



Bosque Animals

Description: Students explore animals' niches in bosque habitats using the Changing River model and see how human-caused changes to the bosque impact the ability of animals to survive and thrive over time.

Objectives: Students will:

- explain structure and function/adaptations of animals surviving in the bosque;
- compare conditions for survival of animals in the past, present and optimal future of the bosque;
- analyze the results of human-caused changes to the bosque on native animals; and
- describe the effects of introduced/exotic animals on native animals.

Materials:

- Scissors to cut the pieces
- Envelopes or plastic sandwich bags to hold the pieces and information cards
- Who Lives Where? animal pictures and description cards
- "Changing River" activity materials for Rio Bravo, Rio Manso, and Rio Nuevo

Phenomenon: Many kinds of animals live in or near the bosque, including lizards, mammals, birds, bugs and fish.

Lesson Questions:

- *What features of animals help them survive in the bosque or river?*
- *How have exotic animals affected native species?*

15. Who Lives Where?



Grades: 2–12

Time: Material preparation: approximately 30 minutes
Activity: one 40-minute class period

Subjects: science

Terms: *adaptation, aquatic, barbels, breed, cavity, camouflage, carrion, colonize, detritus, disease, echolocation, endangered, extinct, gills, habitat, hectare, hibernate, introduced species, larva, meander, metamorphosis, non-native species, plague, predator, prey, raptor, scat, sonar, threatened, transparent, tributary, trilling*



New Mexico STEM Ready! / Next Generation Science Standards NGSS DCIs and New Mexico State Performance Expectations

3.LS2.C Ecosystem Dynamics, Functioning & Resilience
 3.LS2.D Social Interactions & Group Behavior *
 3.LS4.C Adaptation
 3.LS4.D Biodiversity & Humans
 4. LS1.A Structure & Function
 5.LS1.C Organization for Matter & Energy Flow in Organisms *
 5.LS2.A Interdependent Relationships in Ecosystems *
 5.ESS3.C Human Impacts on Earth Systems
 MS.LS1.B Growth & Development of Organisms
 MS.LS2.A Interdependent Relationships in Ecosystems
 MS.LS2.C Ecosystem Dynamics, Functioning & Resilience
 MS.LS4.D Biodiversity & Humans
 MS.ESS3.C (MS-ESS3-3 NM) Human Impacts

NGSS CCCs

Patterns; Cause & Effect: Mechanism & Explanation; Systems & System Models*; Energy & Matter: Flows, Cycles & Conservation; Structure & Function; Stability & Change; Cause & Effect: Mechanism & Explanation; Systems & System Models

NGSS SEPs

Asking Questions & Defining Problems; Developing & Using Models; Constructing Explanations & Designing Solutions; Engaging in Argument from Evidence; Obtaining, Evaluating & Communicating Information*

(* indicates extension activity)

Procedure:

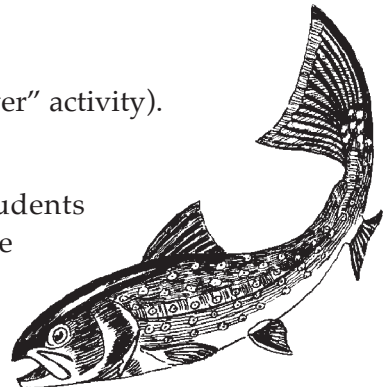
- Prior to the activities with students, cut out the animal pictures and information cards for each animal. Choose which of the animal description cards you will use—each animal has separate cards for older students and younger students (text for older students on top in a single-line box; text for younger students below in larger type with double-line box). The cards should be cut apart and may be colored. We recommend copying the Rio Bravo animals and descriptions on a different color paper than the Rio Manso animals. You may want to code the pictures and descriptions so they can be matched after being mixed up. (A list is included below.) It is best if the name of the animal appears only on the picture and not the description.

Section A: Rio Bravo

- Set up the river as Rio Bravo (see “Changing River” activity).

Introduction:

- Revisit the KWL charts, to consider what students already know about the animals that live along the river and in the bosque. *What do they Know? What do they Want to know? And then, What have they Learned?* at the end of the activity.





Ask students:

What animals live along the river or in the bosque?

What about the way the animal is built or the way it acts allows it to survive there?

(Asking Questions & Defining Problems)

Then follow Option A or Option B, below:

Option A

- ♣ **Animal Match:** Pull one pair of cards for every pair of students in the class. (20 students = 10 animals with both illustration and description cards for each animal) Each student gets either a picture or a description of one Rio Bravo animal.
- ♣ **Challenge the students to find their “partner.”**
Have the students take turns reading a description, with classmates guessing which animal is being described. The student with the matching drawing should place the animal on the model in the habitat described in the reading. Continue around the room until all the animal descriptions are read and all the drawings are placed on the model. Even better is to have students silently read the card, then in their own words tell the class about that animal.

Option B

- ♣ If you have less class time, hand out the animals with their description cards to the students. Each student should have at least one animal of his or her own with the accompanying description card. Have the student carefully read the description and decide where that animal lives. What is its habitat? Students should then place the animal on the bosque model in a location where it would best live. (Place them on the Rio Bravo bosque before placing the ditches, levees and homes.) Have each student describe his or her animal and where it lives to the entire group. Do another round with other animal cards, if appropriate.

Rio Bravo Discussion Questions

Animals provide perfect examples of how an organism’s shape and particular functions in the body help it to survive. Look for patterns of where animals are found in the river and floodplain and how their adaptations help them to survive there.

What do animals need to survive?

Are any particular structures more suited to life along the river or in the bosque?

Look for features that animals have that allow them to survive in their particular habitat and that might be shared by different species (e.g., something that helps them swim better, eat a particular food, etc.).

Think about growth, getting food and water, surviving predators or competitors, reproducing or enduring seasonal changes.

What structures or behaviors does each species have that help it to survive in these habitats?

(3.LS4.C; 4.LS1.A; MS.LS1.B; Patterns; Cause & Effect; Structure & Function)



Think about annual and seasonal changes to the river associated with spring runoff and the resulting flood pulse.

Which animals need high spring water flow?

Will animals move into areas newly changed by a flood? If so, which animals?

Will any animals move out of flooded or changed areas? If so, which animals?

(3.LS2.C; MS.LS2.C)

- ♣ Option: Do the “Bosque Chaos” activity on the model.

How do the “Bosque Chaos” changes affect the animal species that live in the river or bosque?

List ways species continue to thrive or are harmed in these changing conditions throughout the year. **(3.LS2.C; MS.LS2.C)**

Section B: Rio Manso

- ♣ Add the human alterations to the bosque model: irrigation ditches, levees, jetty jacks, etc. (Rio Manso).
- ♣ Place the introduced species on the model, using the method from Option A or Option B above. *Were any of the animals affected by the changes in the river associated with human activities or the introduced species of animals? Which animals are thriving because of the changes along the river and which have lost habitat?*
- ♣ Have the class review “Threatened and Endangered Animals” near the end of this activity—a brief summary of some threatened, endangered, or extinct bosque animals.

Rio Manso Discussion Questions

Think about how human-caused changes affect the availability of resources, such as alterations to the river channel, loss of sandbar habitats, amount and temperature of the water (in the channel, overbank flooding, groundwater), and changes to the plants and wetland habitats that are thriving in the floodplain. These affect animal survival.

How do changes in habitats affect the animal species?

What effects do human activities have on native animals?

Look at the threatened and endangered species that live in the bosque.

What can our local community do to help protect threatened and endangered species?

Make a chart showing which animals are surviving well, which move away, which move in, and which have gone extinct following these human-caused changes; indicate which physical changes affected the animals.

Are there any structural or functional similarities among these different groups of species?

(3.LS2.C; 3.LS4.C; 3.LS4.D; 4.LS1.A; Patterns; Cause & Effect; Structure & Function; Stability & Change)



Think about introduced/exotic species.

What effects do these new species of plants or animals have on native species?

Do some of them affect how well other species of animals survive in the bosque?

What adaptations do these introduced animals have to allow them to thrive and out-compete some native animal species?

(3.LS4.C; 4.LS1.A; 5.LS2.A; MS.LS2.A; Structure & Function)

Section C: Rio Nuevo

- Given that we have introduced species (bullfrogs, European Starlings, etc.), what choices can we make to minimize their effect and to maximize the success of native species? Have students brainstorm restoration ideas that will make habitats more suitable for native animals. Rio Nuevo Habitat Restoration Project Cards from “Changing River” can be used to stimulate discussion. Adjust the model pieces to reflect suggested changes (for example, remove exotic species, add in sandbars, add wetlands, etc.).

How do these restoration projects change the available habitat?

Are native animals helped by these changes? How so or why not?

Which animals are helped, and in what way are they helped?

(5.ESS3.C; MS.ESS3.C; Engaging in Argument from Evidence)

Assessments:

- Revisit the KWL charts. *What have they Learned? What else do students Want to know?* **(Asking Questions & Defining Problems)**
- Work in small groups. Model this bosque ecosystem as you understand it. Now take your model, and choose an animal to reduce (endangered) or add (non-native) to your bosque ecosystem. Based on changing that one component, model what happens to other parts of the ecosystem. Make a list of restoration projects that would help native biodiversity in your ecosystem.
 - Make a poster showing your resulting ideas. Have the class do a gallery walk of posters; each team should explain their main ideas to the class.
 - What additional questions do you have? Explore what students want to know based on their questions.

(Cause & Effect: Mechanism & Explanation; Systems & System Models; Asking Questions & Defining Problems; Developing & Using Models; Constructing Explanations & Designing Solutions)



Extensions:

- Animals provide an excellent path to understanding both matter and energy in ecosystems. Animals depend on plants not only for food and shelter but also for oxygen, which plants produce as a by-product of photosynthesis. Cottonwoods and other plants are important for providing the oxygen we all need to survive.

How do animals get the energy and matter they need?

How might energy or matter be transported into, out of or within an ecosystem (consider the activity of animals, decomposers, flooding, etc.)?

Use the animal cards and plant cards from the “Who Grows Where?” activity to do “The Web” activity in this *Guide*; or to further understand the cycle of matter and flow of energy use the “Who Grows Where?” and “Who Lives Where?” cards in the “Energy in Bosque Ecosystems” activity in this *Guide*.

(5.LS1.C; 5.LS2.A; MS.LS2.A; Energy & Matter; Systems & Systems Models; Developing & Using Models)

- Use the overview of threatened and endangered species and of introduced and non-native species at the end of this activity to further discuss the current situation in the bosque. *What animals are being, or have been, displaced by these introduced species?* Have students research more about either of these topics and present findings in a poster, written paper, oral report or other format. **(Obtaining, Evaluating & Communicating Information)**
- Oral history extension: send animal pictures home with students to ask elders about local names and stories about them. Have students report their findings back to the class. **(Obtaining, Evaluating & Communicating Information)**
- Focus on the animals that live in groups. *How does being in a group help those animals? Are they always in a group, or, if not, when are they in a group?* Some animals to look at are: Harvester ants, Western chorus frogs, Mallards, Canada Geese, Bald Eagles, Sandhill Cranes, Crows, Red-winged Blackbirds, European Starlings, House Sparrows, Coyotes, Mule deer, Elk, Feral dogs, and Rio Grande silvery minnows. **(3.LS2.D)**
- Have students research a particular species of animal to learn more about where it lives, what it needs to survive, etc. They could present this as a poster, written paper, or other format. **(Obtaining, Evaluating & Communicating Information)**

Who Lives Where? Rio Bravo

Common Name	Scientific Name
Mayfly	<i>Baetis</i> sp.
Field Cricket	<i>Gryllus</i> sp.
Plains Cicada	<i>Megatibicen dealbates</i>
Caddisfly	<i>Hydropsyche</i> sp.
Harvester Ant	<i>Pogonomyrmex</i> sp.
Leaf-roller	<i>Anacamptis innocuella</i>
Mosquito	many spp.
Shovelnose Sturgeon	<i>Scaphirhynchus platyrhynchus</i>
Rio Grande Bluntnose Shiner	<i>Notropis simus simus</i>
Red Shiner	<i>Cyprinella lutrensis</i>
Rio Grande Silvery Minnow	<i>Hybognathus amarus</i>
Western Chorus Frog	<i>Pseudacris triseriata</i>
Northern Leopard Frog	<i>Lithobates pipiens</i>
Western Painted Turtle	<i>Chrysemys picta</i>
Spiny Softshell Turtle	<i>Apalone spinifera</i>
New Mexico Whiptail	<i>Aspidoscelis neomexicanus</i>
Bullsnake	<i>Pituophis catenifer</i>
Gartersnake	<i>Thamnophis</i> sp.
Canada Goose	<i>Branta canadensis</i>
Mallard	<i>Anas platyrhynchos</i>
Greater Roadrunner	<i>Geococcyx californianus</i>
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>
Sandhill Crane	<i>Antigone canadensis</i>
Killdeer	<i>Charadrius vociferous</i>
Great Blue Heron	<i>Ardea herodias</i>
Cooper's Hawk	<i>Accipiter cooperii</i>
Bald Eagle	<i>Haliaeetus leucocephalus</i>
Great Horned Owl	<i>Bubo virginianus</i>
Belted Kingfisher	<i>Ceryle alcyon</i>
Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>
American Crow	<i>Corvus brachyrhynchos</i>
Summer Tanager	<i>Piranga rubra</i>
Red-winged Blackbird	<i>Agelaius phoeniceus</i>
Desert Cottontail	<i>Sylvilagus audubonii</i>
Beaver	<i>Castor canadensis</i>
Botta's Pocket Gopher	<i>Thomomys bottae</i>
New Mexico Meadow Jumping Mouse	<i>Zapus luteus luteus</i>
Muskrat	<i>Ondatra zibethicus</i>
White-footed Mouse	<i>Peromyscus leucopus</i>
North American Porcupine	<i>Erethizon dorsatum</i>
Little Brown Bat	<i>Myotis lucifugus</i>
Coyote	<i>Canis latrans</i>
Mule Deer	<i>Odocoileus hemionus</i>





Who Lives Where? Rio Bravo: Upper Watershed Adaptations

Rio Grande Cutthroat Trout	<i>Oncorhynchus clarki virginalis</i>
Osprey	<i>Pandion haliaetus</i>
American Dipper	<i>Cinclus mexicanus</i>
Black Bear	<i>Ursus americanus</i>
Elk	<i>Cervus elaphus</i>

Who Lives Where? Rio Manso: Animals Introduced to the Middle Rio Grande Bosque

Isopods: Pillbug and Sowbug	<i>Armadillidium vulgare</i> and <i>Porcellio laevis</i>
Carp	<i>Cyprinus carpio</i>
Mosquitofish	<i>Gambusia affinis</i>
Bullfrog	<i>Lithobates catesbeiana</i>
European Starling	<i>Sturnus vulgaris</i>
House Sparrow	<i>Passer domesticus</i>
House Mouse	<i>Mus musculus</i>
Feral Dogs and Cats	<i>Canis lupus familiaris</i> and <i>Felis catus</i>

Who Lives Where? Rio Manso: Upper Watershed Adaptations: Introduced

Rainbow Trout	<i>Oncorhynchus mykiss</i>
Brown Trout	<i>Salmo trutta</i>



Coyote at Valle de Oro National Wildlife Refuge in the floodplain of the Rio Grande

Photograph by Laurel Ladwig



NGSS Connections to Who Lives Where? - Disciplinary Core Ideas

3.LS2.C Ecosystem Dynamics, Functioning, and Resilience *When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.*

Rio Bravo: Think about annual and seasonal changes to the river associated with spring runoff and the resulting flood pulse. For example, the Rio Grande silvery minnow needs muddy backwater areas created during overbank flooding to reproduce.

Do any animals depend on high spring water flow? If so, which animals?

Will animals move into areas newly changed by a flood? If so, which animals?

Will any animals move out of flooded or changed areas? If so, which animals?

After "Bosque Chaos" activity on the model:

How do the "Bosque Chaos" changes affect the animal species that live in the river or bosque?

List ways species continue to thrive in these changing conditions throughout the year

Rio Manso:

Think about how human-caused changes affect the availability of resources, such as alterations to the river channel, loss of sandbar habitats, amount and temperature of the water (in the channel, overbank flooding, ground water) and changes to the plants and wetland habitats that are thriving in the floodplain. These affect animal survival. Examples are loss of areas with mature cottonwood and willow trees, which provide holes for cavity-nesting birds and extensive, dense canopy for Yellow-billed Cuckoos.

Make a chart showing which animals are surviving well, which move away, which move in, and which have gone extinct following these human-caused changes; indicate which physical changes affected the animals.

3.LS2.D Social Interactions and Group Behavior *Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size.*

Focus on the animals that live in groups. *How does being in a group help those animals? Are they always in a group, or if not, when are they?* Some animals to look at are: Harvester ants, Rio Grande silvery minnows, Western chorus frogs, Mallards, Canada Geese, Bald Eagles, Sandhill Cranes, American Crows, Red-winged Blackbirds, European Starlings, House Sparrows, coyotes, mule deer, elk, feral dogs.

3.LS4.C Adaptation *For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.*

The riparian ecosystem supports many more animal species than the arid uplands, yet certain species are present only in one habitat or the other. Different animals are adapted to different environments.

What helps each animal survive in the bosque or in the river?

Are native species able to adapt to human-caused changes to the environment?

Think about introduced/exotic species. *What adaptations do these introduced animals have to allow them to thrive and out-compete some species of native animal?*

3.LS4.D Biodiversity and Humans *Populations live in a variety of habitats, and change in those habitats affects the organisms living there.*

Although floodplain ecosystems are very dynamic, with frequent changes to habitats occurring at a local scale, native organisms are less able to deal with the types of changes caused by humans. Prior to human changes, the diversity of species in New Mexican riparian habitats was very high. Changes in floodplain habitats have affected the types of animals living there.

What types of changes in floodplain habitats have affected the animals that live there?

How do these changes in floodplain habitats affect the animals that currently are or used to be found in the bosque?



Killdeer

Photograph by Laurel Ladwig



4.LS1.A Structure and Function *Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.*

Animals have a variety of structures that allow them to survive in given habitats. Think about animals in the bosque and river and what structures help them to survive. Consider growing, getting food and water, surviving predators or competitors, reproducing and enduring seasonal changes.

What structures help each animal grow, survive and reproduce in the bosque or river?

Think of examples of internal and external structures that affect the behavior of an animal? *In what ways do these structures influence behavior?*

5.LS1.C Organization for Matter and Energy Flow in Organisms *Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion.*

There is a large variety of animal species present along the river and floodplain, and these animals depend on a variety of foods for energy and materials needed by their bodies. All animals ultimately depend on plants for both energy and oxygen.

What does each animal consume? What eats it?

5.LS2.A Interdependent Relationships in Ecosystems *The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plant parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.*

Think about this standard from the species perspective, and how the different species interact.

What does each animal consume? What eats it?

How are the animal species’ needs met in the bosque ecosystem?

Are animal species affected by other animal species that are present? If so, how?

Note that a decomposer card is in the “Energy in a Bosque Ecosystem” activity.

What is the role of decomposers in the food web?

Do the Rio Manso model and place the introduced/exotic species.

What effects do these new species have on native species?

How many links to other native species can you discover?

What happens if some of these native species are no longer here?

5.ESS3.C Human Impacts on Earth Systems *Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air and even outer space. But individuals and communities are doing things to help protect Earth’s resources and environments.*

Human activities have altered many habitats along the Rio Grande and its floodplain. Look at the section on Threatened and Endangered Species and consider how the hydrological changes have affected habitats and how those changes affect the animals that live there.

Have human activities affected native animals? If so, how?

Look at the restoration projects discussed in the Rio Nuevo model.

Are any animals helped by these projects? If so, which animals are helped, and in what ways are they helped?

MS.LS1.B Growth, and Development of Organisms

-Animals engage in characteristic behaviors that increase the odds of reproduction.

-Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.

Use *Who Lives Where?* cards along with additional outside research to address how characteristic animal behaviors affect the probability of successful reproduction of animals.

MS.LS2.A Interdependent Relationships in Ecosystems

-Organisms and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.

-In any ecosystem, organisms and populations with similar requirements for food, water, oxygen or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.

-Growth of organisms and population increases are limited by access to resources.

Who Lives Where?

Pick one species of animal. *How are those animals dependent on interactions with other living creatures? (What do they consume? What eats them? What plants do they need —i.e. nest sites?) What nonliving factors does that species depend on? (What water does it need? Is it possible for too much or too little? Temperature? Soil type? Brainstorm ideas.) Are there other bosque species with similar needs? Do they compete? How do they differentiate their role in the ecosystem? Both beavers and porcupines eat cambium—the inner bark of trees. Do they eat the same way? Are they direct competitors? How does flooding, a resource for some animals, affect the population of some animals? (Example-Rio Grande silvery minnow) Look at a native and non-native species like Northern leopard frog and bullfrog. In what way do they directly compete for resources? How do introduced species affect native species when they are competing for the same resources?*



MS.LS2.C Ecosystem Dynamics, Functioning & Resilience

--Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.

--Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.

Each year the flood pulse may make changes to the river channel and banks. Make lists of animals affected by changes in the river, sandbars, banks and floodplain. *How does a change in the physical river or its floodplain affect animals that live in the bosque?* Make the Rio Manso changes to the model. *How do introduced non-native species affect native animals in the bosque?*

MS.LS4.D Biodiversity & Humans *Changes in biodiversity can influence human's resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling.*

Although floodplain ecosystems are very dynamic, with frequent changes to habitats occurring at a local scale, native organisms are less able to deal with the types of changes caused by humans. Prior to human changes, the diversity of species in New Mexican riparian habitats was very high. Changes in floodplain habitats have affected the types of animals living there. *What types of changes in floodplain habitats have affected the animals that live there?*

How do these changes in floodplain habitats affect the animals that currently are or used to be found in the bosque?

MS.ESS3.C Human Impacts on Earth Systems

-Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.

-Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

-The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.

Humans have made many changes to the river valley and the river channel, and these human alterations have changed the dynamic nature of the Rio Grande floodplain and altered many aspects of natural habitats (changing from Rio Bravo to Rio Manso). In Rio Nuevo, students learn how humans are able to make new changes that help restore some of the natural floodplain ecosystems. *What changes did humans make along the Rio Grande to promote agriculture and allow settlement along the floodplain? How did those human alterations affect the bosque, and how could they be modified to allow a more natural, dynamic system? What are the effects on native species from these human activities? How can we decrease the number of individuals of species that are threatened or endangered?*

Land managers along the Rio Grande have made a definite shift in their priorities for how the river and floodplain are used, with a greater emphasis now on protecting natural biodiversity. Follow up any of the above activities by considering the following: *How do you think the biodiversity of the bosque affects you, your family, your community? Is it important to protect the bosque? If so, why?* Design a conservation plan for the bosque that will protect native plants and animals while also contributing to the well-being of human communities living nearby.



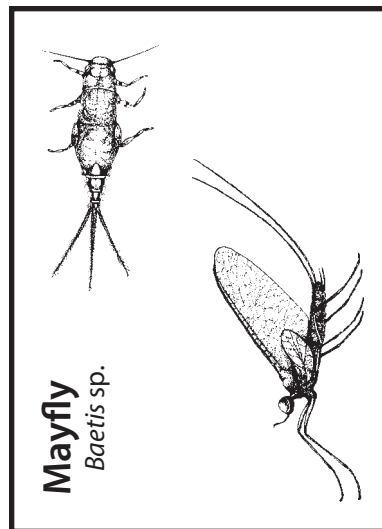
*Sandhill Cranes dancing at
Valle de Oro National Wildlife Refuge
in the floodplain of the Rio Grande
Photograph by Laurel Ladwig*



Who Lives Where? cards

Part 1A: Rio Bravo: Animals Native to the Rio Grande Bosque

Text for older students top in single-line box, for younger students below in larger type in double-line box.



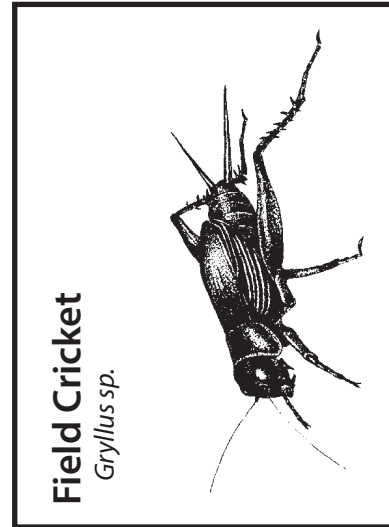
I have six legs and three tails. I spend most of my time under water in places where the sand moves around. I usually eat algae and detritus (dee-TRY-tus)—small pieces of dead plants or animals in the water. As an adult, I live for only a day or two and I don't eat. I attach my eggs to stones or other objects in the water. Many fish eat me, both when I'm young and as an adult. I am named for a month when I can often be seen.

I have six legs and three tails. I live underwater in places where the sand moves around. I eat algae and small pieces of dead plants or animals in the water. As an adult, I only live for a day or two and I don't eat. I hook my eggs to stones or other things in the water. Many fish eat me. I am named for a month when I can often be seen.

Rio Bravo

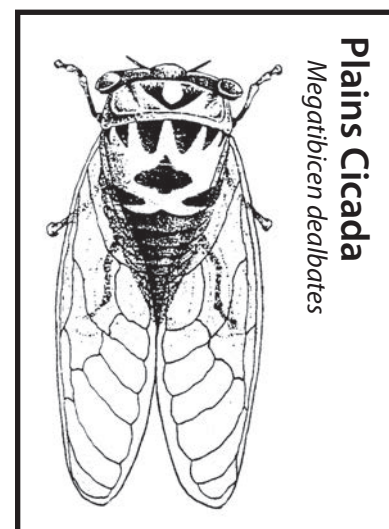
I have large hind legs for hopping on the forest floor. My relatives and I mostly eat dead leaves or sometimes small insects. I prefer to live in areas that get flooded regularly, because the leaves are easier to chew. I “chirp” by rubbing my wings together to attract a mate—my song is very familiar on summer nights. My dark colors help me hide in the leaves. Lizards, birds and small mammals often eat me.

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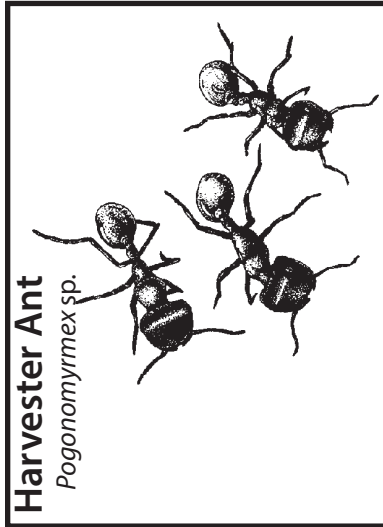


My buzzing call is part of summer. I lay my eggs on twigs in trees; they hatch and fall to the ground. My young go underground and suck the juice of plant roots for many months or years. One summer they climb out of the ground and crawl up a tree trunk. There they shed their skin and come out as adult flying insects with big bodies and transparent wings. Many different birds like to eat us.

My buzzing call is part of summer. After I lay my eggs on twigs in trees; they hatch and fall to the ground. My young go underground and suck the juice of plant roots for many months or years. One summer they climb out of the ground and crawl up a tree trunk. There they shed their skin and come out as flying insects with big bodies and clear wings. Many birds like to eat us.

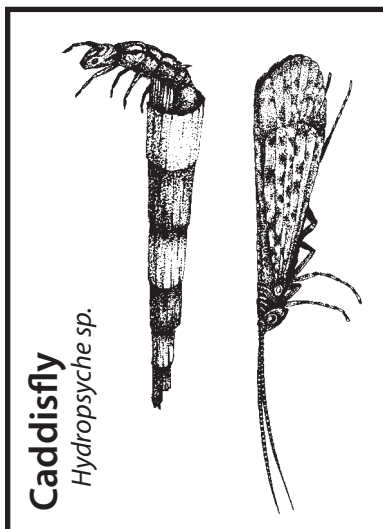


Rio Bravo



I live with hundreds of my relatives in underground tunnels. We build a big mound above ground and clear away the plants around it. We live where the ground is dry with nearby grasses, amaranth and mustard plants that have seeds. Often small trails can be seen going out from the nest. We look for food along these trails. We collect small seeds and store them underground. Sometimes we also eat pillbugs that we sting and then carry below ground. We move our young around in the mound to warm or cool them as needed.

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When I hatch from my egg I am a larva. I make a tube with tiny sticks or rocks for my home. I live on underwater gravel bars in fast-moving water where I catch my food. I eat algae, detritus (dee-TRY-tus) —small pieces of dead plants or animals—and small animals in the water. Fish love to eat me. As an adult, I have large wings to help me fly along the river.

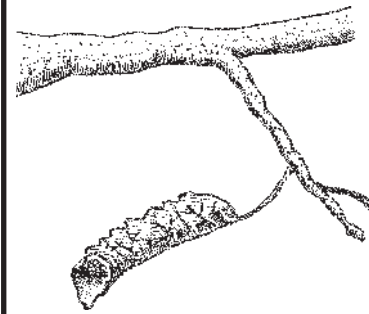
After I hatch from my egg, I make a tube with tiny sticks or rocks for my home. I live in fast moving water where I catch my food. I eat algae, small pieces of plants or animals. Fish love to eat me. As an adult, I have large wings to help me fly along the river.

When I am young I am a caterpillar with a long body and I crawl around. I have strong jaws for chewing, so I can eat leaves of cottonwood trees. I also roll the leaves and tie them with silk. I hide inside and metamorphose. When I come out I am a moth. It's easy to find the rolled-up leaves on the ground after they fall out of the trees. Birds often eat me when I'm young.

When I am young I am a caterpillar. I eat leaves of cottonwood trees. I also roll the leaves and tie them with silk. I hide inside and change form—when I come out I am a moth. It's easy to find the rolled-up leaves on the ground after they fall out of the trees. Birds often eat me when I'm young.

Leaf-roller

Anacampsis innocuella

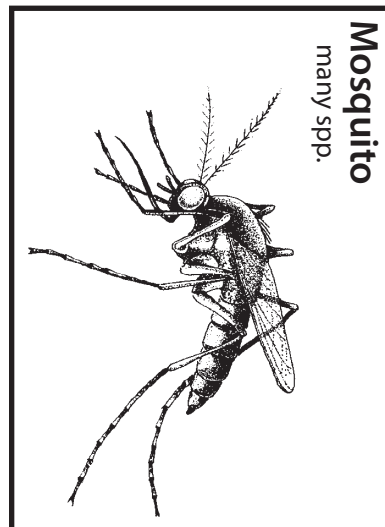


I live in standing pools of water when I'm young. I have a breathing tube at my tail end, which I stick up through the surface of the water for air. I usually eat algae and detritus (dee-TRY-tus) — small pieces of dead plants or animals. As an adult, I fly around and my wings make a buzzing sound. I eat nectar and plant juices, but I need blood from an animal to be able to make my eggs which I lay in the water. Lots of birds and bats eat me.

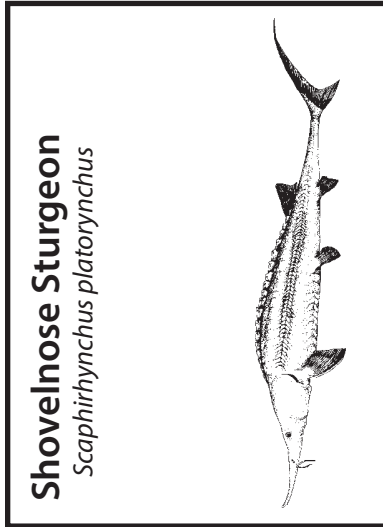
I live in standing pools of water when I'm young. I eat algae and small pieces of dead plants or animals. As an adult, I fly around and my wings make a buzzing sound. I eat nectar and plant juices, but I need blood from an animal to be able to make my eggs. Then I lay my eggs in the water. Lots of birds and bats eat me.

Mosquito

many spp.

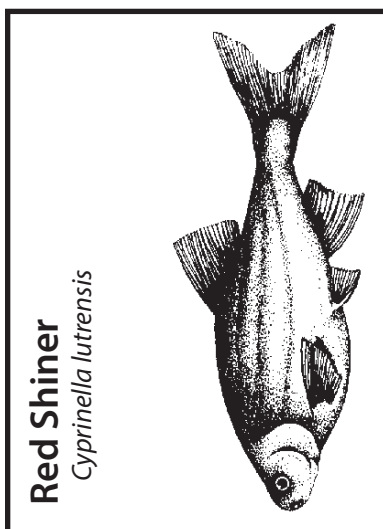


Rio Bravo



I grow to three feet (1 meter) long with a slender body and have rows of bony plates on my back. My nose looks like a shovel. When I eat I stick my extendible mouth out into the bottom of the river. When I pull my mouth back in, I eat the larva of aquatic insects. I usually swim alone in the large channels of the Rio Grande. My young drift downstream, far down the river. When I am an adult, I attend a large family reunion, where all adults return upstream to the place we were born to lay or fertilize our eggs.

I grow to 3 feet (1 meter) long with a thin body and rows of bony plates on my back. My nose looks like a shovel. When I eat I stick my mouth out into the bottom of the river to catch food. I eat baby water insects. I usually swim alone. My young drift far down the river. I return upstream to the part of the river where I was born to lay or fertilize eggs.



Most of the time my fins and scales are a dull color. My 3-inch (7.5-centimeter) body has an olive back, shiny sides and a white belly. However, when I am fertilizing eggs in spring and summer I have a red head and pink sides. Males of my species defend territories where we lay our eggs. I swim in the Rio Grande, where I prefer deeper, slower water. I eat small animals and plants, such as insects, crustaceans and algae.

Most of the time my fins and scales are a dull color. My 3-inch (7.5-centimeter) body has a dark green back, shiny sides and a white belly. However, when I am fertilizing eggs, I have a red head and pink sides. I swim in the slower water of the Rio Grande. I eat small plants and animals such as insects and algae.

Rio Bravo

I am a small, silvery animal with fins and scales. I have small eyes. I rarely get longer than 3.5 inches (9 centimeters). I hatched from a floating egg. I eat algae and tiny plant pieces I find floating in the water and on the gooey river bottom. Sometimes I eat old insect skins. I usually travel in large groups called "schools." I prefer slow-moving waters where the river meanders and braids. I release my eggs when the river flow increases during the early spring to summer.

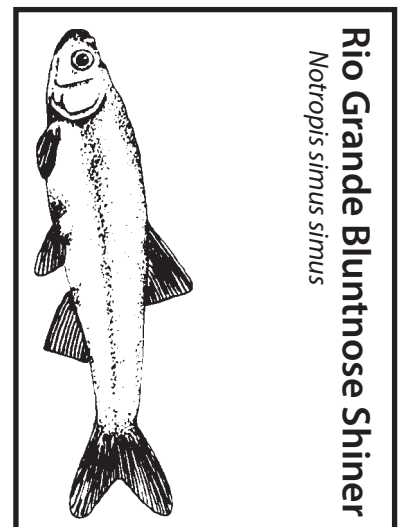
I am a small, silver animal with fins and scales. I have small eyes. I don't get longer than 3.5 inches (9 centimeters). I hatch from a floating egg. I eat algae and pieces of plants and bugs I find floating in the water and on the gooey river bottom. I usually travel in large groups called "schools." I prefer slow moving waters where the river splits in shallow channels.



Rio Grande Silvery Minnow
Hybognathus amarus

I am a small, shiny animal with fins and scales. My back is pale greenish-brown, and I am about 3 inches (7.5 centimeters) long. I am most known for my flat face, well, it's really just my nose that's flat. I eat tiny plants, bugs, and plant pieces. I like to swim in the slow-moving parts of the river where the bottom is sandy and the water is no deeper than a foot (30 centimeters). The Rio Grande and its tributaries are my only home.

I am a small, shiny animal with fins and scales. My back is pale green-brown, and I am about 3 inches (7.5 centimeters) long. I am known for my flat nose. I eat tiny plants, bugs, and plant pieces. I like to swim in the river where the bottom is sandy and the water is shallow and slow. The Rio Grande and the rivers and streams flowing into it are my only home.



Rio Grande Bluntnose Shiner
Notropis simus simus

Rio Bravo



I often sit at night on floating plants with my companions. Our voices join in a trilling song. When danger approaches, I quickly disappear underwater. When I was a tadpole, I lived underwater all the time. Then I ate plants, but as an adult I eat insects. My striped body helps me hide from turtles, birds and mammals. Fish eat my young. In the early spring and fall I am active during the day, but when it gets hot in the late spring and summer I come out at night.

I often sit at night on floating plants with my friends. Our voices join in a song. When danger comes close, I quickly hide underwater. When I was a tadpole, I lived underwater all the time. Then I ate plants, but as an adult I eat insects. My striped body helps me hide from turtles, birds and mammals. Fish eat my young.



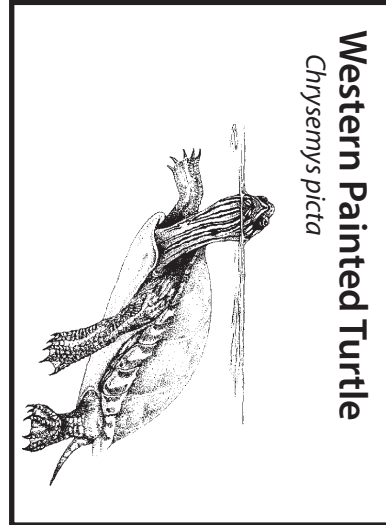
I live near standing water where I can keep my smooth skin wet. I have a fast tongue for catching flying insects. My long legs help me jump away from turtles and birds that want to eat me. My name comes from the spots on my skin. When I was a young tadpole, I used gills to help me breathe underwater but now I have lungs and can live on the shore. I lay my eggs in the water, attached to plants or to the bottom.

I live near still water where I can keep my smooth skin wet. I have a fast tongue for catching flying insects. My long legs help me jump away from turtles and birds that want to eat me. My name comes from the spots on my skin. When I was a young tadpole I used gills to help me breath underwater but now I have lungs and can live on the shore.

Rio Bravo

Most of my body stays hidden inside my hard shell. When I am threatened, I also pull in my striped head and legs. I like areas with quiet water, a soft bottom and lots of water plants. In the winter, I stay in mud under water. When it's warm I climb onto mudbanks, logs or rocks to sun myself. Often many of my friends and I share a log to bask. I eat insects, spiders, earthworms, mollusks, crayfish, fish, frogs and tadpoles. As I get older I eat more aquatic plants.

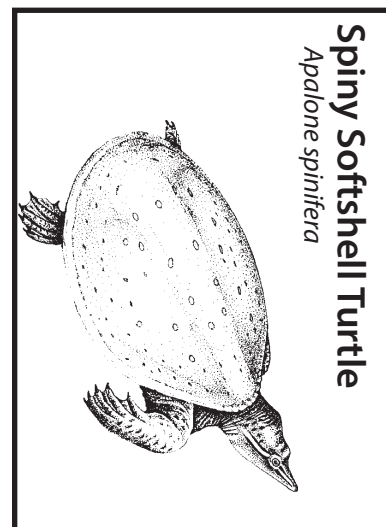
Most of my body stays hidden inside my hard shell. When I am afraid, I pull in my striped head and legs. I like areas with quiet water, a soft bottom and lots of plants. In the winter, I stay in mud under water. When it's warm I like to lie in the sun. I eat insects, spiders, earthworms, mollusks, crayfish, fish, frogs and tadpoles. As I get older I eat more water plants.



Western Painted Turtle
Chrysemys picta

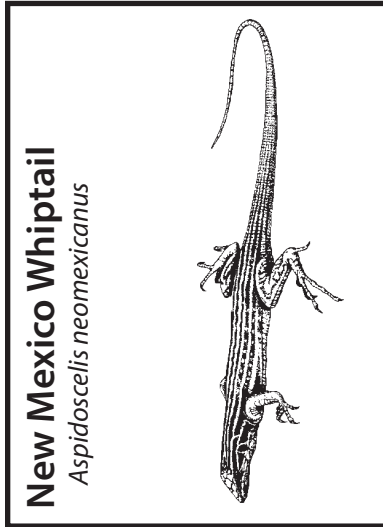
My shell can bend, and it is covered with a leathery skin. My arms, legs and body are flat and my toes are webbed, which helps me swim well. I have a long nose which I stick out of the water for air. I eat earthworms, snails, crayfish, insects, fish, frogs, tadpoles, and some aquatic plants. I like to stay in the river in areas with a sandy bottom and strong currents. On sunny days I like to bask on the riverbank or on logs. I am very fast on land and in the water.

My shell can bend, and it is covered with a tough skin. My arms, legs and body are flat and my toes are webbed, which helps me swim well. I have a long nose that I stick out of the water for air. I eat earthworms, snails, crayfish, insects, fish, frogs, tadpoles, and some aquatic plants. I like to stay in the river in areas with a sandy bottom and strong currents.



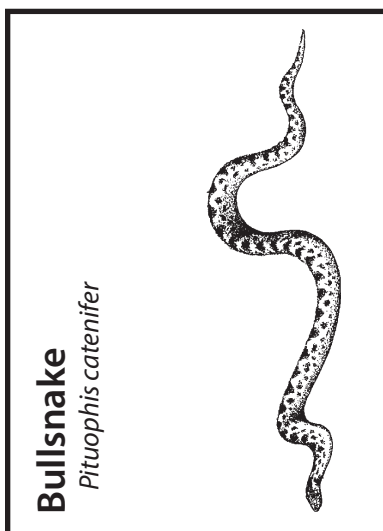
Spiny Softshell Turtle
Apalone spinifer

Rio Bravo



I move very fast on my four legs. I have stripes and light spots along my back. My tail is bright blue when I am young but changes to gray with a gray-green tip when I am grown. I like dry, open areas where I can sit out in the sun. I also seek shade under big trees and shrubs. I sleep through the cold winter. I eat insects and spiders. Roadrunners and other birds like to eat me. I have only sisters, because there are no males of my species. My young hatch from eggs.

I move very fast on my four legs. I have stripes and spots along my back. My tail is bright blue when I am young. Later it is gray. I like dry, open areas where I can sit out in the sun. I also look for shade under big trees and shrubs. I sleep through the cold winter. I eat insects and spiders. Roadrunners and other birds like to eat me. I only have sisters, because there are no males of my kind.



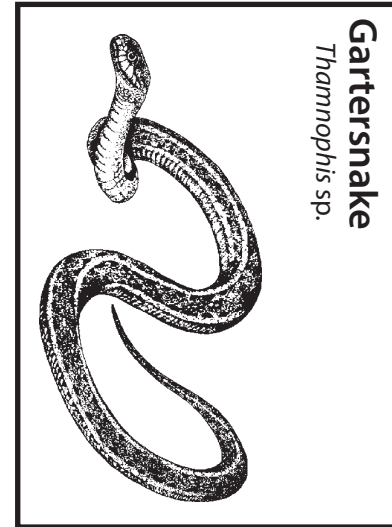
I have a long, slender body with brown and black patches. When disturbed, I shake my tail in leaves on the ground and sound like a rattlesnake. But I do not have a rattle and I am not poisonous. I like to eat mice, rats, eggs, lizards and small birds. I am a constrictor. I squeeze my prey, and then I swallow my food whole. I can even eat prey bigger than my head. I hunt all through the bosque and surrounding uplands. My young hatch from eggs during the summer.

I have a long, slender body with brown and black patches. When upset, I shake my tail in leaves on the ground and sound like a rattlesnake. But I do not have a rattle and I am not poisonous. I like to eat mice, rats, eggs, lizards and small birds. I squeeze my prey, and then I swallow my food whole. I hunt all through the bosque and beyond.

Rio Bravo

I am a reptile without any legs or arms. I have a long yellowish-white stripe down my back. I eat fish, frogs, toads, tadpoles, lizards and worms. I can dislocate my jaw to open my mouth very wide for large prey. I swim well, but usually I slide along the moist ground under plants. Herons, roadrunners and some mammals try to catch me. If I get caught, I can release a stinky material to scare off the predator. My young do not hatch from eggs—they are born live.

I am a reptile without any legs or arms. I have a long yellow-white stripe down my back. I eat fish, frogs, toads, tadpoles, lizards and worms. I can open my mouth very wide to eat. I swim well, but usually I slide along the wet ground under plants. Herons, roadrunners and some mammals try to catch me.



My long neck is dark and I have a white cheek patch, while my body is mostly brownish. My markings help me blend in with the marsh in winter. I am known for my loud "ahonk-ahonk" while I fly in a V-formation with thousands of my kind. I winter in the wetlands where I eat aquatic plants, grasses and some insects and crustaceans. Some of us breed in New Mexico while others head north in the summer. I form a bond with my mate and we breed when we are two or three years old. When our young get a bit older you can see us paddling along with them behind us.

My long neck is dark and I have a white cheek patch. My body is mostly brownish. My markings help me blend in with the marsh in winter. I am known for my loud "ahonk-ahonk" while I fly with my friends. I winter in the wetlands of the Rio Grande watershed. I eat aquatic plants, grasses and some insects and crustaceans. Some of us breed in New Mexico while others head north in the summer.



Rio Bravo



My webbed toes make me a great swimmer but I can also fly to find other places with water. My tail sticks up out of the water when I dip my head below the surface to get food. I have ridges along my bill that let me strain aquatic plants, grass and small insects from the water. I build my nest on the shore. When they hatch, my chicks follow me in a line. Coyotes may try to eat me and raccoons and bullsnakes often eat my eggs.

My webbed toes make me a great swimmer, but I can also fly. When I dip my head below the water to get food, my tail sticks up. I have ridges along my bill so I can strain plants and insects from the water. I build my nest on the shore; when my chicks hatch, they follow me in a line. Coyotes may try to eat me and raccoons and bullsnakes often eat my eggs.



I have sturdy legs, a bushy crest and a long tail. My feathers are streaked, shaggy brown. I can fly but I like to run. My favorite foods are lizards and snakes but I also eat insects, rodents and birds. I hunt in open areas but I build my nest in a low tree or thicket. My husband generally sits on the nest. My mate and I stay together all year. I sing a slow song of low-pitched coos.

I have strong legs, a bushy head and a long tail. I can fly but I like to run. My favorite foods are lizards and snakes, but I also eat insects, mice, and birds. I hunt in open areas but I build my nest in a low tree or thicket. My husband generally sits on the nest. My mate and I stay together all year.

Rio Bravo

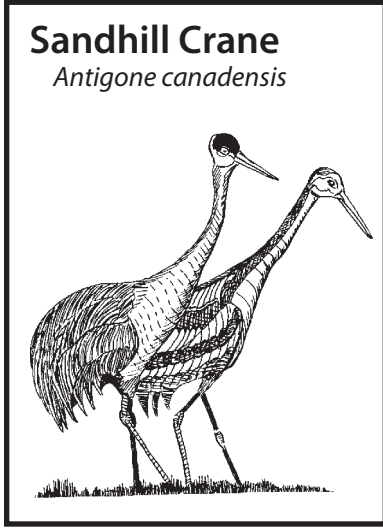
My back is grayish-brown, my belly is white, my wings are rufous, and I have white spots underneath my long, dark tail. I have a yellow lower bill. My favorite food is hairy caterpillars, but I also eat other insects, lizards, berries and fruit. I look for food in dense, leafy trees and shrubs. I often breed where there are cicadas, tent caterpillars or other large insects. I typically need large patches of mature riparian woodland with lots of cover to breed. I build my nest of twigs in mature willows. I spend summers in New Mexico and other parts of the U.S., but I fly to South America for the winter.

My back is grayish-brown, my belly is white and my wings are reddish-brown. I have big white spots under my long, dark tail. My lower bill is yellow. My favorite food is hairy caterpillars. I also eat other insects, lizards, berries and fruit. I need large areas of big trees to build my nest. I build it of twigs in big willows. I spend summers in New Mexico and other parts of the United States. In winter I fly to South America.



I have a long neck and long legs. My feathers are mostly gray, although sometimes there are rust colored feathers on my back and sides. Red feathers top my head. I live near wetlands along the Rio Grande in the winter. We hang out in large groups in open fields and meadows. We eat whatever we can find, especially insects, small animals and plant parts. In the summer we fly north to breed. When we are nesting, my partner and I sing and dance together. My family flies back to the wintering grounds in the fall.

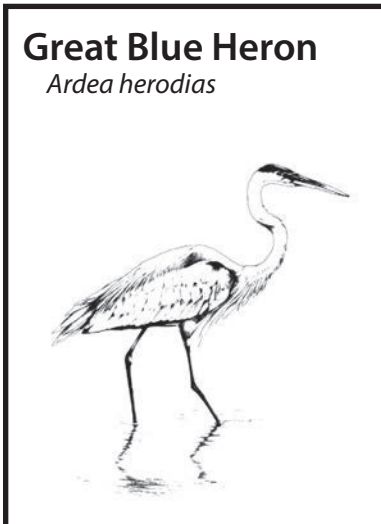
I have a long neck and long legs. Red feathers top my head, but I am mostly gray and rust. In the winter I live near wet areas along the Rio Grande. My friends and I like to be in large fields. We eat insects, small animals, and plant parts. In the summer we fly north to breed. My partner and I like to dance together.





My name is my call. I have two black rings around my neck, brown feathers on my back and a white belly. I run quickly on slender legs along sandbars and riverbanks. I pick up insects, small water animals or plant parts from the surface of the sand or soil. I lay my camouflaged eggs in a depression on the ground among stones and gravel. If a predator comes near my nest, I pretend to have a broken wing to lure it away.

My name is my call. I have two black rings around my neck. I run quickly on skinny legs along the riverbanks. I pick up insects, small water animals or plant parts from the top of the sand or soil. I lay my eggs hidden by their spotted markings on the ground with stones and gravel. If a predator comes near my nest I pretend to have a broken wing to lead it away.



I use my long legs to wade in the water. Blue-gray feathers cover most of my body, with black on my head. I stand patiently waiting for food to come close. With lightning speed I catch fish, frogs, crayfish, and even mice or gophers, using my large spear-like bill. My long neck helps me grab my prey. I hunt during the day and I usually stay near shore or where there are plants, because that's where my food tends to be. I like to hunt alone, but I build my large nest high in cottonwoods with several others of my kind.

I use my long legs to wade in the water. I stand very still waiting for food to come close. I catch fish, frogs, crayfish, and even mice or gophers using my large pointed bill. My long neck helps me grab my prey. I hunt during the day and I stay near shore or where there are plants, because that's where my food tends to be.

I am a raptor, which means I have sharp talons (claws) for catching prey and a hooked beak to tear meat. I have a long tail with dark and light brown bands. I hunt during the day. When I am hungry, I wait on a branch for a small bird to fly by. Then I dash after it, using my binocular vision to skillfully fly around the trees. I also eat small rodents, lizards and rabbits. I build my nest of sticks in the fork of a big cottonwood.

I have sharp claws for catching prey and a hooked beak to tear meat. I have a long tail with dark and light brown bands. I hunt during the day. When I am hungry, I wait on a branch for a small bird to fly by. Then I dart after it, and fly around the trees. I also eat other small animals. I build my nest of sticks in the fork of a big cottonwood.

Cooper's Hawk

Accipiter cooperii

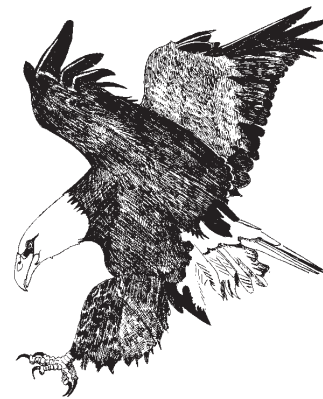


As an adult, I have a dark brown body with a white head and tail. My massive beak is yellow and I have bare yellow legs. When I am young, my whole body is mostly dark brown with blotchy white underneath. As an adult female my wingspan can reach 8 feet (2.4 meters) while as an adult male it is 6 feet (1.8 meters). My wintering grounds include New Mexico, both along the Middle Rio Grande Valley and the upper reaches of the Rio Grande watershed. I go north to breed. I eat mainly fish that I capture with my huge talons, but I also eat carrion (dead animals). We nest in trees or on cliffs.

As an adult, I have a dark brown body with a white head and tail. My large beak is yellow and I have bare yellow legs. When I am young, my whole body is mostly dark brown mixed with white. I live in New Mexico in the winter. I live along the Middle Rio Grande Valley and in the upper watershed. I go north to breed. I eat mainly fish that I capture with my claws. I also eat dead animals.

Bald Eagle

Haliaeetus leucocephalus



Rio Bravo

Great Horned Owl*Bubo virginianus*

My large eyes help me see well as I hunt at night for mice. My soft feathers help me fly quietly to sneak up on my prey. Some feathers on my head look like horns. During the day I hide in large trees where my feathers match the bark. I often use the old nest of a hawk or crow, or make a nest in a cave or a hole in a tree. My young hatch out during the cold winter but they don't leave the nest until spring.

My large eyes help me see well as I hunt at night for mice. My soft feathers help me fly quietly to sneak up on my prey. Some feathers on my head look like horns. During the day I hide in large trees where the color of my feathers matches the bark. My babies hatch during the cold winter but they don't leave the nest until spring.

Belted Kingfisher*Ceryle alcyon*

I can be recognized by my rattling call as I fly along rivers and streams. I have a large head with a heavy bill. My back has bluish gray feathers and my belly is white. I have a bluish breastband if I am a male and two breastbands—one bluish and one rust—if I am a female. I live up to my name because I have excellent fishing skills. I dive head-first into the water to catch fish. I also eat frogs, lizards, insects, mice and even young birds. If you look along the riverbanks, you may find my burrow that I dig using my bill. I teach my young how to fish by dropping dead meals into the water for them to retrieve.

I can be recognized by my rattling call as I fly along the rivers and streams of New Mexico. I have a large, bushy head with a heavy bill. My back has bluish gray feathers and my belly is white with one or two stripes on my chest. I dive head first into the water to catch fish. I also eat frogs, lizards, insects, mice and even young birds. I dig a burrow into a riverbank using my bill.

I perch upright, scanning for insects flying over nearby water. Small feathers around my bill look like whiskers and help me catch flying insects. My back is a brownish color and each of my dark wings has two light stripes on it. I live in dense willow thickets where I build my cup-like nest in the fork of a small tree. I breed in New Mexico but I fly south for the winter.

I sit up straight looking for insects flying over nearby water. Small feathers around my bill look like whiskers and help me catch insects. My back is a brownish color and I have two light stripes on my wings. I live in thick willow patches where I build my cup-like nest in the fork of a small tree. I nest in New Mexico but I fly south for the winter

Southwestern Willow Flycatcher

Empidonax traillii extimus

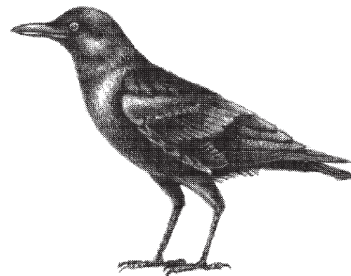


I am all black with a big straight beak. My caw caw warns my companions of danger and tells them where to find food. I use different calls to tell my friends different things. We gather together to feed in the bosque during the winter. We eat anything, including animals and plants. At night, we roost together in big flocks in the trees. In the summer most of us head north to build our nests, although some of us stay in the valley to breed.

I am all black with a big straight beak. My caw caw warns my friends of danger and tells them where to find food. We gather together to feed in the bosque during the winter. We eat anything, including animals and plants. At night, we roost together in big flocks in the trees. In the summer most of us head north to build our nests.

American Crow

Corvus brachyrhynchos



Rio Bravo**Summer Tanager***Piranga rubra*

In the summer I dart about in mature cottonwood trees. I am covered with rosy-red feathers. I like New Mexico summers because there are plenty of insects to feed my young. I like to eat bees and wasps as well as fruit. We build our cup-like nests in trees that grow near water. By the time cold weather comes, my young are grown. We all fly south to Mexico or South America where it is warm in the winter.

In the summer I dart about in big cottonwood trees. I am covered with red feathers. I like New Mexico summers because there are plenty of insects to feed my young. I like to eat bees and wasps as well as fruit. By the time cold weather comes, my young are grown. We all fly south to Mexico or South America where it is warm in the winter.

Red-winged Blackbird*Agelaius phoeniceus*

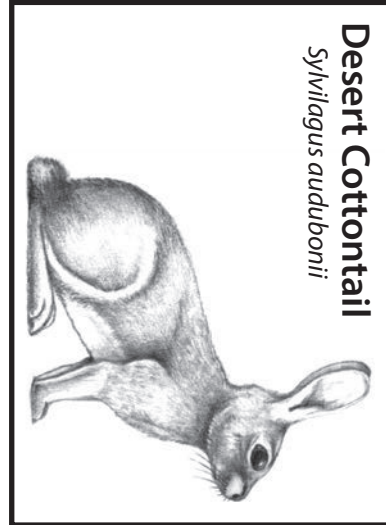
I show the bright red patches in my black wings as I sing loudly from the tops of cattails. My song keeps other males of my kind away from my territory. My wife is dark brown with lots of streaking. We build our nests above the water using stalks of marsh plants. I catch insects to feed my chicks. I travel around in large flocks to search for seeds in winter. Raccoons and some birds eat my eggs, and hawks may try to catch me when I'm older.

I show the bright red patches in my black wings as I sing loudly from the tops of cattails. I build my nest above the water in the cattails. I catch insects to feed my chicks. I travel around in large flocks to search for seeds in winter. Raccoons and other birds often eat my eggs, and hawks may try to catch me when I'm older.

Rio Bravo

I have long ears and a short furry tail. When predators like coyotes or hawks are nearby I may freeze or I may use my big feet to hop away. I like to eat grasses in meadows or in open patches in the forest. I am often out during the day, but I prefer to eat at night. I line my nest with fur from my belly. My babies are born with no fur, and their eyes and ears are closed. They grow quickly and can leave the nest after 14 or 15 days. I may have three or four litters a year.

I have long ears and a short furry tail. When coyotes or hawks are nearby, I may freeze or I may use my big feet to hop away. I like to eat grass in meadows or in the forest. I prefer to eat at night, but I am often out during the day. I line my nest with fur from my belly. My babies are born with no fur and closed eyes and ears.



Desert Cottontail
Sylvilagus audubonii

I have dark brown fur and a broad flat tail. My webbed feet make me a great swimmer. My favorite food is cambium (CAM-bee-um), the inner bark of cottonwood and willow trees, but I may also eat buds and fruits. I use my huge front teeth to cut down trees. I prefer young trees but I can cut big ones, too—then I cut off the branches to eat. My family shares a den in the bank of the river. Usually four to eight of my family members live together. We are most active at night. Coyotes, foxes, bobcats and mountain lions occasionally try to catch us.

I have dark brown fur and a big, flat tail. My webbed feet make me a great swimmer. My favorite food is the inner bark of cottonwood and willow trees but I may also eat buds and fruits. I use my huge front teeth to cut down trees. I dig a den in the bank of the river. I am most active at night. Coyotes, foxes, mountain lion and bobcats try to catch me.

American Beaver

Castor canadensis



Rio Bravo



My tail, ears and fur are very short. My eyes are small. My front legs are very strong. The claws on my front feet are very long. All of these adaptations help me dig and live underground. I burrow in deep, sandy soil where the trees aren't too close together. I push the soil that I dig out of my tunnels up to the surface and leave it in piles on the ground. My cheeks have fur-lined pockets to carry my food. I eat plant roots and occasionally a whole plant. Sometimes a coyote or badger will try to dig me out of my burrow.

My tail, ears and fur are very short. My eyes are small. My front legs are very strong. The claws on my front feet are very long. These things help me dig and live underground. I dig in deep, sandy soil where the trees aren't too close together. I eat plant roots. I have fur-lined pockets in my cheeks to carry my food. Sometimes a coyote or badger will try to dig me out of my burrow.



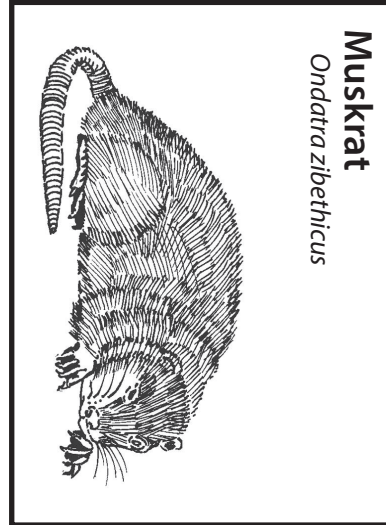
I jump like a frog with my long hind feet but I have fur and a tail. My fur is brownish on my back, yellowish on my sides, and white on my belly. I like to stay among wet grasses and under willows. My family lives around marshes. I mostly eat the flowers and seeds of grasses and other plants as well as insects. I hibernate for half the year, living entirely on fat stored in my body. Coyotes, snakes, hawks and owls try to eat me. When a predator, or something else, startles me, I take several long jumps, but then I try to hide again.

I jump like a frog with my long hind feet and tail, but I have fur. I like to stay in wet grasses and under willows. My family lives around marshes. I eat the flowers and seeds of grasses and other plants as well as insects. I hibernate for half the year, living entirely on fat stored in my body. Coyotes, snakes, hawks and owls try to eat me.

Rio Bravo

I'm smaller than a beaver, and my ribbon-like tail is flattened side to side. I have sleek brown fur. I swim in the river or in a pond and I'm most active at night. When looking for food I can stay under water as long as 20 minutes, but I don't usually stay down that long. I eat aquatic plants, as well as crayfish, fish and other small animals. I make a burrow in the riverbank. I usually live alone unless I have babies. I defend my home territory against others of my kind. Raccoons often eat my young.

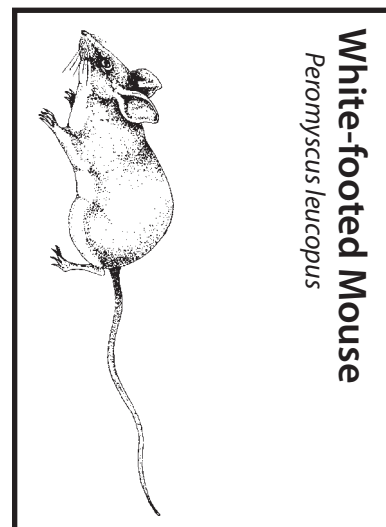
I'm smaller than a beaver, and my ribbon-like tail is flattened sideways. I have smooth brown fur. I swim in the river or in a pond. I am most active at night. I make a burrow in the riverbank. I eat plants, as well as crayfish, fish and other small animals. I live alone unless I have babies. Raccoons often eat my young.



Muskra
Ondatra zibethicus

I am small with grayish or orange-brown fur on my back and sides and a white belly and feet. I am the most common mammal in the bosque. I hide in the day and hunt for food at night. Climbing trees and shrubs is easy for me. I eat insects during the spring and summer, and seeds during the fall and winter. I store nuts and seeds in the fall to eat during the winter. Snakes, coyotes and owls often eat me. My nest is always in a hidden place, maybe a bird's nest, empty burrow or clump of grass.

I am small and brown with white belly fur and feet. I hide in the day and hunt for food at night. Climbing trees and shrubs is easy for me. I eat insects during the spring and summer, and seeds during the fall and winter. Snakes, coyotes and owls often eat me. My nest is always in a hidden place, maybe a bird's nest, empty burrow or clump of grass.



White-footed Mouse
Peromyscus leucopus

Rio Bravo

North American Porcupine
Erethizon dorsatum



I live in trees and in brush piles. You might think I'm a bird's nest. I have sharp quills all over my body that I use to protect myself from coyotes and great horned owls. When upset I show off the warning coloration of my black and white quills, then flick my tail towards whatever is scaring me. I eat cottonwood trees, nibbling off the buds and bark from stems then throwing these "nip twigs" onto the ground. My long claws and strong tail help me climb tall trees. I have big orange incisors (in-SY-zors), or front teeth, that help me eat the inner bark of trees called cambium (CAM-bee-um).

I live in trees. You might think I'm a bird's nest. I have sharp quills all over my body that I use to protect myself from coyotes and great horned owls. When upset I flick my tail towards whatever is scaring me. I eat cottonwood tree inner bark and buds. My long claws and strong tail help me climb tall trees with ease. I have big orange teeth that help me chew on my woody food.

Little Brown Bat
Myotis lucifugus



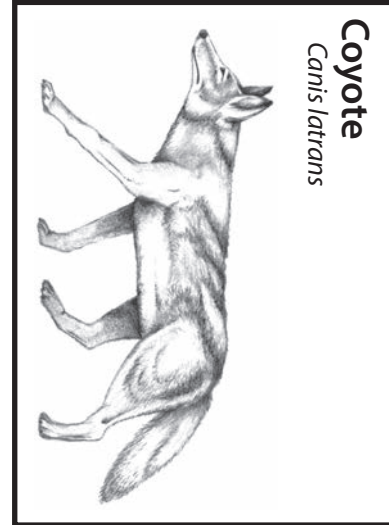
I have wings but I am not a bird. My body is covered with brown fur. I use echolocation (sonar) to catch flying insects like mosquitoes. I skim over streams and ponds at night. During the day I sleep in hollow trees or under bark. When we have our babies, I gather with lots of my friends in sheltered areas like caves or cavities of trees. Sometimes I carry my baby with me as I hunt, but we usually leave them together at the roost. I hibernate during the winter.

I have wings but I am not a bird. I have brown fur. I catch flying insects like mosquitoes. I skim over streams and ponds at night. During the day I sleep in hollow trees. When we have our babies, I get together with lots of my friends in sheltered areas like caves or holes in trees. I hibernate during the winter.

Rio Bravo

I have a bushy tail, four slender legs, pointed ears that stand up and a sandy brown fur coat. In the mornings and evenings I yip and howl with my family. I eat whatever I can find, including mice, jackrabbits, ducks and other birds, berries and insects. I roam across many miles of the bosque and surrounding fields. Once in a while, I catch a roadrunner. I make a den in a sheltered place like an old animal burrow or a hollow log. My pups stay there for two to three weeks. After six to nine months they may go off on their own, or they may stay with me and my mate until the next year.

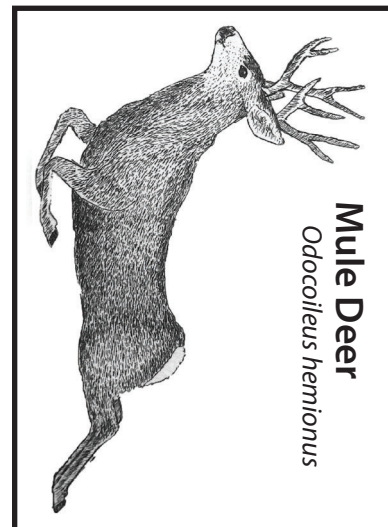
I have a bushy tail, four skinny legs, pointed ears that stand up, and a sandy brown fur coat. In the mornings and evenings I yip and howl with my family. I eat whatever I can find, including mice, jackrabbits, ducks and other birds, berries and insects. I roam across many miles of the bosque, and surrounding fields. Once in a while, I catch a roadrunner.



Coyote
Canis latrans

My summer coat is reddish but changes to blue-gray in winter and I have a whitish rump patch with a black-tipped tail. My ears are quite large! Males have antlers. I travel from lowland river bottoms to canyons and forested high country. I am most active in the morning, evening and on moonlit nights. I eat leaves, stems and buds of woody plants plus grasses and weeds. I have good eyesight, hearing and sense of smell. These help protect me from predators such as coyotes, mountain lions and bears. When our fawns are born they lie still to hide from predators.

My summer coat is reddish but my fur changes to blue-gray in winter. I have a whitish rump patch with a black-tipped tail and large ears. Males have antlers. I travel from river bottoms to canyons and mountain forests. I eat leaves, stems and buds of woody plants plus grasses and weeds. I have very good eyesight, hearing and sense of smell. Coyotes, mountain lions and bears try to eat me.



Mule Deer
Odocoileus hemionus

Who Lives Where? cards



Part 1B: Rio Bravo: Upper Watershed Adaptations: Native

Text for older students top in single-line box, for younger students below in larger type in double-line box.

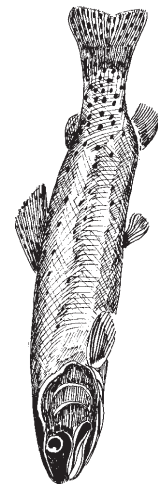
The following cards are for use with the model set up as Rio Bravo, but for upper watershed locations (upper tributaries or areas north of the Middle Rio Grande Valley). Use these if your school is located in the upper watershed or if you want to study the upper watershed.

My yellowish-green to gray-brown body is covered with scales and peppered with black spots. During breeding season the male's belly becomes flaming reddish-orange. I am named for the reddish-orange slash in folds on either side of my lower jaw. I mostly live in headwater streams as I prefer cold, fast-moving waters. I eat aquatic insects and insects that land on the water. As an adult I may also eat small fish. My species was once found in all major watersheds on both sides of the Continental Divide and we were the only species of our kind in many New Mexico waters.

My yellow-green to gray-brown body has black spots. I am covered with scales. Males of my species have a belly that turns reddish-orange. I am named for a reddish-orange slash on the sides of my lower jaw. I mostly live in small, cold streams. I eat water insects and small fish. My species was once the only one of our kind in many New Mexico waters. I lay my eggs from March through July.

Rio Grande Cutthroat Trout

Oncorhynchus clarki virginalis



Rio Bravo

I have long, narrow wings with dark patches at the “wrists,” a dark back, a white underside and a dark stripe through my eyes. I hover high above lakes watching for fish. I can fold my wings and plunge feet-first to scoop up a fish. The best time to see me above New Mexico waters is during spring as I travel north to breed and again in the fall when I fly to southern lands for the winter. I usually mate for life, and my husband fishes for me while I incubate our eggs. As a parent, I am kept very busy fishing for my young. Each chick can eat six pounds (2.7 kg) of fish a day!

I have long, narrow wings with dark patches at the “wrists.” My back is dark and I have a white belly and a dark stripe through my eyes. I hover above lakes watching for fish. I am great at catching fish. The best time to see me in New Mexico is in the spring as I travel north to breed and again in the fall when I fly south for the winter. My mate helps catch fish for our young.

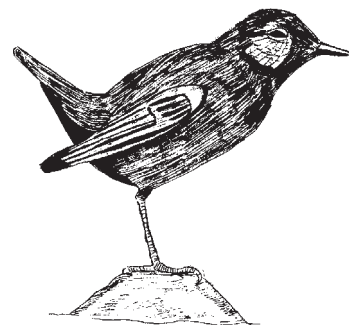
Osprey
Pandion haliaetus



I am small but chunky with slate-colored feathers. Most often I hang out along rushing mountain streams of the upper watershed. I walk along the bottom as I search for caddisfly larvae and other aquatic insects. Sometimes I become completely submerged and I “fly” underwater using my powerful wings. I can even do this in water that is rushing too fast for you to stand in! I have very large oil glands and soft, dense feathers to help keep my body dry. I build my nests behind waterfalls or on rocks in the middle of the stream. You may see me bobbing as I wade and look for aquatic snacks.

I am small but chunky with slate-colored feathers. I hang out along fast mountain streams of the upper watershed. I walk along the bottom as I search for water insects. Sometimes I go all the way underwater and I “fly” using my strong wings. I have large oil glands and soft, dense feathers to help keep my body dry. I build my nests behind waterfalls or on rocks in the middle of the stream.

American Dipper
Cinclus mexicanus

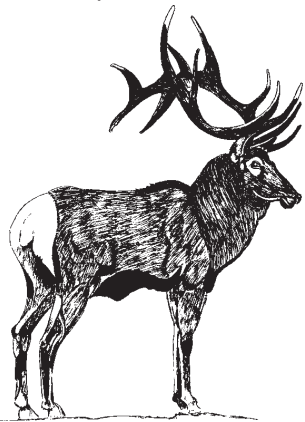


Rio Bravo

Black Bear*Ursus americanus*

My fur can be black, brown, cinnamon, or blond. As an adult male, I can weigh 250 pounds (113 kg) and as a female I am usually around 150 to 180 pounds (65–80 kg). I like to eat berries, rosehips, nuts, insects and honey. I can smell food from a long distance. I usually stay in the mountains, but I also visit lowland streams and river valleys to look for food, or when young are moving to find their own territories. In the winter, I go into a deep sleep, although I may wake up some from time to time. My cubs are born when I am in my winter den. They stay with me through the next winter.

My fur can be black, brown, cinnamon, or blond. I like to eat berries, rosehips, nuts, insects and honey. I can smell food from a long distance. I usually stay in the mountains, but I also visit lowland streams and river valleys to look for food. In the winter, I go into a deep sleep, although I may wake up some from time to time. My cubs are born when I am in my winter den.

Elk*Cervus elaphus*

When I am born, I have a white-spotted fur coat and lie still in tall grass to keep predators from seeing me. I weigh 30 to 40 pounds (13–18 kg). I grow up to 1,000 pounds (450 kg) if I am a male and up to 600 pounds (270 kg) if I am female. My adult body is reddish-brown with a short white tail. The males of my species, called bulls, grow huge racks of antlers and are famous for the bugle call used as an advertisement, a battle cry and a mating call. I feed on grasses and enjoy browsing on riparian willows as I migrate from mountain meadows to lowland river valleys.

When I am just born, I have a white-spotted fur coat. I lie very still in tall grass to keep predators from seeing me. My adult body is reddish-brown with a short white tail. The males of my species grow huge antlers and use their bugle call as a battle cry and a mating call. I feed on grasses. I also eat river willows as I migrate from mountain meadows to lowland river valleys.



Who Lives Where? cards

Part 2A: Rio Manso: Animals Introduced to the Middle Rio Grande Bosque

Text for older students top in single-line box, for younger students below in larger type in double-line box.

The following cards are for use with the model set up as Rio Manso, the tamed river. These are animals that did not evolve in this area, but have been introduced into this ecosystem, both intentionally and accidentally. Often, introduced species out-compete native species, especially when the natural environment has been altered. The river is like an island for the natural species that live there—a long narrow island. They cannot live far from the wet riparian environment. In this restricted area, introduced species and habitat destruction have a great impact. By destroying habitat, the narrow bosque area is cut into smaller pieces that support fewer and fewer native species.

I have 14 legs! I may roll into a ball to protect myself. I live on the forest floor among the leaves as crickets do. I eat dead leaves, leaving behind the “skeleton” of the leaf. Sometimes I eat animal scat (that’s the word biologists use for “poop!”). Harvester ants may catch me, kill me, and carry me down into their burrow. Other small animals may eat me too. We arrived in the U.S. as unplanned cargo in ships from Europe and have spread here, taking over the role crickets had.

I have 14 legs! I may roll into a ball to protect myself. I live on the forest floor. I eat dead leaves, and sometimes I eat animal scat (that’s a word for “poop!”). Harvester ants may catch me, kill me, and carry me down into their burrow. The ants may leave pieces of my white shell near their mound. Other small animals may eat me, too.

Isopods
Armadillidium vulgare (pillbug) and Porcellio laevis (sowbug)

Rio Manso



I am a fish that people in the United States do not usually eat. I came to New Mexico in 1883. I enjoy quiet, warm water but I can live in almost any kind of water. I often change the habitat by uprooting plants, making the water muddy, and eating the eggs of other fish. I spoil the habitat for native fish. I have barbels that look like whiskers. Some people think I am a pest.

I am a fish that people here do not usually eat. I enjoy quiet, warm water but I can live in almost any kind of water. I often change the habitat by pulling plants, making the water muddy and eating the eggs of other fish. I spoil the habitat for native fish. It looks like I have whiskers. Some people think I am a pest.



Look for me in warm, shallow water with many plants. I am 2 inches (5 centimeters) long and my mate is only 1 inch (2.5 centimeters). I am native to the lower Rio Grande but was introduced to the Middle Rio Grande because I eat mosquito larvae. My babies are born alive. I also eat other insect larvae, algae, crustaceans, and fish fry (baby fish). Because I eat fish fry, I sometimes kill off the fish that were in the streams and rivers before I came.

Look for me in warm, shallow water with many plants. I am 2 inches (5 centimeters) long and my mate is only 1 inch (2.5 centimeters). I am native to the lower Rio Grande, but was introduced to the Middle Rio Grande because I eat mosquito larvae. My babies are born live. I also eat other insect larvae, algae and baby fish.

Rio Manso

I am the biggest frog in North America. I didn't always live in the Rio Grande Valley. I was brought here because my legs are so good to eat. I live in still waters of marshes or ponds where native frogs once ruled. I eat insects and any animal small enough for me to swallow, including ducklings. I need two summers to grow from an egg to a tadpole and on to a full-grown frog.

I am the biggest frog in North America. I didn't always live in the Rio Grande Valley. I was brought here because my legs are so good to eat. I live in marshes or ponds where native frogs once ruled. I eat insects and any animal small enough for me to swallow, including ducklings. I need two summers to grow from egg to tadpole and on to a full-grown frog.



Bullfrog
Lithobates catesbeiana

In the fall my black feathers are tipped with white and tan, but in the breeding season my plumage is iridescent black. I have a stocky body and a short, square tail. I can make lots of different sounds and imitate the songs of other species. I eat insects and other invertebrates, fruits and seeds. My ancestors came from Europe, but people took some of them to New York in 1890-91. Soon we spread across the U.S. We can live in many places. We nest in holes and often out-compete native species for nesting sites because we are aggressive and there are many of us.

In the fall my black feathers are tipped with white and tan. They show many colors in the breeding season. I have a stocky body and a short, square tail. I eat insects, fruits and seeds. My kind originally came from Europe. We like many types of habitats. We nest in holes. We take many of the nesting sites so native species can't use them. We often hang out in large flocks.

European Starling
Sturnus vulgaris



Rio Manso

House Sparrow

Passer domesticus



I am a small brown bird with a short, cone-shaped bill. My European relatives were brought to New York in the early 1850s and by 1940 were in the Rio Grande Valley. I have successfully colonized here because I strongly claim cavities for my nests very early in the year, before other birds arrive. I am common around houses and buildings but not very common in the bosque itself. I eat food on the ground, mostly insects, worms, garbage and seeds.

I am a small brown bird with a short, cone-shaped bill. I came from far away but have been very successful in the Rio Grande valley—just look how many of us there are! I build my nest in places very early in the year, before other birds arrive. I am common around houses and other buildings. I eat food on the ground, mostly insects, worms, garbage, and seeds.

House Mouse

Mus musculus



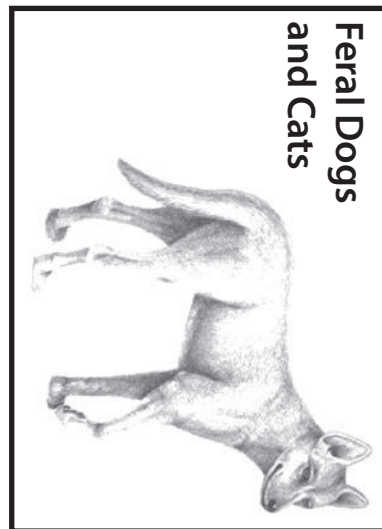
I have gray-brown fur, top and bottom. My scaly tail has little hair on it. My ancestors probably arrived in North America with the first colonists. I do well in areas near humans. I move inside buildings when it gets cold. I usually have four or five young in a litter and they, in turn, can have young six weeks later. I have several litters a year. I eat vegetable matter and bugs.

I have gray-brown fur, top and bottom. My scaly tail has little hair on it. I like to live near humans. I move inside buildings when it gets cold. I usually have four or five young in a litter. They can have young when they are only six weeks old. I eat vegetable stuff and bugs.

Rio Manso

I should be a pet, but I am wild. Since I was abandoned by humans I try to survive on my own. I find lizards and mice to eat. I usually find the native mice are slow and easy to catch. Birds like ducks and quail that nest on the ground can also provide a good meal. I have become afraid of humans so I roam at night looking for food.

I should be a pet, but I am wild. Since humans left me here alone, I try to survive on my own. I find lizards and mice to eat. The native mice are slow and rather easy to catch. Birds that nest on the ground also provide a good meal. I am afraid of humans so I roam at night looking for food.



Who Lives Where? cards



Part 2B: Rio Manso: Upper Watershed Adaptations: Introduced

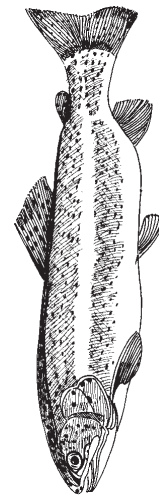
Text for older students top in single-line box, for younger students below in larger type in double-line box.

The following cards are for use with the model set up as Rio Manso, the tamed river, for upper watershed sites (upper tributaries or areas north of the Middle Rio Grande). Use them if your school is located in the upper watershed or if you want to study the upper watershed.

I have a dark back, polished silvery sides, a red band along the lateral line, shimmers of green and blue in the sunlight and black specks from head to tail. I am almost every color of the rainbow! I have been transplanted from my home waters in the Pacific Northwest. I prefer clear, cold water with plenty of dissolved oxygen and many places to hide. In New Mexico I live in the tributaries of the Rio Grande as well as in several cold mountain lakes. I catch insects in the water or near the surface.

I have a dark back and a red band along my silvery sides. Green and blue colors show in the sunlight and I have black dots from head to tail. I am almost every color of the rainbow! I came here from my home waters in the Pacific Northwest. In New Mexico I live in cold, smaller streams that flow into the Rio Grande. I also live in some cold mountain lakes. I catch insects in the water or near the surface.

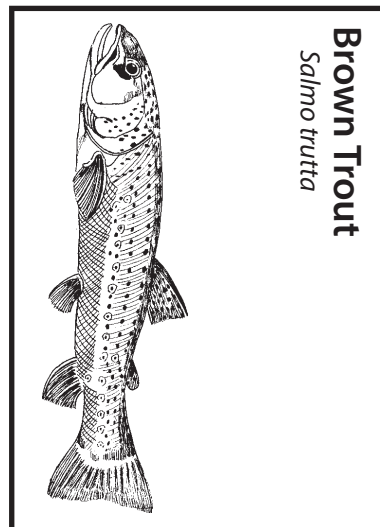
Rainbow Trout
Oncorhynchus mykiss



Rio Manso

I have a sleek, colorful olive-brown body that sparkles with gold. My upper sides are dotted with black and sprinkled with blue-haloed red and orange spots, although my tail has no spots. I live in coldwater streams and lakes, but I prefer deeper, slower and warmer streams than other species like me. I eat minnows and aquatic insects. My species was introduced to North America in 1883. Now I am commonly found throughout the US, including some tributaries of the Rio Grande. I am wary and difficult to catch. I hide under a log or in a rock crevice when startled.

I have a sleek and colorful olive-brown body that sparkles with gold. My upper sides have lots of black, bluish-red and orange spots. I live in small to large coldwater streams and lakes. I eat minnows or water insects. My species was brought to North America in 1883. Now I live in some of the smaller streams of the Rio Grande watershed. I hide under a log or behind a rock when scared.





Threatened and Endangered Animals

An **endangered species** is an animal or plant that may very soon go extinct. When extinct, every individual of that species is gone; not one is alive anywhere. That species is gone from the Earth forever. The term “**extirpated**” is used when a species no longer occurs in a given locality, such as the Middle Rio Grande Valley, but still survives in other places (also referred to as “locally extinct”). A **threatened species** is reduced in numbers and is on its way to becoming endangered and then going extinct. The purpose of listing a species as threatened or endangered is to protect and restore the species to a point where its populations are stable and no longer in need of special protection. The federal Endangered Species Act offers protection both directly for a listed species and for the ecosystems or habitats on which it depends.

The federal government, through the United States Fish and Wildlife Service, lists species as threatened, endangered or extinct. The state government, through the New Mexico Department of Game and Fish, makes its own list of state endangered, threatened or extinct species. The New Mexico Department of Game and Fish also designates Species of Greatest Conservation Need (SGCN) in the State Wildlife Action Plan for New Mexico (SWAP), which includes species that are declining, vulnerable, **endemic** (native and restricted to a certain place), **disjunct** (populations separated geographically) and/or **keystone** (a species that has a disproportionately large effect on its environment relative to its abundance). Natural Heritage New Mexico, a division of the Museum of Southwestern Biology at the University of New Mexico, also ranks plant and animal species, and plant communities, as to their endangerment status and monitors these species closely. Some species may appear on one list and not another, or they may be on all of the lists.

Over forty percent of fishes native to the Middle Rio Grande Valley are no longer here, with at least five species extirpated and two additional species considered extinct. Many factors have contributed to this loss, including pollution, reduced water flow, dams, increased erosion on land leading to more sediment in the water, and introduction of non-native fish species.

Some interesting fish had life cycles that included living part of their lives in the freshwater Rio Grande and part over 1,500 miles (2,400 km) away in the Gulf of Mexico. Such species have been negatively impacted by dams and diversion structures in the Rio Grande. For example, the **American eel**, *Anguilla rostrata*, spawns at sea, in the Sargasso Sea to be exact, after which young females travel up freshwater rivers and can live for 20 - 50 years. Most males stay in the ocean near the shore until females return to the spawning area where they mate, and it is assumed that both sexes then die. It takes three years for the young to get back to fresh water. Eels were historically present in the Rio Grande and the Pecos and maybe also the Canadian River. More recent sightings suggest that eels reintroduced in Colorado may have made their way into New Mexico rivers. Although still considered extirpated from the Rio Grande, eels also occur in the Mississippi River Valley, having been found as far upstream as North Dakota. Eels are not listed federally and populations are considered stable globally. The



freshwater drum, *Aplodinotus grunniens*, today lives primarily in the salt–fresh-water mixed zone of the mouth of rivers. It still comes up the Rio Grande a short way, but cannot make it very far. Remains have been found in archeological sites near Cochiti and Albuquerque with evidence that drum made up a significant component of the fishery of the pre-alteration Middle Rio Grande. Also presumed extirpated from the Rio Grande in New Mexico, populations outside the state remain secure.

The following species are in the “Who Lives Where?” bosque animal activity and are, or have been in the past, threatened or endangered, or are now extinct.

Rio Grande Silvery Minnow, *Hybognathus amarus*

Federal: Endangered; State: Endangered, Species of Greatest Conservation Need

The silvery minnow was placed on the federal endangered species list in 1994. Today you can find this minnow in the Rio Grande only between Cochiti Dam and Elephant Butte Reservoir, a small portion of its historic range. It is endangered due to poor water quality, changes in the structure of the riverbed, lack of water in the river due to irrigation and drought and the presence of non-native species. The minnows lay eggs with the peak spring flows, and the young develop in quiet backwater areas after overbank flooding (See Chapter 2, Introduction, for more information). In 2000, a silvery minnow egg salvage pilot program was begun to increase the likelihood of survival. Managers have allowed high water releases from Cochiti Dam, mimicking the natural flood pulse, with a goal to promote natural breeding in years with high snowpack. As of fall of 2019, over 800,000 minnows hatched in captivity have been returned to the river, but the population is still at great risk.

Rio Grande Bluntnose Shiner, *Notropis simus simus*

Extirpated from New Mexico, may be extinct overall

Last collected in 1964 near Peña Blanca and previously listed as endangered in New Mexico prior to its extirpation. Extinction is suspected as a result of its habitat periodically drying up and the river channel being modified due to water diversions, dams and drought, and possibly competition with introduced species. The **Pecos bluntnose shiner** (*Notropis simus pecosensis*) is listed as threatened federally and as endangered and a Species of Greatest Conservation Need at the state-level.

Shovelnose Sturgeon, *Scaphirhynchus platorhynchus*

State: Extirpated (extinct in New Mexico)

Only one voucher specimen of this fish has been found in New Mexico (in 1875); however, archaeological evidence indicates the fish was eaten in earlier times. One theory to explain the early extinction of this species in New Mexico relates to the sturgeon’s lifecycle. The larval fish drift far downstream, and the adults must return to their birthplace to reproduce. Dams interfere with the movement of these big river fish that require long distances to complete their lifecycle.



Northern Leopard Frog, *Lithobates pipiens*

State: Species of Greatest Conservation Need

All five species of leopard frogs in New Mexico are being carefully monitored and all are considered SGCN. The northern leopard frog was listed on the Navajo Endangered Species List as “threatened” in 1997 but has not been placed on state or federal lists. The **Chiricahua leopard frog** (*Lithobates chiricahuensis*) is considered threatened federally, while the **lowland leopard frog** (*Lithobates yavapaiensis*) is on the state endangered species list and may have been extirpated from New Mexico. Although scientists are not sure exactly why leopard frogs have declined dramatically, many suspect that competition with and predation by introduced bullfrogs or predation by introduced fish or crayfish may be major factors. Other reasons leopard frogs may be declining include damage to their habitat, pollution, pesticides, drought, climate change and disease from the chytrid fungus.

Greater Sandhill Crane, *Antigone canadensis*

Although not currently listed as endangered or threatened, Greater Sandhill Cranes were rare in the 1930s with fewer than 1000 birds in the Central Flyway. This was primarily due to loss and degradation of wetland habitats. The Bosque del Apache National Wildlife Refuge was established in 1939 in part to provide wintering habitat for Greater Sandhill Cranes. Only 17 wintered there in 1941, but now populations have recovered enough that they appear to be secure in New Mexico. In contrast, the **Whooping Crane** (*Grus americana*) is listed as endangered at the federal and state level and is considered extirpated from New Mexico.

Bald Eagle, *Haliaeetus leucocephalus*

State: Threatened, Species of Greatest Conservation Need

Once widespread throughout the United States, a decline in the southern and eastern parts of the Bald Eagle’s range in the 1900s led to its federal listing as endangered. A ban on DDT helped populations recover and, by mid-1995, it was down-listed to threatened. In 2007, it was delisted due to its successful recovery. Major threats remain, however, including habitat loss, nest and roost disturbance by humans, environmental contamination, decreased food supply and illegal shooting, so it is still considered threatened and a Species of Greatest Conservation Need by the state of New Mexico. It is also protected under the Migratory Bird Treaty Act and permits are required for many activities related to the Bald Eagle.

Yellow-billed Cuckoo, *Coccyzus americanus*

Federal: Threatened; State: Species of Greatest Conservation Need

Western populations of Yellow-billed Cuckoos, including those along the Rio Grande, are considered threatened at the federal level and a SGCN by the state of New Mexico. The local subspecies needs large patches of dense riparian forest with fairly dense understory to nest, preferring tall cottonwoods and willows, so it is particularly affected by loss and degradation of habitat. Given the need for dense vegetation, it can also be harmed by removal of exotic vegetation or death of the vegetation due to the introduced tamarisk leaf beetle if there are no native plants that can regrow in the treated area. The eastern population is considered a Species of Greatest Conservation Need in the state.



Southwestern Willow Flycatcher, *Empidonax traillii extimus*

Federal: Endangered; State: Endangered, Species of Greatest Conservation Need

The Southwestern Willow Flycatcher was listed as endangered at the federal level in 1995 and at the state level in 1996. It nests in dense willows and other woody plants that overhang rivers, streams, or wetland habitat. This habitat has been dramatically reduced in the last few decades. When the river was straightened, wetland areas were drained for agriculture. Wetlands were also reduced by the loss of spring flooding. Another contributing factor to the Southwestern Willow Flycatcher's decline is parasitism by Brown-headed Cowbirds. Cowbirds lay their eggs in the nests of other birds, leaving those parents to raise the cowbird chicks. Cowbird eggs hatch earlier than the eggs of the host species, like the Southwestern Willow Flycatcher, and cowbird nestlings are generally bigger and stronger. Cowbird chicks are more aggressive and out-compete chicks from other species for food. Although native, Brown-headed Cowbirds expanded their range with the clearing of forests and the introduction of cattle. They have had a dramatic effect on many species in the Southwest.

New Mexico Meadow Jumping Mouse, *Zapus luteus luteus*

Federal: Endangered; State: Endangered, Species of Greatest Conservation Need

The New Mexico meadow jumping mouse, *Zapus hudsonius luteus*, was listed as federally endangered in 2014. In 2017 this subspecies, which includes all New Mexico populations, was determined to be genetically and ecologically distinct enough to be considered a new species, *Zapus luteus luteus*. This mouse lives in streamside vegetation, wetlands and wet meadows. Its numbers declined when marshes and meadows were drained in the 1930s. Today, the areas where they are found are far from each other and are only small patches of habitat. They often now live along ditches or drains with willows and other vegetation. They are threatened by changes to habitat, due to grazing, drought, development, wildfire, and loss of beavers.

San Juan River Fish Species:

Two species of fish included in the San Juan River adaptation of the *Guide* are also considered endangered. The **Colorado pikeminnow** (also called Colorado squawfish, *Ptychocheilus lucius*) is listed as a federal and state endangered species, as well as a Species of Greatest Conservation Need. Threats to this species include predation from non-native fish, insufficient prey base, habitat loss or alteration, migration barriers and flow modification. The **razorback sucker** (*Xyrauchen texanus*) is also a federal endangered species and a Species of Greatest Conservation Need in the state of New Mexico. This species has been impacted by flow modification, habitat loss / alteration and the introduction of non-native fish.

INTRODUCED AND NON-NATIVE SPECIES

In the Middle Rio Grande Valley, there are many species that have only recently taken up residence. These plants and animals are taking over areas that native species have lived in for thousands of years. There are many reasons that non-native species may be successful, but, in general, they arrive here without the animals or plants adapted to eat or compete with them in their native environment.



Introduced Plants

There are three introduced trees that are very common in parts of the Middle Rio Grande Valley: **tamarisk/saltcedar** (*Tamarix chinensis*), **Russian olive** (*Elaeagnus angustifolia*), and **Siberian elm** (*Ulmus pumila*). In general, they are increasing because human-caused changes in the river valley provide favorable conditions for them to grow.

Saltcedar trees flower and produce seeds throughout the growing season; their reproduction is not restricted to spring/early summer as is the reproduction of native cottonwoods. When bare ground is colonized late in summer by saltcedar, it will not be bare in the spring when cottonwoods are sending out seeds. Both Russian olive and Siberian elm can sprout in shaded areas, under the canopy of the cottonwoods, and are becoming very common in the bosque.

Fires in the bosque are much more common today than in previous centuries. Human-caused fires from factors such as fireworks destroy many acres of the bosque each year. Cottonwoods can survive low- to moderate-severity fires and can re-sprout after high-severity fires, but survival of the aboveground tree tends to be low after high-severity fires. Although the sprouts can grow quickly, it takes some time before they are able to produce seed. Both saltcedar and Russian olive can re-sprout after fires, while aboveground parts of the plants tend to be killed. These species often reestablish after fires more quickly than cottonwoods with seeds coming from plants either close to or upstream from the burned site. Their ability to produce seeds for a longer period than do cottonwoods makes it even more likely that they will reestablish following a summer fire. Also, saltcedar that survive a fire can increase flowering and seed production, again giving this species an advantage in reestablishment over cottonwoods.

Cavity-nesting birds (such as nuthatches, chickadees, and woodpeckers) are an important part of the bosque ecosystem. They use the large cottonwoods to build their nests, but they have not been seen nesting in saltcedar or Russian olive. These introduced trees do not provide suitable cavities for nests. If the number of native trees in the Rio Grande bosque continues to decline while introduced tree species increase, we may see a change in some of the wildlife along our river corridor.

However, attitudes toward these introduced plant species have shifted somewhat among resources managers. Although the goal was once to eliminate non-native plants, it is now understood that a return to conditions in pre-exotic ecosystems is impossible. In many areas, keeping some non-native plants may be necessary to provide habitat for native animals. For example, saltcedar can alter the soil and prevent native plants from growing, even after the saltcedar is removed. In such cases, it is better for birds and other wildlife to have saltcedar than a field of weedy, herbaceous plants, and many native animals will use the saltcedar habitats. There are still efforts to control these introduced plants, but also an acceptance that they will remain part of the riparian ecosystem into the future.



Introduced Fauna

Arthropods

The **isopods**, commonly called pillbugs (*Armadillidium vulgare*) and woodlice (*Porcellio laevis*), were brought to this continent in the holds of ships. Ships carried dirt as ballast on their trips to North America but then dumped the soil to load cargo bound for Europe. Isopods spread from these deposits. In the Rio Grande Valley, the isopod has become the major **detritivore** (eater of dead plant material). **Field crickets** (*Gryllus* sp.) filled this role before, but are now reduced in numbers. Crickets do well in areas that receive spring flooding, but isopods tend to be more numerous in drier sites.

A Tale of Two Exotics

The extensive spread of **tamarisk** (saltcedar) has led resource managers to try a variety of techniques to control this invader, including herbicides and mechanical removal, which have proven difficult and labor intensive. Although it is highly flammable, tamarisk also recovers quickly after fire. Where the plant grows aggressively, it dramatically alters the local habitat, impacting native plants and animals. In the mid-1980s, a search for a biological control agent began. Ultimately, four species of Old World *Diorhabda* beetles were selected to fill this role. The U.S. Department of Agriculture (USDA) launched the **tamarisk beetle program** in 2001, with beetles released at ten different sites in the western US. The beetles are specific to tamarisk trees, so they do not threaten native plants. The larvae can rapidly defoliate a tree, though they don't tend to kill the plants initially. Still, with multiple generations of beetles produced in one growing season, they can greatly reduce tamarisk cover, up to 50-90% in some places. The goal is not to completely eliminate tamarisk, but to reduce its impact enough that native plants can recover. Reduction in live tamarisk has been successful. However, in some places, it may be too successful. Some populations of Southwestern Willow Flycatcher, including some in New Mexico, nest in tamarisk thickets, particularly where native vegetation has been completely displaced. With concern for the flycatcher as the impact of tamarisk beetles spread, the USDA ended the program in 2010. The beetles were not expected to move south, where it was thought that warmer weather would limit their survival. The beetles have expanded their range, however, including into the Middle Rio Grande Valley by 2012 where they, and their host plants, are likely to remain a part of western riparian ecosystems into the future.

Fish

The installation of Cochiti Dam has changed the temperature and the amount of water released downstream throughout the year. These modified conditions change the species of fish able to survive in the reach below the dam and, in some cases, favor non-natives. Non-native fishes have been introduced to the Middle Rio Grande both accidentally and by intentional New Mexico Department of Game and Fish stocking programs. There has been a corresponding reduction in the numbers and distribution of native fishes as the new species compete for food or prey directly on native species. One such species is the **brown trout** (*Salmo trutta*),



which is native to Europe. Brown trout now reproduce naturally in many of New Mexico's streams and rivers, and these non-native fish prey upon our native trout, including the **Rio Grande cutthroat** (*Oncorhynchus clarki virginalis*). In some cases, an introduced relative is hybridizing with the native species. For example, the native **Pecos pupfish** (*Cyprinodon pecosensis*) is listed as threatened and a Species of Greatest Conservation Need by the state. The biggest threat to this species is hybridization with the non-native **sheepshead minnow** (*Cyprinodon variegatus*). While the **western mosquitofish** (*Gambusia affinis*) is native in some parts of the Rio Grande and other streams in New Mexico, mosquitofish have been introduced to control mosquitoes in the Middle Rio Grande Valley, as some eat mosquito larvae. This competitive and aggressive species is actually distributed by the City of Albuquerque for mosquito control. Never release mosquitofish, or any other pet fish, into the wild as they threaten our native aquatic ecosystems!

Amphibians

Although native to the eastern U.S., it is unknown whether **bullfrogs** (*Lithobates catesbeiana*) are native to New Mexico. They were introduced throughout the west, probably including part of New Mexico, to provide a source of frog legs for people to eat, and this is likely how they got into the Middle Rio Grande. Bullfrogs are large frogs that eat almost anything they can capture and swallow, even ducklings! They are known for eating other frogs and have been blamed for the decline of several species. The Northern leopard frog may have declined in part due to predation by bullfrogs.

Reptiles

Native to the Pecos and Canadian river drainages, the **red-eared slider** (*Trachemys scripta*) has been introduced to the Rio Grande. This is the common, aquatic pet turtle species, that has been released by short-sighted pet owners. The red-eared slider can hybridize with the **Big Bend slider** (*Trachemys gaigeae*), that is native to the Rio Grande and considered a Species of Greatest Conservation Need in New Mexico. Big Bend sliders have a very limited range in New Mexico, occurring only from Bosque del Apache National Wildlife Refuge south to Caballo Lake, although they also occur in Texas and Mexico. Hybridization threatens the persistence of this species. Never release pet turtles into the wild!

Birds

European Starlings (*Sturnus vulgaris*) were introduced into Central Park, New York City in 1890; by 1952 they were found across the United States. They primarily eat insects but also eat seeds and scavenge garbage. They nest in cavities and so compete directly with native, cavity-nesting birds. Starlings nest early in the year and are very aggressive about claiming nest holes. They may even evict the large woodpeckers that excavated the hole! Many species of birds are now reduced in numbers due in part to competition from starlings.

House Sparrows (*Passer domesticus*) were introduced to Brooklyn, New York, in the early 1850s and subsequently to various cities across the United States. They had spread throughout the country by the early 1900s. They live in and around buildings, close to humans. Like starlings, House Sparrows start nesting earlier in the year than native birds and claim prime nesting habitat (they nest in cavities but



can also build a bulky nest in dense vegetation). They may even appropriate nests of other birds, killing eggs and nestlings if occupied. House Sparrows tend to have several broods a year.

Rock Pigeons (*Columba livia*), also known as Rock Doves, are common and widespread, particularly around towns and cities, though they also make use of riparian woodlands. They compete with native species for habitat and forage. The **Eurasian Collared-Dove** (*Streptopelia decaocto*) is a more recent immigrant but is increasing in abundance and spreading. Like the pigeon, it may negatively affect native species as it competes for habitat and forage.

Mammals

House mice (*Mus musculus*) move along with humans into an area. They have large numbers of young that can reproduce when only two months old. Although they are not common in bosque sites away from the city, in the Albuquerque bosque they are often captured in areas of dense vegetation, especially near water. They do not tend to be in areas of mature cottonwoods. With more human development in or near the bosque, and a shift in vegetation, house mice will likely spread into more areas. The **Norway rat** (*Rattus norvegicus*) was also introduced to the valley and is found in agricultural areas, but is not very common in the bosque. Although these non-native rodents can cause problems, note that when poisoning rodents the poison can be passed up the food chain and will affect other, possibly native bosque species. Don't poison our native animals!

Feral cats (*Felis catus*), and pet cats allowed to wander outdoors, eat native rodents, birds, lizards and amphibians. Studies estimate that free-ranging domestic cats in the US kill 1.3 – 4.0 billion birds and 6.3 – 22.3 billion small mammals every year! Keep your cats indoors to protect wildlife!

Feral dogs (*Canis lupus familiaris*) often roam in packs and also eat many native animal species. They can easily kill ground-nesting birds such as ducks and geese or destroy their nests and eggs. Feral dogs can also threaten people and their pets. Never release puppies or dogs into the wild!

SUMMARY

Introduced and non-native species have had, and continue to have, a great impact on the native plants and animals of the Middle Rio Grande bosque. Many of these introductions happened years ago. The people releasing the animals or bringing in the plants did not know the effects they would have. It is with hindsight that we wish some of these species had not been brought here. Today, we should not repeat the mistakes of the past. Do not release unwanted pets into the bosque or any river, drain, or ditch. An unwanted kitten or puppy should be taken to Animal Control or the Humane Society. Don't vacation in another state or go to a local pet store and bring home an animal, such as a turtle, for a pet, then let it go in the bosque when you can't take care of it any more. There are also strict rules about collecting wild animals or moving them between states; you don't want to break the law! We have a rich and diverse population of plants and animals particularly adapted to the Middle Rio Grande Valley. We should work hard at learning about the natural ecosystem and keeping our native species abundant and healthy.