



# Natural Resources Education Quarterly

Fall 2005, Volume 4, Issue 3

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*Mission:  
Facilitate programs and services in environmental education for the people of the San Luis Valley*

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## *Change Happens!*

Although we may not always notice, nature is in a constant state of flux. Sometimes change is slow and hard to detect, such as the growth of mountains and the weathering of rocks. Other times, change is rapid and catastrophic, as with hurricane Katrina. Regardless of the speed of change, nature has developed systems to adapt.

This issue of the Natural Resources Education Quarterly takes a look at natural and human-caused changes in the San Luis Valley. Read on to learn about the effects of shifting sands, wildland fires, and human development on our local plants and wildlife.



*Million Fire burned area, 2005  
Photo by Mike Blakeman*

## *Plant Adaptations to Active Dune Systems*

*By Phyllis Pineda Bovin, Great Sand Dunes National Park*

Deceptively barren and dry at first observation, the Great Sand Dunes harbor a surprisingly rich and beautiful variety of plant life. Despite constant disturbance and a harsh growing environment, many plants have developed adaptations to overcome these challenges and thrive in a niche that few other plants could survive in.

can add up to nearly 30 inches of sand moved from a single location during a 24-hour period!

Shifting sand is probably the single greatest challenge a plant can face. If a typical desert plant, shrub, or tree were exposed to that rate of soil movement, a number of things would happen: 1) roots could be deeply buried and the resulting decrease of oxygen could suffocate the plant, 2) roots could be excavated and exposed, removing the plant's "anchor", and 3) if the nutrients and moisture contained in soil are removed, the plant can starve.

Nitrogen is very important to the growth of plants in any soil type. One way that nitrogen is made available to living vegetation is that as plants die off or shed

## **Check It Out!**

There is still transportation money in the Wheels to the Field Fund

[www.slv-ecec.org](http://www.slv-ecec.org)

### **The Challenges of a Harsh Growing Environment**

*Wind and dune movement.* Active sand dunes experience sand movement through the process of "saltation" (meaning "to leap"), in which individual grains rise up to 12 inches into the air, fall, bounce up again, and so on. Depending on the strength and duration of a windstorm, sand can move to the leeward side of a dune at a rate of more than an inch per hour. That

## More Than Just A Pretty View (Continued from page 1)



Scurf Pea  
Photo courtesy of  
Interactive Earth



Indian Rice Grass  
W.L. Wagner @ USDA-  
NRCS PLANTS Database



Prairie Sunflower  
Clarence A. Rechensthan @  
USDA-NRCS PLANTS  
Database

leaves, plant litter accumulates and is broken down by decomposers and moisture in the soil, releasing nitrogen. Sparse plant growth on dunes yields little or no accumulation of dead plant material and any that may fall is quickly dried out and whisked off by the wind.

*Sun, heat and photorefectivity.* Other components of the harsh dune environment are heat and photorefectivity. On a sunny day, the temperature of the sand can reach over 140°F and when temperatures are too high, photosynthesis shuts down. For most plants, the optimal temperature range for photosynthesis is between 68-95°F.

*Water in sandy soils.* Despite their barren appearance, sand dune systems are often deceptively moist. Even when the surface is unbearably hot, sand is cool and moist just a few inches below. Sandy soils have small pore spaces which permit rainfall to percolate deep into a dune, however, the holding capacity of water in sandy soils is very low, so water is not very available to plant roots. This moisture content also dilutes concentrations of nutrient ions, making sand a nutrient-poor growth medium.

### Overcoming the Challenges to Live on the Dunes

*Standing up to the Wind.* During the spring and early summer, when wind storms are most severe, the leafy shoots and rhizomes of certain plants grow very rapidly – sometimes at a rate of over 2.5 inches per day! Growth at this rate keeps leaves and flowers above the accumulating sand, but to grow so quickly, a plant must have a high rate of photosynthesis.

Rhizomes will also enable a plant to survive if it is buried, excavated, or both. Exposed rhizomes will begin to produce leaves and flowers, allowing the plant to continue manufacturing food. Plants that have undergone excessive burial will often have thick ropy roots extending 6 feet or more below the surface of the sand.

When stems possessing adventitious roots are buried by moving sand, actual roots begin to form, anchoring the plant in place and allowing it to take up moisture and nutrients. An example of a plant with this characteristic is blowout grass (*Redfieldia flexuosa*), which is easily observed on the crests of smaller dunes and within the moist swales between larger dunes.

*Surviving the heat.* If, for most plants, the maximum temperature at which photosynthesis can take place is 95°F, how does a plant survive on active dunes where surface temperatures climb to 140°F? A number of dune plant species have developed silvery, grayish, or whitish leaves. Fine hairs or scales on the leaves and stems of these plants give a whitish cast, which blocks or reflects excess light and heat. This regulates, at the level of the leaf surface, a temperature optimal for photosynthesis to continue. Leaf hairs also slow the rate of water evaporation. An example of a plant that has this characteristic at Great Sand Dunes is the prairie sunflower (*Helianthus petiolaris*).

*Finding nutrients in a barren soil.* Sandy soils are notoriously low in nutrients. Some dune plants, mainly members of the pea and bean family, can use their root nodules to fix nitrogen from the air and turn it into a form useful to the plant. A common example of this plant at Great Sand Dunes is scurfpea (*Psoralidium lanceolatum*).

Dune grasses, such as needle-and-thread grass (*Hesperostipa comata*) and Indian ricegrass (*Achnatherum hymenoides*), can acquire nitrogen with the assistance of nitrogen-fixing bacteria present in the sand. These grasses exude a slimy glue from their roots which cements sand grains to the roots. Nitrogen-fixing bacteria live inside these sandy sheaths, where the soil moisture and organic content is higher compared with the sand on the outside.

## *We're Talking about Excellence!*

Free Training in the  
Guidelines for Excellence for EE Resources and Resource Reviews

Challenge yourself!  
Discover untapped potential in your EE program/materials and in yourself!

Your clients and learners deserve the best you can give. Have you challenged yourself to produce the best EE programs or materials possible? Are you building excellence into your design of EE programs/materials? Why not assess how your EE program/materials stack up according to the North American Association for Environmental Education's guidelines for excellence? Renew, refresh, reinvigorate your EE program/materials.

In this self-review workshop you'll get up close and personal with the national Guidelines for Excellence - and learn how they are applied to the EE Resource Review process. Then, you'll be given time to analyze and self-review one of your own programs and/or materials -- in a collaborative setting, with help available from Guidelines coaches and mentors, and peers. Self-reviews are required to submit your EE program/material to the EE Resource Review system, a peer-review process that will help you assess your program and establish a baseline by which you can find ways to improve your EE products, materials, and services.

### DETAILS:

September 30th (Friday) 8:30 am - 4:30 pm  
Great Sand Dunes National Park and Preserve

Visit <http://www.caee.org> for more information on the Resource Review process!

Contact CAEE to register by September 23rd

To register, call: 303-273-9527 or email: [info@caee.org](mailto:info@caee.org)

These trainings are free of charge, but require a \$20 refundable registration deposit (this fee will be returned to you at the workshop, and will not be returned if you do not attend).

## *Angie Says Goodbye*

August will mark my last month as the San Luis Valley Agriculture Education & Outreach Specialist for the San Luis Valley Conservation Districts. For the past four years, I have had the opportunity to be involved in several educational projects and have gotten to know countless talented educators. I will miss working with all of you and will be anxious to stay in touch and hear about all that is going on! I am also excited about the next adventure that my life holds...my family is opening up the Valley's first brewery and restaurant and I am going to start working on that endeavor full-time. I hope to see you at The San Luis Valley Brewing Company!

Best Wishes to All!

Angie Graber

*We Will Miss You Angie!*

Editor's Note: The agriculture education position will be filled soon. Contact information on the new position will be posted at the ECEC website: [www.slv-ecec.org](http://www.slv-ecec.org)



## *What's A Little Disturbance Now And Then?*

*By Mike Blakeman, Rio Grande National Forest*

*The earth, born in fire,  
baptized by lightning,  
since before life's begin-  
ning, has been and is a  
fire planet.*

- E.V. Komarek

It was 3:00 p.m. on June 19, 2002, and a huge plume of gray and black smoke billowed up 15,000 feet above Beaver Mountain near South Fork. Yellow and orange flames shot up 200 feet above the trees while the inside of the smoke column glowed orange like a blast furnace. There was no controlling the wildland fire. Two weeks later, when the ash finally settled, it was determined the Million Fire charred over 9000 acres of forest and destroyed eleven homes.

Most people seem to view our mountains as fairly static systems, that is, they really don't seem to change much from year to year. In fact, people get so comfortable with their view of the landscape, that when significant changes do occur, they think it is

a crying shame. But nature is very much a dynamic system and every decade there seems to be at least a few events that cause large changes to specific landscapes—sometimes very quickly.

These changes can result from a variety of natural disturbances, such as landslides,



Photo by Gilbert Becenti

Continued on page 5

## *Getting Crowded*

*By Nicole Langley, EarthNest Institute*

If you are fortunate to live in the foothills or to visit the edges of the San Luis Valley in late fall, you've probably seen large herds of Rocky Mountain elk seeking winter forage in those lower elevations where the flat Valley meets the San Juans or the Sangre de Cristos.

In summer time we often see elk in a variety of habitats at different elevations. But when winter snows cover the ground, this limits their food, so they travel to lower elevations looking for bunchgrasses and other forage found in the Valley.

Today human development has encroached upon many wildlife habitats, disturbing the natural patterns of species in ways we often don't notice or recognize. In our own human lives we have different customs and patterns of behavior surrounding ways we relax, sleep, eat, care for our young ones, and stay healthy. Humans everywhere have these basic needs. Imagine what it would be like to have these patterns profoundly disturbed – as elk do – by some encroaching species.

Elk have to jump over fences, navigate high-speed traffic on our highways, and often must defend themselves against a sudden encounter with back-yard dogs. What invasion of aliens might cause US such trouble?

Another less obvious threat to elk forage are invasive plants like spotted knapweed. These weeds displace the native bunchgrasses that elk eat. Foresters and wildlife managers in the Mormon Ridge Weed Control Project have tried helicopter applications of herbicides which are supposed to not be harmful to the elk. Precautions are taken during these applications of pesticide to avoid water contamination in nearby streams. The idea is to increase the ability of our national forests to provide the forage that the elk need over the long term – like for the next 50 to 100 years.

In those areas that were tested, 98 percent of the weeds were reduced, with seven times as much bunchgrass, food for the elk, growing back.



## *A Little Disturbance... (Continued from page 4)*

wind and/or snow events, fire, floods, large avalanches, drought, and insect infestations. For example, the heavy wet snows that blanketed our mountains last winter caused hundreds of large avalanches that knocked down, or broke off, tens of thousands of trees throughout the upper Rio Grande watershed. And presently, many thousands of acres of forests surrounding the San Luis Valley are being impacted by bark beetle infestations.

Humans cause their share of disturbances to the landscape too, of course. We build roads, create subdivisions, log forests, plow up land for crops, and graze livestock. Sometimes human-caused disturbances are very dramatic, as with the Million Fire. Other times we disturb the landscape in a less obvious manner, such as with the intended, or unintended, introduction of non-native species (e.g., brown trout and knapweed).

All is not lost when disturbances occur on the landscape. Within nature, there are many types of plants and animals that actually need disturbance in order to thrive. The large stands of beautiful aspen trees found in our mountains are mostly the result of past fires. Aspen generally regenerate by new trees sprouting from the roots of adult

trees that were killed by fire or logging. Without disturbance, coniferous trees, such as spruce, will grow up under the aspen canopy and eventually shade out and replace the sun-loving aspen trees.

This replacement of one plant community by another is called succession. Without disturbance, the succession of plant communities continues until it reaches a stable, "climax" community. When a major disturbance occurs in a climax community, the "successional clock" resets and the process starts over. Because of the intensity of the Million Fire, the "successional clock" of many areas within the burn was reset back to the beginning. The Forest Service bumped the "clock" ahead in some areas by spreading grass seed. Other areas of the burn are recovering naturally without assistance by humans.

If you look up at the mountains from the edge of the Valley floor, you will notice a mosaic of plant communities. Aspen forests, coniferous forests, mixed forests, meadows, and rock slides. Each one of these communities represents a different successional stage and this variety of stages supports the wonderful diversity of wildlife that we all cherish... so there's something to be said for a little disturbance now and then.



Aspen sprout in burned area.

**Explore  
The Stages of  
Succession.**

Visit the Million Fire  
burned area with your  
students.

**Contact:  
Mike Blakeman at:  
719-852-6212**

### *EE Contacts*

Geology, Ecosystems, Cultures & Archacology	Great Sand Dunes National Park and Preserve . . . Kathy Zelenka . . . 719-378-6344 Kathy_Zelenka@nps.gov
Wetland Ecosystems and Wildlife	Alamosa, Baca, Monte Vista National Wildlife Refuges . . . 589-4021
Water and Soil Conservation	SLV Conservation Districts & NRCS . . . . . 589-3907 x123
Service Learning	Volunteer Connections. . . . . 719-589-5688. . .vcf@amigo.net
Sustainable Development and Culture	EarthNest Institute. . . . . Nicole V. Langley. . . 719-206-2222 nlangley@fone.net
Natural Resource Conservation	Colorado State University Extension Service. . . Robert Mathis. . .657-0213
Camp at Beaver Creek Forest, Range and River Ecosystems	Rio Grande National Forest . . . Mike Blakeman . . .852-6212. . . mblakeman@fs.fed.us
Other Resources	SLV Resource Conservation and Development. . . Jim Mietz james.mietz@co.usda.gov

*Kids In The Field!****Each autumn, over 700 SLV students visit the Rio Grande National Forest's South Fork Education Center***

Contact: Mike Blakeman, Conservation Education Specialist  
Rio Grande National Forest. 719-852-6212



## Calendar of Events

September 23-25 Project WILD and Project Learning Tree 4th Annual Autumn Extravaganza, Great Sand Dunes National Park and Preserve. Explore the natural history of the San Luis Valley and Sand Dunes National Park and Preserve using Project Learning Tree and Project WILD. Must Register by September 13. Contact: Deb Ackley at 719-630-3745 or 719-327-2820 ext. 49

September 24 National Public Lands Day. Hug a ranger!

September 30 Training in the Guidelines for Excellence for EE Resources and Resource Reviews. See details on page 3.

October 15 Kid's Crane Festival, Monte Vista Wildlife Refuge. Outdoor and indoor activities for kids starting at 2:00 p.m. Contact: Tim Armstrong at 719-589-7211 or 719-852-2452

Introducing....  
Great Sand Dunes National Park & Preserve's  
*Out of the Blue* curriculum

[www.nps.gov/grsa/resources/curriculum/intro.htm](http://www.nps.gov/grsa/resources/curriculum/intro.htm)

Out of the Blue

Roo-Rats Elementary Teachers Lesson Plans

Coyote-Kids Middle School On-line Activities

Ravens High School Classrooms Town Hall Interactive

a curriculum for [teachers](#) and students made possible by *Parks As Classrooms*

an Interactive Earth production

Features:

- Pre-trip, post-trip, park-based, and classroom activities
- Correlations to Colorado Content Standards
- Lesson plans for Elementary teachers in six subject areas
- Interactive Middle School puzzles based on authentic research
- A High School 'town hall meeting' unit about water and water-related issues
- Cross referencing tool
- Background information, animations, and photos
- Maps, chaperone guidelines, and additional field trip planning help

## Land of Many Opportunists

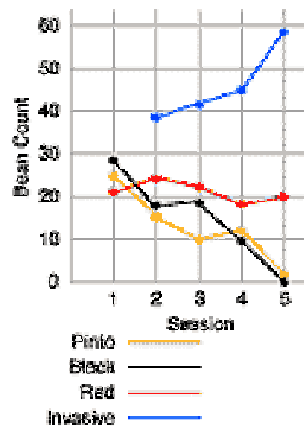
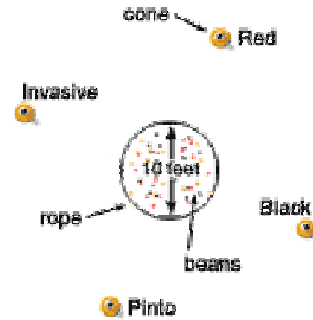
This activity is taken from the Great Sand Dunes National Park and Preserve website. To see the entire activity with background information, go to:

<http://www.nps.gov/grsa/resources/quizes/invasives/opportunists.htm>

### Procedure

In this relay game of tag there are four teams: red bean, black bean, pinto bean, and invasive (exotic). The goal of each team is to gather as many of their resources (beans) as they can and make a pile at their team's cone.

The course is laid out with a ten-foot diameter rope circle in the center. About 100 beans of each type are scattered in the circle. Four team cones or home base makers are set equidistant around the circle, about fifteen feet from the rope's edge.



Each of the five or more game sessions lasts for only three minutes. After each session, the bean count for each team will be graphed on graph paper and all the beans will be re-scattered into the center of the circle. The team with the least number of beans after each session will be required to move their cone ten feet farther from the circle, representing the weakening of a population due to strengthening competitors. (If the team that moved ten feet back in a previous session collects the most beans during subsequent sessions, they may return their cone to its previous position.)

The first session begins by establishing a baseline. Only the three bean teams will compete. One student per team will run to the rope enclosure and collect five of their team's bean resources (pintos are collected by the pinto team, reds by the red team, etc.), return to their cone, and place the beans in a pile next to the cone. Then the next member of their team will be allowed to go and collect beans. When the three minutes are up, the game will be stopped and beans will be counted and graphed. Team members that are not actively collecting beans must be touching their team's cone.

The second session is played similarly to the first, with the addition of the invasive team. Since the members of the invasive team are opportunists, they may collect up to ten beans of any color with each member's turn to go to the circle.

The third and fourth session are played identically to the second. Remember to move the cone of the team with the least beans back ten feet after each session.

In the fifth session, the invasive team is allowed to be an 'aggressive' invasive species (without being physically or verbally aggressive). When they approach the center, they can either collect beans or acquire another person's beans by tagging someone within the circle.

At the end of the game, discuss the outcomes which are visually displayed on the graph. With older students, be sure to discuss these questions:

- Native species usually play an important role in supporting their ecosystem. Since the reds, blacks, and pintos have been reduced in numbers and are not able to play their supporting role in the local ecology, how will the invasive species cope with a weakening ecosystem?
- It is usually the case in ecosystems that a consumer actually plays a role in supporting the producer on which it depends.
  - What may happen to the populations of native producers (beans) when their biological consumers/supporters (students) diminish in population? And since invasive species have not evolved naturally in conjunction with the native producers,
  - will the invasive species be able to support the native producers or will they destroy the integrity of the resources on which they have become dependent?
- What might happen to the invasive species if it becomes a monoculture and entirely displaces the native consumers?

### Learner Outcomes

Students will learn how aggressive exotic species take advantage of a wide range of resources in order to expand their range and compete in a nonnative habitat.

### Grade

Fourth and up

### State Standards

Science 3.1

### Group Size

Eight to 30 students

### Time

Forty minutes

### Location

Outdoors, near water or sandy areas.

### Materials

Pinto beans, red beans, black beans, 60 feet of rope, 6 boundary cones, clipboard, graph paper

### Vocabulary

baseline, consumer, exotic, habitat, monoculture, nonnative, opportunist, producer, species

### Safety

General outdoor safety