

Challenge students: I will tell you about the changes that Israel has experienced. Think about how these changes would effect the environment and the butterfly population. Once you have heard about the changes, you will write what you think the results of these changes have been to the environment in your Butterfly Notebooks. Then we will see if you predicted what has happened.

1. Israel's population grew from 600,000 people in 1948 to 7,000,000 in 2008. This is the fastest population growth in the world.
2. The growing population requires more cities and many roads (in a very small area).
3. There has been global climate change (not just in Israel, but around the entire globe), and in Israel this results in shorter winters, less rainfall, warmer temperatures and more extreme weather events.
4. On the other hand, there are many new conservation areas to protect nature. Jewish National Fund has planted forests, built parks, and helped farmers - so there is more agriculture and more green. In an effort to combat desertification, many of these green areas are on the edge of the desert and even deep inside it.

Instruct students to write the answers to the questions below on page ten of their Butterfly Notebooks.

1. Do you think butterfly habitats have changed? (Answer: in the towns and populated areas, butterflies disappear. In the greening areas, butterflies from the north shift south into the desert).
2. How do you think the habitat changes have affected butterfly migration, if at all? (Answer: more migration events, shift more in reaction to unusual weather; migrate earlier into the colder parts of the country and stay there longer)
3. Do you think there has been a change in length of the season during which butterflies can be observed? (Answer: butterflies appear earlier, but sometimes do not appear at all if there is no rain; migratory butterflies stay longer and survive the winter more often)
4. Do you think the population of butterflies has increased or decreased? (There is not one correct answer, encourage discussion. Nature is complex and so is the effect of humans. Here are some ideas: the answer differs in different places: in the densely populated areas butterflies have become rare. In the desert, butterflies appear less often because often there is no rain. But in conservation areas, the environment has improved and there are more butterflies. Overall, butterflies are probably suffering because of the fast population growth of humans.)

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Give students a moment to write their answers in their notebooks. Then call on students to share their predictions. Encourage students to raise their hands if they have predicted the same thing as the student who reads what s/he has written.

MAKE A DIFFERENCE
(10 - 20 minutes planning, activity can be ongoing)

Follow up with a plan that empowers your students. Some suggestions:

1. **Butterfly Monitoring:** Plan, as a class, to visit a local butterfly habitat. Select a spot and visit regularly in spring through summer. Visit Monarch Butterfly Journey North http://www.learner.org/jnorth/monarch/ for more information
   - Monitoring of butterflies can take place in conservation areas, but it is just as important to monitor butterflies next to your own home, in town, in urban parks, or in any natural areas near where you live.
   - Where and when? You must have a constant place which you can always come back to: your garden, a park that you like, or a natural area near your house. Grasslands with many flowers can be great for monitoring. The location should be not too far away, so that you can visit often.
   - Mark the route so that you can always do the same transect-walk, or, if it's in your garden or a park, make sure you always spend the same amount of time there. Half an hour is a perfect amount of time.
   - Come only when the weather is good! Sunny days with no wind are good. If you have a thermometer, try to come out only if the temperature is above 15°C or 59°F.
   - Butterflies are not early-birds! It's best is to do your observations after 10 am and end before 3 pm.
   - Write down all the butterfly species you see and how many of each. Try not to count a butterfly twice!
   - If you do not know the butterfly, try to take a photo. If you want to do it without making the butterfly escape – wear camouflage clothes and move SLOWLY (Careful of your shadow, it moves with you too! Cast shadow on your butterfly and it will fly away!).
   - If you want, you can write down which plants the adult butterflies come to. You may see them nectaring, but if you are lucky you may also see them mating, or watch the females laying eggs.
   - Come back every week from the beginning of spring to the end of autumn to do your observations.
   - Bring your list to the teacher or coordinator! Your observations are always important!

2. **Plan a butterfly garden:** Bring nature back and help butterflies live nearby! You know that the larvae of each butterfly needs specific host plants. Many of these plants are considered weeds and we often clear them away. Plant good nectar sources for butterflies. (Milkweed is best for Monarchs in North America.) Monitor your butterfly garden and compare with parks that have only grass and flowers that do not supply nectar to butterflies. For more information, visit Monarch Watch Butterfly Gardening: http://www.monarchwatch.org/garden/index.htm

3. **Clean up** a local environment (either on your school grounds, or in your neighborhood) It's easy to plan, following these eight easy steps:
   STEP 1: PICK YOUR LOCATION
   Pick a place that you use often, perhaps part of a park with which you are familiar. If you invite the community to help, they will be most excited to work in an area that they use, and will be more likely to help if they don't have to travel too far.

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STEP 2: GET PROPER PERMITS if necessary.
STEP 3: PICK A DATE AND TIME that will work for many people.
STEP 4: GET GIVE-AWAYS to say thank you to volunteers. Ask local businesses for support in exchange for free advertising.
STEP 5: INVITE THE COMMUNITY to help out. Place posters in local stores and hand out flyers. Make sure there is an RSVP so that you know how many people to expect.
STEP 6: BE PREPARED! On the day of the cleanup, arrive before the volunteers do and have all the necessary supplies ready.
STEP 7: CLEAN UP THE PARK, get rid of the trash, and say thank you to your volunteers.
STEP 8: ENJOY YOUR CLEAN PARK!

4. **Reduce your carbon footprint by planting trees in Israel**. Calculate your carbon footprint with the on-line carbon calculator at *www.jnf.org/goneutral.* Offset your carbon output by planting trees in Israel or by supporting development of alternate sources of energy.

5. **Educate the community**: Make posters telling about bioindicators and the steps everyone can do to help the environment. Hang them around your building and in your community. Before students make the posters, they should brainstorm: What are some things individuals can do to help the environment? (A few examples: walk, ride a bike, or carpool; turn off the lights when not in use; conserve water.)

Use the Press Release template on page 34 to let the community know about your projects.

PRESS RELEASE

FOR IMMEDIATE RELEASE
Contact: [insert name here]
Title:
Phone:
Email:

[School name] Students to Improve the Environment
through Social Action Project

Date -- Place --
Students at [insert school name here] have been participating in a new environmental education program created by Jewish National Fund in partnership with the US Forest Service, ***Parparim,*** **Butterfly Migration in the Middle East: Beyond the Boundaries**. Through this program students learn about the geography and climate of Israel and the Middle East through the framework of butterfly migration and the environment. As part of the curriculum, students participate in community service projects to benefit conservation locally and in Israel.

[participating school give details of event here]

[Insert quote from school here about the great project.]

Throughout the last century, JNF has been known as a global environmental leader, greening the land of Israel by planting 240 million trees. Together with the US Forest Service, JNF provides environmental education in the fall, through World Water Monitoring Day, and recently added this new spring program, ***Parparim***.

Jewish National Fund (JNF) began in 1901 collecting coins in blue boxes to purchase land and return the Jewish people to their homeland. In over 107 years, JNF has evolved into a global environmental leader and become the central address for partnering with the land and people of Israel. JNF has planted 240 million trees; built over 1,000 parks and recreational areas; constructed security roads; educated students around the world about Israel; created new communities so that Jews from around the world would have a place to call home; discovered new means of growing plants under arid conditions, bringing green to the desert; and built over 200 reservoirs and water recycling centers, increasing Israel's water supply by 10%. Today, JNF is supporting Israel's newest generation of pioneers by bringing life to the Negev Desert, Israel's last frontier.

A United Nations NGO, JNF sponsors international conferences on desertification, shares afforestation techniques, and funds research on arid land management. JNF is a registered 501(c)(3) organization and continuously earns top ratings from charity overseers. For more information on JNF, call 888-JNF-0099 or visit http://www.jnf.org/.

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UNIT FOUR
Butterflies and Biodiversity

Key Concept:

Every organism in an ecosystem, no matter how small, is essential to the functioning of the system. In nature, diverse ecosystems are stronger and more resistant to adverse conditions. Diverse ecosystems also provide better services to humans – food, building material, medical substances, places for recreation etc. Therefore, protecting biodiversity is important both for nature and for humans. Similarly, every member of the human society/community offers a unique contribution to the group, and a diverse society is therefore stronger because of the different talents that each member offers.

Israel is a very small country, but has a diversity of climates, species and ecosystems. There is also a diverse human population, since people from all over the world have immigrated to Israel. This is something that Israel shares with the United States: people in both countries came to seek freedom and better lives, resulting in a diverse population. Appreciation of, and tolerance to, the variety of people and opinions is therefore necessary in both countries in order to enjoy the benefits of this diversity.

Skills:

- Research and Presentation
- Cooperation/Group work

Materials:

- Butterfly Notebook
- (optional) Poster board and Markers
- (optional) Musical instrument

Vocabulary:

biodiversity - (n) the variety of life in the world, or in a particular ecosystem – includes the diversity of populations, species, and ecosystems
ecosystem service - (n)) the benefits provided to humans by natural ecosystems. These include the resources such as food, shelter and building materials, but also the processes such as cleaning water and air. Ecosystem services are divided into four types: provisioning, regulating, supporting, and cultural.
indigenous - (adj) originating in and characteristic of a particular region or country; native

Objectives:

- To learn how biodiversity affects ecosystems and humans, and what the implications of biodiversity loss are for ecosystems and humans
- To learn about biodiversity in Israel
- To find value in each living thing
- To appreciate differences and see what is positive about these differences

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Background:

An ecosystem is an interdependent system of plants and animals in their surroundings. It can be as large as the Sahara Desert, or as small as a pond in a local park. The elements of an ecosystem interact with each other and depend on each other. One example of this balance of nature is pollination. As insects are being nourished by flowers, the plants are benefiting as well. Different flowers are pollinated by different factors, some of them for instance by insects (bees, butterflies, flies etc). If the ecosystem loses its balance, some species may disappear and eventually every member may suffer. For example: remove a predator which feeds on a certain herbivore (grass-eater), and that grass-eater will reproduce and consume the grasses and bring the ecosystem to collapse. Pollute the environment, and insects will disappear, alongside the plants that require them for pollination. Or vice versa: Remove birds which feed on insects, and the insects will reproduce so much that they will consume their own plants and lead the ecosystem to collapse again. This means that predator and prey, food and shelter, clean air and enough open space must remain in correct proportions in order for ecosystems to function correctly and serve all of its members.

Biodiversity is the variety of life forms within an ecosystem. It is important to preserve biodiversity because diverse ecosystems provide "ecosystems services" not only for the animals and plants who live in them, but also for humans: many people depend on wood for building or heating; people still hunt or collect fruits, herbs or medical herbs in nature; pollination is needed for many of our crops. We also need clean water and stable soil for agriculture. When forests are cut down, the soil is washed away and floods may occur. We depend on nature for pure beauty as well: a world without a green place to rest is a hostile and harsh one! Ecosystem services can be divided into four types: *provisioning* (i.e. food, water, energy or building materials), *regulating* (e.g. purification of water or air; "pest control" by birds or insects; crop pollination), *supporting* (helping the recycling of materials or the dispersal of seeds) and *cultural services* (such as places for recreation, cultural and intellectual inspiration, tourism, or even places for scientific research). Diverse ecosystems are more able to offer these services than ecosystems that have been degraded or damaged.

The world is also changing rapidly: people move into cities and away from nature; natural areas disappear; agricultural fields grow huge and homogeneous; and the climate is changing. Diverse ecosystems can better withstand such changes, and survive adverse conditions such as drought, heat or climate change.

A related value is that communities benefit from having diverse members. Each person in a group has something unique to contribute.

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Procedure:
Activities:

POLLINATION AND BALANCE (5 - 10 minutes)

The following activities are modular. Choose the ones that fit into your schedule.

1 – 3 class periods, possible homework assignment

Begin with a review question: What do adult butterflies eat? (Students will probably remember that adult butterflies feed on nectar, the sugary fluid secreted by plants.) *Explain:* Plants produce nectar for a reason! It's a reward to attract pollinators. As the butterflies feed on the plants' nectar, they help the plants by conveying pollen between the flowers to fertilize them so that they can produce seeds or fruits. (Butterflies are not as "loyal" to certain types of flowers as bees are, so they are not as efficient pollinators as bees, but still,) butterflies are important pollinators for several groups of flowers. Additionally, butterflies are on the bottom of the food chain - many other animals feed on them, and will suffer if butterflies are gone. Lastly, remember that butterflies are also bioindicators: when butterflies disappear, very often other animals, such as bees, start disappearing as well. So, no part of the ecosystem can be changed without an effect on the others.

Israel, despite its small size, has a diverse climate and a large variety of plants and animals. Its location at the crossroads of different climate regions has made it home to over 2,780 plant species, 140 species of butterflies, 7 amphibian species, 97 reptile species, 511 bird species, and 116 mammal species. The north of Israel has a Mediterranean climate and the south is Desert. The area in between, the central part of the country, is a transitional area. *Explain the assignment:* Israel is divided into four geographic regions. Each region has distinct geography, climate, plants and animals. We are going to learn about the regions. You will work in groups - each group focusing on one region, and then teaching the rest of the class about it. You have learned that it is necessary to maintain a balance in nature. Give examples of this balance as you learn, and teach the rest of the class, about each geographic region.

GROUP RESEARCH PROJECT (30 - 60 minutes, or assign as homework)

Divide students into groups. Try to include students in each group with various talents. Assign a geographic region to each group to research. The group will present information about the region to the rest of the class. The presentation should include both straightforward text, and a creative feature, such as posters to illustrate the information, a skit, a game, or even a song or a dance. As students work together on the project, they will find that each member of the group contributes something unique.

Geographic Regions: Coastal Plain • The Galilee • Negev Desert • Rift Valley
Research questions:

1. What is the name of the geographic region and its location?
2. How was the region formed?
3. Describe the land. Is it flat or mountainous? Is it fertile? Rocky? High or low elevation? Rough or soft terrain? Are there water resources? Forests?

4. Describe the weather. Are there distinct seasons? Is the climate rainy, dry, warm, cool?
5. What kinds of plants and animals are indigenous (native) to this geographic region?
6. Do many people live here? How many?
7. Have people changed the area? If so, describe the changes that have taken place.
8. Is any special effort being made to preserve or restore the area?
9. Do many kinds of animals, plants, and people live in this region? Explain.
10. What do you think would happen if all of the insects in this region disappeared? What do you think would happen if just one species of insect disappeared? What would happen if raptors (predatory birds) were removed? What if other predators, such as snakes, disappeared?

PRESENTATIONS
(5 - 10 minutes per group)

Answer the questions above and tell more about them on a poster, or create a skit a game, a song or a dance to teach the class.

Suggested Resources:

- *Israel Ministry of Foreign Affairs:* http://www.mfa.gov.il/MFA/Facts+About+Israel/Land/THE+LAND-+Geography+and+Climate.htm
- *Israel On-line Publications:* http://library.thinkquest.org/26823/georegions.htm
- *Topographic Map of Israel:* http://upload.wikimedia.org/wikipedia/commons/b/b5/Israel_Topography.png

2010: THE YEAR OF BIODIVERSITY

The United Nations has declared 2010 to be the International Year of Biodiversity. It is a celebration of life on earth and of the value of biodiversity for our lives, but also a struggle to increase awareness of the rapid loss of biodiversity. We must take responsibility to halt this loss. The activity below helps students to understand both the importance of biodiversity to nature and humans, and also the contribution of diversity to our community.

Choose an ecosystem (for example, a pond in a local park) *and ask students:* How do the members of this ecosystem help each other? (Answers may include: plants are food for insects, insects feed on plants but also pollinate them; some other insects prey on insects; and all of these insects may serve as food for birds, reptiles and amphibians; which may be food to foxes, wild cats, cougars etc.) Remember that in addition to needs such as food and shelter, the systems provides other needs as well: for example, trees provide shade for visitors to the park, and the pond provides beauty for visitors to enjoy. *Then challenge students:* What would happen if we left trash in the park? This may serve as food for animals such as raccoons or foxes, who will now reproduce and start affecting the system – for instance, they will start preying on the birds in the ecosystem. What would happen if the birds disappeared? (the insect population might become too great, and destroy the plants) *Explore another scenario:* What if foxes ate the wild deer and other herbivores? (Some plants would start growing wild, but others might disappear. Possibly too much woody material would accumulate and fires would break out!) *Ask:* What if farmers near the area sprayed their fields without caution and

killed the insects in the natural area as well? (plants would not be pollinated, and food in the fields would suffer as well)

You can play various "scenario games" with the children . Ask them to explore in the internet for cases of this kind, or bring them local examples if you know of any. Good resources are Begon ("Ecology"), or Meffe and Carol (Introduction to Conservation Biology). These works provide various examples. As long as the ecosystem is clear, the list of "players" is clear and the effect of humans is clear, children are likely to identify, intuitively, how we alter ecosystems and distort them. A useful search term for this may be "keystone species" (a species which, if disappearing, changes the entire ecosystem).

ALTERNATE GROUP RESEARCH PROJECT
(30 - 60 minutes, or assign as homework)

Divide students into groups. Try to include students in each group with various talents. Assign a local ecosystem to each group to research. The group will present information about the ecosystem to the rest of the class. The presentation should include both straightforward text, and a creative feature, such as posters to illustrate the information, a skit, a game, or even a song or a dance. As students work together on the project, they will find that each member of the group contributes something unique. Biodiversity makes an ecosystem stronger, and diversity makes a group stronger.

Suggested ecosystems: Pond in a local park • Student's back yard • Urban garden or park • Nearby natural conservation area • Local natural forest

Research questions:

1. Where is this ecosystem located?
2. Is it natural, like a nature preserve, or have people changed the area? If so, describe the changes that have taken place.
3. Describe the land. Is it flat or mountainous? Is it fertile? Rocky? High or low elevation? Rough or soft terrain? Are there water resources? Forest?
4. Describe the weather. Are there distinct seasons? Is the climate rainy, dry, warm, cool?
5. What kinds of plants and animals are indigenous (native) to this ecosystem? Name as many as possible from different levels in the food-chain..
6. What ecosystem services do they provide to each other? (In other words, how do the plants and animals in the ecosystem depend upon each other?) What services do they provide to us?
7. Choose a species of plants in the ecosystem and a species of animals. How do you think it would affect the ecosystem if each disappeared?

PRESENTATIONS
(5 - 10 minutes per group)

Answer the questions above and tell more about them on a poster, or create a skit a game, a song or a dance to teach the class.

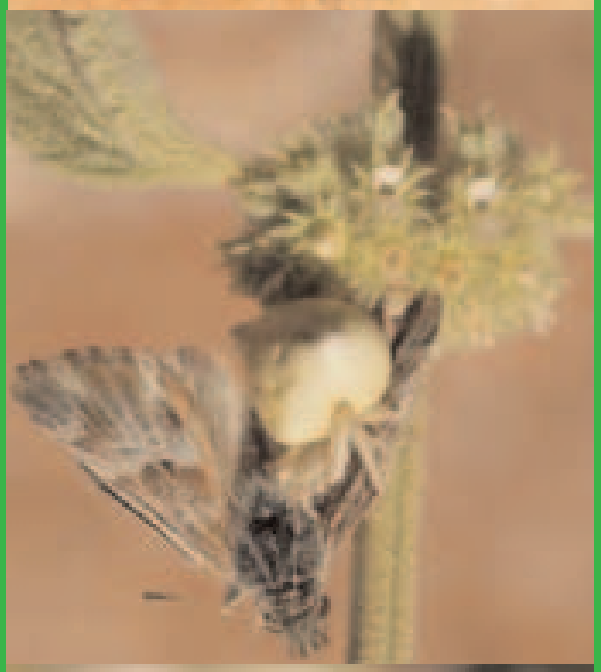
Find out more at: *http://www.iucnredlist.org/species-of-the-day*

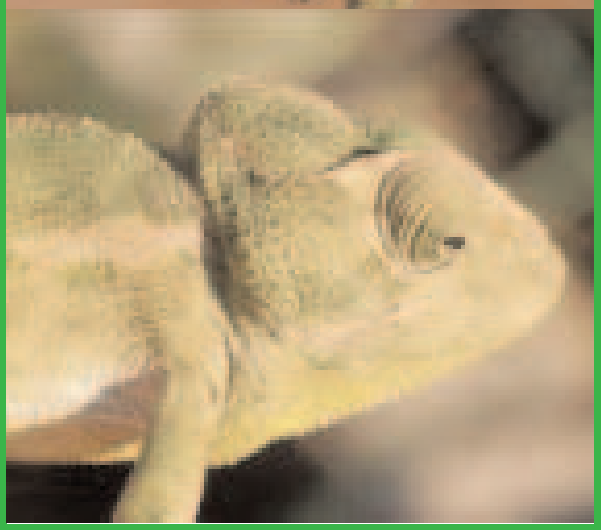
SUPPLEMENTAL MATERIAL

Enemies:
parasites such as wasps or flies

Enemies:
an aphid attacks an egg of a Great Salmon Arab butterfly

Survival Strategy: Camouflage

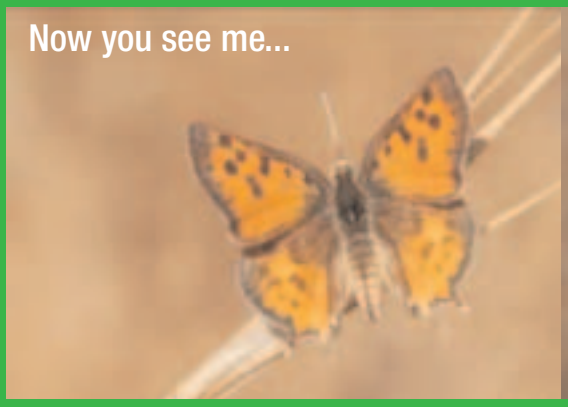




SUPPLEMENTAL MATERIAL

Survival Strategy:

Camouflage



Survival Strategy:

Bright colors often mean poison!

Survival Strategy:

Disguise

Eyes for frightening (Caligo butterfly from South America)

Eyes for confusing as a head (Lang's Short-tailed Blue, Jerusalem)