



# UNIT FOUR

## RESTORING THE BALANCE

# JUNTOS

Lesson 1.  
Restoring the Balance - Case Studies

Lesson 2.  
Juntos Class Project



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# **RESTORING THE BALANCE: CASE STUDIES**

## **LESSON OVERVIEW**

In this lesson, the class is provided with a set of case studies which overview actual strategies that people have used to benefit the environment in our region. The case studies include specific examples of the establishment of biosphere reserves and other protected areas, habitat restoration, species reintroduction, water study projects, community actions, and other environmental projects that have been carried out by people in this region. Student teams will review their assigned case studies and discuss their findings with the class. Each student also completes a study guide that reviews new vocabulary and asks questions about the case studies.

## **TEACHER PREPARATION**

- ✓ Be sure each student has a copy of the Student Activity - Study Guide: *Restoring the Balance - Local and Regional Strategies*.
- ✓ Prepare copies of Student Activity - Study Guide: *Restoring the Balance - Local and Regional Strategies* (one copy for each student)
- ✓ Have ready, an overhead projector
- ✓ Have ready, the overhead transparency master: *Restoring the Balance - Strategies for Improving the Environment*

## **TEACHING STRATEGY**

1. **Bring the lesson into context.** This activity should be introduced in the context of the entire Juntos curriculum. Remind students that throughout this program they have been studying the Sonoran Desert Ecoregion. From Unit I, in which they were introduced to the general geography and ecology of the region. Through Unit III, in which they looked at particular environmental issues that are relevant to our border region. You might ask students what lessons or aspects of their Juntos studies they recall. Following discussion and review, explain to students that for the next two lessons, they will complete the Juntos program by looking at ways to "restore the balance" and improve the environment.

2. **Review strategies for improving the environment.** Use the overhead transparency master, *Restoring the Balance - Strategies for Improving the Environment* to review some of the strategies that people use to address environmental issues. Have students follow along and complete Part I of their Student Activity as you review the terms. It is important to point out that there are a variety of ways (or strategies) that people can "tackle" environmental problems. There are also a variety of different levels at which to approach environmental issues (from individual to global efforts). It is also important for students to understand the difference between being "proactive" and "reactive."

3. **Create student teams and assign Case Studies.** Divide students into 10 teams. Assign each team a specific *Restoring the Balance - Case Studies*.

4. **Review Case Studies and complete Part 2 of Study Guides.** Have students read their Case Studies and discuss them with their team members. Each student should first complete Part 2 of his or her own Study Guide-answering the questions about their

## **LESSON OBJECTIVES**

Upon completion of this activity, students will be able to:

- define and discuss the differences between conservation, preservation, protection, mitigation, reintroduction, and restoration and give local examples of each.
- define "sustainable use" and analyze the sustainability of different land use practices.
- suggest strategies for increasing the sustainability of various land use practices.
- list and describe relevant border environmental laws and treaties.
- analyze environmental effects of specific border related issues such as immigration, trade, transportation of hazardous materials, and border area waste management.
- identify, plan, and execute a personal or classroom environmental project.

## **TIME NEEDED**

This lesson can be completed in one class period. To include more extensive class presentations of each team's assigned case study, part of an additional class period would be needed.

## **MATERIALS NEEDED**

- Overhead projector
- Overhead transparency master: *Restoring the Balance - Strategies for Improving the Environment*
- *Restoring the Balance - Case Studies*
- Student Activity - Study Guide: *Restoring the Balance - Local and Regional Strategies*

## **CURRICULUM TIES**

Arizona: 1SC-D3; 3SC-P1; 3SC-P4; 3SC-D1  
O'odham: A.2.8; A.11; B.7.2

team's particular Case Study.

5. **Team presentations of Case Studies.** Give each team a chance to share their Case Study with the rest of the class. (Both during and after the class discussion, students will need to answer the questions on Part 3 of their Study Guides in reference to other teams' Case Studies.)
6. **Complete Part 3 of Case Studies.** As stated above, the questions in Part 3 of the Study Guide are in reference to all the Case Studies and must be answered after all of the teams have shared their Case Studies (students may want to answer some of the questions during the presentations).
7. **Class Discussion.** One way to conduct the discussion and review of Case Studies could be to revisit the overhead transparency and ask for examples of each of the different strategies presented. Summarize by stating that, to restore environmental balance in our world, we need to approach environmental concerns from many angles and use as many strategies as possible.

## **EXTENSIONS**

Have students conduct additional research and prepare detailed presentations of their Case Studies. They might use photos, graphics, maps or other visual aids.

For most of the Case Studies, contact information is provided. Have students contact the people involved in selected cases and interview them about their specific environmental projects.

**RESTORING THE BALANCE - STRATEGIES FOR IMPROVING THE ENVIRONMENT**

Strategies. The following are examples of strategies people use to help improve the environment:

CONSERVATION - using the environment and its resources in the wisest possible way today in order to maintain the resources for the future

PRESERVATION - maintaining (a place or species) in its existing condition (connotes not using the resource)

RESTORATION - through reintroduction of a species, or repair and enhancement of a habitat, the return of a species or habitat to, or close to, its original condition

REINTRODUCTION - returning a population of plants or animals to an area where it historically occurred

PROTECTION - using legal or physical means to help a place or species avoid degradation or harm

EDUCATION - increasing the awareness and knowledge of others

MITIGATION - environmental improvement which occurs as an exchange to offset a negative impact to a place or species

LEGAL ACTION - creating and enforcing law (to protect a place, species, or the environment in general)

## RESTORING THE BALANCE - STRATEGIES FOR IMPROVING THE ENVIRONMENT

Taking action. Doing something to improve the environment can be done before or after a problem develops:

PROACTIVE - doing something before a serious problem arises - initiating activity without be prompted to do so

REACTIVE - doing something in response to a known issue or problem - initiating activity as a reaction to something

Who's taking action? Environmental improvement can occur at many different levels. From individuals to communities to international efforts, anyone can get involved in environmental endeavors. Typical "action takers" include the following:

INDIVIDUALS - any person or "unorganized" group of people

GRASSROOTS - a group of ordinary people (usually local) with similar interests and concerns who organize themselves to focus on a project, problem, or issue

NON-GOVERNMENTAL ORGANIZATION (NGO) - an association, community organization, foundation or other similar institution created with the purpose of improving social and environmental conditions

GOVERNMENT - any agency or organization associated with, funded through, and operated by local, state, or national governing body

NOT-FOR-PROFIT - a formal organization established with a specific mission and purpose often toward the improvement of social, cultural, or environmental conditions

EDUCATIONAL INSTITUTION - any school, university or other body of education

**RESTORING THE BALANCE - LOCAL AND REGIONAL STRATEGIES**

**Part 1.** *Fill in the blanks below with the correct term as presented on the overhead transparency in the class discussion.*

Strategies:

- \_\_\_\_\_ using the environment and its resources in the wisest possible way today in order to maintain the resources for the future
- \_\_\_\_\_ maintaining (a place or species) in its existing condition (connotes not using the resource)
- \_\_\_\_\_ through reintroduction of a species, or repair and enhancement of a habitat, the return of a species or habitat to, or close to, its original condition
- \_\_\_\_\_ returning a population of plants or animals to an area where it historically occurred
- \_\_\_\_\_ using legal or physical means to help (a place or species) to avoid harm or degradation
- \_\_\_\_\_ increasing the awareness and knowledge of others
- \_\_\_\_\_ environmental improvement which occurs as an exchange to offset a negative action (impact) to a place or species
- \_\_\_\_\_ creating and enforcing law (to protect a place, species, or the environment in general)

**Part 2.** *Review and discuss your assigned case study with your teammates. Answer the questions below about your specific case study.*

1. Describe your case study:
  
  
  
  
  
  
  
  
  
  
2. What kind of strategy that is being used in this case study? Explain your answer.
  
  
  
  
  
  
  
  
  
  
3. Were the people involved in your case study being proactive or reactive about their particular environmental issue? Explain your answer.
  
  
  
  
  
  
  
  
  
  
4. Who took action in your case study (individual, government, etc.)?

**Part 3.** *Listen carefully as other students share their case studies. Answer the following questions:*

1. What animal is being protected in the Tohono O'odham Nation?
2. Who helped the Ajo Elementary School kids dig their garden?
3. What does the Native Seeds/SEARCH seed bank help conserve?
4. Name at least two biosphere reserves in the region.
5. What protected species is being carefully monitored and managed?
6. What habitat is being restored?
7. What two rivers are being monitored by high school students as part of an international exchange program?
8. The Cienega de Santa Clara and the Colorado River Delta were included in what biosphere reserve?
9. Two case studies deal with some kind of recycling. What two things are being recycled?

**RESTORING THE BALANCE  
CASE STUDY # 1**

**AJO ELEMENTARY SCHOOL GARDEN - SOWING SEEDS, GROWING HAPPINESS**

"A garden in every school, everywhere."

That's what Paul Crawford of the International Sonoran Desert Alliance believes is necessary and possible. Necessary because it helps kids get in touch with the earth and gain an understanding of the cycle of life, and possible because he's seen it happen in the local elementary school in Ajo, Arizona.

Planting and maintaining a garden does indeed give students an opportunity to touch the soil, get their hands dirty, and help bring to life plants which in turn feed and give life to us through their energy. It is a very real way to take part in the cycle of life.

Recognizing the value of planting gardens, Paul teamed up with Janice Cantu and other teachers from Ajo Elementary School to realize their combined dream of creating a schoolyard garden. There was space on the school ground, committed and interested teachers, support from the school's administration, and the willingness on Paul's part to help organize the garden project. They first selected a site in back of the school and then designed the garden following a technique called "biointensive gardening." Paul and the elementary teachers then asked for assistance from students at the local high school. At least eight members of Ajo High School's football team came out to help with digging the garden. When the soil was ready, students from several elementary classes planted the vegetables and flowers. They named their garden "The Garden of Happiness."



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According to Ms. Cantu, the students did a great job. The soil was terrific for planting and the students grew tomatoes, garlic, potatoes, zucchini, mint, and flowers. "This teaches them responsibility, respect for the land and the environment, and pride in their work," said Ms. Cantu. The assistance from the high school students was also valued by the elementary students.

Though a small project, planting a school garden can have a big impact in the lives of the participants. A school garden has also been planted by students at Baboquivari High School in Sells, Arizona. There, students have focused on growing traditional crops. Students at Rio Rico High School have a green house and have grown ornamental plants and trees to be planted around the school. Planting a garden not only beautifies the land and gives us food to eat, but it helps people gain a connection with the earth and develop a desire to care for the planet.

source:

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## BUENOS AIRES NATIONAL WILDLIFE REFUGE - HABITAT RESTORATION

If you had visited the Altar Valley a couple of hundred years ago, you would have been greeted by seemingly endless vistas of lush grassland. The grass was tall, belly-high to a horse. There were few trees or large shrubs. Clear streams flowed. Masked bobwhite quail were abundant, and huge herds of pronghorn antelope thrived in the wide-open valley.

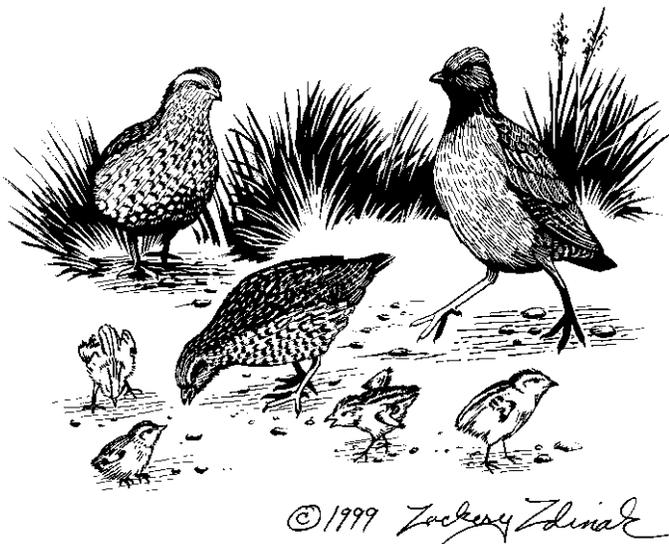
When people of European heritage came, they realized that cattle could thrive here too. In the 1800s, they brought large numbers of cattle. At that time, people understood very little about the concept of carrying capacity, or the number of animals that land could support. When the first cattle grew fat, people brought in more and more cattle. Then, with cattle numbers already too high for the land to sustain for very long, a major drought struck.

The overgrazing and drought combined to cause long-term changes. The grass became sparser, leaving more bare ground. The grass cover was no longer thick enough to carry the naturally-occurring wildfires that had kept most young shrubs or trees from getting established. People even tried to suppress fires, not understanding their importance to the health of the ecosystem. This made it easier for mesquite, snakeweed, burroweed, and other shrubs to invade the grassland.

The soil blew away in the wind or washed away in the rain, since it was no longer as sheltered by grass or anchored by grass roots. Without plants, roots, and soil to slow and capture it, water rushed away after rainstorms, reducing stream flow between rains. People introduced exotic plants to the area.

Within one hundred years, the Altar Valley looked very different. Degradation of the plant community affected the animals: Populations of pronghorn and other large mammals, including bears, jaguars, and wolves, were decimated by hunting, trapping, and changes in their habitat. Many grassland birds, including the masked bobwhite quail, were greatly reduced in numbers or even close to extinction.

The Buenos Aires Wildlife Refuge was established in 1985. A major goal on the 115,000-acre refuge is to restore the native grasses. Habitat restoration is helping the grassland bird and mammal species make a comeback.



Refuge biologists use fire as their most important tool for habitat restoration. Controlled burns are conducted about every five years. This reduces the invasion of shrubs, but benefits the grasses, which evolved to thrive with frequent wildfires. The land is also rested from grazing and otherwise left undisturbed. Biologists are even propagating native grasses and planting them in the wild on small experimental plots.

Although the refuge is in the U.S.A., biologists there work cooperatively with families in Sonora who are interested in improving the wildlife habitat on their ranches. Improving wildlife habitat on private land is a good idea in general, and draws in hunters and ecotourists, bringing sustainable income to local people.

On the National Wildlife Refuge, biologists have set up over 80 plant transects, each 100 meters long. They check these regularly to track changes in plant cover (how much of the ground is covered by plants) and plant diversity (how many kinds of plants there are). The goal is to monitor how the grassland benefits from the fires and by being rested from human uses.

So far, research indicates clear progress toward restoring the habitat. Invasive trees and shrubs are being held in check, while native grass species are doing well. There is more plant cover, and the biodiversity of native grasses has increased. Pronghorn antelope and masked bobwhite quail, which had disappeared from the area, have been reintroduced and their populations appear stable. Other large mammals, like deer, javelina, coyotes, and foxes, are doing well. The refuge boasts over 300 species of birds, including many migratory species, which appear to be doing well too. The story of Buenos Aires National Wildlife Refuge shows that habitat restoration efforts can help return the balance of nature to our Sonoran Desert borderlands.

source:

Sally Gall, Wildlife Biologist

Buenos Aires National Wildlife Refuge

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**RESTORING THE BALANCE**  
**CASE STUDY # 3**

**TERRACYCLE TECHNOLOGIES: EVERYONE WINS**

In the mid-1990s, there was concern that the only landfill for Arizona's Santa Cruz County was filling up too quickly. It was beginning to appear that, within a few years, it would become necessary for the county to begin sending waste to a landfill near Phoenix. This would increase waste disposal costs, and a lot of energy and other natural resources would be used just to transport waste.

A significant portion of what went into the Santa Cruz County landfill was produce. Nogales is a major port for entry of fruits and vegetables into the U.S. In fact, over 70 percent of the winter produce needs of U.S. citizens enter the country through ambos Nogales.

Unfortunately, in the large-scale export-import produce trade, a lot of produce gets wasted. This can be due to decreased demand, a glut on the market, bad winter weather delaying shipments, or other considerations which make produce less marketable. So for many reasons, an estimated 5,000 to 20,000 tons of produce were dumped in the Santa Cruz County landfill each year.

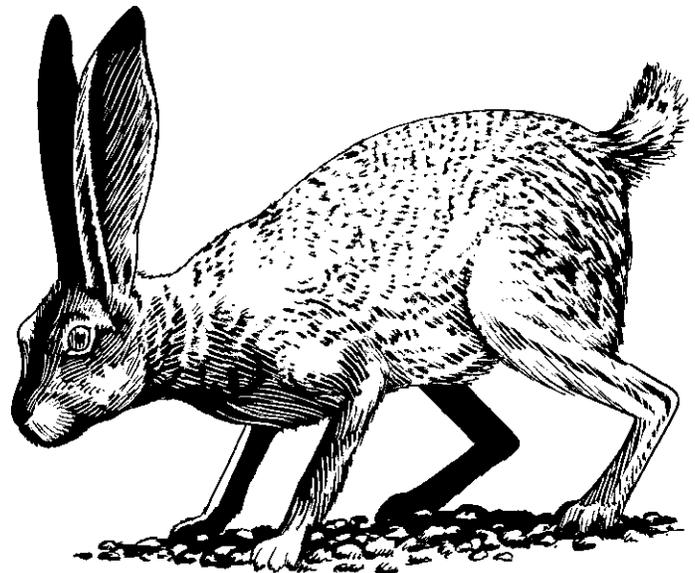
Two families talked about this problem. They knew that organic material can be composted to make it into a useful soil conditioner. They decided to start a new business called TerraCycle. A grant from the Arizona Department of Environmental Quality helped them get started. Now they're on their own. Their business diverts truckloads of organic waste from the landfill and composts it. They sell some of the finished compost and use some of it on their own organic farm.

TerraCycle set up their business just off the main highway, so it's easy to get to. They charge shipping companies to dump unwanted produce, but because they charge less than the landfill, companies are glad to pay. Other people bring organic waste to TerraCycle too. Landscaping companies, construction companies, and individuals or families bring waste from trimming plants or clearing land. The Arizona Department of Transportation brings waste after it cuts brush along highways. Even schools bring organic waste to TerraCycle!

All this material goes through a grinding machine that chops it into small pieces. The chopped-up material is placed in huge windrows, or big long piles of debris. To help the composting process, the windrows are kept moist and are turned periodically with heavy equipment.

Composting is a natural process - the decomposition or breaking down of organic matter. In nature, organic material breaks down naturally, through the action of tiny organisms. When people make compost, they speed the process along by controlling the moisture level and other conditions. The result of decomposition is dark, crumbly compost with a clean, slightly earthy smell. Compost is a valuable soil conditioner. Adding compost to soil helps condition soil so that it holds more moisture. Soil with compost is less dense than mineral soil and lets more air get to plant roots. And compost is full of nutrients that plants need to grow. Trees, shrubs, grass, flowers, and fruit and vegetable plants all benefit from compost.

In summer, less produce is shipped through Nogales, and the compost side of the business slows down. Then Terra



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Cycle focuses on its 20-acre organic farm. They grow a variety of vegetables, and even have a pumpkin patch. They sell produce from the farm locally, as well as in Green Valley and Tucson, through farmers' markets or small businesses. Sometimes school groups take field trips to see the TerraCycle compost facility and farm.

This family-owned, family-operated business is filling a special niche and helping restore balance to our border environment. TerraCycle is taking something that previously was considered waste and was causing a problem, and turning it into something good and useful. Many people (and plants!) have benefited from the TerraCycle operation.

source:

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celenes@azstarnet.com

**RESTORING THE BALANCE**  
**CASE STUDY # 4**

**BIOSPHERE RESERVES: LINKING THE LOCAL AND GLOBAL**

One of the biggest challenges facing humanity is how to conserve biological diversity and maintain the health of natural systems - and, at the same time, meet the needs of our growing human population. Biosphere Reserves are a worldwide success story in this regard. They present a model for balancing the protection of biological resources with the economic needs of local communities.

In 1968, UNESCO (United Nations Education, Scientific, and Cultural Organization) initiated international discussion about the need to establish a balance between what people used to think of as conflicting goals: conserving biodiversity, promoting economic development, and maintaining the cultural values of local peoples. (Now we call this kind of balance sustainable development.) Representatives from around the world thought it would be a good idea to show how these goals can be balanced. So in the 1970s UNESCO began to establish Biosphere Reserves under a program called "Man and the Biosphere."

While all Biosphere Reserves are part of a world network, they are nominated by their national governments and remain under the complete control of the country where they're located. There are now 368 Biosphere Reserves in 91 countries. In the Sonoran Desert, we have the Alto Golfo de California y Delta del Rio Colorado, El Pinacate y El Gran Desierto, and the Organ Pipe Cactus Biosphere Reserves. The Alto Golfo Reserve, in Sonora and northern Baja California, includes the Upper Gulf of California marine environment, the Colorado River delta, and coastal wetlands. The Pinacate Reserve includes the Gran Desierto dunes, the volcanoes and mountains of El Pinacate, and surrounding desert. The Organ Pipe Cactus Reserve is centered around Organ Pipe Cactus National Park, in Arizona.

Each of the Biosphere Reserves around the world is unique. The areas protected include examples of major biogeographic regions, such as forests, deserts, plains, tundra, or coastal ecosystems. Although each Biosphere Reserve is different, all of them are intended to serve three functions:

conservation - conserving species and ecosystems

development - fostering sustainable economic development

information exchange - research, education, and information exchange related to conservation and development

Also, to show how protection of natural resources is complementary to the use of those resources, Biosphere Reserves are set up with a system of three zones: the core area, a buffer zone, and a transition area. Core areas have official legal status as a protected area - for example, as national park. Usually there is very little human activity in the core area. A publicly or privately owned buffer zone surrounds the core area. It has more human activity, but only activities that support conservation in the core area. A larger transition area surrounds the core and buffer. Usually privately owned, this area may encompass human communities and intensive human activities like agriculture.

The Biosphere Reserve concept has been very successful. Biosphere Reserves benefit wildlife, plants, and people. Local communities, often including native people or rural residents, are usually able to maintain their traditional cultural and economic activities. The reserves can provide a stable and diverse economic base and even employment opportunities. Land, water, and other resources are protected, providing a healthier environment in which to raise families. Also, local



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communities and private interests are involved in planning Biosphere Reserves, so people often have more influence than they otherwise would in determining local land uses. Biosphere Reserves offer a good model for sustainable development or development that respects the environment as well as local cultures and values. Living sustainably means that we make our living while taking care of the environment in a way that people in the future can also live well.

The World Network of Biosphere Reserves was first envisioned by an international group. National and local governments embraced the strategy. In the Sonoran Desert borderlands, we are lucky to be able to visit and benefit from three Biosphere Reserves in our area.

source:

<http://www.ine.gob.mx>

<http://www.usmab.org/>

<http://www.puerto-penasco.com>

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**RESTORING THE BALANCE**  
**CASE STUDY # 5**

**BICAS - BUILDING BIKES, COOPERATION, AND COMMUNITY**

What would you do with a lot of used bike parts, people who needed transportation, and little bit of bike maintenance skill? Kim Young, of Tucson, Arizona brought it all together and created BICAS (Bicycle Inter-Community Action and Salvage), a cooperative organization which teaches people how to build and maintain bikes using recycled bike parts.

Used and recycled bicycles and bike parts are donated to BICAS, and Kim and her associates help others to refurbish and rebuild them into new bikes. The staff at BICAS work primarily with kids (and adults) in at-risk communities, giving them extensive hands-on training in bicycle maintenance and repair. After the training program, participants not only have a new marketable skill, but they get to keep the bike they rebuilt for their very own pollution-free transportation! Through BICAS'S "build-a-bike" program, thousands of bikes have been recycled and are back on the streets.

BICAS is about more than just recycling bikes, however. It is also about working together and building community. Because it is a cooperative operation, anyone who has bike maintenance skill or wants to learn about bikes can work with BICAS. BICAS also supports bicycle co-ops in towns along the U.S. / Mexico border. BICAS regularly donates bicycles to Mexican organizations such as Fundación Apoyo Infantil, a youth advocacy organization in Ciudad Obregón, Sonora. They have also gone to border towns to help communities setup their own bike coops.

When Paul Crawford of the International Sonoran Desert Alliance (ISDA) heard about BICAS, he invited them to Mexicali, Baja California to help create a bike coop in that community. Paul helped arrange the donation of old bikes and parts from a bike shop in San Bernadino, California. Kim and her staff met with Paul and together, they all traveled to Mexicali to conduct a three day bike workshop organized by several local high schools. Students and teachers attended the workshop and all came away with a bike they had built themselves. Additionally, besides gaining bike mechanic skills, they also came away with ideas about how to start their own bike cooperative. They plan to help others build their own bikes and if they have a bike surplus, they can sell them to help their operations.

Building bikes also contributes to the restoration of the environment by reusing materials that would otherwise be "thrown away"- likely taking up space in landfills or dumped on the side of the road. It involves people in this process in a way that also builds community. People come together with different skills and ideas and everyone can go away with a bike. Some people don't just "ride off into the sunset" however. They stick around to help others build bikes. They find a skill they are good at or they find they like working with people. Through BICAS, with the seeds of an idea and some left-over bike parts, more than just a bike was built.

source:

BICAS, Kim Young, former director  
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or

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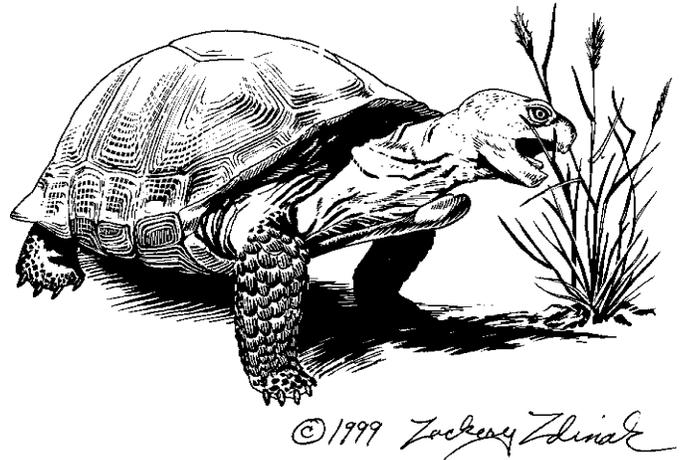
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**RESTORING THE BALANCE**  
**CASE STUDY #6**

**DESERT TORTOISE: CAN THE KOMCKUD MAKE A COMEBACK?**

The range of the desert tortoise (*Gopherus agassizi*) encompasses warm desert areas in the southwestern U.S. and northwestern Mexico, and even reaches into the subtropical thornscrub and tropical deciduous woodlands of Mexico. However, these unusual and interesting animals are much less common than they were in the past and are on the U.S. endangered species list.

Desert tortoises are herbivores and feed on grasses, annual wildflowers, and other low-growing, tender plants. They are active mostly in the morning and late afternoon, seeking the shade of their burrow during the heat of the day. During winter, they hibernate. Desert tortoises are not just slow-moving; they are also slow-growing, taking 15 to 20 years to mature.



Several types of human activity are a threat to the survival of the desert tortoise. Even people with good intentions can unknowingly cause problems for tortoises. Desert tortoises are so interesting and easy to catch that people often pick them up just to take a closer look. Most people don't know that merely handling a desert tortoise can threaten its life. This relates to the fact that tortoises store water in an organ called a cloaca. Picking up a wild tortoise may cause it to expel the water in its cloaca through fear or the effort of trying to escape. During a long period without rain, this can be a matter of life or death. If you see a tortoise in the wild, watch it from several feet away so that it does not consider your presence a significant threat.

Another way that people cause problems for desert tortoises is by releasing captive animals. Captive tortoises often carry a respiratory disease that may eventually be fatal. Releasing an infected individual into the wild furthers the spread of this disease through the wild population. Captive desert tortoises should not be released.

Habitat loss is a significant factor in some parts of the desert tortoises' range. Growing human communities are building new developments in tortoise habitat. Roads and highways crossing otherwise undeveloped tortoise habitat cause many tortoise deaths as well, as the slow-moving animals are often hit by cars.

On the Tohono O'odham Nation, many tortoises spend the winter in dens among the rocky hills around Baboquivari Peak. At the end of winter, they leave their dens and move out into open desert. So each fall and spring they cross the highway. Many tortoises ended up dead on the road. Large mature tortoises have hardly been seen on the Nation in recent years.

Jefford Francisco organized a project to reduce tortoise deaths by keeping the komckud safe and off the roadways. This was done by building two-foot-high fences of wire mesh, at the base of regular barbed-wire fences, along the highway. The low barrier fences prevent tortoises from crossing the road. The tortoises can follow the fence to a wash and cross under the road there. Signs were also put up to caution drivers to be careful of tortoises.

A lot of people have worked with Jefford to protect the tortoises. When the project started, Jefford worked for the Arizona Nature Conservancy. Conservancy staff worked with Arizona Department of Transportation staff and with employees, adult volunteers, and even student volunteers on the Tohono O'odham Nation. Now Jefford works for the Tohono O'odham Wildlife and Vegetation Management Program. So this has been a cooperative effort with many people involved, from government agencies, non-profit groups, and citizen-volunteers. The project is ongoing, with more fences being built each year. Now there are over 8000 feet of highways with the barrier fences.

Efforts to protect the desert tortoise in this way appear to be very successful so far. Less tortoises are being killed on the road. Hopefully this cooperative project will allow the population to recover, and large komkud will again be a common sight on the Tohono O'odham Nation.

Source:

Scott Bailey

Jefford Franciso

Tohono O'odham Wildlife and Vegetation Management Program

520-383-2362

**RESTORING THE BALANCE**  
**CASE STUDY #7**

**ECOTOURISM IN CIENEGA DE SANTA CLARA**

Through eons of time, the muddy-red waters of the Colorado River carried rich silt to the Gulf of California and deposited it into a massive river delta. Historically, millions of acres of lush wetlands covered the delta. Huge flocks of water-loving birds were everywhere and native fish were abundant. As the rich waters flowed into the Gulf, they helped support a large shrimp population. The Colorado River Delta was one of the largest and most productive estuaries in the world.

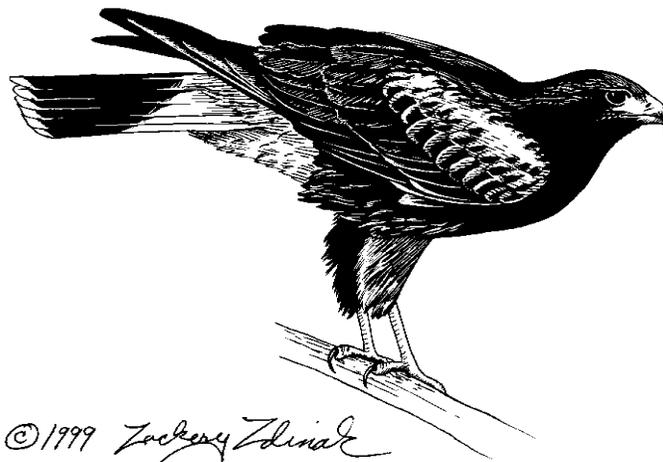
The river channel itself was bordered by tall willows, cottonwoods, and mesquite trees. The river was navigable, and during the 19th century, steamboats regularly cruised between Yuma and the Gulf. The "river people" or Cucapah tribe had long relied upon the abundant game, fish, and native plants for their survival. Later, Mexicans settled in small towns scattered across the delta and earned their living fishing and farming.

As the western U.S.A. became increasingly settled, more and more of the river water was diverted for agriculture and other uses. In 1922, the seven U.S. states in the Colorado River Basin came to an agreement as to how to split the Colorado River water among themselves - without any consideration for Mexico, the delta ecosystem, or the people that lived there. Later, in 1944, the U.S.A. and Mexico signed an agreement which committed about ten percent of the river's flow to Mexico. However, with most of the water being used or diverted up-stream, sometimes not even a trickle reached the delta or the sea for years at a time.

The delta ecosystem faded. With so little fresh water coming in, the estuary waters became nearly as salty as the ocean - too salty for most wildlife. Habitat loss and over-fishing caused fish populations to plummet. Biologists thought that the delta was an environmental catastrophe - a largely dead expanse of dry, salty soil. This put local human communities in a state of cultural and economic flux. Now many delta residents make daily bus trips to earn a living in farming and manufacturing jobs along the border, and many young people have moved away to seek work elsewhere.

But then in the 1980s and 1990s, a number of wet years brought floodwaters all the way to the Gulf of California. Riparian vegetation grew back along a 60-mile stretch of the river. Some of the native flora in a small portion of the delta began to recover, and fish populations began to rebound. A canal that drained extra irrigation runoff began to create a wetland, the Cienega de Santa Clara. The endangered desert pupfish are doing well in this marsh, the endangered Yuma Clapper Rail thrives there, and many migratory birds are using the area.

Mexican scientists recognized the importance of these newly re-created ecosystems. In 1993, the Cienega de Santa Clara and Colorado River Delta were included in the Upper Gulf of California and Colorado River Delta Biosphere Reserve. This gave the area a special status through the United Nations' international system of Biosphere Reserves. The future of the



area is still very uncertain, because the "extra" floodwaters that have revitalized it may not continue to flow, and neither government has any kind of treaty or policy about letting water reach the area. Also a water de-salting plant in Yuma will need a place to dump its brine (which would be so salty that it would be poisonous to most living things) when the plant is fully operational.

But a growing number of people on both sides of the border are determined to protect the area. People from several delta towns who fish, farm, and hunt formed the Ecological Association of Users of the Hardy and Colorado Rivers, and are working with city and state government planning efforts. State and national Mexican conservation groups are also giving attention to the area. And a group of 39 Mexican and U.S. environmental organizations sent letters to their governments, asking for a formal policy agreement committing water to the Cienega de Santa Clara and the Colorado River.

Having even a small portion of the delta ecosystems restored is bringing economic benefits to the local communities. At Ejido Luis Encinas Johnson, several local people have established an eco-tourism business. Birdwatchers and other ecotourists spend money for guides, lodging, and meals, and often purchase locally-made crafts. Several other small towns near the Cienega also stand to benefit from ecotourism. Ecotourism also can help people from all over understand the important ecological values of the area.

Hunting and fishing opportunities have improved markedly. Of course, the Mexican and Cucapah people benefit directly from hunting for their own purposes. Waterfowl hunting in particular also draws in hunters from elsewhere, who often rent cabins, buy food, and hire guides. And fishing, long a local tradition is becoming more important again. At least one local family has established a fish farm. Hunting and fishing opportunities are likely to economically benefit a large number of people in the widely-dispersed towns of the delta. This can help reverse the economic decline in local communities and help preserve family structure.

This story shows how resilient nature is. But the ending of the story is uncertain. People of diverse backgrounds and interests will have to work together, and work hard, to convince their governments to take all the necessary steps to protect the Colorado River Delta and its special ecosystems, both to protect nature and provide for a stronger local economy.

Sources:

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**RESTORING THE BALANCE**  
**CASE STUDY #8**

**NATIVE SEEDS: TO SEARCH AND SHARE**

Traditionally, Native American peoples of the southwestern U.S. and northwestern Mexico grew many, many varieties of food and other crops. But after centuries of forced migrations, cultural change, and environmental damage, these rich agricultural traditions almost died out.

In the early 1980s, Mahina Drees and Gary Paul Nabhan were talking with a group of Tohono O'odham elders who commented that they really missed having the kind of squash they had eaten as children. Later, Mahina and Gary found those squash seeds in another community and brought them to the elders. It was apparent that the crops, seeds, and farming methods that had sustained native peoples for generations were in danger of being lost. This was the inspiration for Native Seeds/SEARCH (NS/S).



Native Seeds/SEARCH was founded as a non-profit organization in 1983. NS/S collects and saves the seeds of ancient crops, grows more of them, and distributes them to Native Americans and others. The organization gives free memberships and free seeds to native peoples in the southwestern U.S. and northwestern Mexico. NS/S also works to record and preserve knowledge about traditional farming methods and traditional uses of crops. Finally, NS/S also works to protect the wild relatives of crop plants.

Native Seeds/SEARCH acts as a "seed bank." A financial bank provides a safe place to keep money, a place to invest money so that its value increases over time, and a place to borrow money. In a similar way, NS/S provides safekeeping for the seeds of traditional crops and for information about those crops. The seeds are planted so that their genetic traits can be studied and more seeds can be produced. And the new seeds are shared with people who need them.

The organization now has a seed bank with approximately 1900 different accessions. These accessions have come from 18 different tribes. Over half of the accessions are for varieties of the three sisters - corn, squash, and beans. The many other seeds include everything from amaranth to watermelon, as well as wild relatives of cotton and several other crops. The seed bank helps conserve biodiversity. Traditional crop plants and their wild relatives carry genetic traits that are not found in modern crop plants. These unique plant varieties are usually drought tolerant and many are resistant to common plant diseases or insects. They are useful in their own right, and also provide a "genetic library" of desirable traits that could be bred into modern crop plants. Thus the agriculture of the past may make important contributions to the agriculture of the future.

Native Seeds/SEARCH also works to conserve cultural diversity. NS/S has established a Cultural Memory Bank. This project involves collecting and sharing as much cultural and historical information as possible about traditional crops, the conditions they do best in, how they were grown and used, and other information about their cultural context. Students from the Tohono O'odham Nation and other tribes are involved with interviewing elders to gather as much oral history as possible about their agricultural traditions.

In Native American communities, traditional farmers can act as a stabilizing force. When traditional crops are available, a community is able to prepare traditional foods, create traditional arts, or keep traditional ceremonies and feast days alive.

Growing heirloom crops helps a people stay in touch with their past and find meaning in their future. For many Native Peoples whose cultures were historically based on agriculture, keeping their agricultural heritage alive helps keep the whole culture alive.

NS/S is now a major regional seed bank and leader in the heirloom seed movement. The organization has a farm and is involved with numerous projects. Native Seeds/SEARCH protects both biological diversity and cultural diversity, and helps link new generations to the rich heritage of the past.

Source:

Native Seeds/SEARCH

526 N. 4th Avenue

Tucson, Arizona 85705

*info@nativeseeds.org* *http://www.nativeseeds.org*

**RESTORING THE BALANCE**  
**CASE STUDY #9**

**FROM ONE RIO TO ANOTHER: WATER QUALITY, COMMUNICATION,  
AND CULTURAL EXCHANGE**

Historically, a greater number of perennial streams were found in the Sonoran Desert than exist here now. Over the last century or so, the majority of stream and riparian habitats were lost because of human impacts and droughts. This makes it important for us to conserve those that still exist. The first step is to better understand the habitats that remain. Students at Rio Rico High School, near Nogales, Arizona and at COBOSH in Magdalena, Mexico have been studying streams in their respective areas.

In 1995, science teacher Karen Sondak guided students at Rio Rico High School in starting a water quality monitoring program on the Santa Cruz River. Every month, the students take a bus trip to at least three points along the Santa Cruz, where they perform chemical, physical, and biological analyses. A standard water testing kit is used to check the water for pH, dissolved oxygen, nitrates, phosphates, chlorine, and ammonia. The students also measure turbidity, flow (or volume), and velocity of the water. They also conduct biological surveys, checking for bacteria and macro-invertebrates, and sometimes even do fish counts.

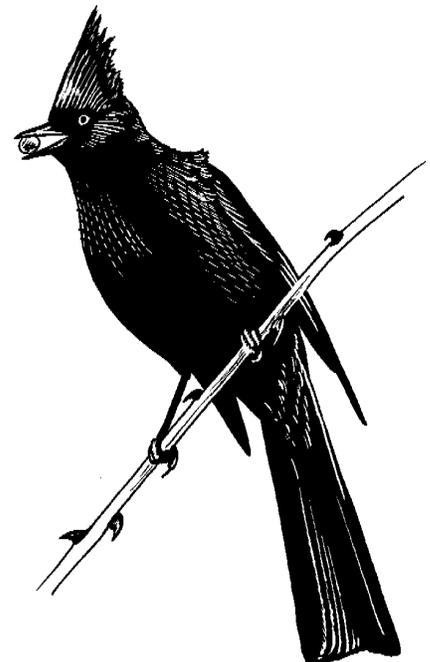
In time, the high school students started presenting programs for younger children, teaching them about the river, water quality, and the environment in general. Then, on a trip through Sonora, Ms. Sondak saw the Rio Magdalena and recognized that conditions there were similar to those on the Santa Cruz. Both rivers are of limited flow much of the year, pass by sizeable communities, and are contaminated by untreated or inadequately treated human sewage. This causes problems with high levels of bacteria, as well as high levels of ammonia.

In 1987, the Arizona-Sonora Desert Museum helped Ms. Sondak make contact with COBOSH. With other help from Juntos Unidos, Friends of the Santa Cruz River, and student fundraising projects, the Rio Rico students went to Magdalena. They brought the COBOSH students a test kit just like the one they had been using and shared what they knew.

Every year since then, a bi-national exchange has taken place between the two high schools. Some years, the Rio Rico students go to Mexico, and other years, the Magdalena students go to the U.S. A number of agencies and organizations have helped by sharing information or expertise or funding. These include the Arizona-Sonora Desert Museum, Friends of the Santa Cruz River, Arizona Game and Fish Department, Tubac International Rotary Club, Juntos Unidos, and others.

Each year, the project takes a slightly different form. Water quality monitoring is at the core of the program. In other ways, the project is re-created by the students and organizations that choose to get involved in a given year. The number of participating students has varied from 15 to 40. Often the students take a tour of a wetlands, a wastewater treatment plant, a museum, or another new activity. One year the U.S. students even went to the Magdalena city hall to discuss water quality issues with local political leaders.

In general, it seems that each year more organizations get involved in the project. Although the program still revolves around water quality, it has evolved to encompass broader environmental and cultural exchanges. A great deal of cooperative planning and fundraising are necessary to make each trip possible. New lines of communication have opened up within the local communities as well as across the international border. And more people are becoming aware of water quality concerns.



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To restore balance to our Sonoran Desert borderlands, it necessary for diverse people to work together - people from many walks of life, many communities, and different nations. This program demonstrates how students can be involved in helping monitor environmental problems, an important step in restoring balance to our world.

Source:

Karen Sondak  
Rio Rico High School  
1220 Camino Lito Galindo  
Rio Rico, Arizona 85648  
(520) 281-8282

## MIGRATORY POLLINATORS: THE WINGED PILGRIMS

Pollination is the transfer of pollen from one flower to another to ensure that the plant produces fruit and seeds. Some flowering plants are wind-pollinated, others are self-pollinated, but most require insects or other animals to pollinate their flowers. The relationships between pollinators and plants are important mutualisms in which both parties benefit from the arrangement. Plants receive pollination services to ensure production of fruit and seeds. Pollinators receive rewards such as nectar, pollen, and oils. The most common reward given by the plant in this exchange is nectar. Nectar provides a high-energy food source for pollinators. It is the fuel that feeds their flight. This food is utilized by a variety of pollinators. Some are residents of the area and spend their entire lives in the place where they were born. Others are migratory and travel seasonally from one place or habitat to another to avoid unfavorable climatic conditions and/or to seek more favorable food conditions. They migrate great distances to obtain the nectar fuel the flowers provide.

The pollinators are very important because pollination by animals is essential to the reproduction of 80% of the world's flowering plants. More than three-quarters of the crop plants that feed the world, as well as many of the plants from which we derive medicines for our pharmacies, rely on pollination by insects or other animals to produce healthy fruits and seeds. Pollination is critical to commercial orchard and field-crop production, endangered species protection, urban gardening, ecological restoration and forage production for the dairy and beef industry.

Unfortunately, current evidence suggests that populations of some pollinators are declining because of habitat loss and fragmentation, pesticide use, and the effects of invasive species. Among these pollinators are four migratory pollinators that share homes between Mexico and the USA - Lesser long-nose bats, Rufous hummingbirds, White-winged doves, and Monarch butterflies.

In an effort to address the decline of these (and other) important pollinators, the Arizona-Sonora Desert Museum established the Migratory Pollinator Program in 1998. The program is a collaborative, binational research and education program and includes participation from local communities, teachers, organizations, researchers, and citizens concerned about the conservation of migratory pollinators across borders.

The Migratory Pollinator Program provides educational materials and training to teachers/educators on both sides of the border and also provides pollination garden planting guidelines and monitoring protocols. Teachers and students, in turn, learn how to make observations and record information about pollinators including their arrival and departures times, floral resources availability, and the relative abundance of pollinators. Students also help restore pollinator habitats and spread the word that pollinators and plants need protection.

Through the Migratory Pollinator Program, students are not only gathering vital information about pollinators, but they are spreading the word about the importance of pollinators. These are very important contributions to the overall conservation of our environment. By being involved in this program, students can play an important role in "restoring the balance."

The Migratory Pollinator Program is but one of the many educational programs of the Arizona-Sonora Desert Museum. Refer to the *Student Guide to Environmental Resources and Opportunities* for more information about the Desert Museum's



programs. The Desert Museum is a private, non-profit organization founded in 1952. The *Arizona-Sonora Desert Museum* mission is to inspire people to live in harmony with the natural world by fostering love, appreciation, and understanding of the Sonoran Desert.

Source:

Yajaira F. Gray

Migratory Pollinator Program

Robin Kropp

Education Department

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<http://www.desertmuseum.org>

# JUNTOS CLASS PROJECT

## LESSON OVERVIEW

This is the culminating activity of the Juntos program. It is intended to encourage continued involvement in environmental studies and projects as well as continued contact with the students' communities. Students will first conduct a review and valuing activity. Then, based on everything they have learned, contacts they have made, and interests they have developed during the course of this program, students will select and pursue an environmental project. Students may choose to work in teams on different projects, or as a class on a single project. To facilitate this effort, this lesson includes questions to aid in brainstorming, class project suggestions, and strategies for creating a project action plan. The ultimate goal of this activity is to get students involved in projects, research, and environmental endeavors in their own school, community, and/or region.

## TEACHER PREPARATION

- ✓ Review the Teaching Strategy and have it with you to refer to the lists and questions when you present the lesson to your students.
- ✓ Using poster board or other sturdy paper, create five different signs which state: Strongly Agree, Agree, No Opinion, Disagree, Strongly Disagree.
- ✓ Display the signs around the room to create a continuum of opinion from Strongly Agree to Strongly Disagree.

## TEACHING STRATEGY

Part 1 - Discussion

1. **Engage students.** Focus class attention by asking students to recall what they have learned about their region's environment (from previous lessons) that is most interesting or surprising to them. Is there something they learned that really concerns them?
2. **List environmental issues.** Ask students to help you generate a list of environmental issues in the region (have them consider their recent case studies on environmental issues and resolution of environmental issues). After responses slow, ask students about the costs of these issues and benefits of working to resolve these issues. (e.g., "What is the cost of a destroyed habitat and the benefit of restoring the habitat?", "What is the cost of air or water pollution and benefit of improving air or water quality?", etc.) Remind students that there are economic and environmental costs. Be sure students consider personal as well as societal and environmental benefits. Quality of life and economic concerns should also be discussed.
3. **List and discuss who is responsible.** Next, discuss the responsibilities that different segments of society can assume for improving the environment. Write the following list on the board and ask students to brainstorm contributions that can be made by each of the groups. Discuss the importance of these groups working together.
  - governments (national and local)*
  - business and industry*
  - scientists*
  - technology*

## LESSON OBJECTIVES

Upon completion of this activity, students will be able to:

- list four ways that technology, science, business and industry, governments, and individuals and families can contribute to improving environmental quality.
- describe three economic or environmental costs of selected environmental issues
- describe three benefits of improving the quality of the environment
- describe a planning and implementation process for completing a class or team project

## TIME NEEDED

Part 1 - One half to one full class period.  
Part 2 - The selection and planning process may take up to a full class period. Much of the selected projected may be done after class. Overall, time for completing the project is highly variable and project dependent.

## MATERIALS NEEDED

- Signs stating: Strongly Agree, Agree, No Opinion, Disagree, Strongly Disagree

## CURRICULUM TIES

Arizona: 1SC-P1; 1SC-P4; 3SC-P1; 3SC-D1  
O'odham: A.2.8; A.4.3; A.7.3; A.10.3; A.11; B.7.2



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*grassroots organizations  
individuals and families*

- 4. Conduct a valuing activity.** Be sure your signs are placed around the room to create a continuum of opinion: Strongly Agree, Agree, No Opinion, Disagree, Strongly Disagree. One at a time, present the following statements (or create others of your own) about the environment and ask student to go to the sign that describes their feelings about each statement.  
*Something should be done to improve the quality of our environment.*  
*It's up to government and industry, not me, to solve our environmental problems.*  
*Technology will always be able to solve any environmental problems we create.*  
*As an individual, there is nothing I can do to improve the environment.*  
*I am willing to do what I can to help improve the quality of our environment.*  
*I am willing to learn more about the environment.*  
*I am willing to share what I know about the environment with others.*
- 5. Ask questions.** Discuss the following questions with the students:  
*How much do you think most people know about the Sonoran Desert and our region's environmental issues? (Most adults probably know less than the students now do!)*  
*Do you think people know about things they can do to help improve environmental quality?*  
*Do you think people know about things they can do to help improve environmental quality?...but don't do those things?*  
*What will it take to inspire or motivate people to do something to improve their environment?*
- 6. Wrap up.** Summarize by having students remember some of the case studies they recently read. What inspired people in those case studies to take action? Do students think that there must be an environmental crisis for people to take action or can people be motivated to be pro-active? Explain that the next part of this lesson will give students the opportunity to be pro-active in taking on an environmental project.

## Part 2 - Student Action/Outreach Project

- 1. Brainstorm project ideas.** If students would like to learn more about the environment or be involved in an environmental project, invite them to brainstorm project ideas. It is a vital and fun part of the process and is empowering to students to have them generate and choose their own ideas. Explain that brainstorming means generating ideas without judging them. Record every idea, even those that initially seem silly or inappropriate. Consider questions like the following to stimulate the brainstorming process:  
*What environmental issue are we concerned with the most?*  
*What organizations have we encountered in our studies that might offer student opportunities?*  
*In what ways can our class make a difference?*  
*Do we want to do something at the school or in the community?*  
*If we do an education project, what audiences can we reach?*  
*Is there an environmental organization close by that we would like to help?*  
(Possible projects might include: Invite BICAS to your community to conduct a bike maintenance workshop and have them assist with the establishment of a local bike coop; contact a local land management organization--such as a park, biosphere reserve, forest, or other governmental agency--and offer your class's help in an exotic species eradication project; create a school-yard habitat with native species--include a guided nature trail through it; develop a school garden--plant native crops; contact a local wildlife organization or agency and offer the class's assistance with conducting a wildlife survey; develop and disseminate an informational brochure about a specific environmental topic; create a display about a species of concern in your area and have it displayed in the school library, in a local business office, or at a wildlife agency; organize a water conservation campaign; create an environmental lectures series and host different speakers to come to your school once a month on a designated evening for the rest of the school year--invite the public to the lectures; organize a trash clean-up day around your school; etc.)
- 2. Hone your project list.** Review the brainstorming list as a group, delete ones that everyone agrees are impractical. Decide whether the entire class will choose one project for everyone or if teams will take on different projects. You may want to give students time to research some of the ideas further and present them back to the class with more information. Some students may want to further investigate opportunities in the Student Guide to Environmental Opportunities and present those to the class. Narrow the list to several choices. Before voting to select the project, have students consider the following:

*Which ideas have the most potential to make a difference?*

*Which ideas are most practical or feasible in terms of time, money, and logistics?*

*Which ideas are we most enthusiastic about?*

*Which ideas will be able to involve everyone in the class?*

3. **Select your project (or projects) and develop an action plan.** After students vote on and select their preferred project, develop a class action plan by answering the questions below. Assign a student team to record the answers and develop an action plan chart.

*What is our final goal? (Articulate this answer carefully so students will know objectively when it has been accomplished)*

*What resources or partners may available to help us? (Consider seeking cooperation, support, or sponsorship from student council, the PTO, local environmental groups, local businesses, etc.)*

*What specific steps must be taken to reach our goal? (Make a list of every single task. Sequence the task list.)*

*Who is responsible for each item?(Assign tasks to teams of students. Record the teams and their responsibilities.)*

*What time frame is appropriate? (Select a completion date and then specify target dates for each task or step.)*

4. **Implement your plan!** As the project develops, remind students that unexpected challenges are likely to occur. Upon completion of the project, conduct a debriefing or evaluation process appropriate to the project. Be sure to discuss the importance of citizen involvement and place the project in the context of being one of the many valid and worthwhile ways that we can contribute to our world.

## **EXTENSIONS**

Encourage students to document and share what they have done with others on bulletin boards or on the internet.

Have students submit their project to the Juntos Development Team at the Environmental Education Exchange for inclusion in future Juntos newsletters or case studies.