

AUDUBON ARIZONA'S

# RIVER PATHWAYS



# RIVER PATHWAYS

Audubon Arizona, the Bureau of Land Management, the Phoenix Union High School District and Phoenix College have teamed up to provide high school students with a clear path to ecological understanding, stewardship, and careers in land and resource management. The River Pathways program introduces students to Arizona's amazing riparian areas through roughly one week of hands-on classroom activities, followed by a field trip to the Rio Salado Audubon Center and opportunities to take part in actual monitoring efforts being undertaken by the Bureau of Land Management on the Agua Fria National Monument. Interested students will also receive information about resource management career opportunities and will be counseled regarding the training and education necessary to pursue professions in environmental sciences. Most importantly, students from highly urbanized areas will be able to experience nature in a way that they otherwise may not have a chance to do. It is experiences like these that will enable these students to become the future stewards of the environment that our world so greatly needs.

 Audubon ARIZONA



## Acknowledgments

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River Pathways Authors:

- Steven Prager, Teacher/Naturalist, Audubon Arizona
- Cathy Wise, Education Director, Audubon Arizona
- Vashti “Tice” Supplee, Director of Bird Conservation, Audubon Arizona

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- Kent Scribner, Superintendent, Phoenix Union High School District
- Russ Shaffer, Science Curriculum Coordinator, Phoenix Union High School District
- Phoenix College
- The Desert Botanical Garden

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## Teacher Contributions

Throughout the development of the River Pathways curriculum and during the 2011 pilot program, many teachers offered Audubon Arizona staff materials that they had developed and thought aligned well with the subject and activities. Audubon Arizona appreciates the generosity of so many participants, and wants to be sure that these materials are available to interested teachers who wish to enrich their students' River Pathways experience.

These enrichment materials, which include everything from research projects to in-class labs, can be found on the Audubon Arizona website: [http://az.audubon.org/Education\\_RiverPathways.html](http://az.audubon.org/Education_RiverPathways.html).

Audubon Arizona invites you to share your great ideas. If you have instructional materials that support the River Pathways curriculum, and you are interested in sharing them with other teachers, please contact Steven Prager at [sprager@audubon.org](mailto:sprager@audubon.org).

**THANK YOU!**

**Botanical Illustrators**

Susan Ashton  
Marsha Bennett  
Sally Boyle  
Katherine Callingham  
Lynne Davis  
Karen Gengle  
Molly Gill  
Gabriele Henn  
Wendy Hodgson, Project Coordinator  
Elaine Hultgren  
Jo Ann Loza  
Joyce Peters  
Deborah Ravin  
Lynn Reves  
Gillian Rice  
Daniela Siroky  
Sandy Turico  
Marceline VandeWater  
Gigi Wilson

**Zoological Illustrator**

Zackery Zdinak, Life Drawing & Education

# RIVER PATHWAYS

## River Pathways Standards (High School) Arizona State Standards

### Module 1 Introduction to Riparian Areas

#### Strand 2 History and Nature of Science

##### Concept 1 History of Science as a Human Endeavor

- PO1 Describe how human curiosity and needs have influenced science, impacting the quality of life worldwide

#### Strand 3 Science in Personal and Social Perspectives

##### Concept 1 Changes in Environments

- PO1 Evaluate how the processes of natural ecosystems affect, and are affected by, humans
- PO2 Describe the environmental effects of the following natural and/or human-caused hazards: flooding drought, earthquakes, fires, pollution, extreme weather
- PO5 Evaluate the effectiveness of conservation practices and preservation techniques or environmental quality and biodiversity

##### Concept 2 Science and Technology in Society

- PO4 Analyze the use of renewable and nonrenewable resources in Arizona: water, land, soil, minerals, air
- PO5 Evaluate methods used to manage resources

#### Strand 6 Earth and Space Science

##### Concept 1 Geochemical Cycles

- PO5 Describe factors that impact current and future water quantity and quality including surface, ground and local water issues

### Module 2 Riparian Plants

#### Strand 1 Inquiry Process

##### Concept 2 Scientific Testing

- PO5 Record observations, notes, sketches, questions, and ideas using tools such as journals, charts, graphs and computers

# RIVER PATHWAYS

## River Pathways Standards (High School) Arizona State Standards

### Module 3 Riparian Animals

#### Strand 4 Life Science

##### Concept 3 Interdependence of Organisms

- PO1 Identify the relationships among organisms within populations, communities, ecosystems and biomes
- PO2 Describe how organisms are influenced by a particular combination of biotic and abiotic factors in an environment

##### Concept 4 Biological Evolution

- PO4 Predict how a change in an environment can affect the number and diversity of species in an ecosystem

##### Concept 5 Matter, Energy and Organization of Living Systems (Including Human Systems)

- PO5 Describe the levels of organization of living things from cells, through tissues, organs, organ systems, organisms, populations, and communities to ecosystems

### Module 4 Multiple Use

#### Strand 3 Science in Personal and Social Perspectives

##### Concept 1 Changes in environments

- PO1 Evaluate how the processes of natural ecosystems affect, and are affected by, humans
- PO2 Describe the environmental effects of the following natural and/or human-caused hazards: flooding, drought, earthquakes, fires, pollution, extreme weather
- PO3 Assess how human activities can affect the potential for hazards

### Module 5 Riparian Birds

#### Strand 1 Inquiry Process

##### Concept 2 Scientific Testing

- PO5 Record observations, notes, sketches, questions, and ideas using tools such as journals, charts, graphs and computers

# RIVER PATHWAYS

## River Pathways Standards (High School) Next Generation Science Standards

### Module 1 Introduction to Riparian Areas

- HS-LS2 Ecosystems: Interactions, Energy and Dynamics
- HS-LS2-7 Design, evaluate and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- HS-LS2-8 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce
- HS-ESS3 Earth and Human Activity
- HS-ESS3-1 Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- HS-ESS3-3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations and biodiversity.
- HS-ESS3-6 Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

### Module 2 Riparian Plants

N/A

### Module 3 Riparian Animals

- HS-LS2 Ecosystems: Interactions, Energy and Dynamics.
- HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- HS-LS2-6 Evaluate the claims, evidence and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
- HS-LS2-8 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce

### Module 4 Multiple Use

- HS-LS2 Ecosystems: Interactions, Energy and Dynamics
- HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- HS-LS2-6 Evaluate the claims, evidence and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
- HS-LS2-7 Design, evaluate and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- HS-LS2-8 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce

### Module 5 Riparian Birds

N/A



# RIVER PATHWAYS

## River Pathways Standards (Middle School) Arizona State Standards

### GRADE 6

#### Module 1 Introduction to Riparian Areas

##### Strand 3 Science in Personal and Social Perspectives

###### Concept 1

- PO2 Describe how people plan for, and respond to, the following natural disasters: drought, flood, tornadoes

##### Strand 4 Life Science

###### Concept 3 Populations of Organisms in an Ecosystem

- PO2 Describe how the following environmental conditions affect the quality of life: water quality, climate, population density, smog

##### Strand 6 Earth and Space Science

###### Concept 1 Structure of the Earth

- PO2 Explain the composition, properties, and structure of Earth's lakes and rivers
- PO5 Describe ways scientists explore the Earth's atmosphere and bodies of water

#### Module 2 Riparian Plants

##### Strand 1 Inquiry Process

###### Concept 2 Scientific Testing

- PO5 Record observations, notes, sketches, questions, and ideas using tools such as written and/or computer logs

#### Module 3 Riparian Animals

##### Strand 1 Inquiry Process

###### Concept 3 Analysis and Conclusions

- PO2 Form a logical argument about a correlation between variables or sequence of events
- PO3 Evaluate the observations and data reported by others

# RIVER PATHWAYS

## River Pathways Standards (Middle School) Arizona State Standards

### Module 4 Multiple Use

#### Strand 1 Inquiry Process

##### Concept 3 Analysis and Conclusions

- PO2 Form a logical argument about a correlation between variables or sequence of events

#### Strand 3 Science in Personal and Social Perspectives

##### Concept 1

- PO2 Describe how people plan for, and respond to, the following natural disasters: drought, flood, tornadoes

#### Strand 4 Life Science

##### Concept 3 Populations of Organisms in an Ecosystem

- PO2 Describe how the following environmental conditions affect the quality of life: water quality, climate, population density, smog

#### Strand 6 Earth and Space Science

##### Concept 1 Structure of the Earth

- PO5 Describe ways scientists explore the Earth's atmosphere and bodies of water

### Module 5 Riparian Birds

#### Strand 1 Inquiry Process

##### Concept 2 Scientific Testing

- PO5 Record observations, notes, sketches, questions, and ideas using tools such as written and/or computer logs

# RIVER PATHWAYS

## River Pathways Standards (Middle School) Arizona State Standards

### GRADE 7

#### Module 1 Introduction to Riparian Areas

##### Strand 3 Science in Personal and Social Perspectives

###### Concept 1 Changes in Environments

- **PO1** Analyze environmental risks (e.g., pollution, destruction of habitat) caused by human interaction with biological or geological systems
- **PO2** Analyze environmental benefits of the following human interactions with biological or geological systems: reforestation, habitat restoration, construction of dams
- **PO3** Propose possible solutions to address the environmental risks in biological or geological systems

##### Strand 4 Life Science

###### Concept 3 Populations of Organisms in an Ecosystem

- **PO4** Evaluate data related to problems associated with population growth (e.g, overgrazing, forest management, invasion of non-native species) and the possible solutions
- **PO5** Predict how environmental factors (e.g., floods, droughts, temperature changes) affect the survival rates in living organisms

##### Strand 6 Earth and Space Science

###### Concept 1 Structures of the Earth

- **PO3** Explain the processes involved in the formation of the Earth's structure: erosion, deposition, plate tectonics, volcanism

#### Module 2 Riparian Plants

##### Strand 1 Inquiry Process

###### Concept 2 Scientific Testing

- **PO5** Record observations, notes, sketches, questions, and ideas using tools such as written and/or computer logs

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## River Pathways Standards (Middle School) Arizona State Standards

### Module 3 Riparian Animals

#### Strand I Inquiry Process

##### Concept 3 Analysis and Conclusions

- PO2 Form a logical argument about a correlation between variables or sequence of events

#### Strand 4 Life Science

##### Concept 3 Populations of Organisms in an Ecosystem

- PO1 Compare food chains in a specified ecosystem and their corresponding food web
- PO2 Explain how organisms obtain and use resources to develop and thrive in: niches, predatory/prey relationships
- PO3 Analyze the interactions of living organisms within their ecosystems: limiting factors, carrying capacity
- PO4 Evaluate data related to problems associated with population growth (e.g, overgrazing, forest management, invasion of non-native species) and the possible solutions
- PO5 Predict how environmental factors (e.g., floods, droughts, temperature changes) affect the survival rates in living organisms

### Module 4 Multiple Use

#### Strand 3 Science in Personal and Social Perspectives

##### Concept 1 Changes in Environments

- PO1 Analyze environmental risks (e.g., pollution, destruction of habitat) caused by human interaction with biological or geological systems
- PO2 Analyze environmental benefits of the following human interactions with biological or geological systems: reforestation, habitat restoration, construction of dams
- PO3 Propose possible solutions to address the environmental risks in biological or geological systems

#### Strand 4 Life Science

##### Concept 3 Populations of Organisms in an Ecosystem

- PO4 Evaluate data related to problems associated with population growth (e.g, overgrazing, forest management, invasion of non-native species) and the possible solutions
- PO5 Predict how environmental factors (e.g., floods, droughts, temperature changes) affect the survival rates in living organisms

### Module 5 Riparian Birds

#### Strand I Inquiry Process

##### Concept 2 Scientific Testing

- PO5 Record observations, notes, sketches, questions, and ideas using tools such as written and/or

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## River Pathways Standards (Middle School) Arizona State Standards

### GRADE 8

#### Module 1 Introduction to Riparian Areas

##### Strand 2 History and Nature of Science

###### Concept 1 History of Science as a Human Endeavor

- PO4 Evaluate career opportunities related to life and physical sciences

##### Strand 3 Science in Personal and Social Perspectives

###### Concept 1 Changes in Environments

- PO1 Analyze the risk factors associated with natural, human induced, and/or biological hazards, and the environment
- PO2 Analyze possible solutions to address the environmental risks associated with chemicals and biological systems

#### Module 2 Riparian Plants

##### Strand 1 Inquiry Process

###### Concept 2 Scientific Testing

- PO5 Record observations, notes, sketches, questions, and ideas using tools such as written and/or computer logs

#### Module 3 Riparian Animals

##### Strand 1 Inquiry Process

###### Concept 3 Analysis and Conclusions

- PO2 Form a logical argument about a correlation between variables or sequence of events

##### Strand 3 Science in Personal and Social Perspectives

###### Concept 1 Changes in Environments

- PO1 Analyze the risk factors associated with natural, human induced, and/or biological hazards, and the environment
- PO2 Analyze possible solutions to address the environmental risks associated with chemicals and biological systems

##### Strand 4 Life Science

###### Concept 4 Diversity, Adaptation, and Behavior

- PO1 Explain how an organism's behavior allows it to survive in an environment
- PO4 Compare symbiotic and competitive relationships in organisms within an ecosystem

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## River Pathways Standards (Middle School) Arizona State Standards

### Module 4 Multiple Use

#### Strand 2 History and Nature of Science

##### Concept 1 History of Science as a Human Endeavor

- PO4 Evaluate career opportunities related to life and physical sciences

#### Strand 3 Science in Personal and Social Perspectives

##### Concept 1 Changes in Environments

- PO1 Analyze the risk factors associated with natural, human induced, and/or biological hazards, and the environment
- PO2 Analyze possible solutions to address the environmental risks associated with chemicals and biological systems

### Module 5 Riparian Birds

#### Strand 1 Inquiry Process

##### Concept 2 Scientific Testing

- PO5 Record observations, notes, sketches, questions, and ideas using tools such as written and/or computer logs

## River Pathways Standards (Middle School) Next Generation Science Standards

### Module 1 Introduction to Riparian Areas

#### MS-LS2 Ecosystems: Interactions, Energy and Dynamics

- MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems
- MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations
- MS-ESS3 Earth and Human Activity
- MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

### Module 2 Riparian Plants

N/A

### Module 3 Riparian Animals

- MS-LS2 Ecosystems: Interactions, Energy and Dynamics
- MS-LS2-1 Analyze and Interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem
- MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems
- MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations

### Module 4 Multiple Use

- MS-LS2 Ecosystems: Interactions, Energy and Dynamics
- MS-LS2-1 Analyze and Interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem
- MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems
- MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations
- MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services

### Module 5 Riparian Birds

N/A

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## MODULE I: An Introduction to Riparian Areas

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## MODULE I: An Introduction to Riparian Areas

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\*PowerPoint and video presentations are available as a DVD from Audubon Arizona, or online at [http://az.audubon.org/Education\\_RiverPathways-Curriculum.html](http://az.audubon.org/Education_RiverPathways-Curriculum.html).

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Teacher Instructions

Module I provides students with the foundation for the River Pathways curriculum, including introductory lessons, activities, and field experiences.

Students will be introduced to riparian areas and learn that these areas are valuable and extremely important to both wildlife and humans, especially in the desert.

Students will also learn about many of the threats to riparian areas and that scientific monitoring can help protect and restore them. Finally, they will learn how the need for monitoring can offer future careers in resource management, enabling young people to become the future stewards of our desert rivers.

#### Materials:

1. River Pathways Introductory Video
2. Introduction to Riparian Areas PowerPoint
3. Student Reading: Introduction to Riparian Areas
4. Student Activity Sheet: Introduction to Riparian Areas
5. Answer Key: Introduction to Riparian Areas
6. Animal Homework Research Thread Materials

#### Before the lesson:

1. Print copies of the reading and activity sheets for your students

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Teacher Instructions

#### Introduce the Lesson:

1. Show the Introductory Video.
2. Introduce the River Pathways curriculum. Tell the students over the next several days, they'll be learning about riparian environments in the desert and how important they are to animals and people.
3. Ask students to tell you what they think it means to be a riparian area.
4. Show the "Introduction to Riparian Areas" PowerPoint presentation.
5. Distribute "An Introduction to Riparian Areas" reading and the worksheet to the class. Ask them to use the reading to help them complete the activity.
6. When students have finished the activity, use the answer key to check their work.

Continue Module 1 by Introducing the "Animal Homework Research Thread"  
Instructions and materials are found on page 12.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Introduction to Riparian Areas Reading

**Riparian** Relating to or living or located on the bank of a natural watercourse (such as a river) or sometimes of a lake or tidewater *Merriam-Webster Dictionary (online)*

Riparian areas are “ribbons of life.” They are considered the most productive habitats in North America. In the arid western United States, riparian areas occupy less than 2% of the total land area. In Arizona, experts estimate that riparian areas make up only 0.4% of the total land area.

1. Although riparian habitats make up such a small part of the total ecosystem, they serve many ecological functions provide and provide many valuable uses. Their role is disproportionate to their size.
  
2. While ecological functions and values may appear to be the same, in fact, they are not synonymous.
  - **Functions** are the ecological, hydrological, or other processes that maintain the ecosystem
  - **Value** is the worth, desirability, or usefulness of a resource.
    - The individual that utilizes the resource defines its value. **Value can change over time while functions are constant.**
  
3. Riparian areas offer several important ecological functions:
  - They provide habitat to fish and wildlife.
  - They filter and retain upland sediment.
  - They stabilize streambanks and allow for the build up of new streambanks.
  - They increase water storage in subsurface aquifers.
  - They reduce floodwater runoff.



*Figure 1: Unstable streambank (left) and stable streambank (right). One important function of riparian habitats is to maintain streambank stability.*

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Introduction to Riparian Areas Reading

4. Riparian areas have many significant values:
- They increase drinkable water quality and quantity by reducing nonpoint source pollutants, which are pollutants that cannot be traced back to single sources.
  - They provide habitat for 70% of the **threatened and endangered** vertebrates in Arizona! This makes riparian areas a high conservation priority for legislation like the Endangered Species Act of 1973 (amended in 1988) which aims to conserve and monitor all threatened and endangered species.



*Figure 2: Endangered species: Gila trout (left) and Southwestern willow flycatcher (right)  
Photos courtesy of the AZ Game and Fish Department*

- They provide ranchers with important resources for livestock production:
  - Water
  - Forage
  - Shade



*Figure 3: Sheep and cows can graze riparian areas.*

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

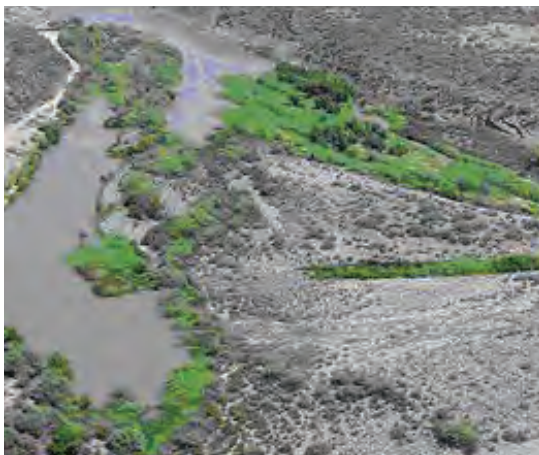
#### Introduction to Riparian Areas Reading

- They provide areas for popular recreational activities such as hiking, horseback riding, cycling, fishing, hunting, swimming, rafting, boating, canoeing, bird & wildlife watching, picnicking, camping and off-road vehicle use.
- They reduce the impacts of seasonal flooding

#### Future of Riparian Areas in Arizona

Why manage riparian areas?

- Countless people find value in riparian areas and even more benefit from their functions. Therefore, these areas are a monitoring priority for land managers. However, since individuals tend to have differing opinions about which values and functions are most important, and since many uses can conflict with one another, managing these areas has the potential for creating conflict.



*Figure 4: Aerial view of the Verde River riparian area.*

- Experts estimate that 70-90% of riparian areas in the United States have been altered by human activities including construction of dams, agriculture, and urbanization.
- Riparian areas have been and will continue to be a valued commodity for many different uses.
- The significant increase in urban population compared to rural population is a very important trend when thinking about Arizona's riparian areas.
  - As Arizona's urban population increases, there will also be a significant increase in environmental and recreation-oriented values for riparian areas.
  - While rural communities share many values with urban communities, they also see these areas as an important resource for community economic development. For example, many communities depend on raising livestock as their main source of income.

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Introduction to Riparian Areas Reading

- Restoration of riparian areas should be a national goal.
  - Monitoring is essential for successful and effective conservation in riparian areas, especially in arid and semi-arid regions.
  - Conservation is impossible without accurate data that reveals the quality and quantity of remaining riparian habitat.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Introduction to Riparian Areas Worksheet

Name \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

Use the information you've learned in the PowerPoint and reading to complete the sentences below. You may refer to the handout.

1. Riparian areas make up only [ ] % of Arizona's total land area. Their role is [ ] to their size, particularly in the semi-arid regions of North America. This is mainly due to the many [ ] and [ ] of riparian areas.
2. While ecological functions and value may appear to be the same, in fact, they are not [ ]. [ ] can change through time while [ ] are constant.
3. Some of the most important functions of riparian areas are [ ] and [ ] habitat, [ ] and [ ] of upland sediment, increased [ ] in subsurface aquifers, and reduced [ ].
4. The most important values of riparian areas today are increasing [ ] and [ ] of drinking water, providing habitat for [ ] species, providing resources for [ ] production, and providing areas for popular [ ] activities.
5. Since individuals tend to have differing opinions about which values and functions are most important, and since many uses can conflict with one another, [ ] these areas has the potential for creating [ ].



RIVER PATHWAYS  
Module I: An Introduction to Riparian Areas



Introduction to Riparian Areas Worksheet

Name \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

6.  is essential for successful and effective conservation in riparian areas, especially in arid and semi-arid regions.
  
7. The significant increase in  population compared to  population is a very important trend when thinking about Arizona's riparian areas.
  
8.  is impossible without accurate data that reveals the quality and quantity of remaining riparian habitat.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Introduction to Riparian Areas Answer Key

#### Answer Key

1. Riparian areas make up only  % of Arizona's total land area. Their role is  to their size, particularly in the semi-arid regions of North America. This is mainly due to the many  and  of riparian areas.
2. While ecological functions and value may appear to be the same, in fact, they are not .  can change through time while  are constant.
3. Some of the most important functions of riparian areas are  and  habitat,  and  of upland sediment, increased  in subsurface aquifers, and reduced .
4. The most important values of riparian areas today are increasing  and  of drinking water, providing habitat for  species, providing resources for  production, and providing areas for popular  activities.
5. Since individuals tend to have differing opinions about which values and functions are most important, and since many uses can conflict with one another,  these areas has the potential for creating .

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Introduction to Riparian Areas Answer Key

6.  is essential for successful and effective conservation in riparian areas, especially in arid and semi-arid regions.
7. The significant increase in  population compared to  population is a very important trend when thinking about Arizona's riparian areas.
8.  is impossible without accurate data that reveals the quality and quantity of remaining riparian habitat.

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Animal Homework Research Thread

#### Teacher Instructions

The Animal Homework Research thread is designed to do more than introduce students to Arizona's riparian wildlife. It will also develop their conviction that these areas must be conserved. By connecting the plight of riparian areas to the well-being of riparian animals, students will become aware of the true value of these areas.

#### Arizona Science Standards:

- Science Strand 3: Concept 1 - PO 1 & 3
- Science Strand 4: Concept 3 - PO 1
- Science Strand 4: Concept 4 - PO 4

#### The Animal Homework Research will:

- Familiarize students with common riparian animals of Arizona.
- Introduce and emphasize the many types of relationships that occur between organisms such as predator/prey, introduced species/native species, competition, and parasitism.
- Introduce and highlight the value of certain organisms as predators or keystone species.
- Introduce and emphasize the importance of streamside vegetation to riparian organisms.
- Highlight the need for scientific monitoring in riparian areas.

#### Materials:

1. (30) Animal Worksheets
2. (30) Animal Worksheet Answer Sheets
3. Animal Group Worksheets (see Module 3)
  - If there are not enough (30) students to complete all of the Animal worksheets, hand out the worksheets in the order designated by the groups in the Animal Group Worksheets (module 3). This will ensure there will be complete groups for the Module 3 group activity.
4. Animal Homework Background Information (optional)

## RIVER PATHWAYS

### Module 1: An Introduction to Riparian Areas

#### Animal Homework Research Thread Teacher Instructions

##### Before the lesson:

1. Make copies of the Animal Worksheets and Animal Worksheet Answer Sheets for your students.
2. If your students will not have easy access to the Internet in order to complete the required research, make copies of the Animal Homework Background Information packet for each student.

##### Introduce the Homework Sequence

###### Module 1:

In class: After completing the activities in Module 1, Introduce the assignment.  
Distribute the Animal Worksheets (and information packets if necessary).

Tell the students to research their organisms on their own, and fill out their worksheets. The information that they need to complete the worksheet can be found at:

- a. [www.desertusa.com](http://www.desertusa.com)
- b. [www.desertmuseum.org](http://www.desertmuseum.org)
- c. [www.azgfd.gov](http://www.azgfd.gov)

The homework is due prior to Module 3.

###### Module 2:

In class: No activity

Homework: Complete the Animal Worksheets. The assignment is due on \_\_\_\_\_.

###### Module 3:

In class:

Students must have completed their Animal Worksheets in order to participate in the Module 3 classroom activity.

Before beginning the next activity, collect the students' Animal Worksheets and correct them using the key provided OR go over the answers in class.

RIVER PATHWAYS  
Module I: An Introduction to Riparian Areas  
Animal Homework Research Thread Worksheet

Name \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

Yellow-billed cuckoo

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. Your animal has specific breeding requirements that include where it must breed and what plants must be present. Describe these requirements.
5. What does your animal eat? Where/how does it search for this food source?
6. What are your animal's main predators? What are its main competitors?



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Zone-tailed Hawk

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. How can you tell your animal apart from a turkey vulture? How can you tell it apart from a common black-hawk?
4. Where does your animal live? Does it have any specific habitat requirements?
5. What does your animal eat? Where/how does it search for this food source?
6. What are your animal's main predators? What are its main competitors?



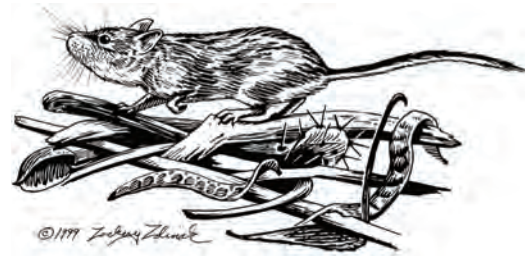
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White-throated Woodrat



1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. Your animal builds interesting nests that have earned them the nickname "packrats". Describe these nests.
5. What does your animal eat? Where/how does it search for this food source?
6. What are your animal's main predators? What are its main competitors?



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Lowland Leopard Frog

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal has greatly declined in number in Arizona. What factors led to this decline?



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Green Sunfish

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal is an introduced species in Arizona. How did it get here? Has it caused any problems since its arrival?



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Arizona Black Rattlesnake

1. What is your animal's scientific name?

2. What does your animal look like? Be sure to note features that make your animal different from similar species.



3. Your animal changes dramatically in appearance as it ages. Describe this change.

4. Where does your animal live? Does it have any specific habitat requirements?

5. What does your animal eat? Where/how does it search for this food source?

6. What are your animal's main predators? What are its main competitors?

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Round-tailed Ground Squirrel

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.



3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal has interesting social behaviors. Describe some of these.

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Yellow Warbler

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal is often visited by nest parasites (other birds who lay their eggs in the warbler's nest). What does your animal do in reaction to these eggs?



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Brown-headed Cowbird

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal has an interesting reproductive strategy. Explain this strategy.



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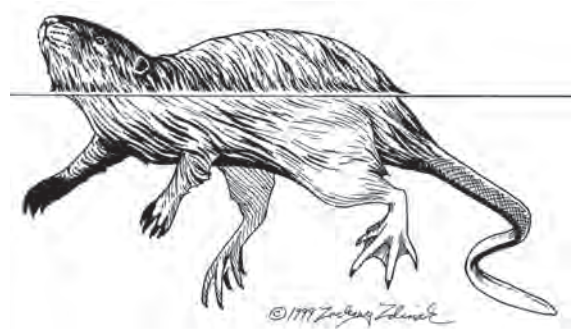
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Muskrat

1. What is your animal's scientific name?

2. What does your animal look like? Be sure to note features that make your animal different from similar species.



3. Where does your animal live? Does it have any specific habitat requirements?

4. What does your animal eat? Where/how does it search for this food source?

5. What are your animal's main predators? What are its main competitors?

6. Your animal is known for the interesting shelters it builds. Describe these shelters.

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Common Black-hawk

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. How can you tell your animal apart from a turkey vulture? How can you tell it apart from a zone-tailed hawk?
4. Where does your animal live? Does it have any specific habitat requirements?
5. What does your animal eat? Where/how does it search for this food source?
6. What are your animal's main predators? What are its main competitors?





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American Bullfrog

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal is an introduced species in Arizona. How did it get here? Has it caused any problems since its arrival?



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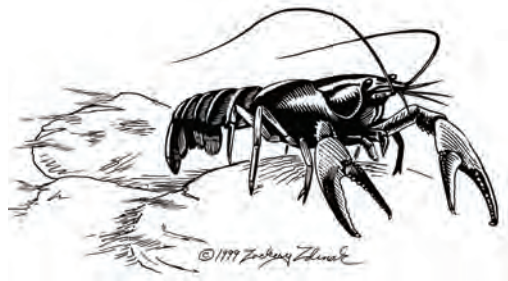
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Northern Crayfish

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal is an introduced species in Arizona. How did it get here? Has it caused any problems since its arrival?



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Gila Topminnow



1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal has greatly declined in number in Arizona. What factors led to this decline?

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Largemouth Bass

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal is an introduced species in Arizona. Why was it introduced? Has it caused any problems since its arrival?



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Merriam's Kangaroo Rat



1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal does not need to drink water to survive. How does it stay hydrated?

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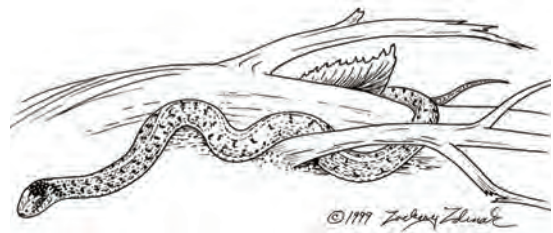
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Terrestrial Garter Snake



1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal is born in a way that is unusual for reptiles. Explain.

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Longfin Dace



1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal has greatly declined in number in Arizona despite some of its more remarkable adaptations. What are some of the adaptations that allow this fish to survive in Arizona and what factors led to this decline?

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Toe Biter

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. After mating, your animal does something interesting with its eggs. Describe this behavior.





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Red-spotted toad



1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. What does your animal do during the dry summer months?

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Beaver

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal is known for building dams. What impact do these dams have on the surrounding ecosystem?



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Sonora Sucker



1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. What are the main differences between your animal and a desert sucker? Consider both habitat and appearance.

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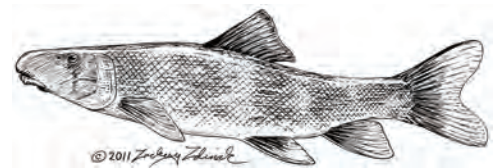
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Desert Sucker



1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. What are the main differences between your animal and a Sonora sucker? Consider habitat, diet, and appearance.

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Abert's Towhee

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal has a very restricted range. Where can it be found?



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Song Sparrow

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Where does your animal build its nest? What does its nest look like?



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Common Kingsnake

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. What adaptations make your animal good at hunting other snakes?



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Rock Squirrel



1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal is highly social. Describe a typical colony of these animals.



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Desert Pupfish

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal has greatly declined in number in Arizona. What factors led to this decline?



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Canyon Treefrog

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Canyon treefrogs are often heard before they are seen. Describe the vocalizations of these frogs.



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Raccoon

1. What is your animal's scientific name?
2. What does your animal look like? Be sure to note features that make your animal different from similar species.
3. Where does your animal live? Does it have any specific habitat requirements?
4. What does your animal eat? Where/how does it search for this food source?
5. What are your animal's main predators? What are its main competitors?
6. Your animal has greatly increased in numbers and expanded their range. What factors have led to these increases?



# RIVER PATHWAYS

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### Animal Homework Research Thread Answer Key

#### Yellow-billed cuckoo

1. What is your animal's scientific name?

*Coccyzus americanus*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The yellow-billed cuckoo is a slender, medium sized bird with an overall length of about 30 centimeters. It is dull brown to black above and creamy white below. It has a long tail with large white spots along the edges and a curved beak that is yellow on the top and black on the bottom.



3. Where does your animal live? Does it have any specific habitat requirements?

This bird lives in open woodlands with dense, scrubby vegetation and wide-open clearings, often near water. Each summer, the yellow-billed cuckoo travels from Mexico to breed in Arizona's riparian areas.

4. Your animal has specific breeding requirements that include where it must breed and what plants must be present. Describe these requirements.

During breeding season, this bird depends on riparian areas and the cottonwood and willow trees they support. The yellow-billed cuckoo depends on these trees in which they build their nests and forage for food. This strong dependence on specific habitat requirements makes this bird particularly vulnerable to environmental change.

5. What does your animal eat? Where/how does it search for this food source?

Its preferred diet is cicadas, tent moth caterpillars, and sphinx moth caterpillars. It forages for these food resources in the canopies of mature riparian trees.

6. What are your animal's main predators? What are its main competitors?

During its stay in Arizona, the cuckoo must avoid raccoons and ravens that can eat its eggs and raptors that can feed on young birds. In addition, the cuckoo competes with birds and small mammals that prey on large insects.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Zone-tailed Hawk

1. What is your animal's scientific name?

*Buteo albonotatus*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The zone-tailed hawk is a medium-sized to large hawk with an overall length of over 50 centimeters and a wingspan of 1.2 meters. It is black overall with two or three contrasting white bands on the underside of the tail. The undersides of the wings are two-toned with dark linings and lighter flight feathers. The legs and skin on the face are yellow.



3. How can you tell your animal apart from a turkey vulture? How can you tell it apart from a common black-hawk?

The turkey vulture can be distinguished by the lack of white bands on the tail and its featherless, reddish head. The black hawk can be distinguished by its short tail, with only a single white band.

4. Where does your animal live? Does it have any specific habitat requirements?

This bird lives in arid, semi-open areas such as deciduous pine-oak woodlands. During the summer, it nests in Arizona's riparian areas. It builds its nest, in extremely tall, mature riparian trees and actively defends it from threats.

5. What does your animal eat? Where/how does it search for this food source?

The preferred prey of this hawk includes birds, small mammals, and lizards. It searches for this food resource while soaring over open ground.

6. What are your animal's main predators? What are its main competitors?

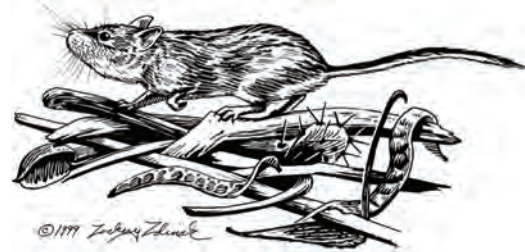
There is little predation on adult zone-tailed hawks. However, eggs and nestlings can be preyed upon by great-horned owls, jays, ravens, and large mammals. This bird competes with other raptors, mammals, and snakes for its preferred prey of birds, small mammals, and lizards.

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### Animal Homework Research Thread Answer Key

#### White-throated Woodrat



1. What is your animal's scientific name?

*Neotoma albigula*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The white-throated woodrat is a large rat that grows up to 27 centimeters in length, not including the length of the tail. It is grayish brown above and white underneath. It has white feet and throat and a long tail covered in short hairs.

3. Where does your animal live? Does it have any specific habitat requirements?

This rat is most common in Sonoran and Chihuahuan desert grassland and desert scrub habitats. It is often found in areas with creosote bush, cholla cactus, mesquite, prickly pear cactus, acacia, and palo verde trees. These plants provide the rat with its two most important habitat needs: cover and a food source with high water content. The white-throated woodrat can also live in riparian areas.

4. Your animal builds interesting nests that have earned them the nickname "packrats". Describe these nests.

These rats are often called packrats because of their nests. Nests are built with collected materials such as twigs and grass. Cholla cactus is used to line the entrance and upper chamber. Below the cactus-lined upper chamber is a second chamber lined with soft grasses; the rat uses this area as home and nursery. White-throated woodrats are notorious for gathering up just about anything to use in their nests. Many campers have stories about them sneaking into camp at night and stealing items that have been left by a campfire.

5. What does your animal eat? Where/how does it search for this food source?

At night, white-throated woodrats use their strong sense of smell and good vision to search for seeds, fruit, plants, beetles, and small reptiles. They focus on foods that have a high water content.

6. What are your animal's main predators? What are its main competitors?

These rats must avoid many predators, including mammals, raptors, and snakes while they compete with other mammals, birds, and insects.

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## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Lowland Leopard Frog

1. What is your animal's scientific name?

*Rana yavapaiensis*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.



The lowland leopard frog is a small frog, about 8 centimeters in length. It is light brown to green above and yellowish below. It has dark dorsal spots with no light outline. Typically there are no spots on the nose or in front of the eyes. The frog has a faint light stripe on its upper lip and a white band along its side that is interrupted near the lower back.

3. Where does your animal live? Does it have any specific habitat requirements?

Lowland leopard frogs stay close to water including ponds, lakes, and streams. They depend on dense streamside vegetation in which to hunt for food and hide from predators.

4. What does your animal eat? Where/how does it search for this food source?

Tadpoles eat aquatic vegetation while adults eat insects, fish, and smaller frogs. They hunt for this prey while hiding in streamside and submerged vegetation.

5. What are your animal's main predators? What are its main competitors?

Lowland leopard frogs are preyed upon by birds, fish, snakes, larger frogs and large mammals like raccoons and badgers.

6. Your animal has greatly declined in number in Arizona. What factors led to this decline?

Predation and competition has increased as species such as bullfrogs and green sunfish have been introduced into the lowland leopard frog's habitat. This pressure, along with loss of habitat and diseases brought in by non-native amphibians, has caused a significant decrease in lowland leopard frog populations.

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#### Animal Homework Research Thread Answer Key

##### Green Sunfish

1. What is your animal's scientific name?

*Lepomis cyanellus*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.



The green sunfish is a medium-sized fish that grows up to 20 centimeters in length. It has a dark green body with bluish green iridescent stripes along its face and sides. It has a large mouth, a dorsal fin with a spiny front and rounded back, and a large black spot behind the head and on both the dorsal and anal fins.

3. Where does your animal live? Does it have any specific habitat requirements?

The green sunfish occupies slow-moving water and is extremely tolerant of low water quality and murky conditions. It tends to hide around brush piles and submerged vegetation.

4. What does your animal eat? Where/how does it search for this food source?

Green sunfish aggressively hunt for smaller fish, frogs, and aquatic insects which they ambush by hiding in underwater vegetation and debris.

5. What are your animal's main predators? What are its main competitors?

Predators of the green sunfish include birds and larger fish. Competitors include all other fish, amphibians, crustaceans, and insects that forage for insects and small fish in slow moving murky water.

6. Your animal is an introduced species in Arizona. How did it get here? Has it caused any problems since its arrival?

Green sunfish were introduced into Arizona waters when anglers, using them as baitfish, released them. Since the time of introduction, they have seriously hurt populations of native fish such as Gila topminnow, Gila chub, and desert pupfish through competition and predation.



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#### Arizona Black Rattlesnake

1. What is your animal's scientific name?

*Crotalus cerberus*



2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The black rattlesnake is a medium-sized snake that grows over 1 meter in length. It has black blotches on a dark grey to black background, a slender neck, and triangular head. The base of its tongue is purple.

3. Your animal changes dramatically in appearance as it ages. Describe this change.

Juvenile snakes look dramatically different from adults. They are much lighter in color and have prominent brown blotches along their back. As juveniles age, they darken and the blotches fade. Some adults may appear entirely black with only faint, yellowish crossbars along their backs.

4. Where does your animal live? Does it have any specific habitat requirements?

The black rattlesnake is common in rocky drainages with perennial water. It requires dense vegetation in which to hunt and hide from predators.

5. What does your animal eat? Where/how does it search for this food source?

Preferred prey of the Arizona black rattlesnake includes birds, small mammals, and other reptiles which it waits for in ambush and then uses its strong venom to subdue..

6. What are your animal's main predators? What are its main competitors?

Predators of the Arizona black rattlesnake include hawks, eagles, roadrunners, and kingsnakes. They compete with carnivorous mammals, birds, and other snakes that share the same prey.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Round-tailed Ground Squirrel

1. What is your animal's scientific name?

*Spermophilus tereticaudus*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The round-tailed ground squirrel is a large squirrel growing up to 27 centimeters in length including the tail. It is a uniform sandy brown above and a lighter tan below. It has a long round tail with a black tip and furry hind feet. Round-tailed ground squirrels resemble prairie dogs in appearance.



3. Where does your animal live? Does it have any specific habitat requirements?

The round-tailed ground squirrel can live in a variety of habitats, but prefers open areas with abundant herbaceous vegetation. This provides them water and soft soil in which they can dig deep burrows.

4. What does your animal eat? Where/how does it search for this food source?

Similar to other small desert mammals, round-tailed ground squirrels primarily eat seeds, insects, and plants with high water content. They forage for these foods using their keen sense of smell.

5. What are your animal's main predators? What are its main competitors?

Predators include raptors, large mammals, and snakes. Competitors include mammals, birds, and insects that also forage on seeds and herbaceous plants.

6. Your animal has interesting social behaviors. Describe some of these.

Round-tailed ground squirrels are somewhat social. They live in loose colonies consisting of many individuals. They will warn others when danger is present, but will also defend their individual burrows from any colony member who comes too close. This colonial lifestyle helps the animals to avoid predators and to keep away competitors.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Yellow Warbler

1. What is your animal's scientific name?

*Dendroica petechia*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The yellow warbler is a small bird with an overall length of 12 centimeters. It has a round body and a small pointed black beak. It is bright yellow above and olive green to bright yellow below. Males have light brown streaks on the chest.



3. Where does your animal live? Does it have any specific habitat requirements?

This bird is found in riparian areas where it nests in the dense canopies formed by willow trees.

4. What does your animal eat? Where/how does it search for this food source?

Yellow warblers eat insects and occasionally fruit for which they forage in the canopies of trees.

5. What are your animal's main predators? What are its main competitors?

Predators of the yellow warbler include raptors, corvids such as jays and ravens, snakes, and large climbing mammals. Predation concentrates on eggs, nestlings, and fledgling birds. Competitors include other insect-eating organisms that forage in trees.

6. Your animal is often visited by nest parasites (other birds who lay their eggs in the warbler's nest). What does your animal do in reaction to these eggs?

Nest parasitism is a big problem for yellow warblers. Nest parasitism occurs when birds lay their eggs in the nests of another other species of bird, with the expectation that the other bird will be “tricked” into raising its young. Since the yellow warbler is so small, it often cannot remove an intruder's large eggs. To solve the problem, the warblers will build a new nest on top of their previous one and lay new eggs. This requires a large investment of time and energy and can reduce the success rate of nesting warblers. As native vegetation is replaced by non-native plants, the levels of parasitization increase. The warblers cannot defend themselves against parasitization and predation as easily in non-native trees.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

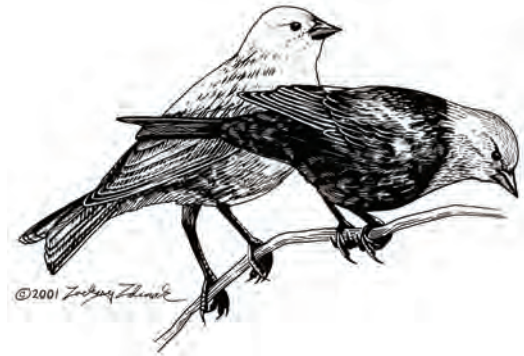
### Animal Homework Research Thread Answer Key

#### Brown-headed Cowbird

1. What is your animal's scientific name?

*Molothrus ater*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.



The brown-headed cowbird is a smallish blackbird with an overall length of 19 centimeters. It has a shorter tail, thicker head, and thicker-based bill than other blackbirds. Males are shiny black with deep brown heads while females are brown overall with light heads and fine streaking on its underside.

3. Where does your animal live? Does it have any specific habitat requirements?

These birds prefer open habitat such as fields, pastures, forest edges, and lawns. Their range has been dramatically increased due to land clearing, urban development, and habitat fragmentation.

4. What does your animal eat? Where/how does it search for this food source?

Cowbirds forage for seeds and insects, but will also eat snail shells and the eggs of other birds. They forage mostly on the ground and can often be seen following cattle, waiting for insects to be stirred up by their hooves.

5. What are your animal's main predators? What are its main competitors?

Brown-headed cowbirds compete with other organisms that forage for seeds and insects on the ground. They are preyed upon by raptors, corvids such as jays and ravens, large mammals, and snakes.

6. Your animal has an interesting reproductive strategy. Explain this strategy.

Brown-headed cowbirds are nest parasites, which lay their eggs in the nests of other birds with the expectation that the other bird will raise the alien offspring. Yellow warblers, who are too small to push the cowbird egg from their nest, are common victims.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

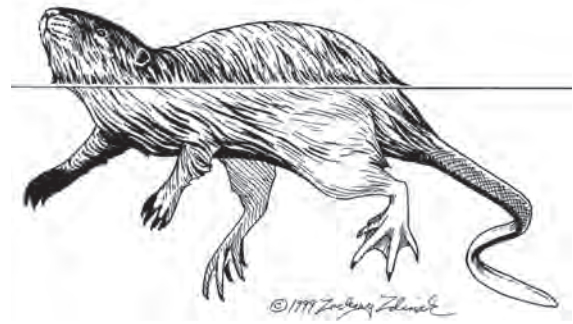
### Animal Homework Research Thread Answer Key

#### Muskrat

1. What is your animal's scientific name?

*Ondatra zibethicus*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.



The muskrat is a beaver-like rodent that grows to up to 1.2 meters in length. The animal is covered in short, dark brown fur, has a long flattened tail covered in scales, and partially-webbed hind feet. On land, it is easy to distinguish a muskrat from a beaver due to the difference in size and form of its tail. In water, muskrats have a distinctive manner of swimming. They swim with a motion that causes their body to produce two humps above the water's surface while beavers swim with a motion that produces only one.

3. Where does your animal live? Does it have any specific habitat requirements?

The muskrat lives in wetlands, riparian areas, drainage ditches, and canals.

4. What does your animal eat? Where/how does it search for this food source?

Muskrats feed on aquatic vegetation as well as some snails, freshwater mussels, and crayfish. They forage for these resources beneath the water's surface.

5. What are your animal's main predators? What are its main competitors?

Predators include raptors, large mammals, and snakes. Competitors include beavers and fish who compete for food and habitat.

6. Your animal is known for the interesting shelters it builds. Describe these shelters.

Muskrats build underwater lodges out of mud and plants such as cattails and sedges. A lodge contains a dry inner compartment in which to sleep and raise young. Muskrat lodges can also contain feeding platforms and a series of tunnels. One tunnel entrance is always above the water line.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Common Black-hawk

- 1) What is your animal's scientific name?

*Buteogallus anthracinus*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The common black-hawk is a medium-sized to large hawk with an overall length of 53 centimeters and a wingspan of nearly 1.2 meters. It is an almost completely black hawk with a white spot just behind the bill and bright yellow legs. It has a single white band and white tip on its tail.



3. How can you tell your animal apart from a turkey vulture? How can you tell it apart from a zone-tailed hawk?

This hawk can be distinguished from a turkey vulture by the banded tail and its black, feathered head unlike the turkey vulture, which has red skin. It can be distinguished from the zone-tailed hawk by its shorter tail with a single white stripe (the zone-tailed hawk's tail has three white bands).

4. Where does your animal live? Does it have any specific habitat requirements?

The common black-hawk spends much of the year on coasts, in mangrove swamps, estuaries, and adjacent woodlands of central America. It migrates northward into Arizona in the summer where it depends on riparian areas in which to breed and hunt. This hawk requires mature trees to provide both roosting locations and branches that extend over water and prove good vantage points for hunting.

5. What does your animal eat? Where/how does it search for this food source?

The common black-hawk mainly eats aquatic prey like fish, frogs, snakes, crayfish, turtles, as well as some small mammals and birds. It hunts for this prey by observing the area from high perches in mature riparian trees.

6. What are your animal's main predators? What are its main competitors?

Predators include great horned owls, large mammals, and corvids (jays, ravens). Most predation occurs to eggs or nestlings. Competitors include carnivorous fish, frogs, and mammals that also feed an aquatic prey.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### American Bullfrog

1. What is your animal's scientific name?

*Rana catesbeiana*

- 2) What does your animal look like? Be sure to note features that make your animal different from similar species.



The American bullfrog is a very large frog growing 17 to 25 centimeters in length. It is light to olive green with a creamy yellow underside. It is covered in dark blotches, and has a fold of skin that extends from behind the eye to the forearm, as well as pronounced humps on its back that are caused by its hips. It also has a large tympanum (ear). In males, this organ can exceed the size of the eye.

3. Where does your animal live? Does it have any specific habitat requirements?

These frogs prefer warm sunny areas near any source of permanent water. Tadpoles take over a year to develop into adults, so water must be present throughout the year.

4. What does your animal eat? Where/how does it search for this food source?

It is an extremely aggressive hunter and can eat anything small enough to fit in its mouth, such as fish, crayfish, small mammals, lizards, birds, and other frogs.

5. What are your animal's main predators? What are its main competitors?

The American bullfrog is preyed upon by birds, fish, snakes, and large mammals. Due to its diverse diet, it encounters little competition.

6. Your animal is an introduced species in Arizona. How did it get here? Has it caused any problems since its arrival?

Bullfrogs were introduced into Arizona as a food source and game species. Since its arrival, the animal has outcompeted and preyed upon native fish and amphibian species, causing these important local populations to decline in number.

# RIVER PATHWAYS

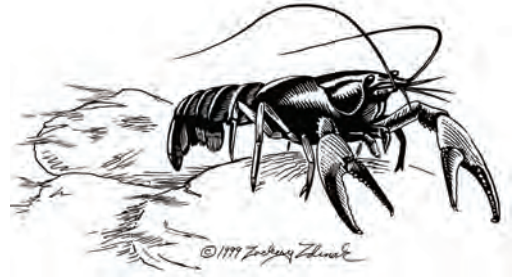
## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Northern Crayfish

1. What is your animal's scientific name?

*Orconectes virilis*



2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The northern crayfish is a small lobster-like crustacean with green to reddish brown coloration. The pincers are often greenish blue — especially in males — and may have orange tips and white bumps.

3. Where does your animal live? Does it have any specific habitat requirements?

These animals are capable of surviving in many different environments: the only real requirement is permanent access to well-oxygenated water. The northern crayfish can live in shallow depths of a few centimeters to as deep as 30 meters. It can survive in temperatures that range from 0 to 32 degrees Celcius.

4. What does your animal eat? Where/how does it search for this food source?

Northern crayfish eat aquatic plants, fish, snakes, small turtles, insects, and even other crayfish. They search for these food items with their long antennae.

5. What are your animal's main predators? What are its main competitors?

They are preyed upon by large fish, mammals, and bullfrogs and compete intensely with many aquatic herbivorous and carnivores. However, due to the animal's diverse diet, competition has little negative impact on the crayfish.

6. Your animal is an introduced species in Arizona. How did it get here? Has it caused any problems since its arrival?

Northern crayfish were introduced to Arizona's waters by anglers who used them as bait. Since their arrival, they have harmed ecosystems by preying on native fishes and outcompeting many native species, whose populations have dwindled as a result.



# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Gila Topminnow



1. What is your animal's scientific name?

*Poeciliopsis occidentalis*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The Gila topminnow is a guppy-like fish that grows to 5 centimeters in length. Females and non-breeding males are silver to tan in color with a faint dark stripe along their sides. Breeding males turn solid black with yellow fins. The fish's mouth is located at the very tip of its snout, which is called "terminal". The mouth is pointed upwards, which helps the fish catch insects as they rest on the water's surface.

3. Where does your animal live? Does it have any specific habitat requirements?

The Gila topminnow prefers slow moving waters including springs, streams, and ponds. It lives in the top few inches of water and is heavily dependent on streamside vegetation.

4. What does your animal eat? Where/how does it search for this food source?

This fish forages for its preferred diet of plant matter and aquatic insect larvae, including mosquitoes, in slow moving water with heavy streamside vegetation by searching the water's surface with its terminal mouth.

5. What are your animal's main predators? What are its main competitors?

The fish has many predators including larger fish, crayfish, frogs, birds, snakes, and large aquatic insects. Competitors include other insect larvae consumers such as desert pupfish and mosquitofish.

6. Your animal has greatly declined in number in Arizona. What factors led to this decline?

Unfortunately, the population of Gila topminnows has declined so drastically that it has been transformed from Arizona's most common fish to an endangered species. This decline has many causes including loss of habitat, predation by non-native species, and heavy competition from non-native mosquito fish.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Largemouth Bass

1. What is your animal's scientific name?

*Micropterus salmoides*



2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The largemouth bass is a large fish that grows to 1.2 meters in length or more. It is dark green to brownish above and white to yellowish below, has dark blotches that form a jagged stripe down its side, and dorsal fins that are spiny in the front and rounded in the back. The upper jaw, which extends behind the eye, differentiates this fish from the smallmouth bass.

3. Where does your animal live? Does it have any specific habitat requirements?

Largemouth bass prefer clear, deep, slow-moving water in streams and lakes. They use cover such as rocks, logs, and streamside vegetation to shelter themselves from predators.

4. What does your animal eat? Where/how does it search for this food source?

The fish leave their shelters to forage in open water for prey, smaller fish, insects, insect larvae, frogs, crayfish, snakes, birds, and small aquatic mammals.

5. What are your animal's main predators? What are its main competitors?

Predators include large fish, birds, snakes, crayfish, frogs, and large mammals. Most predation occurs on young fish due to their large size as adults. These fish suffer little competition due to their broad diet.

6. Your animal is an introduced species in Arizona. Why was it introduced? Has it caused any problems since its arrival?

The largemouth bass was introduced to Arizona as a sports fish. Since the species' arrival, it has preyed heavily on many native species. This has caused the population numbers of native organisms to decline.

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Animal Homework Research Thread Answer Key

##### Merriam's Kangaroo Rat

1. What is your animal's scientific name?

*Dipodomys merriami*



2. What does your animal look like? Be sure to note features that make your animal different from similar species.

Merriam's kangaroo rat is a small rat growing to 10 centimeters in length without the tail. It has yellow to brown fur above and white fur below. It has a long tail with a wide, white stripe and a tufted end. Each rear foot has four toes.

3. Where does your animal live? Does it have any specific habitat requirements?

Kangaroo rats prefer to live in open areas with sandy or rocky soil and little vegetation.

4. What does your animal eat? Where/how does it search for this food source?

They feed on seeds, insects, and herbaceous plants for which they forage for on the ground at night.

5. What are your animal's main predators? What are its main competitors?

This animal is preyed upon by birds, snakes, and large mammals and competes with all other animals that forage on the ground for seeds and herbaceous plants.

6. Your animal does not need to drink water to survive. How does it stay hydrated?

By eating foods with high water content, they can stay hydrated during the hottest summer months. Although this ability increases the rat's ability to survive in arid regions, it also increases its need for herbaceous plants and seeds with extremely high water content.

# RIVER PATHWAYS

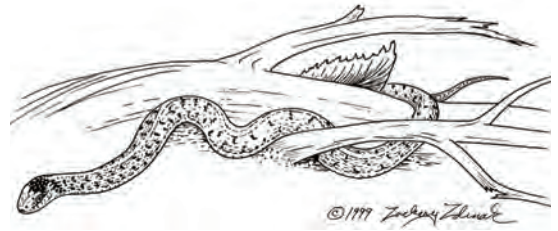
## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Terrestrial Garter Snake

1. What is your animal's scientific name?

*Thamnophis elegans*



2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The terrestrial garter snake is a slender snake that grows over 1 meter in length. It is dark grey with black spots and three light stripes along the length of its body. One of the stripes is on the snake's back while the other two are on the sides of the 2nd and 3rd rows of scales. The head is usually dark and sometimes has a yellow mark.

3. Where does your animal live? Does it have any specific habitat requirements?

The terrestrial garter snake tends to stay near permanent water but can stray far from it. It is found in many habitats including grasslands, forests, and riparian areas.

4. What does your animal eat? Where/how does it search for this food source?

Hidden under low-lying vegetation, this snake actively forages for fish, frogs, and small mammals.

5. What are your animal's main predators? What are its main competitors?

They compete with other snakes, fish, frogs, birds, and mammals but, due to their diverse diet, the impact of competition is minimal. Terrestrial garter snakes are preyed upon by birds, other snakes, large fish, crayfish, and large mammals.

6. Your animal is born in a way that is unusual for reptiles. Explain.

Unlike many reptiles, terrestrial garter snakes are "live-bearers." This means that they give birth to live young rather than laying eggs. Live-bearing snakes produce an egg internally that thins and disappears prior to birth. This differs from mammals and other true live-bearing animals where the young are never encased in an egg.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Longfin Dace

1. What is your animal's scientific name?

*Agosia chrysogaster*



2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The longfin dace is a small, slender fish that grows up to 10 centimeters in length. It is silver in color with a prominent black stripe along its sides. Its head is blunt and mouth is “subterminal,” positioned slightly behind the fish’s snout.

3. Where does your animal live? Does it have any specific habitat requirements?

This fish prefers the shallow waters of small streams and sandy or gravelly substrates. They require overhanging banks or streamside vegetation for cover from predators.

4. What does your animal eat? Where/how does it search for this food source?

The longfin dace has a diverse diet of aquatic vegetation, detritus, insect larvae, and fish fry.

5. What are your animal's main predators? What are its main competitors?

Predators include larger fish, crayfish, frogs, birds, and snakes. It competes for food with the Gila topminnow, desert pupfish, and aquatic organisms with similar diets.

6. Your animal has greatly declined in number in Arizona despite some of its more remarkable adaptations. What are some of the adaptations that allow this fish to survive in Arizona and what factors led to this decline?

The longfin dace is one of Arizona’s most resilient fish. For example, during the day when plants’ high water demands can dry out streams, the fish can bury itself under wet plant material and debris. At night, when plants start using less water and the stream begins to flow, the longfin dace swims again. Despite this resilience, populations of the fish are dwindling due to loss of habitat, excessive competition and predation from non-native species.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Toe Biter

1. What is your animal's scientific name?

*Lethocerus sp.*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.



Toe biters are large, beetle-like insects with small antennae and large raptor-like front legs that much thicker than the hind two pairs of legs. The middle and back pairs of legs are covered with short hairs that and are used to swim and to hold onto small bubbles of air, enabling the toe biter to breathe while under water.

3. Where does your animal live? Does it have any specific habitat requirements?

This insect prefers warm water with diverse substrate and heavy streamside vegetation and can withstand extremely poor water quality. It uses streamside vegetation to hide from predators such as fish, frogs, and larger aquatic insects.

4. What does your animal eat? Where/how does it search for this food source?

By holding its wings flat against its body, this insect can disguise itself as a dead, floating leaf. The insect will disguise itself among dense submerged and streamside vegetation to wait in ambush for its preferred food source of aquatic insects, fish, and frogs. It is this specialized hunting method that allows this animal to compete with other aquatic carnivores.

5. What are your animal's main predators? What are its main competitors?

Predators include fish, frogs, and other aquatic insects. Competitors include all other aquatic carnivores.

6. After mating, your animal does something interesting with its eggs. Describe this behavior.

One of the most interesting aspects of the toe biter is its breeding behavior. After mating, the female deposits all of her eggs onto the back of the male. The eggs remain on the male's back while he waits for them to hatch, hiding in a protected portion of his habitat

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Red-spotted toad

1. What is your animal's scientific name?

*Bufo Punctatus*



2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The red-spotted toad is a small toad that doesn't exceed 8 centimeters in length. It is grey to reddish brown overall and has small red bumps covering its body. Its paratoid glands, the glands right behind its eyes, are round.

3. Where does your animal live? Does it have any specific habitat requirements?

This toad is found mainly in desert streams but can also be found far from water. It needs temporary pools or puddles in which to breed and does not require permanent water. The toad tends to be found in rocky areas where it hides among rocks from predators such as birds, snakes, frogs, mammals, and fish. It forages actively for small insects by darting towards food and using its sticky tongue to pull it into its mouth. It competes with other insectivores such as fish, frogs, and lizards.

4. What does your animal eat? Where/how does it search for this food source?

It forages actively near water for small insects by darting towards food and using its sticky tongue to pull it into its mouth.

5. What are your animal's main predators? What are its main competitors?

Predators include birds, snakes, other frogs, mammals such as raccoons, and fish. Competitors include both terrestrial and aquatic animals that prey on small insects such as fish, other frogs, and lizards.

6. What does your animal do during the dry summer months?

The red-spotted toad has the amazing ability to spend long periods of time buried in the earth. As temporary ponds, puddles, and streams dry up, they burrow into the soil beneath them. Toads can remain buried for over a year, until the summer rains replenish their water.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Beaver

1. What is your animal's scientific name?

*Castor canadensis*



2. What does your animal look like? Be sure to note features that make your animal different from similar species.

Beavers are large aquatic rodents with thick brown fur. They can grow up to 1.2 meters in length, including the tail, and can weigh up to 27 kilograms. These animals have short front arms with large claws, webbed back feet, and large, flat, nearly hairless tails.

3. Where does your animal live? Does it have any specific habitat requirements?

These rodents live in a variety of habitats but always stay near permanent water and are most commonly found in riparian areas. Only their heads are visible when swimming. Beavers need large trees both for food and to build their dams. They also require large areas of habitat. For example, one family of beavers requires about a kilometer of riparian habitat.

4. What does your animal eat? Where/how does it search for this food source?

Beavers primarily eat tree bark and cambium, the soft tissue that grows just under the bark. However, they also consume fruits and aquatic plants.

5. What are your animal's main predators? What are its main competitors?

Predators include large mammals and raptors. However, there is little predation since beavers spend so much of their time in the water or in their lodges. Competition is also minimal due to the beaver's unique diet.

6. Your animal is known for building dams. What impact do these dams have on the surrounding ecosystem?

Beaver dams can drastically alter ecosystems. The dams slow water flow, which creates ponds and wetlands. This slowed flow can also cause a build-up of silt and even raise the water table. In extreme cases, beaver dams can completely stop the flow of water, causing ponds to dry up and meadows to form.



# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Sonora Sucker



1. What is your animal's scientific name?

*Catostomus insignis*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The Sonora sucker is a large fish that grows up to 80 centimeters long. It is distinctively bi-colored with brown above and yellow below. It has large scales, a rounded snout, and an extremely thick lower lip.

3. Where does your animal live? Does it have any specific habitat requirements?

This fish prefers streams with deep pools and gravelly substrates. While it thrives in pools, it is less successful in lakes created by dams.

4. What does your animal eat? Where/how does it search for this food source?

The Sonora sucker feeds on aquatic insects, plants, and detritus which it searches for by swimming aimlessly with its large mouth open.

5. What are your animal's main predators? What are its main competitors?

Predators include birds, large fish, snakes, frogs, and large mammals. Competitors include all other aquatic organisms with similar diets.

6. What are the main differences between your animal and a desert sucker? Consider both habitat and appearance.

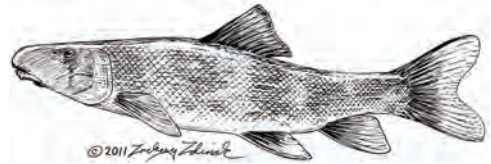
The Sonora sucker can be distinguished from the desert sucker by its lack of dark bands, cartilaginous plate, and notched mouth. The two fish can also be differentiated by their behavior. Desert suckers scrape algae off rocks while Sonora suckers search for insects and plants by swimming with their mouths open. Another way to tell these fish apart is by their habitats. Sonora suckers depend more on pools while desert suckers require riffles.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Desert Sucker



1. What is your animal's scientific name?

*Catostomus clarki*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The desert sucker grows up to 33 centimeters in length. It is distinctively bi-colored with brown to silver above and yellow below. The fish often has dark, jagged, vertical dark bars on its sides, and some fish will be more highly patterned than others. The mouth has a large plate made of cartilage that forms two notches on the sides of its mouth. The plate is used to scrape algae, a primary food, from rocks and debris in the stream.

3. Where does your animal live? Does it have any specific habitat requirements?

The desert sucker prefers small and medium sized streams with a mix of pools and riffles. During the day, it tends to stay in pools with undercut banks or heavy streamside vegetation in in order to avoid predators. At night, it moves into the rocky riffles in search of food.

4. What does your animal eat? Where/how does it search for this food source?

These fish forage amongst riffles for diatoms, algae, and some insects and plants. They use the cartilaginous plate on their mouths to scrape their food off rocks and other underwater surfaces.

5. What are your animal's main predators? What are its main competitors?

Predators include birds, large fish, snakes, frogs, and mammals such as raccoons. Competitors include other bottom feeding fish as organisms like snails and crayfish.

6. What are the main differences between your animal and a Sonora sucker? Consider habitat, diet, and appearance.

Sonora suckers lack the dark bands, cartilaginous plate, and notched mouth of the desert sucker. The fishes can also be differentiated by their behavior. Desert suckers scrape algae off rocks while Sonora suckers search for insects and plants by swimming with their large mouths open. Another way to tell these fish apart is by the habitat they occupy. Sonora suckers depend almost exclusively on pools while desert suckers can often be found in riffles.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Abert's Towhee

1. What is your animal's scientific name?

*Pipilo aberti*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.

Abert's towhee is a medium-sized bird with an overall length of 24 centimeters. It has a uniformly pinkish-brown body, a long tail, and a pale bill that contrasts sharply with its black face. The underside of its tail is rufous (rust) colored.

3. Where does your animal live? Does it have any specific habitat requirements?

This bird prefers riparian habitats with bushy ground cover, cottonwoods, and willows.

4. What does your animal eat? Where/how does it search for this food source?

These birds search for food by scratching at the ground with their feet. Scratching unearths small insects and seeds, which are the towhee's primary foods.

5. What are your animal's main predators? What are its main competitors?

Predators include large mammals, snakes, and birds. Competitors include all other animals that forage for seeds and insects on the ground.

6. Your animal has a very restricted range. Where can it be found?

Abert's towhee has one of the smallest ranges of any North American bird. It exists only in the lower Colorado River and Gila River watersheds. As the bird has lost its favored riparian habitats to development, over-grazing, and other human activities, the species' population has declined significantly.



# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Song Sparrow

1. What is your animal's scientific name?

*Melospiza melodia*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The song sparrow is a small bird growing to 15 centimeters in length. It is a light brown and grey bird with bold brown streaks down its white chest. It has a short bill, a rounded head, and a long rounded tail



3. Where does your animal live? Does it have any specific habitat requirements?

The song sparrow can occupy a variety of habitat types including deserts, forests, grasslands, riparian areas, and residential areas. In any habitat, the song sparrow requires dense ground cover in which to forage.

4. What does your animal eat? Where/how does it search for this food source?

These birds forage for seeds, insects, and fruit amongst dense vegetation. .

5. What are your animal's main predators? What are its main competitors?

Predators include large mammals, snakes, and birds. Competitors include all other animals that forage for seeds and insects on the ground.

6. Where does your animal build its nest? What does its nest look like?

Although the song sparrow can occupy a wide variety of habitats during much of the year, when breeding its requirements become more specific. In order to protect its young and ensure a reliable source of food, the birds hide their nests in low, dense vegetation near water. Nests are small, sturdy, cup-shaped, and composed of grasses and weeds. The outer layer is made of bark and the interior is lined with grasses and animal hair. In the desert, the need to nest near water under cover of dense vegetation causes song sparrows to be dependent on riparian areas.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Common Kingsnake

1. What is your animal's scientific name?

*Lampropeltis getula*



2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The common kingsnake is a large, slender snake with patterned in black and white. Patterns vary from distinct black and white bands, to mottled black and white, to completely black. The snake's head is barely wider than its body.

3. Where does your animal live? Does it have any specific habitat requirements?

The common kingsnake lives in a wide variety of habitats including forests, fields, and riparian areas. Although it is a terrestrial snake, the animal tends to stay close to water due to the high availability of food. Diet includes snakes, small mammals, lizards, birds, eggs, and amphibians which. Riparian areas are also preferred due to the large amount of brushy vegetation in which the snake can hide from predators such as large mammals and birds.

4. What does your animal eat? Where/how does it search for this food source?

Diet includes snakes, small mammals, lizards, birds, eggs, and amphibians which it captures by waiting in ambush, biting and then constricting with its powerful body.

5. What are your animal's main predators? What are its main competitors?

Predators include large birds and mammals. Competitors include most other carnivorous animals. However, due to its wide diet, competition is minimal.

6. What adaptations make your animal good at hunting other snakes?

The kingsnake earns its name from its habit of eating other snakes. It has several physical adaptations that make this possible, including the fact that it is an extremely powerful constrictor and is naturally immune to pit viper venom. This immunity enables the common kingsnake to capture, kill and consume nearly any snake smaller than itself, including rattlesnakes!

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Rock Squirrel

1. What is your animal's scientific name?

*Spermophilus veriegatus*



2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The rock squirrel is a large squirrel that can grow up to to 30 centimeters in length, excluding the tail. It has speckled grayish-brown fur above and light brown fur below. The rock squirrel has light colored rings around its eyes and a bushy tail that is nearly as long as its body.

3. Where does your animal live? Does it have any specific habitat requirements?

Rock squirrels can be found in a variety of desert habitats, but are less drought tolerant than other ground squirrels. Therefore, they must live closer to water than similar species. Rock squirrels also require large rock outcroppings or canyon walls which can be used as lookout points from near their dens. This helps them to avoid predators such as large mammals, birds, and snakes as well as search for food sources such as insects, seeds, flowers, herbaceous plants, fruits, carrion, and even birds.

4. What does your animal eat? Where/how does it search for this food source?

This animal has a wide diet including seeds, flowers, herbaceous plants, insects, birds, carrion, and fruit. It actively forages for food both on the ground and in trees.

5. What are your animal's main predators? What are its main competitors?

Predators include large mammals, birds, and snakes. Due to its wide diet, competition is minimal, but competitors include all other animals that share similar food and den resources.

6. Your animal is highly social. Describe a typical colony of these animals.

Rock squirrels are highly social. They live in colonies consisting of one male, several females, and juveniles. Males defend their dens against other males, but allow females and young to come and go freely. When young are born, males are often forced away from the den to peripheral burrows.

# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Desert Pupfish

1. What is your animal's scientific name?

*Cyprinodon macularius*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The desert pupfish is a small, stocky fish that rarely grows over 5 centimeters in length. Females and non-breeding males are silver with vertical black bands. Breeding males are blue with yellow fins. The fish has a short, upturned mouth, rounded fins, and a faint stripe of dark spots near the base of its caudal, or tail, fin.



3. Where does your animal live? Does it have any specific habitat requirements?

The desert pupfish prefers warm, sunny pools and the backwaters of slow-moving streams where they require fine substrate in which to lay and defend their eggs

4. What does your animal eat? Where/how does it search for this food source?

This fish forages actively in open water for its preferred food source of insects, diatoms, and plants.

5. What are your animal's main predators? What are its main competitors?

Predators include fish, snakes, frogs, and birds. Competitors include other fish that live in pools feeding on insects and plants such as the Gila topminnow and mosquitofish.

6. Your animal has greatly declined in number in Arizona. What factors led to this decline?

Although the desert pupfish was once common, it is now critically endangered. Loss of streamside vegetation in riparian areas prevents the formation of backwater habitats on which these fish depend. In addition, the introduction of non-native species has led to increased competition and predation. Together these two factors have led to significant declines in the number of desert pupfish and has limited the species' potential for reintroduction.

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Animal Homework Research Thread Answer Key

##### Canyon Treefrog

1. What is your animal's scientific name?

*Hyla arenicolor*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.

The canyon treefrog is a small frog growing up to 5 centimeters in length. It has rough skin and large, sticky toe pads. It is grey to dark green with dark spots above and yellow or orange below. It prefers rocky riparian areas with large boulders where it hides in cracks from predators such as snakes, birds, other frogs, fish, and large mammals.



3. Where does your animal live? Does it have any specific habitat requirements?

These frogs prefer rocky riparian areas where they use cracks in large rocks and boulders to hide from predators during the day.

4. What does your animal eat? Where/how does it search for this food source?

At night, canyon treefrogs emerge from their hiding places and move to the edges of slow-moving streams and backwaters. They linger in these areas throughout the night, foraging for small insects.

5. What are your animal's main predators? What are its main competitors?

Predators include snakes, birds, other frogs, fish, and mammals such as raccoons. Competitors include other insectivorous riparian animals such as fish and other frogs.

6. Canyon treefrogs are often heard before they are seen. Describe the vocalizations of these frogs.

During breeding seasons, male canyon treefrogs emit a loud bark to attract mates. The call is common and unmistakable, and is often said to sound similar to a bleating sheep. They emit this call at night, and it is common to hear this species before seeing it.



# RIVER PATHWAYS

## Module I: An Introduction to Riparian Areas

### Animal Homework Research Thread Answer Key

#### Raccoon

1. What is your animal's scientific name?

*Procyon lotor*

2. What does your animal look like? Be sure to note features that make your animal different from similar species.



The raccoon is a large mammal with body length that can exceed 60 centimeters in length, not including the tail. The animal is grey to brown in color, has rounded ears, distinct black facial markings, and a bushy, striped tail. Raccoons have large paws with five long digits and large claws.

3. Where does your animal live? Does it have any specific habitat requirements?

Raccoons can survive in a wide variety of habitats. They avoid open, sparsely vegetated areas and are most common in heavily-wooded, riparian corridors. Raccoons climb trees to avoid the threat of predators such as large mammals and birds. They also need access to water in order to forage for their preferred diet of fish and amphibians.

4. What does your animal eat? Where/how does it search for this food source?

The preferred diet of raccoons consists of fish, amphibians, insects, fruits, nuts, and plants. Raccoons also consume insects, fruit, nuts and plants. They actively forage close to water using their keen senses to locate prey and their dexterous hands to examine it before eating.

5. What are your animal's main predators? What are its main competitors?

Predators include large mammals and birds. The raccoon has many competitors but due to its extremely wide diet, competition is not a heavy pressure for raccoons.

6. Your animal has greatly increased in numbers and expanded their range. What factors have led to these increases?

Since the 1950's, the raccoon's range has expanded. They were once common only in riparian and heavily wooded areas, but can now be found in nearly every type of habitat. Urbanization, increased agriculture, intentional introductions, and extermination of natural predators has allowed this expansion to occur.

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Animal Homework Research Thread Background Information

##### Yellow-billed Cuckoo (*Coccyzus americanus*)

In mid-summer, the yellow-billed cuckoos begin their annual journey from South America to Arizona's riparian habitats. These birds are 30 centimeters in length and have a long, slender appearance. They have brown backs that contrast neatly with their creamy white chests and bellies. Yellow-billed cuckoos have long tails with large white spots on the underside and a curved beak that is yellow on the top and black on the bottom. Despite their magnificent appearance, these birds, hidden deep within the high canopies of mature riparian trees, are more often heard than seen. They are found along Arizona's streams for a very short time each summer, only staying long enough to find a mate, breed, and fledge young.



Upon arrival, the yellow-billed cuckoos are greeted by a suite of species already taking advantage of the desert oases found beneath the canopies of Arizona's cottonwood and willow dominated riparian areas. Insects such as tent moths, sphinx moths, and cicadas breed en masse, making easy meals for the foraging cuckoos. While the cuckoos are out foraging, other animals such as raccoons, ravens, and hawks keep their eyes open for distracted birds or unattended young on which to feed. In these lush habitats, predators are as plentiful as prey.

The yellow-billed cuckoo is one of the last avian migrants to arrive from south of the border each summer and is one of the first to return to its tropical wintering grounds. After finding a mate, the entire breeding cycle from egg-laying to fledging only takes a little over two weeks. Although the yellow-billed cuckoo is only a summer visitor to Arizona, the habitat it finds here is vital to its survival. As Arizona's riparian areas continue to be destroyed and altered, these birds find fewer and fewer suitable breeding locations. If this trend is not reversed, the bird may disappear from Arizona's streams entirely.

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Animal Homework Research Thread Background Information

##### Zone-tailed Hawk (*Buteo albonotatus*)

As summer approaches, zone-tailed hawks begin to nest within Arizona's riparian areas. Along the desert's rivers, these birds nest in the canopies of the tallest cottonwood and sycamore trees available, as these provide excellent vantage points from which to watch for nest predators. Great-horned owls, jays, ravens, and large mammals could make a great meal out of a zone-tailed hawk chick, but few will make it past the attentive parents.

Zone-tailed hawks, with an overall length of up to 50 centimeters, a wingspan of 1.2 meters, and a yellow beak and legs, superficially resemble other large birds found in and around Arizona's riparian areas during the summer months. However, their feathered heads and banded tails distinguish them from the turkey vultures that they are often seen soaring with, mimicking their flight patterns to ambush prey and their long triple-banded tails, slender wings, and piercing shriek distinguish them from the stouter-bodied common black-hawks that they share their breeding habitat with.



When breeding is over and young have fledged, the zone-tailed hawks will head southward in search of suitable wintering habitat. They will seek out open, brushy areas that support abundant prey items such as birds, lizards, and small mammals. Zone-tailed hawks will stay in open country until the following summer. Then, they will again return to Arizona's rivers to nest and raise young.

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Animal Homework Research Thread Background Information

##### White-throated Woodrat (*Neotoma albigula*)

In the Sonoran Desert, times when resources are abundant are few and far between. Rainfall arrives almost exclusively during the summer and winter and much of this water drains quickly towards the desert's riparian areas, leaving the uplands dry. One native desert animal, the white-throated woodrat, seems to be aware of these trends.



This large 27 centimeter rat, with its grayish brown back and white underside, feet, and throat, makes the most of the desert's most productive times. At night, it scurries beneath dense ground cover, using its keen sense of smell and vision to collect the seeds from trees like the mesquite and palo verde as well as fruit from prickly pear cactus. Insects, beetles, and even small reptiles round out the rat's opportunistic diet. In addition to foodstuffs, the woodrat will also pick up seemingly useless objects, such as shiny coins or scraps of metal. Once collected, this animal, aptly nicknamed the "packrat", brings these items to its burrow, preparing for the dry days that are always around the corner.

Once at its burrow, the rat pushes downward through a cholla cactus-lined entrance, through an equally spiny first chamber and into a much softer grass-lined chamber below. Here its hoard of moisture-rich food is safe from potential intruders that would like to steal it. When the time comes, the rodent will also use this chamber to safely raise young, hidden away from snakes, raptors, and larger mammals that also occupy the desert. Young woodrats will soon learn, like their parents, that preparedness is the key to survival in the harsh Sonoran Desert.

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Animal Homework Research Thread Background Information

##### Lowland Leopard Frog (*Rana yavapaiensis*)

The Sonoran desert seems like an unlikely place for an amphibian to call home, but deep within the desert's many riparian areas, the native lowland leopard frog finds refuge. Growing only 8 centimeters in length and with a dark brownish-green, spot-covered back and yellowish-white underside, these frogs blend in perfectly beneath the streamside cottonwood and willows. The lack of nose spots, faint light stripe on the upper lip and interrupted dorsolateral folds all add to this frog's camouflage while distinguishing it from the desert's many other amphibians.



The lowland leopard frog is designed perfectly for Arizona's unpredictable desert streams. They stay close to water where insects, fish, and smaller frogs are plentiful, but are not as tied to permanent water as other frogs. Their tadpoles can develop into adults in a single season, unlike many other species, and are especially adept at surviving the flash floods that are so common in Arizona. The adults can even survive in temporary pools, traveling long distances between water during the dry months.

Despite their hardiness, lowland leopard frogs are not as common as they once were. Like countless other species, this frog is losing habitat at an alarming rate. As water tables are lowered, cattle are grazed, and people recreate irresponsibly, the valuable riparian areas on which these frogs depend are disappearing. In addition, introduced species such as green sunfish and bullfrogs have brought with them increased competition, predation, and disease. Luckily for this small frog, it can survive in areas where these invasive species, not adapted to the desert, cannot. As long as these areas persist, so will the lowland leopard frog.

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Animal Homework Research Thread Background Information

##### Green Sunfish (*Lepomis cyanellus*)

In Arizona's riparian areas, water is seasonally limited, flash floods are extremely common, and many introduced aquatic species cannot survive. If the invaders are not swept downstream during floods, they are likely to get trapped in the pools that form when water recedes. As the water evaporates from these pools, the water quality plummets. For this reason, fish not as well adapted to these systems as our natives often do not last a single season. However, some introduced species, like the green sunfish, thrive.



The green sunfish, with its dark green body, blue iridescent stripes along its face and sides, spiny dorsal fin, and large black spot behind its head, spends much of its time in murky waters to avoid being spotted by predators such as birds and larger fish. Growing up to 20 centimeters in length with a large mouth and a tendency to ambush prey from submerged cover, this fish is a voracious predator. For the many smaller native fish, amphibians, and insects that live in Arizona's waters, green sunfish impose an unprecedented level of competition and predation.

When the green sunfish arrived in Arizona, they were not the large pan fish that now occupy our desert rivers. They were much smaller juveniles, destined to be placed on the end of an angler's line as bait for a much larger fish. When bait was left over, it was poured into the stream where those tiny fish grew, multiplied, and flourished. Now that the green sunfish has found a home in Arizona's waterways, it seems that it is here to stay.

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Animal Homework Research Thread Background Information

##### Black Rattlesnake (*Crotalus cerberus*)

In the bottom of Arizona’s rocky canyons, deep beneath the grasses, shrubs, and debris that falls from high in the riparian canopy, juvenile Arizona black rattlesnakes can barely be seen. Their appearance allows them to be almost invisible to the small mammals, lizards, and birds that they seek. Young snakes are light tan and have prominent brown blotches down their length that perfectly resemble the surrounding debris. As the juveniles grow, eventually reaching over a meter in length, their scales and blotches will darken until they are entirely black and dark gray. A few faint cream-colored crossbars are the only bits of color they may retain to adulthood.



Snakes, like all reptiles, are unable to regulate their body temperature internally. They must take advantage of sunlight to warm them up and allow them to perform vital bodily functions. For this reason, it is common to see snakes basking in the open sunlight in order to build up enough energy to digest their last meal. The dark color of the adult Arizona black rattlesnake allows them to bask freely on the streamside boulders and take advantage of the daytime heat. With so few markings, they are able to hide in plain sight from the hawks, eagles, roadrunners and kingsnakes that may try to make a meal of them.

Found only in Arizona and a tiny western patch of New Mexico, the Arizona black rattlesnake is as unique as Arizona’s riparian areas themselves. As Arizona’s riparian areas continue to be destroyed and altered, populations of these snakes persist in fewer and fewer drainages. If this trend is not reversed, this snake may disappear from Arizona’s streams entirely.

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Animal Homework Research Thread Background Information

##### Round-tailed Ground Squirrel (*Spermophilus tereticaudus*)

In the Sonoran Desert, the life of a rodent is particularly challenging. Rain falls almost exclusively in the summer and winter, with long periods of desiccation between. This limited water produces an equally limited crop of moisture-rich herbaceous plants, insects, and seeds over which these rodents and other animals all compete. The low number of shade-providing trees makes these animals particularly vulnerable to soaring predators and the uneven rocky landscape provides countless ambush opportunities for the snakes and larger mammals that also call this desert home.



Many of the desert's rodents depend on their small size and nocturnal habits to avoid predators and make the most of the deserts few resources but, being diurnal and growing up to 68 centimeters in length, the prairie dog-like round-tailed ground squirrel employs neither of these strategies. Instead, the round-tailed ground squirrel depends on two different strategies, camouflage and sociality, to survive in Arizona's harsh deserts.

Even in the open areas where these squirrels build their deep burrows, their uniformly sandy brown fur above, lighter tan fur below, black-tipped tail, and furry hind feet allow them to hide in plain sight. Adding to their security, these squirrels live in loose colonies consisting of many individual burrows. They will warn others when danger is present, but will also defend their burrow from colony members that venture too close. This social strategy allows round-tailed ground squirrels to forage by day, when the majority of their competition is still in hiding.



## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Animal Homework Research Thread Background Information

##### Yellow Warbler (*Dendroica petechia*)

Along Arizona's rivers, the song of the yellow warbler is a sure sign that summer has arrived. Each year, these bright yellow and round-bodied birds travel great distances to arrive in these riparian areas. While there, they can be seen foraging in the high canopies of cottonwoods and willows, using their pointed black beaks to glean insects from leaves and branches. Not only do tall native trees provide areas for the yellow warblers to forage, but they also provide sheltered nesting places that conceal eggs and young from hungry raptors, corvids, and snakes.



On many sections of Arizona's rivers, native trees have been and continue to be pushed out by non-native species. For the yellow warbler, invasive tree species such as tamarisk provide far less cover for nesting than native species. As a result, nests constructed in non-native trees are often raided by hungry animals or are parasitized. Nest parasitism is the process by which an invading bird sneakily lays its egg in the nest of a host bird. In this way, the host bird is tricked into raising the invader's young along with their own brood. Would-be host birds often push the foreign eggs out of their nest if they are recognized as not belonging.

In Arizona, the most common nest parasite is the brown-headed cowbird. Yellow warblers, growing only 12 centimeters in length, are too small to remove the cowbirds' foreign eggs even when they recognize that they are not their own. Instead, they often just build a new nest on top of their previous one and lay new eggs. This behavior uses large amounts of time and resources and in some cases can prove too much for this small migratory bird.

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Animal Homework Research Thread Background Information

##### Brown-headed Cowbird (*Molothrus ater*)

Named for their tendency to follow cattle, foraging for seeds and insects stirred up by their hooves, the brown-headed cowbird has responded differently than the majority of species to human land use. For most species, human encroachment means loss of habitat, but for this species it means just the opposite. This bird is dependent on open habitat such as fields, pastures, forest edges, and lawns where it can actively forage with a clear view of potential predators such as raptors, ravens, jays, large mammals, and snakes. This species has been dramatically expanding its range since activities like cattle grazing, land clearing, and urban development began altering the landscape.



The brown-headed cowbird is a smallish blackbird growing to only 19 centimeters in length with a shorter tail, thicker head, and thicker-based bill than other blackbirds. Males are shiny black with deep brown heads while females are brown overall with light heads and fine streaking on their undersides. Despite their small size and relatively unimpressive appearance, these birds can have a dramatic effect on the ecosystems in which they live.

Brown-headed cowbirds are nest parasites, meaning they lay their eggs in the nests of other birds with the expectation that the other bird will raise the alien offspring. The hatchling cowbirds will exhaust the resources of the parent and often push their true young out of the nest, resulting in an unsuccessful breeding season for that bird. As habitats change and cowbirds expand their range, the rate of nest parasitism for many species has increased dramatically. For species already suffering due to habitat loss and fragmentation, this is a very concerning trend.

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Animal Homework Research Thread Background Information

##### Muskrat (*Ondatra zibethicus*)

The muskrat is a beaver-like rodent that grows to up to 60 centimeters in length. The animal is covered in short, dark brown fur, has a long flattened tail covered in scales, and partially-webbed hind feet. Considering the animal's size, unique appearance, and commonness in habitats such as wetlands, riparian areas, drainage ditches, and canals, it is a wonder that this animal is so seldom seen.



Muskrats are often confused for beavers, but they are unique animals. They are easiest to distinguish from beavers on land where their smaller size and narrow tail are apparent. In the water, their swimming style distinguishes them. Beavers swim with only their heads visible while muskrats swim with their head and back above water. Even when the animals themselves are not visible, the two can be distinguished by the signs they leave throughout the habitat. Muskrats, like beavers, build lodges using mud and plant materials in order to protect themselves from predators such as raptors, large mammals, and snakes. These lodges contain a dry inner compartment in which the animals sleep and raise their young, a system of underwater tunnels, and a feeding platform where they eat the plants, mussels, crayfish, and snails they collect. Unlike beavers, however, these lodges always have at least one entrance above the surface of the water.

Although much riparian and wetland habitat has been altered or destroyed in recent decades, muskrats are still thriving and continue to be one of Arizona's most common mammals. Their success can be attributed to their ability to live in human-made waterways such as canals and drainage ditches, along with their taste for the cattails that grow prolifically in disturbed wetland areas.

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Animal Homework Research Thread Background Information

##### Common Black-hawk (*Buteogallus anthracinus*)

As summer approaches, common black-hawks begin to nest in Arizona's riparian areas. These birds nest in the canopies of the tallest cottonwood and sycamore trees available, as these trees provide ideal vantage points for watchful parents. Many predators such as great-horned owls, jays, ravens, and large mammals could make a great meal out of a common black-hawk chick, but few will make it past their attentive parents.

Common black-hawks, with an overall length of 53 centimeters, a wingspan of nearly 1.2 meters and a yellow beak and legs, superficially resemble other large birds found in and around Arizona's riparian areas during the summer months. However, their feathered heads and banded tails distinguish them from turkey vultures that are common during Arizona's summers and their shorter, single-banded tails and much broader wings distinguish them from the zone-tailed hawks with which they share their breeding habitat.

When breeding is over and young have fledged from their nests, the common-black hawks will head southward in search of suitable wintering habitat. They are often observed in coastal mangrove forests where aquatic prey such as fish, frogs, snakes, crayfish, and turtles are plentiful. Common-black hawks will stay in these habitats until the following summer when they will return to Arizona's rivers to give rise to next year's birds.



## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Animal Homework Research Thread Background Information

##### American Bullfrog (*Rana catesbeiana*)

Brought to Arizona as a food source and game species, few invasive animals are as prolific as the American Bullfrog. Growing up to 25 centimeters in length, it easily out-competes Arizona's much smaller native amphibians. It is light to olive green with a creamy yellow underside, is covered in dark blotches, and has a fold of skin that extends from behind the eye to the forearm. These frogs also have pronounced humps on their back caused by their hips and a large tympanum (ear) that in males can exceed the size of the eye.



These frogs prefer warm, sunny areas and since tadpoles take over a year to develop into land-dwelling adults, they stay near to permanent water. They are known to consume nearly anything they are able to subdue and fit in their mouth including fish, crayfish, lizards, birds, and other frogs. This voracious appetite can easily result in them becoming the only amphibian species present in the aquatic systems they inhabit. Even the fish, snakes, birds, and large mammals that feed on these frogs can do little to keep their numbers down.

Since its arrival, this animal has caused severe harm to native amphibian populations. They have created unprecedented levels of competition and predation and have brought new diseases to Arizona's waterways. These threats, coupled with loss of habitat, have caused many of Arizona's native amphibians to disappear. Bullfrogs are a prime example of how relocating species, even with the best of intentions, can go incredibly wrong.

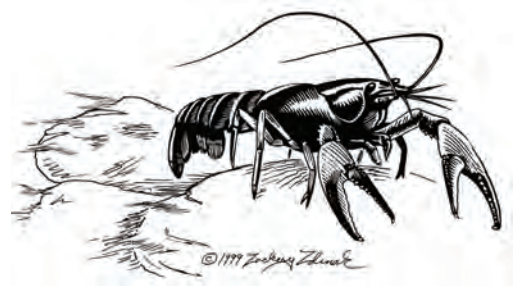
## RIVER PATHWAYS

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##### Northern Crayfish (*Orconectes virilis*)

Once the only US state with no crayfish species, Arizona is now home to the invasive northern crayfish. This animal is a small lobster-like crustacean with green to reddish coloration. Particularly in males, the pincers are often greenish blue and may have orange tips and white bumps. In Arizona's aquatic ecosystems, which have no natural niche for a creature such as this, these animals pose an enormous threat.



These animals are capable of surviving in nearly any aquatic habitat as long as they have access to well-oxygenated water. They can tolerate depths as shallow as a few centimeters to as deep as 30 meters and thrive in water temperatures ranging from 0 to 32 degrees Celsius. They are known to consume nearly anything they are able to get their claws on including aquatic plants, fish, snakes, small turtles, insects, and even other crayfish. This voracious appetite combined with their ability to breed extremely rapidly can easily result in them becoming the dominant species present in the aquatic systems they inhabit. Even the large fish, mammals, and bullfrogs that feed on these crayfish can do little to keep their numbers down.

Since its arrival as bait in anglers' buckets and its eventual release and dispersal, this animal has caused severe harm to aquatic species and habitat. They have created unprecedented levels of competition and predation and often greatly alter their habitats by consuming aquatic vegetation at an extraordinary rate. These threats, coupled with habitat loss, have caused many of Arizona's native aquatic species to disappear. Efforts are being made to keep northern crayfish populations under control but unfortunately, there is little hope of ever completely removing them from Arizona's waterways.

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##### Gila Topminnow (*Poeciliopsis occidentalis*)

With a wide range of biotic communities including conifer woodlands, Sonoran desert scrub, and even alpine tundra, Arizona is known for its habitat diversity. Although water is a limited resource in the majority of these habitats, the state's aquatic ecosystems are equally varied. Within its borders exist raging rapids, shallow backwaters, deep canyon-shaded pools, and isolated desert potholes.



Unfortunately, human activity has caused changes to many of these habitats at the expense of Arizona's native aquatic species. Of the state's 36 native fish species, one is extinct and 20 are listed as federally endangered. Once Arizona's most common fish, the Gila topminnow is now amongst those most threatened.

The Gila topminnow is a guppy-like fish that grows to 5 centimeters in length. Females and non-breeding males are silver to tan in color with a faint dark stripe along their sides. Breeding males turn solid black with yellow fins. The fish's mouth is located terminally, or at the very tip of their snout, and is pointed upwards. This placement helps the fish catch insects that are resting on the water's surface. Gila topminnow prefer slow moving waters including springs, streams, and ponds where it occupies the top few inches of water and forages for plant matter and small insect larvae. As a very small fish, it is heavily dependent on streamside vegetation in which to hide from predators such as larger fish, crayfish, frogs, birds, snakes and aquatic insects.

As rivers have been dammed and the water table has been lowered, many of the shallow backwaters, springs and pools on which the Gila topminnow depends have disappeared. This sad state of affairs, combined with human activities that have removed streamside vegetation and the introduction of non-native species such as bullfrogs and mosquito fish, has resulted in this fish being added to the federal list of endangered species. Large scale breeding and reintroduction efforts have been and continue to be undertaken and hopefully this fish will someday be a common sight in Arizona's waters again.

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##### Largemouth Bass (*Micropterus salmoides*)

Arizona’s waterways look drastically different today than they did before human settlement arrived. In those days, the state’s rivers were undammed, meaning they were free to rage during seasonal floods and dwindle during the dry periods. Today, the need for flood control, power production, and recreation has created countless dams, canals, and artificial lakes resulting in a greater number of deep, slow-moving water sources that are ideal habitat for introduced sports fish such as the largemouth bass.



The largemouth bass is a large fish that grows to 1.2 meters in length or more. It is dark green to brownish above and white to yellowish below, has dark blotches that form a jagged stripe down its side, and has dorsal fins that are spiny in the front and rounded in the back. The upper jaw, which extends behind the eye, differentiates this fish from smallmouth bass. In Arizona’s man-made lakes and modified rivers, these fish depend on rocks, logs, and streamside vegetation in which to shelter themselves from predators such as large fish, birds, snakes, crayfish, frogs, and large mammals. They leave these shelters to forage for prey such as fish, insect larvae, frogs, crayfish, snakes, birds, and small aquatic mammals in open waters.

Introduced to Arizona as a sports fish, the largemouth bass has had many unforeseen consequences such as increased predation on smaller native species such as Gila topminnow and desert pupfish and increased competition with larger natives such as Gila chub. However, the introduction of this fish hasn’t all been negative. It has also brought countless individuals to Arizona’s waters to recreate, helping to show the public the amazing resources Arizona’s natural areas have to offer.



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##### Merriam's Kangaroo Rat (*Dipodomys merriami*)

In the Sonoran Desert, times when levels of resources are high are few and far between. Rainfall arrives almost exclusively during the summer and winter and much of this water drains quickly towards the desert's riparian areas, leaving the uplands dry. The majority of the desert's residents are dependent on this limited resource, seeking water at temporary ponds or riparian areas. The Merriam's kangaroo rat, however, has a unique way to deal with these dry spells.



This small, 10 centimeter rat, with its yellow-brown back, white underside and long, tufted, white-striped tail can obtain enough moisture even during the driest times in the desert. At night, it scurries amongst sparse ground cover, using its keen sense of smell and vision to collect seeds from trees like mesquite and palo verde, forage on herbaceous plants, and capture insects. These food items all have extremely high water content and if enough are collected, the rat will never have to consume liquid water.

Even without the need for water, life in the Sonoran Desert is challenging. While foraging in the sparse habitats they occupy, these rodents are vulnerable to predation by birds, snakes, and large mammals. In addition, they face high levels of competition. It is no secret that moisture-rich food is a means of survival and the Merriam's kangaroo rat is not the only animal to make use of it. Despite these challenges, this rodent manages to thrive in the harshest of habitats, even in the driest of years.

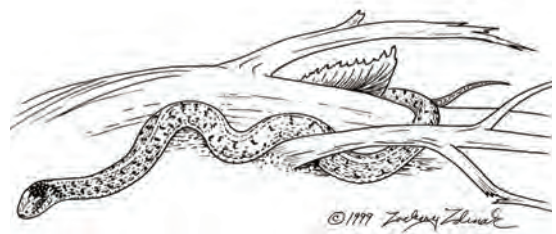
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##### Terrestrial Garter Snake (*Thamnophis elegans*)

For many people, the wide distribution, subtle coloration, and relatively small size of the terrestrial garter snake makes it a fairly unimpressive animal. This snake is quite slender, grows to only just 1 meter in length, and is a dull grey with black spots and has lightly colored striped along the length of their bodies. They tend to stay near permanent water but as their nickname, “the wandering garter snake” implies, they can stray far from any water source. They inhabit grasslands, forests, riparian areas, mountains, and deserts and are often among the most common snakes in their range. Despite their commonness in many habitats and their bland appearance, this snake is far from ordinary.



These animals are as diverse in their diet as they are in their preferred habitat. They actively forage during the day for fish, frogs, and small mammals. Thanks to the variance in their diet, they suffer little from competition from other predators. While foraging, they depend upon their subtle markings to hide within low-lying vegetation from predators like birds, other snakes, fish, frogs, crayfish, and large mammals.

The most unique thing about this snake is its breeding and reproduction habits. Upon emerging from hibernation in spring, they immediately begin searching for a mate. It is not uncommon for many males to attempt to breed with a single female, resulting in large “breeding balls” consisting of several animals. In addition, unlike the majority of snakes, the terrestrial garter snake gives birth to live young that are independent from birth. These unique breeding traits, along with their ability to thrive in nearly any habitat, make this animal extraordinary despite its abundance.

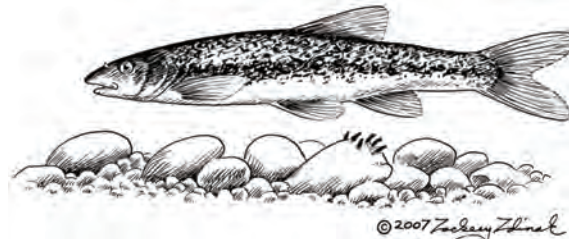
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##### Longfin Dace (*Agosia chryogaster*)

In Arizona's riparian areas, water is seasonally limited and flash floods are extremely common. Aquatic animals can be swept downstream during floods, trapped in temporary pools with diminishing water quality, or even stranded in dewatered stretches of stream. For these reasons, fish not well adapted to these desert systems often do not last a single season. However, native fishes that have evolved with these rivers, like the longfin dace, manage to thrive.



The longfin dace, a small slender fish, grows only 10 centimeters in length. It is silver in color with a prominent black stripe along its sides, has a blunt head, and its mouth is positioned slightly behind its snout. They prefer the shallow waters of small streams and depend on sandy or gravelly substrates in which to excavate their spawning beds. They require overhanging banks or streamside vegetation to provide cover from predators such as larger fish, crayfish, frogs, and birds while foraging for aquatic vegetation, detritus, insect larvae, and fish fry. They compete for food with the Gila topminnow, desert pupfish, and other aquatic organisms with similar diets but thanks to their incredible resilience and ability to survive in a multitude of habitats, competition is limited.

This fish may not be visually impressive, but what it lacks in aesthetics it more than makes up for with its ability to survive in the harshest of Arizona's riparian systems. For example, during the day when plants' high water demands can dry out streams, this fish can bury itself under wet algae and debris. When the plants' water demands dwindle and water returns to the streams, the longfin dace emerge to forage and seek more suitable habitat. Despite this resilience, populations of this fish are dwindling. Not even the longfin dace is immune to the loss of habitat and introduction of invasive species that is so common throughout Arizona's riparian areas.

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##### Toe Biter (*Lethocerus sp.*)

For small fish and amphibians living in Arizona's riparian areas, predators are plentiful. They are preyed upon by birds, mammals, snakes, and even larger members of their own species. These interactions are well known but one group of predators, the insects, is often overlooked. One insect in particular, the toe biter, can be especially voracious.



Toe biters are large beetle-like insects with leathery wings, small antennae, and large raptorial front legs that are much thicker than the hind two pairs. These back two pairs of legs are covered with short hairs that help the insect swim and allow it to hold onto small bubble of air, allowing it to breath beneath the water's surface. They also have a large spear-like mouth part called a proboscis which they use to impale their prey, inject them with digestive fluids, and suck out the partially digested remains. Despite their menacing appearance, these animals are easily overlooked. They spend much of their time with their wings flat to their backs, mimicking dead leaves amongst debris, heavy streamside vegetation, and diverse substrate. This allows them to hide in plain sight from predators like fish, frogs, crayfish, and larger insects while patiently waiting to ambush prey items including insects, fish, and frogs. This hunting method is extremely efficient and allows these insects to compete with the many other aquatic predators they share habitat with.

Toe biters are prolific breeders. After mating, the female deposits hundreds of eggs on the back of the male where they remain until they hatch. In addition, they prefer warm water and are tolerant of extremely poor water quality. For this reason, these insects thrive in streams that have been drained of much of their water, leaving behind stagnant pools, and in heavily polluted waters. They are incredible creatures, but their presence in high numbers can often be an indicator of degraded rivers.

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##### Red-spotted Toad (*Bufo punctatus*)

The arid landscape of Arizona seem like an unlikely place for an amphibian to call home, but in the state's riparian areas, rocky canyons, forests, grasslands, and deserts, the native red-spotted toad finds refuge. This small toad, growing only 8 centimeters in length, is grey to reddish brown overall, has small red bumps covering its body, and unlike all other Arizona toads, the paratoid glands behind their ears are round. Like much of Arizona's other wildlife, these toads are perfectly adapted to take advantage of the little water the landscape receives.



The red-spotted toad is found primarily near streams but can venture far from water. With eggs that hatch in three days and develop into adults in just 6 to 8 weeks, they need only temporary water. This differentiates this toad from many other amphibians that require permanent water to raise tadpoles that take multiple seasons to develop. They are most common in rocky areas where they hide in cracks and crevices from predators such as birds, snakes, frogs, mammals, and large fish. They also use these secure hiding places to wait in ambush for prey such as insects, fish, and smaller amphibians which they catch with their sticky tongues.

This toad is designed perfectly for life in Arizona's harshest habitats. When temporary waters dry up, they can push beneath the earth and remain buried for over a year until the next rainy season. During this time, they are capable of surviving a loss of up to 40 percent of their bodies' water content. When rain finally falls again, they emerge from the soil in abundance. They take advantage of these short windows to rehydrate, forage, and breed before disappearing once again.

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##### Beaver (*Castor canadensis*)

The beaver is a large aquatic rodent that grows to up to 1.2 meters in length. The animal is covered in thick, dark brown fur, has a long flattened, nearly hairless tail, and short forearms with large claws. Considering the animal's size, unique appearance, and commonness in habitats such as wetlands and riparian areas, it is a wonder that this animal is so seldom seen.



Beavers can easily be confused for muskrats, but they are unique animals. They are easiest to distinguish from beavers on land where their larger size and wide tail are apparent. In the water, their swimming style distinguishes them. Beavers swim with only their heads visible while muskrats swim with their head and back above water. Even when the animals themselves are not visible, the two can be distinguished by the signs they leave throughout the habitat. Beavers, like muskrats, build lodges using mud and plant materials in order to protect themselves from predators such as raptors and large mammals. Unlike muskrat lodges however, beaver lodges do not have entrances above the water's surface.

In Arizona, beavers have lost substantial amounts of habitat as riparian areas have been altered and degraded. These animals depend upon large trees for both construction of their lodges and dams and for a source of food. These animals do consume some fruits and aquatic plants, but depend almost entirely on tree cambium and bark. They suffer no competition for this unique food source, but in order to have enough trees to meet their dietary and constructive needs, one family of beavers still needs about a kilometer of riparian habitat. Along these stretches they inhabit, beaver dams drastically alter the landscape. They slow water, allowing for the creation of ponds, wetlands, and eventually meadows as the beaver ponds fill with silt from upstream. Without the beavers, this succession from riparian area to meadow would not be possible and countless other species would suffer.

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##### Sonora Sucker (*Catostomus insignis*)

In Arizona's riparian areas, water is seasonally limited and flash floods are extremely common. Aquatic animals can be swept downstream during floods, trapped in temporary pools with diminishing water quality, or even stranded in dewatered stretches of stream. For these reasons, fish not well adapted to these desert systems often do not last a single season. However, native fishes that have evolved with these rivers, like the Sonora sucker, manage to thrive.



The Sonora sucker, one of Arizona's larger native fish, grows up to 80 centimeters in length. It is distinctly bi-colored with brown above and yellow below, has large scales, a rounded snout, and a disproportionately thick lower lip. They prefer deep pools within streams where they can forage, using their mouths to pull in and spit out gravelly substrates, filtering out aquatic insects, plant matter, fish fry, and detritus. While foraging for these resources, they depend on overhanging banks or streamside vegetation to provide cover from predators such as birds, large fish, snakes, frogs, and large mammals. Despite its dependence on deep pools, this fish does not do well in large man-made bodies of water like Arizona's many man-made lakes.

The Sonora sucker competes with other bottom feeders such as crayfish, snails and similar fish such as the desert sucker. The Sonora and desert sucker are superficially similar; however the Sonora sucker's larger size, lack of dark bands, cartilaginous mouth plate, or notched mouth set it apart. Also, these two fish have vastly different behaviors and habitat preferences. Unlike the Sonora sucker which forages amongst the substrate of pools, the desert sucker is most often seen scraping algae off of rocks within the riffle portions of streams. Both fish, however, depend on habitat diversity. As rivers are modified, degraded, and altered, diverse stretches of riffles, runs, and pools are often replaced with endless stretches of uniform habitat. This is a trend that could be devastating for both of these native fish.

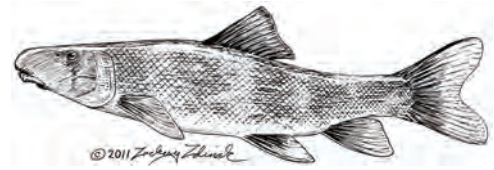
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##### Desert Sucker (*Catostomus clarkii*)

In Arizona's riparian areas, water is seasonally limited and flash floods are extremely common. Aquatic animals can be swept downstream during floods, trapped in temporary pools with diminishing water quality, or even stranded in dewatered stretches of stream. For these reasons, fish not well adapted to these desert systems often do not last a single season. However, native fishes that have evolved with these rivers, like the desert sucker, manage to thrive.



The desert sucker is a medium sized fish, growing up to 33 centimeters in length. It is distinctly bi-colored with silver above and yellow below, has jagged, dark vertical bars along its sides, large scales, a rounded snout, and a large cartilaginous plate that forms two notches on the sides of its mouth. These fish spend the day in deep pools where they can avoid predators such as larger fish, frogs, snakes, birds, and large mammals, taking refuge beneath overhanging banks and streamside vegetation. At night, they move into the rocky riffles in search of food. There, they will use their large cartilaginous plate to scrape algae from large rocks.

The desert sucker competes with other bottom feeders such as crayfish, snails and similar fish such as the Sonora sucker. The desert and Sonora sucker are superficially similar; however the desert sucker's smaller size, dark bands, cartilaginous mouth plate, and notched mouth set it apart. Also, these two fish have vastly different behaviors and habitat preferences. Unlike the desert sucker which scrapes algae from rocks within riffles, the Sonora sucker is most often seen foraging in deep pools with gravelly substrate. Both fish, however, depend on habitat diversity. As rivers are modified, degraded, and altered, diverse stretches of riffles, runs, and pools are often replaced with endless stretches of uniform habitat. This is a trend that could be devastating for both of these native fish.



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##### Abert's Towhee (*Pipilo aberti*)

As summer comes to an end, many of Arizona's riparian birds are through breeding and are preparing to leave the state and head for their wintering grounds. The Abert's towhee however, is making no such preparations. This bird is a permanent resident in Arizona and has one of the smallest ranges of any North American bird: it winters and breeds only in a small portion of the southwest, namely the lower Colorado and Gila River watersheds.



The Abert's towhee is a medium-sized bird with an overall length of 24 centimeters. It has a uniformly pinkish-brown body except for some slight rufous beneath its long tail. It can be identified easily, even at a distance, by its pale bill that contrasts sharply with its black face. This bird prefers riparian habitats with bushy ground cover, cottonwoods, and willows. In the dense brush, the Abert's towhee hides from predators such as large birds, snakes, and mammals while searching for foodstuffs such as small insects and seeds by scratching at the ground with its feet. This method allows the towhee to find food which competitors such as other seed eating birds, mammals, and insects may have missed.

With such a small home range, the Abert's towhee is particularly vulnerable to habitat loss. When the bird loses habitat to development, over-grazing, and other human activities, it is not just a particular population that is harmed, it is the entire species. Unfortunately, this bird has lost much of its favored riparian habitat and its numbers have declined significantly. If this trend is not reversed, this bird could be lost from a large part of its range, forever.

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##### Song Sparrow (*Melospiza melodia*)

The song sparrow is one of North America's most versatile birds. It can occupy an incredible variety of habitats including marshes, grasslands, desert scrub, pine forests, prairies, chaparral, agricultural fields, pastures, and even parks. In any of these habitats, these birds require a mixture of open and brushy areas. In the brush, song sparrows can be seen foraging for seeds, fruit, and insects while keeping a watchful eye for large mammals, snakes, and large birds that might prey on them as well as for rodents and smaller birds with which they might compete.



The song sparrow is a small bird growing to 15 centimeters in length. It is a light brown and grey bird with bold brown streaks down its white chest, a short bill, a rounded head, and a long rounded tail. In many areas, it is the most common heavily-streaked sparrow. Although throughout much of its range this sparrow can occupy a wide variety of habitats, in the Arizona summer it is more restricted.

During the summer breeding season, Arizona's song sparrows require dense vegetation near water and they find it within the state's riparian areas. In these areas, the birds seek out low, dense ground cover in which they build small, sturdy, cup-shaped nests composed of an inner layer of grasses, weeds, and animal fur and an outer layer of bark or tightly woven grasses. The nests are kept near water to ensure the parents will be able to find enough protein-rich insects to feed their young until they grow into adult birds. These birds would not be able to find enough food to support their young in their arid wintering habitats throughout the state. Without riparian areas, fledging next year's song sparrows would not be possible.

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##### Common Kingsnake (*Lampropeltis getula*)

Snakes often have a bad reputation. They are seen as evil creatures that are only here to deceive, harm, and kill. However, of Arizona's 52 species of snakes, 38 are harmless to humans and each of them plays a vital role in the ecosystem they inhabit. Some, such as the common kingsnake, fill an important niche unknown to most of the desert's inhabitants; one most of them would not want to have unfilled.



The common kingsnake is a large, slender snake patterned in black and white with a head barely wider than its body. Patterns vary from distinct black and white bands, to mottled black and white, to completely black. This snake can be found in an extremely wide variety of habitats including forests, deserts, fields, and riparian areas. Although it is a terrestrial snake, the animal tends to stay close to water due to the high availability of food and the large amounts of brushy vegetation from which to hunt and hide from predators such as large mammals and birds.

Its diet includes snakes, small mammals, lizards, birds, eggs, and amphibians which it hunts by waiting in ambush and kills through constriction. This diverse diet allows the snake to suffer from very little competition.

The kingsnake earns its name from its tendency to eat other snakes. It is an extremely powerful constrictor that can easily catch and overpower most other snakes. In addition, it is immune to pit viper venom which places rattlesnakes on its menu. It is this ability and propensity to eat rattlesnakes that makes many desert residents happy to share the landscape with the common kingsnake. It is one of the rattlesnakes' very few predators and without them the desert would be a much more treacherous place.

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##### Rock Squirrel (*Spermophilus variegatus*)

In the Sonoran Desert, the life of a rodent is particularly challenging. Rain falls almost exclusively in the summer and winter, with long periods of desiccation between. This limited water produces an equally limited crop of moisture-rich herbaceous plants, insects, and seeds over which these rodents and other animals all compete. The low number of shade-providing trees makes these animals particularly vulnerable to soaring predators and the desert's uneven rocky landscape provides countless ambush opportunities for the snakes and larger mammals that also call this region home.



Many of the desert's rodents depend on incredible adaptations that allow them to go without drinking water for a lifetime, but others, such as the rock squirrel, are more restricted by their need to hydrate. These squirrels are large, growing up to 30 centimeters in length, excluding the tail. They have speckled grayish-brown fur above, light brown fur below, light colored rings around their eyes and bushy tails that are nearly as long as their body. Less drought tolerant than other desert rodents, these animals are tied to areas close to water, such as desert riparian areas, where they depend upon large rock outcroppings or canyon walls.

From their rocky perches, rock squirrels tirelessly defend their territories from predators such as large mammals, birds, and snakes as well as from other animals that compete for food such as insects, seeds, flowers, fruit, herbaceous plants, and carrion. In order to make defending their valuable territories easier, rock squirrels are highly social. They live in colonies consisting of a single male, several females, and juveniles. Females and young are permitted to come and go freely, but males, both adult and juvenile, are often forced away from their burrows by other males. It may seem cruel to push out one's own family, but in a desert where moisture is extremely scarce, water-front property is invaluable.

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#### Desert Pupfish (*Cyprinodon macularius*)

With biotic communities ranging from conifer woodlands, to Sonoran desert scrub, to alpine tundra, Arizona is known for its habitat diversity. Although water is a limited resource in the majority of these habitats, the state’s aquatic ecosystems are equally varied. Within its borders exist raging rapids, shallow backwaters, deep canyon-shaded pools, and isolated desert pools. Unfortunately, human activity has caused changes to many of these habitats at the expense of Arizona’s native aquatic species. Of the state’s 36 native fish species, one is extinct, and 20 are listed as federally endangered. Once among Arizona’s most common fish, the desert pupfish is now amongst those most threatened.



The desert pupfish is a small, stocky fish that rarely grows over 5 centimeters in length. Females and non-breeding males are silver with vertical black bands while breeding males are blue with yellow fins. Both genders have short, rounded fins and a faint stripe of dark spots near the base of their caudal, or tail, fins. They have upturned, protractile mouths that help them when foraging for insects and aquatic plants. These fish prefer warm, slow moving waters including springs, streams, backwaters, and ponds. During the night and during cold weather, they are heavily dependent on streamside vegetation in which to hide from predators such as larger fish, crayfish, frogs, birds, snakes, and aquatic insects. In addition, the desert pupfish require fine substrates in which to lay eggs and defend territories.

As rivers have been dammed and the water table has been lowered, many of the shallow backwaters, springs, and pools on which the desert pupfish depend have disappeared. Combined with human activities that have removed streamside vegetation, introduction of non-native species such as bullfrogs and mosquito fish, these threats have secured a place for this fish on the federal list of endangered species. Large scale breeding and reintroduction efforts have been and continue to be undertaken and hopefully this fish will again be a common sight in Arizona’s waters.

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##### Canyon Treefrog (*Hyla arenicolor*)

The arid landscape of Arizona seems like an unlikely place for an amphibian to call home, but along the state's rocky rivers within deserts, chaparral, and wooded areas, the canyon treefrog takes refuge. These small frogs, growing only 5 centimeters in length, are grey to dark green with dark spots above and yellow or orange below. They have rough skin similar to that of a toad, but their large sticky toe pads differentiate them as a frog. Like much of Arizona's other wildlife, these frogs are perfectly adapted to survive in the harsh habitats they occupy.



The canyon treefrog is found primarily near streams but can venture far from water. Their eggs hatch in two weeks and develop into adults in just over 10, so they require only seasonally permanent water. This quick development is a key trait that allows this frog to survive in Arizona's arid habitats where many other amphibians with tadpoles that take multiple seasons to develop cannot. Also helping them survive where other amphibians cannot, these frogs have incredible camouflage that allows them to hide in plain sight. Their color varies slightly from region to region, often matching the color of the area's substrate. This allows them to thrive in rocky areas with minimal cover where they hide in cracks and crevices from predators such as birds, snakes, frogs, mammals, and large fish.

At night, they emerge from these hiding places and move to the edges of slow-moving streams and backwaters. They linger in these areas throughout the night, foraging for small insects. This limited diet forces canyon treefrogs to compete with all other insectivorous riparian animals, but with the help of their long sticky tongues that they use to pull prey into their wide mouths, they manage to get their fill. In fact, they do so well, that their unmistakable call is one of the most common sounds along Arizona's streams during summer nights. Often said to sound like bleating sheep, this call is often the only evidence of the high numbers in which this incredibly well-hidden creature exists.

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##### Raccoon (*Procyon lotor*)

As urbanization increases and encroaches on natural areas, it is unfortunately common for population numbers of native species to decline and for some species to disappear altogether. These species are inextricably tied to their natural habitats and the resources they hold. Without them, they cannot survive. However, no two species respond to environmental disturbance the same way and some even follow opposite trends. One such animal, the raccoon, has drastically expanded its range as development has spread across North America.



Raccoons are large mammals whose body can exceed 60 centimeters in length, not including the tail. They are grey to brown in color, have rounded ears, distinct black facial markings, five fingered hands complete with large claws, and a bushy, striped tail. Historically, these animals were found in heavily-wooded areas and riparian corridors where they depended on large trees in which to avoid predators such as large mammals and raptors. They also rely on heavy undergrowth in which they would forage for food using their keen senses and incredibly dexterous hands.

It is this animal's diverse diet and high level of intelligence that has allowed it to continue to thrive and expand its territory as humans began to modify the land. With a wide diet including fish, amphibians, small mammals, invertebrates, and plants, there is no limit to what a raccoon can consume. With the intelligence to explore new potential resources and the dexterity to closely examine any potential food resource, they are not limited to any particular habitat type. For these reasons, raccoons were able to follow urbanization and agriculture, making use of the resources humans added to the landscape. In addition, large scale predator control and intentional introductions further allowed them to expand. Today, these animals are common in a wide variety of habitats. As long as they have access to food, water, and shelter, these animals will continue to prosper.

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#### Vocabulary

**abiotic factor** - physical, or nonliving, factor that shapes an ecosystem.

**annual vegetation** - a plant that flowers once and then dies.

**autotroph** - organism that can capture energy from sunlight or chemicals and use it to produce its own food from inorganic compounds; also called a producer.

**bank alteration** - any change to the stream bank; could be caused by animals, people or flooding.

**binomial nomenclature** - classification system in which each species is assigned a two-part scientific name.

**biomass** - the total mass of all living material in a specific area, habitat or region.

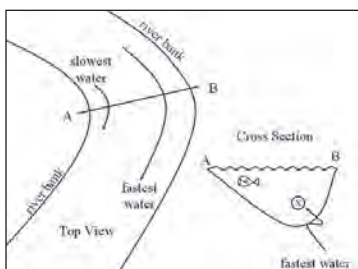
**biotic factor** - biological influence on organisms within an ecosystem.

**classification** - systematic grouping of organisms according to shared characteristics.

**cobbles** - a sediment particle that is larger than gravel but smaller than a boulder.

**consumer** - organism that relies on other organisms for its energy and food supply; also called a heterotroph.

**cross section** - a view of a river from bank to bank when sliced vertically.



**deposition** - the settling or coming to rest of transported material from streams or wind.

**downstream** - away from the stream's source; in the direction of the stream's current or flow.

**ecosystem** - collection of all the organisms that live in a particular place, together with their nonliving (abiotic) environment.

**embedded rock** - rock that cannot be easily removed from the ground in which it rests.



## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Vocabulary

**erosion** - the gradual wearing away of rocks, sediment and soils, by the action of water or wind; usually involved the transfer of material from the upstream portion of a river to the downstream portion.

**evapotranspiration** - the loss of water by evaporation from soil and the transpiration of plants.

**forage** - food such as grass or hay for horses and cattle

**fracture** - any break in rock where no movement (up or down) has taken place.

**gravel** - rounded particles bigger than 2 millimeters in diameter.

**grazing** - method of feeding by herbivores.

**green line** - a continuous stretch of perennial vegetation above the water.

**ground water** - water below the ground that has greater pressure than above the ground.

**habitat** - the area or natural environment in which an animal or plant normally lives.

**herbaceous** - a plant that does not have a woody stem and dies back at the end of the season.

**heterotroph** - organism that relies on other organisms for its energy and food supply; also called a consumer.

**invasive species** - species that spread aggressively and are not native to an area; these invasions can lead to loss of biological diversity by eliminating habitat for native species.

**keystone species** - a species whose presence and role within an ecosystem has a disproportionate effect on other organisms within the system. A keystone species is often a dominant predator whose removal allows a prey population to explode and often decreases overall diversity. Other kinds of keystone species are those, such as coral or beavers, that significantly alter the habitat around them and thus affect large numbers of other organisms.

**meander** - a loop-like bend in the course of a stream.

**native species** - species that occur naturally in an area.

**non-native species** - species that are not naturally occurring in an area or environment; not necessarily invasive (see definition of invasive species).

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Vocabulary

**nonpoint source pollution** - pollution resulting from multiple sources that can spread long distances, making it difficult to impossible to pinpoint there original source. Some sources of nonpoint source pollution include vehicle emissions and agricultural runoff.

**overgrazing** - the destruction of the protective vegetation cover by having too many animals grazing upon it.

**perennial** - a plant that flowers year after year.

**pools** - a deep or still spot within a stream.

**precipitation** - any form of water that falls to Earth's surface from the clouds.

**producer** - also called autotroph; organism that can capture energy from sunlight and use it to produce its own food.

**riffle** - is a shallow stretch of a river or stream, where the current is above the average stream velocity and where the water forms small rippled waves as a result.

**riparian area** - the margins of streams or rivers where vegetation is strongly influenced by the presence of water. An estimated 80% of all vertebrate species in the desert southwest depend on riparian areas for at least some part of their life cycle.

**runoff** - water that flows over the land rather than going into the ground.

**sand** - a sediment particle that is smaller than gravel but larger than mud particles.

**sediment** - silt, sand, gravel, cobbles and other matter carried and deposited by water, wind, or ice.

**seedling** - a young tree that is less than 3 feet tall.

**slump** - the downward slipping of rock or other material moving as a unit along a curved surface.

**species** - a group of similar organisms that can breed and produce fertile offspring.

**stubble** - the part of a plant that is left behind after harvest or grazing.

**stream bank** - the sides of a stream or river channel.

**stream channel** - the physical confines of a stream including a bed and stream banks. The stream channel development is controlled by both water and movement of sediment.

## RIVER PATHWAYS

### Module I: An Introduction to Riparian Areas

#### Vocabulary

stream velocity - the speed of water travelling down a stream channel.

substrate - the material (sand, gravel, etc) that rests on the bottom of the stream.

substrate dwellers - organisms that live (dwell) within the substrate of the stream.

taxonomy - the study of classification of organisms.

understory - the layers of plants that grow underneath trees.

upstream - towards the stream's source; against the flow or current.

vascular plant - a plant that has a food and water transport system inside that transports food and water up and down the plant using pipe-like structures.

vegetation - all the plant life in a particular area.

# RIVER PATHWAYS

## MODULE 2: Riparian Plants

 Audubon ARIZONA



# RIVER PATHWAYS



## MODULE 2: Riparian Plants

### CONTENTS

Teacher Instructions 2

#### Classroom Materials

- Plant Identification Game
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  - Plant Identification PowerPoint Followup 5
  - Plant Identification Teacher's Reference 7
  - Plant Identification Game Instructions 9
  - Plant Identification Game Example 10
  - Plant Cards 19
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  - Plant Identification List 37
  - Plant Identification Game Answer Sheet 38
  - Plant Identification Game Answer Key

\*PowerPoint and video presentations are available as a DVD from Audubon Arizona, or online at [http://az.audubon.org/Education\\_RiverPathways-Curriculum.html](http://az.audubon.org/Education_RiverPathways-Curriculum.html).

## RIVER PATHWAYS

### Module 2: Riparian Plants

#### Teacher Instructions

Module 2 of River Pathways will develop three skills that students will need in careers managing our natural areas.

- Familiarity with some of Arizona's most common riparian plants.
- The ability to write detailed descriptions of plants.
- The ability to use descriptions to identify plants.

Riparian vegetation is vital to stream health. Among other functions, vegetation holds banks in place, creates shade which maintains water temperatures, and provides wildlife with food and shelter. In order to conduct the monitoring necessary to maintain our riparian areas, familiarity with riparian vegetation is essential.

Given the vast diversity of plant species found in riparian areas, it is common to come across an unfamiliar plant in the field. In such cases it is important to be able to write a detailed description of the plant that can then be used to identify and document the plant after returning from the field.

#### Materials:

1. Plant Identification PowerPoint presentation “River Pathways: Riparian Vegetation”
2. Plant Identification Teacher Narrative
3. Plant Identification Teacher’s Reference
4. Plant Identification Game
  - i. Teacher Instructions
  - ii. 25 Plant Cards
  - iii. 25 Lettered Cards
  - iv. 25 Plant Lists
  - v. 25 Answer Sheets
  - vi. 1 Answer Key

## RIVER PATHWAYS

### Module 2: Riparian Plants

#### Teacher Instructions

##### Before the lesson:

- Using the Plant Identification Teacher’s Reference, familiarize yourself with how to describe plants for identification purposes.
- Print plant cards, lettered cards, plant lists, answer sheets, and answer key. Laminate plant cards and lists for reuse in the future.
- Pair each plant card with a blank “lettered” card as listed in the Answer Key.

##### Introduce The Lesson:

- Show the Plant Identification PowerPoint presentation “River Pathways: Riparian Vegetation.”
- Review the information in the presentation using the Plant Identification Teacher Narrative.
- Introduce the idea of creating plant descriptions that can be used for identification.
- Play the Plant Identification Game.

##### After the Lesson:

- Remind the students about the Animal Homework worksheets they were assigned during Module 1.
- Assign a due date. This date should be before you introduce Module 3.

## RIVER PATHWAYS

### Module 2: Riparian Plants

#### Plant Identification: PowerPoint Followup

Review the PowerPoint with your students.

You may wish to ask them to tell you what they remember, using the bullet points below.

#### Why are riparian plants important?

Riparian plants serve many important functions in the environment.

- They provide bank stability by holding onto soil.
- They provide habitat for countless organisms.
- They keep water shaded and at an appropriate temperature.
- They slow flows during flash flood events.

#### Why is it important to be able to identify riparian plants?

Since riparian vegetation is so vital to the health of riparian ecosystems, it is essential that biologists are familiar with common riparian plants. Given the diversity of plants in these areas, it is unreasonable to expect that one person will know every single species.

- When a biologist comes across an unfamiliar plant, he/she must be able to write a detailed description so that the plant can be identified upon returning from the field.
- When the researcher returns to the office, he/she must use field guides and their written descriptions to identify the plant.

These skills are essential to monitoring streamside vegetation.

Monitoring streamside vegetation is essential to managing these valuable riparian areas!



## RIVER PATHWAYS

### Module 2: Riparian Plants

#### Plant Identification Teacher's Reference

When writing descriptions of plants to be used for later identification, there are many important plant features to consider. Please note: many of these features are only observable in the field and will not be useful in the classroom where the students' descriptions will be based on drawings.

- **Basic Category:** is the plant a...
  - Tree?
  - Shrub?
  - Grass?
  - Cactus?
  - Forb?
  - etc.
  
- **Overall Form:** How does the plant grow?
  - Describe the plant's size.
  - Is it neat, messy, dense, sparse, etc.?
  
- **Location:** In what type of habitat does the plant grow?
  - Is the plant near water?
  - Is it in a rocky area, sand, gravel, etc.?
  - Is it in the shade or direct sunlight?
  
- **Distinguishing Characteristics:** What makes the plant different from all the others?
  - Stems/trunk:
    - Describe the texture and color of the stem/trunk.
    - Describe the size and width of the stems/trunk.
    - Describe how the stems/branches come together.
  - Leaves:
    - Describe the shape, size, color and texture.
    - Describe the edges. Are they smooth or serrated?
    - Describe how leaves are arranged along the stem.
  - Flowers/seeds/fruit:
    - Describe the shape, size, color, and texture of the flowers, seeds, or fruit.
  
- **Additional Features:**
  - There is no such thing as too much information. If anything seems unique or special, be sure to write it down. It is better to have extra information than to miss a detail that will be vital for identification. Additional features include, but are not limited to
    - Scents.
    - Wildlife seen utilizing the plant.
    - Similarity to a common object. For example, one might say an agave resembles the top of a pineapple.

## RIVER PATHWAYS Module 2: Riparian Plants

### Plant Identification Teacher's Reference

Example:

Desert Senna (*Senna covesii*)



#### Description:

A small shrub, less than 2 feet tall, that grows in open desert on rocky slopes. The leaves are a grayish green and each is composed of 2-3 pairs of oval-shaped leaflets. The individual leaflets of each pair grow opposite each other on the leaf's central stem. It has bright yellow flowers that grow at the tip of the branches. It produces seeds in short pods that are fuzzy when young and rattle loudly when dried. The stems are gray, fuzzy, and thornless.

## RIVER PATHWAYS

### Module 2: Riparian Plants

#### Plant Identification Game Instructions

##### Objectives:

- Familiarize students with some of Arizona's most common riparian plants.
- Write detailed descriptions of plants based on significant physical features.
- Use written descriptions to identify riparian plants.

##### Instructions:

###### Materials:

1. 25 Plant Cards
2. 25 Lettered Cards
3. 25 Plant Lists
4. 25 Answer Sheets
5. 1 Answer Key

##### Game:

**Step 1:** Write a detailed description of a given riparian plant.

- Introduce the concept of creating descriptions that can be used to identify plants
- Give each student a Plant Card, a Lettered Card, a Plant List, and an Answer Sheet. Make sure to hand out the plant and lettered cards in the pairs listed on the Answer Key.
- Tell the students to describe the plant that is illustrated on the card, and write the description on the blank card.
- Demonstrate the activity using the example provided (Desert Senna).
- Instruct the students to describe their plant on their blank card in a way that their classmates will be able to identify the plant using the plant list.
- Tell the class that for fun, they'll be competing to write the BEST description, and that the best description is one that causes the most students to identify the plant correctly.
- Collect the blank cards on which the students have written their descriptions.

## RIVER PATHWAYS

### Module 2: Riparian Plants

#### Plant Identification Game Instructions

**Step 2:** Use descriptions to identify plants.

- Shuffle the students' plant descriptions and redistribute them to the class.
- Instruct students to identify the plant using the description provided and the Plant List. Record answers on the answer sheets. Allow 1 minute.
- After 1 minute, instruct the students to pass their cards one student to the right, regardless of whether or not they have finished identifying the plant.
- Repeat the activity until each student has had a chance to use each description.
- Instruct the students to exchange Answer Sheets.
- Using the Answer Key, reveal the answers to the class. Ask the students to raise their hands if the answer is correct on the answer sheet they are scoring. Record the number of correct identifications for each plant on the key.

**Step 3:** Identify the best description(s)!

- Which plant was accurately identified most frequently?
- The student who wrote the description that yielded the most frequent identifications wins!

**Discussion:**

- Ask the most successful students to read their descriptions aloud.
- What may have caused their descriptions to be more effective than the others?

# RIVER PATHWAYS

## Module 2: Riparian Plants

### Plant Identification Game Example

#### Plant ID Game Example

Plant Card:

Desert Senna



\*Student cards use line drawings instead of photographs, similar to many published plant keys.

Lettered Card:

**A**

A small shrub, less than 2 feet tall, that grows in open desert on rocky slopes. The leaves are composed of 2-3 pairs of oval-shaped leaflets. The individual leaflets of each pair grow opposite each other on the leaf's central stem. It has small flowers that grow at the tip of the branches. It produces seeds in short pods.

\* Note that many features described in the “Plant Identification Teacher’s Reference” are missing here, such as color. Those details cannot be gleaned from line drawings, thus are not included in the description.

# Gooddings Willow



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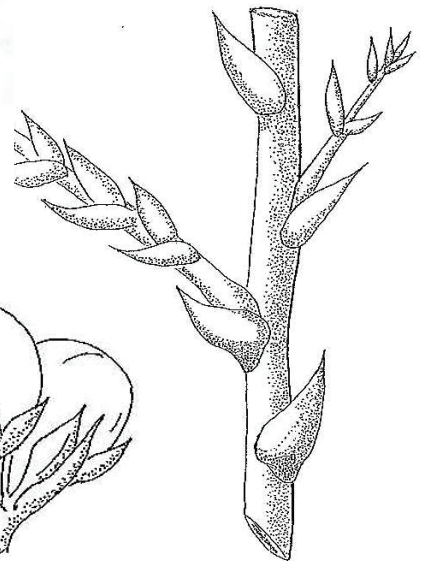
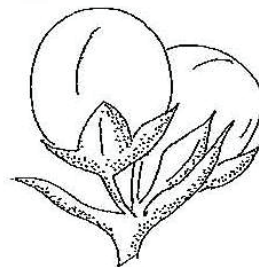
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# Seep Willow

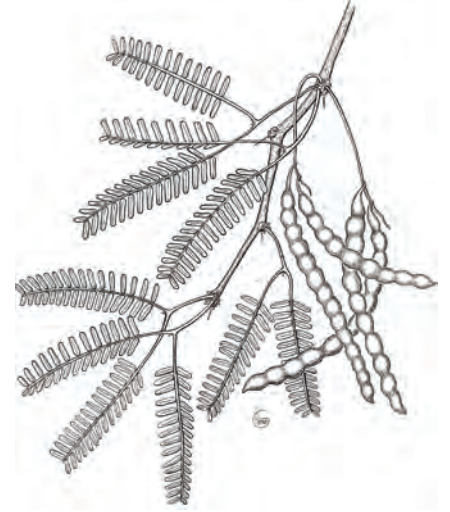
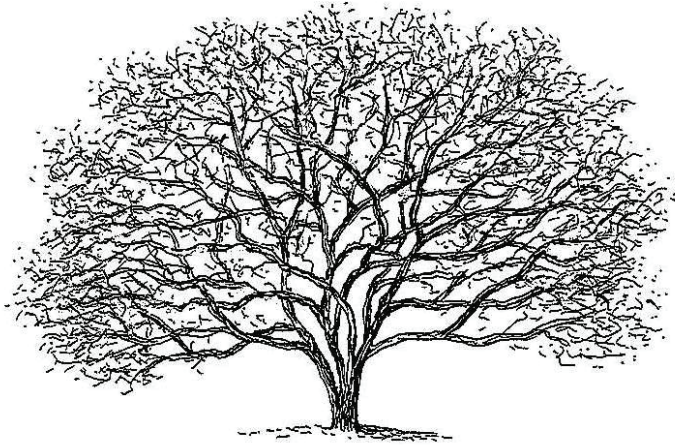


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# Tamarisk/Salt Cedar



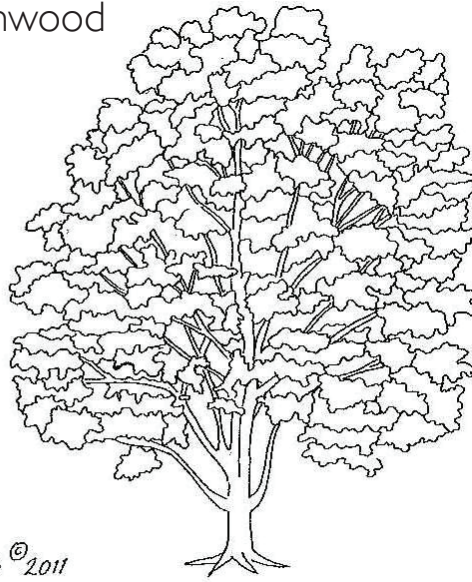
# Velvet Mesquite



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# Fremont Cottonwood



*K Gengle © 2011*

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# Velvet Ash



Up to 35' high



Audubon ARIZONA

RIVER PATHWAYS

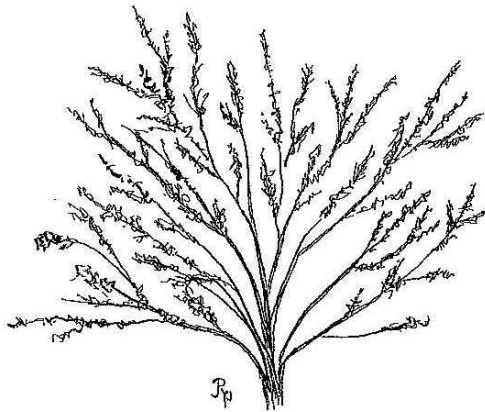
Plant ID Game Cards

RIVER PATHWAYS Module 2 ■ 11

Redberry Juniper



Red Barberry



Three Leaf Sumac



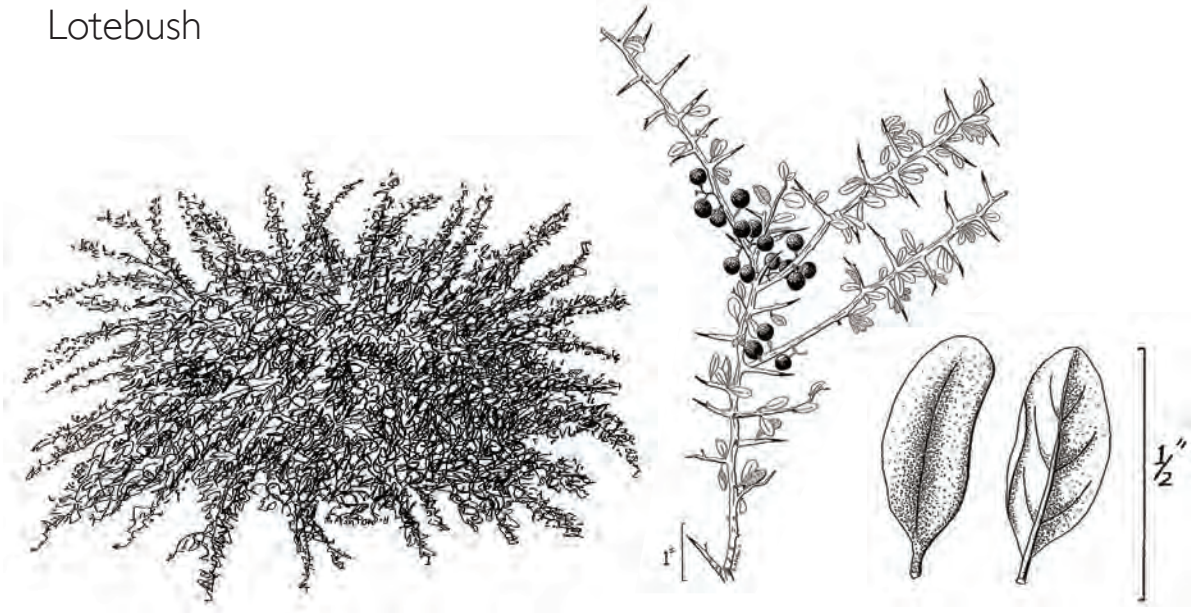
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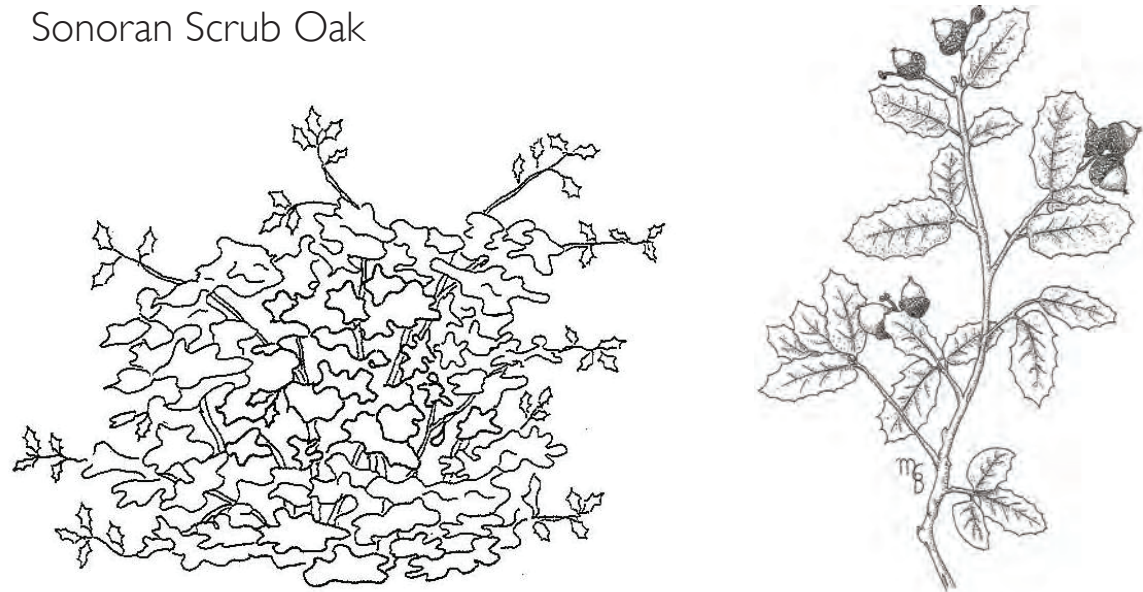
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Lotebush



Sonoran Scrub Oak



Desert Broom

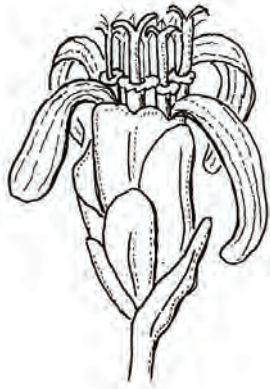


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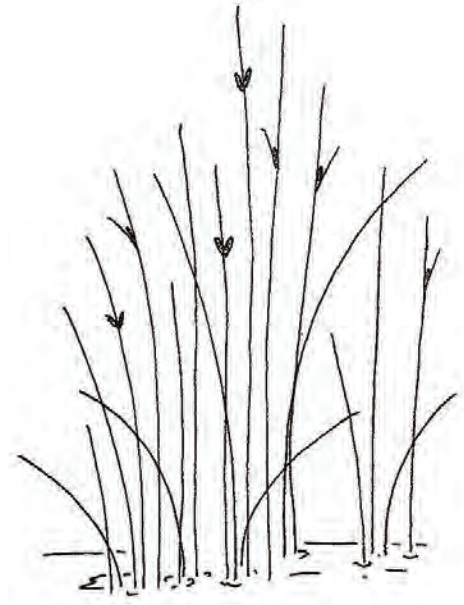
# Broom Snakeweed



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# Common Three Square Bulrush

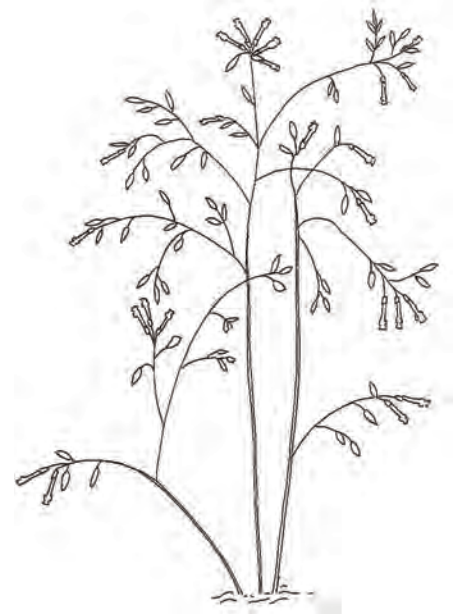


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# Bermuda Grass



# Tree Tobacco



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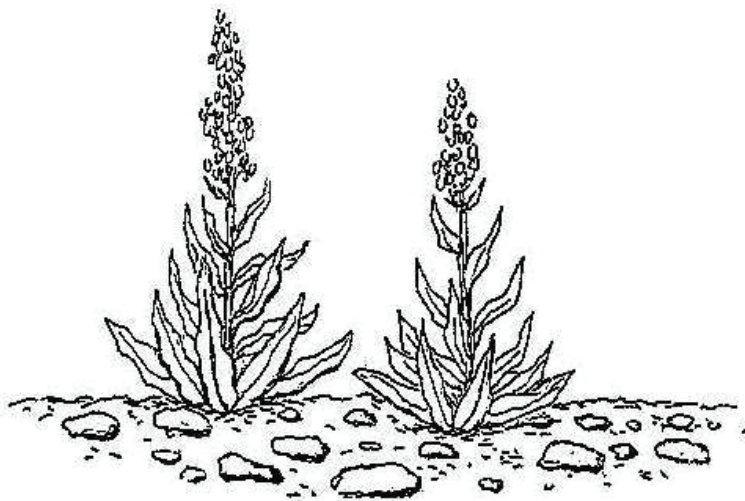
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# Johnsongrass



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# Desert Rhubarb



Catnip



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Spikerush

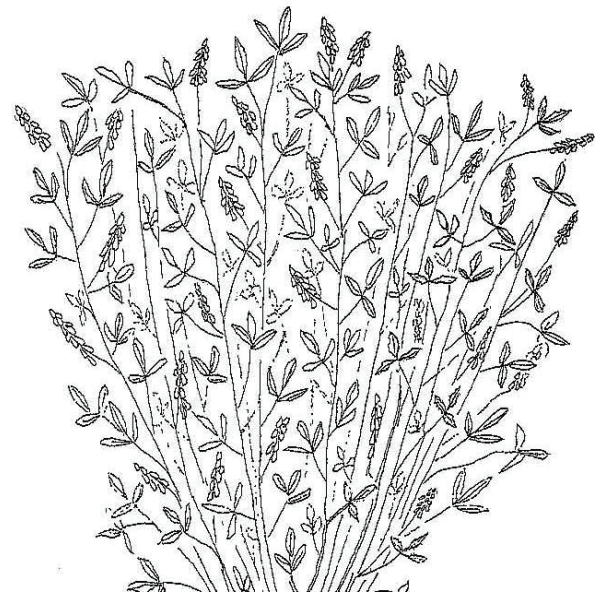


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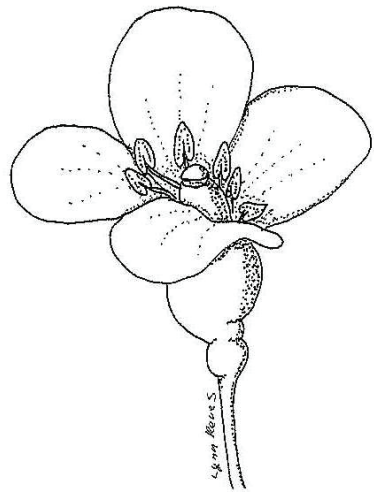
Rabbit's Foot Grass



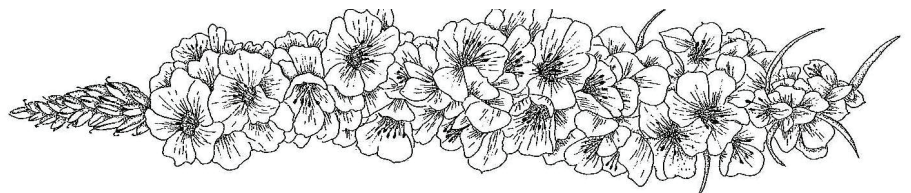
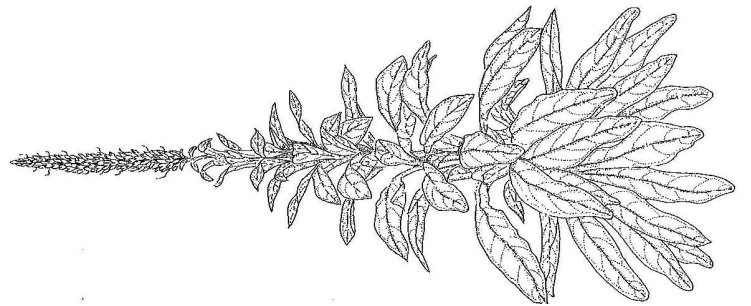
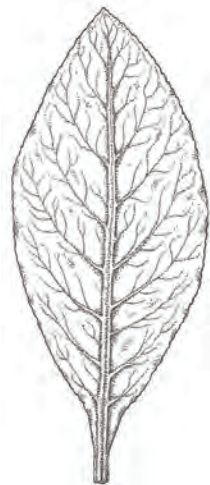
Yellow Sweet Clover



Watercress



Common Mullein

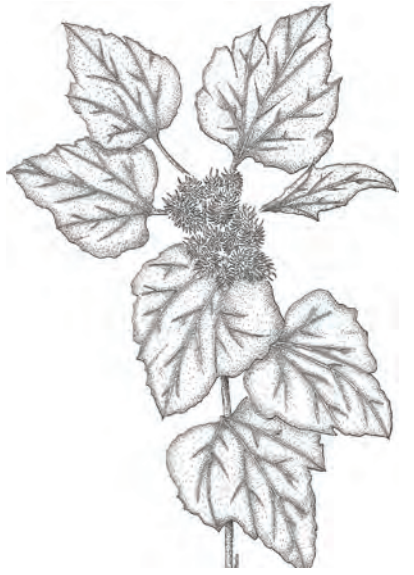
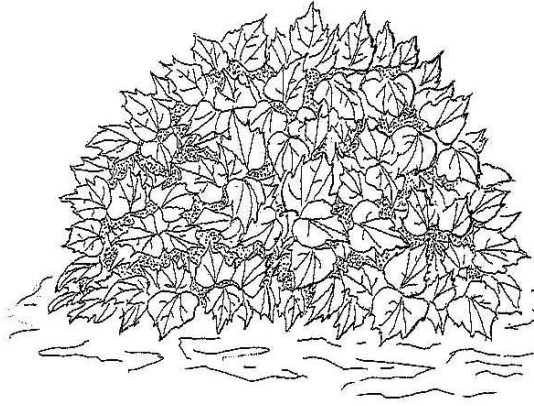


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Cocklebur



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A

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B

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C

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**RIVER PATHWAYS**

Plant ID Game Cards

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E

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Audubon ARIZONA

RIVER PATHWAYS

Plant ID Game Cards

RIVER PATHWAYS Module 2 ■ 20



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RIVER PATHWAYS

Plant ID Game Cards

RIVER PATHWAYS Module 2 ■ 21

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Plant ID Game Cards

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Audubon ARIZONA

RIVER PATHWAYS

Plant ID Game Cards

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**RIVER PATHWAYS**

Plant ID Game Cards

RIVER PATHWAYS Module 2 ■ 24

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Plant ID Game Cards

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**RIVER PATHWAYS**

Plant ID Game Cards

RIVER PATHWAYS Module 2 ■ 27

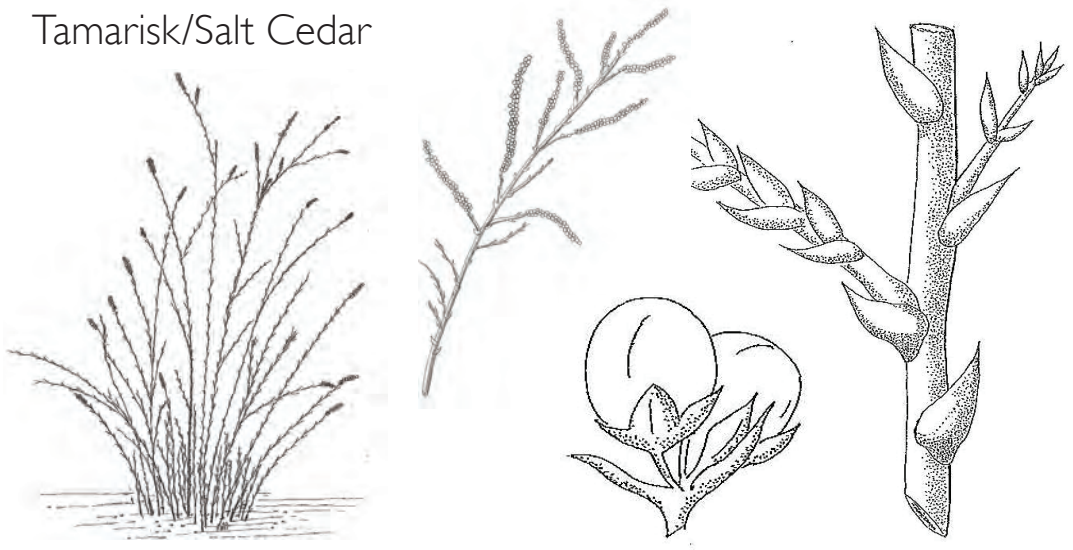
### Gooddings Willow



### Seep Willow

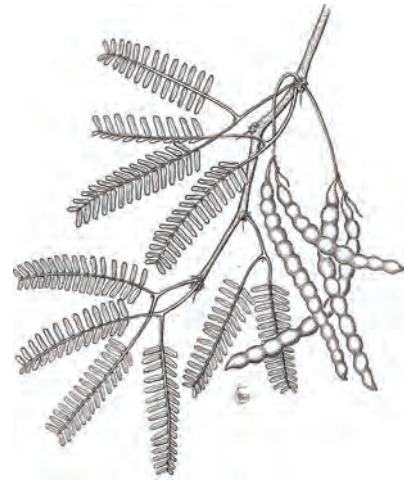
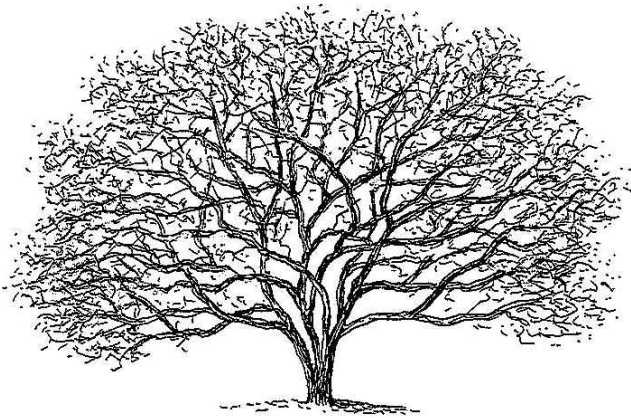


### Tamarisk/Salt Cedar

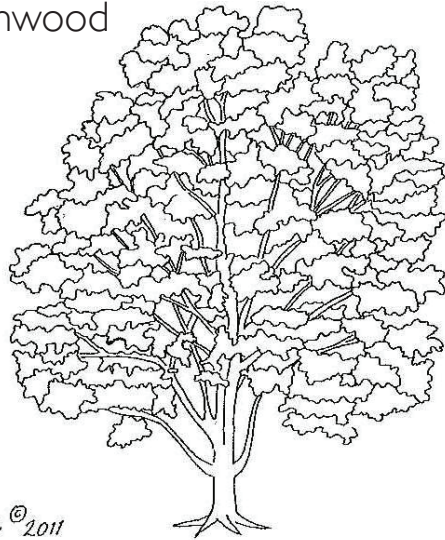




Velvet Mesquite



Fremont Cottonwood



*K Gengle © 2011*

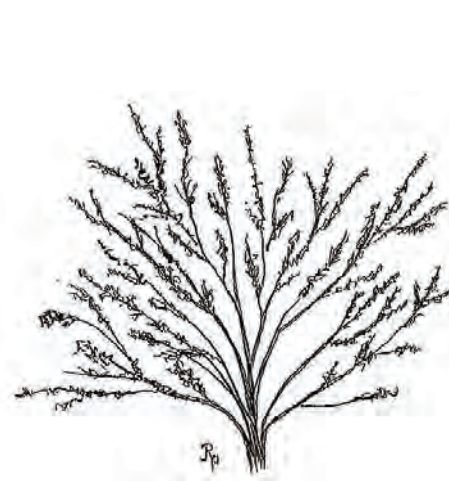
Velvet Ash



Redberry Juniper



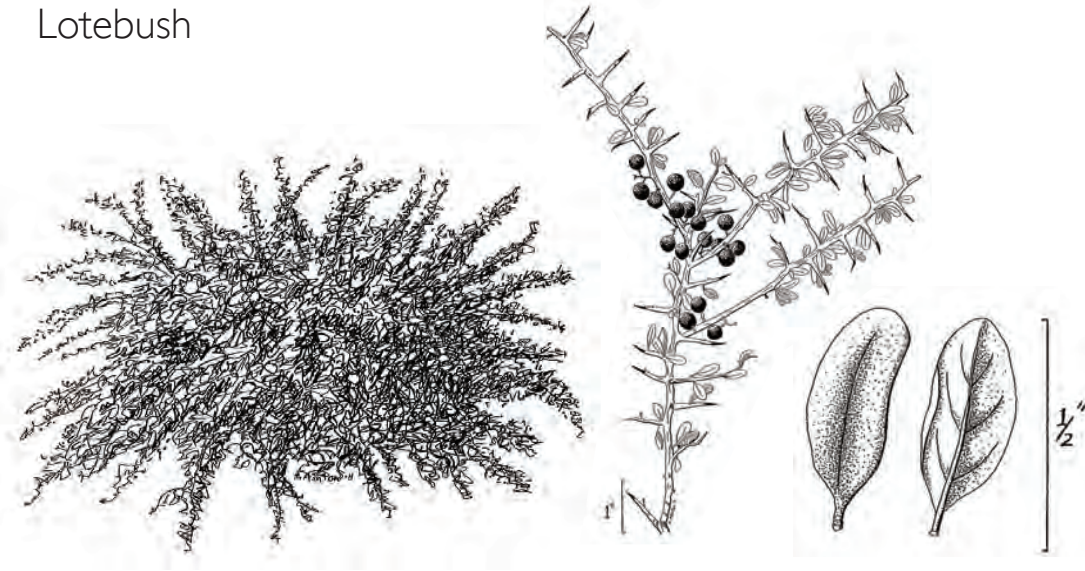
Red Barberry



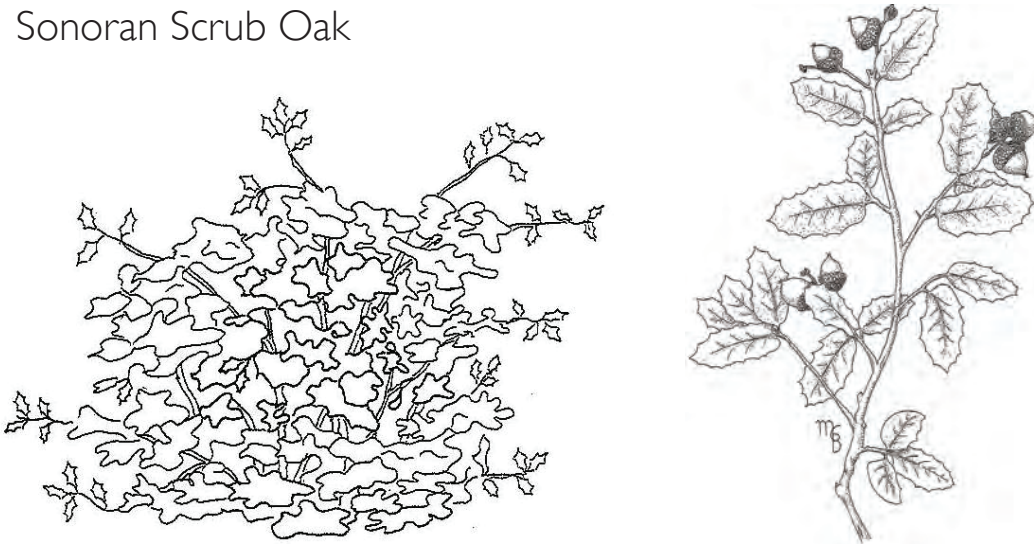
Three Leaf Sumac



Lotebush



Sonoran Scrub Oak



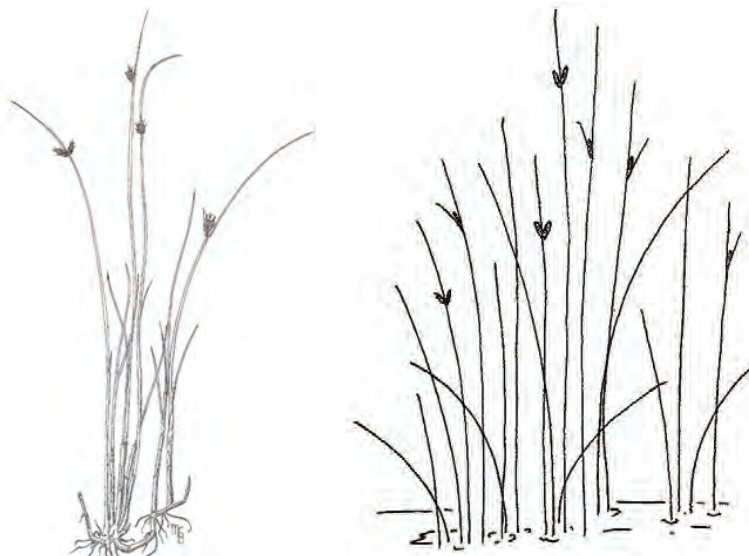
Desert Broom



Broom Snakeweed



Common Three Square Bulrush



Bermuda Grass



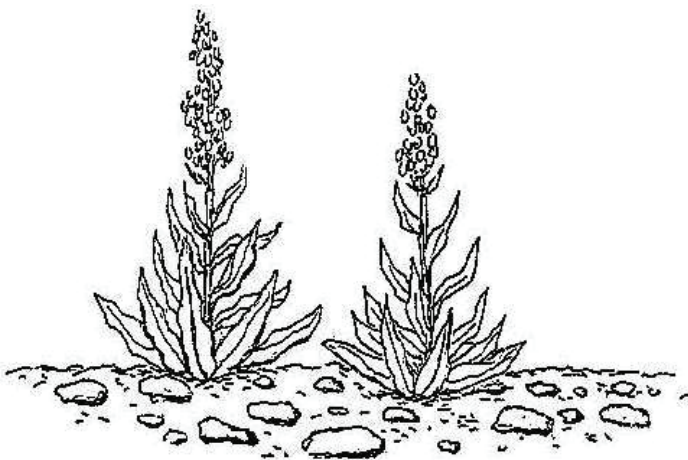
Tree Tobacco



Johnsongrass



Desert Rhubarb



Catnip



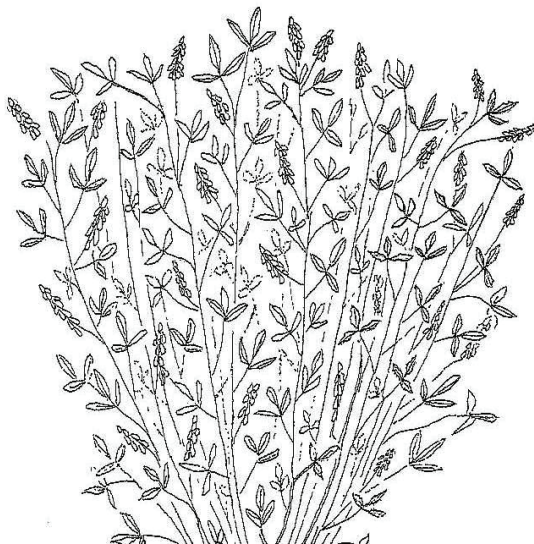
Spikerush



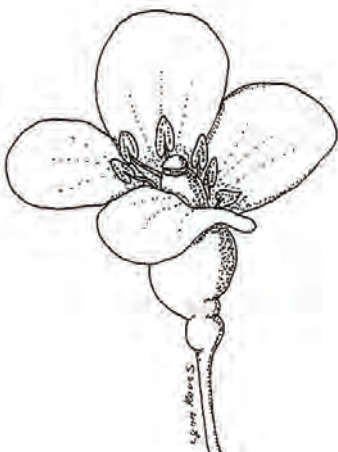
Rabbit's Foot Grass



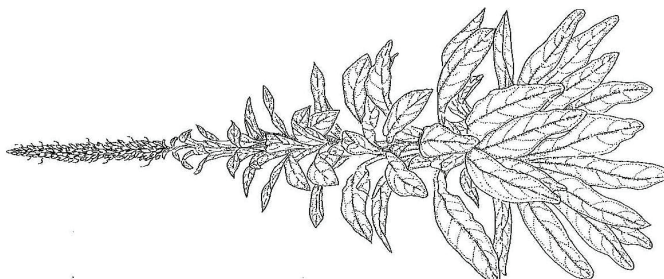
Yellow Sweet Clover



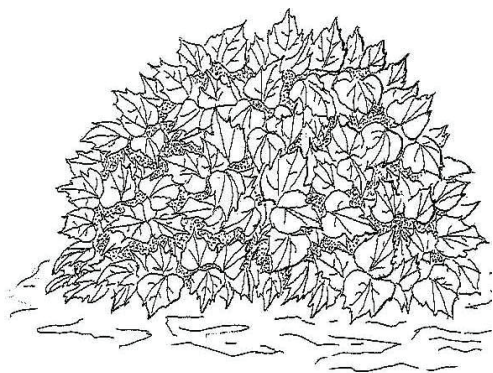
Watercress



Common Mullein



Cocklebur





RIVER PATHWAYS  
 Module 2: Riparian Plants



Plant Identification Game Answer Sheet

Name \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

KEY LETTER	PLANT
_____	Goodding's Willow
_____	Seep Willow
_____	Tamarisk/Salt Cedar
_____	Velvet Mesquite
_____	Fremont Cottonwood
_____	Velvet Ash
_____	Redberry Juniper
_____	Red Barberry
_____	Three Leaf Sumac
_____	Lotebush
_____	Sonoran Scrub Oak
_____	Desert Broom
_____	Broom Snakeweed
_____	Common Three-Square Bulrush
_____	Bermuda Grass
_____	Tree Tobacco
_____	Johnsongrass
_____	Desert Rhubarb
_____	Catnip
_____	Spikerush
_____	Rabbit's Foot Grass
_____	Yellow Sweet Clover
_____	Watercress
_____	Common Mullein
_____	Cocklebur

## RIVER PATHWAYS

### Module 2: Riparian Plants

#### Plant Identification Game Answer Key

TALLY	KEY	PLANT
_____	B	Goodding's Willow
_____	E	Seep Willow
_____	X	Tamarisk/Salt Cedar
_____	I	Velvet Mesquite
_____	P	Fremont Cottonwood
_____	V	Velvet Ash
_____	J	Redberry Juniper
_____	D	Red Barberry
_____	O	Three Leaf Sumac
_____	R	Lotebush
_____	Q	Sonoran Scrub Oak
_____	F	Desert Broom
_____	A	Broom Snakeweed
_____	G	Common Three-Square Bulrush
_____	H	Bermuda Grass
_____	K	Tree Tobacco
_____	N	Johnsongrass
_____	Y	Desert Rhubarb
_____	T	Catnip
_____	L	Spikerush
_____	M	Rabbit's Foot Grass
_____	S	Yellow Sweet Clover
_____	W	Watercress
_____	U	Common Mullein
_____	C	Cocklebur

# RIVER PATHWAYS

## MODULE 3: Riparian Animals

 Audubon ARIZONA



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# RIVER PATHWAYS



## MODULE 3: Riparian Animals

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\*PowerPoint and video presentations are available as a DVD from Audubon Arizona, or online at [http://az.audubon.org/Education\\_RiverPathways-Curriculum.html](http://az.audubon.org/Education_RiverPathways-Curriculum.html).

## RIVER PATHWAYS

### Module 3: Riparian Animals

#### Teacher Instructions

Protecting the homes of animals is one of the most powerful reasons behind many people's motivation to preserve natural areas. Luckily for our riparian areas, they are filled with charismatic wildlife that can spark support for conservation. Module 3 of the River Pathways curriculum will introduce students to some of these animals, including their behaviors, their needs, and stresses that threaten their survival.

#### Materials:

- Animal Research Thread: Group Worksheets
- Completed Student Homework: Animal Research Worksheets
- PowerPoint Presentation: River Pathways Animal Presentation
- One copy of the Food Web Activity (homework) per student

#### Instructions:

1. By now, each of the students has completed an Animal Homework Worksheet. If you have not reviewed their worksheets using the key provided, consider distributing copies of the Animal Paragraphs (provided in Module 1) so that students will be assured of having sufficient, accurate information to complete their next homework assignment.
2. Have your students use the animal that they have researched and organize themselves into groups as follows:

##### Group 1:

yellow-billed cuckoo, zone-tailed hawk, white-throated woodrat, lowland leopard frog, and green sunfish

##### Group 2:

Arizona black rattlesnake, round-tailed ground squirrel, yellow warbler, brown-headed cowbird, muskrat

##### Group 3:

common black-hawk, American bullfrog, northern crayfish, Gila topminnow, largemouth bass

##### Group 4:

terrestrial garter snake, Merriam's kangaroo rat, longfin dace, toe biter, red-spotted toad

##### Group 5:

beaver, sonora sucker, desert sucker, Abert's towhee, song sparrow

##### Group 6:

common kingsnake, rock squirrel, desert pupfish, canyon treefrog, raccoon

## RIVER PATHWAYS

### Module 3: Riparian Animals

#### Teacher Instructions

3. Distribute the Animal Research Group Worksheets to the appropriate groups.
4. Give students time to discuss the responses on their individual Animal Homework Worksheets and use this information to answer the questions on the group's worksheet. Instruct all students in each group to record their answers on a separate piece of paper. They will need this information to complete the homework activity.
5. Have each group share the results of their discussion (recorded on the completed worksheet) with the class. Use the Riparian Animal PowerPoint slides as a visual aid. This PowerPoint contains slides that depict the animals in each given group.
6. Instruct students to take thorough notes on their classmates' presentations, especially when the presented information pertains to their animal. This information will be necessary for this module's homework, which involves creating a fairly substantial food web.

Distribute the Food Web Activity (homework) and assign the students to complete the worksheet. Tell them that this homework will be due \_\_\_\_\_.

RIVER PATHWAYS  
Module 3: Riparian Animals



Animal Research Group Worksheet

Names \_\_\_\_\_  
Date \_\_\_\_\_  
Period \_\_\_\_\_

Group 1:  
Yellow-billed cuckoo, zone-tailed hawk, white-throated woodrat, lowland leopard frog, and green sunfish

1. Describe all predator/prey/competitor relationships within your group of animals.
2. Describe the relationship between green sunfish and population declines of lowland leopard frogs.
3. Out of these five animals, which would be most sensitive to changes in riparian vegetation? Why?

# RIVER PATHWAYS

## Module 3: Riparian Animals



### Animal Research Group Worksheet

Names \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

Group 2:

Arizona black rattlesnake, round-tailed ground squirrel, yellow warbler, brown-headed cowbird, muskrat

1. Describe all predator/prey/competitor relationships within your group of animals.
2. Human activity in riparian areas often leads to a loss of streamside vegetation. How would this affect the animals in your group?
3. Consider the changes in population numbers of brown-headed cowbirds from the last question. How would this change affect the yellow warblers?





# RIVER PATHWAYS

## Module 3: Riparian Animals



### Animal Research Group Worksheet

Names \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

#### Group 4:

Terrestrial garter snake, Merriam's kangaroo rat, longfin dace, toe biter, red-spotted toad

1. Describe all predator/prey/competitor relationships within your group of animals.
2. Toe biters can live in water of extremely low quality. Considering this, how would a decline in water quality affect the other species in your group?
3. Garter snakes prey on all of the animals in this group. If they went extinct, populations of the other animals would increase unchecked. What effect would this have?

RIVER PATHWAYS  
Module 3: Riparian Animals



Animal Research Group Worksheet

Names \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

Group 5:

Beaver, Sonora sucker, desert sucker, Abert's towhee, song sparrow

1. Describe all predator/prey/competitor relationships within your group of animals.
2. What positive and negative effects would beavers have on the two species of fish in this group?
3. What would happen if beavers were removed from the ecosystem entirely?

# RIVER PATHWAYS

## Module 3: Riparian Animals

### Animal Research Group Worksheet

Names \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

#### Group 6:

Common kingsnake, rock squirrel, desert pupfish, canyon treefrog, raccoon

1. Describe all predator/prey/competitor relationships within your group of animals.
2. How would the increase in raccoon populations affect the riparian ecosystem as a whole?
3. Loss of streamside vegetation results in soil filling the stream, leaving it with very few deep pools. How would this affect your group of animals?

# RIVER PATHWAYS

## Module 3: Riparian Animals

### Animal Research Group I Answer Key

Group I:

Yellow-billed cuckoo, zone-tailed hawk, white-throated woodrat, lowland leopard frog, and green sunfish

1. Describe all predator/prey/competitor relationships within your group of animals.

Species	Predators	Prey	Competitors
Yellow-billed cuckoo	zone-tailed hawk		
Zone tailed hawk		yellow-billed cuckoo, white-throated woodrat, lowland leopard frog, green sunfish	
White-throated woodrat	zone-tailed hawk		
Lowland leopard frog	zone-tailed hawk, green sunfish	green sunfish	
Green sunfish	lowland leopard frog	lowland leopard frog	lowland leopard frog

2. Describe the relationship between green sunfish and population declines of lowland leopard frogs.

Green sunfish, an introduced species, share habitat with, prey on, and compete with our native lowland leopard frogs. These stresses have led to severe population declines in these frogs.

3. Out of these five animals, which would be most sensitive to changes in riparian vegetation? Why?

The yellow-billed cuckoo would be the most sensitive to vegetation change. This is because it has strict requirements for breeding and foraging. It needs both cottonwoods and willows in order to successfully nest and forage for food.

# RIVER PATHWAYS

## Module 3: Riparian Animals

### Animal Research Group 2 Answer Key

Group 2:

Arizona black rattlesnake, round-tailed ground squirrel, yellow warbler, brown-headed cowbird, muskrat

1. Describe all predator/prey/competitor relationships within your group of animals.

Species	Predators	Prey	Competitors
Arizona black rattlesnake		round-tailed ground squirrel, yellow warbler, brown-headed cowbird, muskrat	
Round-tailed ground squirrel	Arizona black rattlesnake		brown-headed cowbird
Yellow warbler	Arizona black rattlesnake		Parasited by brown-headed cowbirds
Brown-headed cowbird	Arizona black rattlesnake		
Muskrat	Arizona black rattlesnake		

2. Human activity in riparian areas often leads to a loss of streamside vegetation. How would this affect the animals in your group?

Each species would be affected differently. Arizona black rattlesnakes would suffer due to lack of cover from which to hunt. Ground squirrels would have more open areas in which to forage but would be more prone to predation. Yellow warblers would suffer due to a lack of trees in which to forage. Brown-headed cowbirds would do better as they forage on open ground. Muskrats would suffer since streamside vegetation provides cover for them while in the water. If vegetation loss is extreme enough to cause streambank stability to falter, muskrats could lose habitat as the stream becomes shallower and warmer.

3. Consider the changes in population numbers of brown-headed cowbirds from the last question. How would this change affect the yellow warblers?

Increased numbers of brown-headed cowbirds caused by loss of streamside vegetation would result in increased rates of nest parasitization for yellow warblers.

# RIVER PATHWAYS

## Module 3: Riparian Animals

### Animal Research Group 3 Answer Key

Group 3:

Common black-hawk, American bullfrog, northern crayfish, Gila topminnow, largemouth bass

1. Describe all predator/prey/competitor relationships within your group of animals.

Species	Predators	Prey	Competitors
Common black-hawk		American bullfrog, northern crayfish, largemouth bass	northern crayfish, American bullfrog, largemouth bass
American bullfrog	Common black-hawk, northern crayfish largemouth bass	northern crayfish, largemouth bass, Gila topminnow	northern crayfish, largemouth bass, common black-hawk
Northern crayfish	American bullfrog, common black-hawk, largemouth bass	Gila topminnow, American bullfrog, largemouth bass	American bullfrog
Gila topminnow	American bullfrog, largemouth bass, northern crayfish		Largemouth bass, northern crayfish
Largemouth bass	common black-hawk, northern crayfish, American bullfrog	Gila topminnow, northern crayfish, American bullfrog	northern crayfish, American bullfrog, common black-hawk

2. Describe the relationship between the introduced species in your group and the decline in Gila topminnow populations.

Largemouth bass, northern crayfish, and American bullfrogs are all introduced species. Each of these species preys upon the Gila topminnow. The bass and crayfish compete with it. These new stresses, along with loss of habitat, have led to extreme population declines in this native fish.

3. What effect might the introduced species have on black hawks?

These introduced species serve as both prey and competitors for the common black-hawk. These two impacts would likely balance each other and have little effect on common black-hawk populations.

# RIVER PATHWAYS

## Module 3: Riparian Animals

### Animal Research Group 4 Answer Key

Group 4:

Terrestrial garter snake, Merriam’s kangaroo rat, longfin dace, toe biter, red-spotted toad

1. Describe all predator/prey/competitor relationships within your group of animals.

Species	Predators	Prey	Competitors
Terrestrial Garter snake	toe biter	Merriam’s kangaroo rat, longfin dace, toe biter, red-spotted toad	toe biter
Longfin dace	terrestrial garter snake, toe biter	toe biter (larvae)	toe biter, Red-spotted toad
Merriam’s kangaroo rat	terrestrial garter snake		
Red-spotted toad	terrestrial garter snake, toe biter		longfin dace
Toe biter	terrestrial garter snake, longfin dace	longfin dace, red-spotted toad	longfin dace, red-spotted toad, terrestrial garter snake

2. Toe biters can live in water of extremely low quality. Considering this, how would a decline in water quality affect the other species in your group?

Low water quality would negatively affect longfin dace and red-spotted toads and positively affect toe biters. This would lead to an increase in numbers of toe biters and, therefore, increased predation on longfin dace and red-spotted toads. The combination of these two stresses would be extremely detrimental to populations of red-spotted toads and longfin dace.

3. Garter snakes prey on all of the animals in this group. If they went extinct, populations of the other animals would increase unchecked. What effect would this have?

This would have cascading effects throughout the ecosystem. For example, increased populations of red-spotted toads could forage along the stream. Competition between increased populations of red spotted toads, longfin dace, and toe biters would cause insect populations to dwindle, harming all three species. The loss of seeds to sprout and insects to pollinate would cause a loss in streamside vegetation which would in turn lower the water quality. This could result in a stream where only the hardy toe biters could survive.



# RIVER PATHWAYS

## Module 3: Riparian Animals

### Animal Research Group 5 Answer Key

Group 5:

Beaver, Sonora sucker, desert sucker, Abert's towhee, song sparrow

- Describe all predator/prey/competitor relationships within your group of animals.

Species	Predators	Prey	Competitors
Beaver			
Sonora sucker			Desert sucker
Desert sucker			Sonora sucker
Abert's towhee			Song sparrow
Song sparrow			Abert's towhee

- What positive and negative effects would beavers have on the two species of fish in this group?

Both species would be affected differently. Sonora suckers, who prefer deep slow moving pools, would have more habitat as a result of beaver dams. In contrast, desert suckers would lose the riffle habitat on which they depend.

- What would happen if beavers were removed from the ecosystem entirely?

The ecosystem would change drastically. There would be fewer deep pools for the suckers to utilize. Many insect populations that depend on standing water in which to breed would decline. In addition, there would be a lack of meadows where song sparrows and Abert's towhees can forage for these insects.

# RIVER PATHWAYS

## Module 3: Riparian Animals

### Animal Research Group 6 Answer Key

Group 6:

Common kingsnake, rock squirrel, desert pupfish, canyon treefrog, raccoon

1. Describe all predator/prey/competitor relationships within your group of animals.

Species	Predators	Prey	Competitors
Common Kingsnake	raccoon	raccoon, rock squirrel, canyon treefrog	raccoon
Rock squirrel	common kingsnake		raccoon
Desert pupfish			canyon treefrog
Canyon treefrog	raccoon, common kingsnake		desert pupfish
Raccoon	common kingsnake	canyon treefrog, common kingsnake	common kingsnake

2. How would the increase in raccoon populations affect the riparian ecosystem as a whole?

An increase in population of raccoons would result in increased predation and competition for many of the species in this group. Kingsnakes would be heavily preyed upon and competed with. Rock squirrels would suffer from increased competition, and canyon treefrogs would be heavily preyed upon. This would result in a decline in all three of these species which could in turn harm the newly increased population of raccoons due to lack of food sources.

3. Loss of streamside vegetation results in soil filling the stream, leaving it with very few deep pools. How would this affect your group of animals?

Loss of vegetation would hurt all five of these species. Kingsnakes and raccoons would not have cover from which to hunt. Rock squirrels would lose a food source. Treefrogs would be more prone to predation when foraging near the stream. Desert pupfish would lose habitat as the deep pools they depend upon filled and dried up.

## RIVER PATHWAYS

### Module 3: Riparian Animals

#### Animal Game Directions

##### Goals:

- Students are familiarized with some of Arizona’s riparian species, both native and non-native
- Students learn to build and use dichotomous keys
- Students gain an appreciation for Arizona’s riparian areas through an understanding of the organisms that live there

##### Activity: Introduction to Riparian Animals and Dichotomous Keys

##### Materials

- A Master Answer Key for the instructor
- Answer Keys for each group of students.

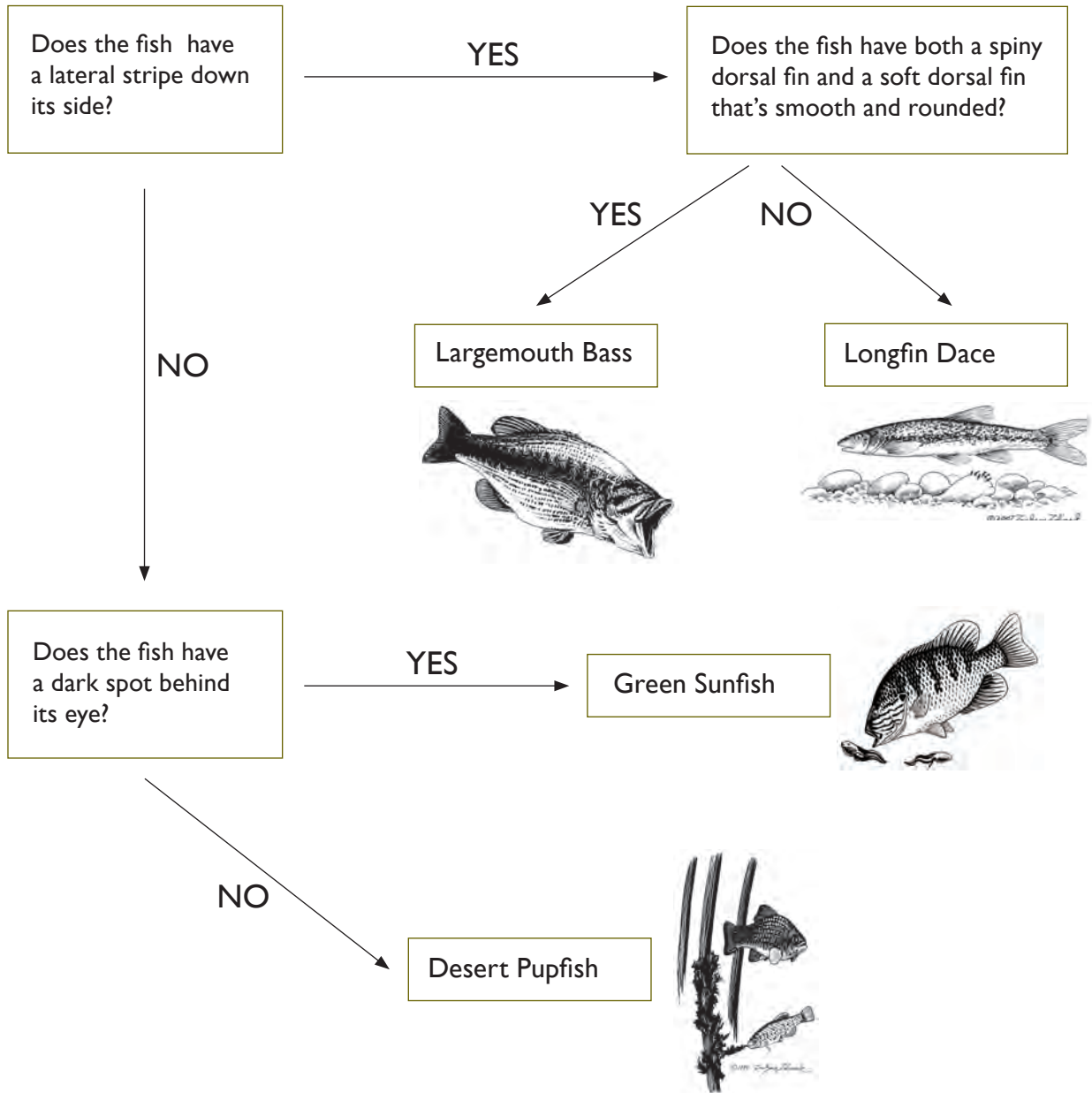
##### Activity:

- Divide the students into 4 equal groups. Assign a group of animals to each student group. The groups are Birds, Fish, Amphibians, and Mammals.
- Using the pictures provided, have each group create a dichotomous key for their four animals (see example).
- Once completed, tell the students to pass their completed key to the next group. This group will use the key to try to decipher which animal is which. Students should record their answers on sheets provided.
- Repeat this process until each group has had a chance to use each of the three keys.
- Using the Master Key, have the students grade their own papers. Whose key was the most successful in producing correct answers?

RIVER PATHWAYS  
Module 3: Riparian Animals

Animal Game Example

Sample Dichotomous Key



# RIVER PATHWAYS

## Module 3: Riparian Animals

### Animal Game Master Key

#### Introduction to Riparian Animals and Dichotomous Keys

#### BIRDS



Yellow-billed  
cuckoo



Abert's towhee



Yellow warbler



Song sparrow

#### FISH



Green sunfish



Largemouth bass



Longfin dace



Desert pupfish

# RIVER PATHWAYS

## Module 3: Riparian Animals

### Animal Game Master Key

#### Introduction to Riparian Animals and Dichotomous Keys

#### AMPHIBIANS



American bullfrog



Canyon treefrog



Lowland leopard frog



Red-spotted toad

#### MAMMALS



White-throated woodrat



Merriam's kangaroo rat



Rock squirrel



Round-tailed ground squirrel

# RIVER PATHWAYS

## Module 3: Riparian Animals

### Introduction to Riparian Animals and Dichotomous Keys

#### Animal Game Answer Sheet for Bird Group

#### BIRDS



Yellow-billed  
cuckoo



towhee



Yellow warbler



Song sparrow

#### FISH



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_

# RIVER PATHWAYS

## Module 3: Riparian Animals

Introduction to Riparian Animals and Dichotomous Keys

Animal Game Answer Sheet for Bird Group

### AMPHIBIANS



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_

### MAMMALS



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_



RIVER PATHWAYS  
Module 3: Riparian Animals

Introduction to Riparian Animals and Dichotomous Keys

Animal Game Answer Sheet for Fish Group

BIRDS



FISH



Green sunfish



Largemouth bass



Longfin dace



Desert pupfish

# RIVER PATHWAYS

## Module 3: Riparian Animals

Introduction to Riparian Animals and Dichotomous Keys

Animal Game Answer Sheet for Fish Group

### AMPHIBIANS



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_

### MAMMALS



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_

# RIVER PATHWAYS

## Module 3: Riparian Animals

Introduction to Riparian Animals and Dichotomous Keys

Animal Game Answer Sheet for Amphibian Group

### BIRDS



### FISH



# RIVER PATHWAYS

## Module 3: Riparian Animals

Introduction to Riparian Animals and Dichotomous Keys

Animal Game Answer Sheet for Amphibian Group

### AMPHIBIANS



American bullfrog



Canyon treefrog



Lowland leopard frog



Red-spotted toad

### MAMMALS



# RIVER PATHWAYS

## Module 3: Riparian Animals

Introduction to Riparian Animals and Dichotomous Keys

Animal Game Answer Sheet for Mammal Group

### BIRDS



### FISH



RIVER PATHWAYS  
Module 3: Riparian Animals

Introduction to Riparian Animals and Dichotomous Keys

Animal Game Answer Sheet for Mammal Group

AMPHIBIANS



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_

MAMMALS



White-throated woodrat



Merriam's kangaroo rat



Rock squirrel



Round-tailed ground squirrel

RIVER PATHWAYS  
Module 3: Riparian Animals



Animal Research Food Web Activity

Name \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

Using your animal, your group's animals, and as many animals from the class list as you can, create a food web. Be sure to include predator, prey, and competitor relationships.

# RIVER PATHWAYS

## MODULE 4: Managing Riparian Areas for Multiple Uses

 Audubon ARIZONA





# RIVER PATHWAYS



## MODULE 4: Managing Riparian Areas for Multiple Uses

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\*PowerPoint and video presentations are available as a DVD from Audubon Arizona, or online at [http://az.audubon.org/Education\\_RiverPathways-Curriculum.html](http://az.audubon.org/Education_RiverPathways-Curriculum.html).

## RIVER PATHWAYS

### Module 4: Managing Riparian Areas for Multiple Uses

#### Teacher Instructions

Countless users—both human and animal — depend on riparian areas. The diverse demands placed on riparian areas are reflected in a pattern of multiple-use that creates many challenges for the professionals who manage these areas.

Natural resource managers must ensure that the riparian areas are suitable for wildlife, ranchers, farmers, recreationalists, and countless other individuals who wish to make use of the habitat. Unfortunately, each of these kinds of uses impart a certain level of impact to the habitat. It is up to resource managers to monitor these various impacts and make certain that no one stakeholder's activities are preventing another from using the area.

In the Module 4 of the River Pathways curriculum, students will confront the challenge of multiple-use and gain an inside look at the dilemmas of a professional resource manager.

#### Materials:

##### Habitat Game

- Gameboard
- “No Habitat” cards
- Animal game cards
- Game markers
- Scenario cards
- Discussion guide

#### Before the Lesson:

1. Print copies of the Gameboard, playing pieces, markers, animal and scenario cards. The game is designed for 4 players, so you will need several sets of materials, depending on the size of your class.
2. Divide the class into groups of 4 players, and distribute the game materials.
3. Ask students to cut out the various pieces in preparation for play.

## RIVER PATHWAYS

### Module 4: Managing Riparian Areas for Multiple Uses

#### Teacher Instructions

##### Introduce the Lesson:

Tell the students that riparian areas are as important to Arizona’s human population as they are for our native wildlife. Countless people depend on these areas for their living or for recreation. Everyone who uses a river or riparian area must work together, to ensure that their activities are not causing destructive levels of disturbance to the habitat. If the human users fail to work together, habitat will be destroyed to bad effect for people and animals.

Imagine that you are an individual (such as a farmer, rancher, miner or recreationalist) who depends on one of our desert rivers.

In this game, you will travel down the river as you work to meet your needs.

**Be careful!** If you don’t pay close attention to the impact you and others are making on the river, you may destroy it ... and lose it forever!

##### Play the Game

1. Explain the game rules.
2. Give students time to play at least one round of the “River Pathways Habitat Game.”
3. At the conclusion of play, reconvene the class. Discuss the students’ experience and the outcome of the game, using the questions provided as a guide.
4. If time allows, give students a chance to play another round or two. Encourage them to try to achieve a different outcome than they did during their first round(s).

## RIVER PATHWAYS

### Module 4: Managing Riparian Areas for Multiple Uses

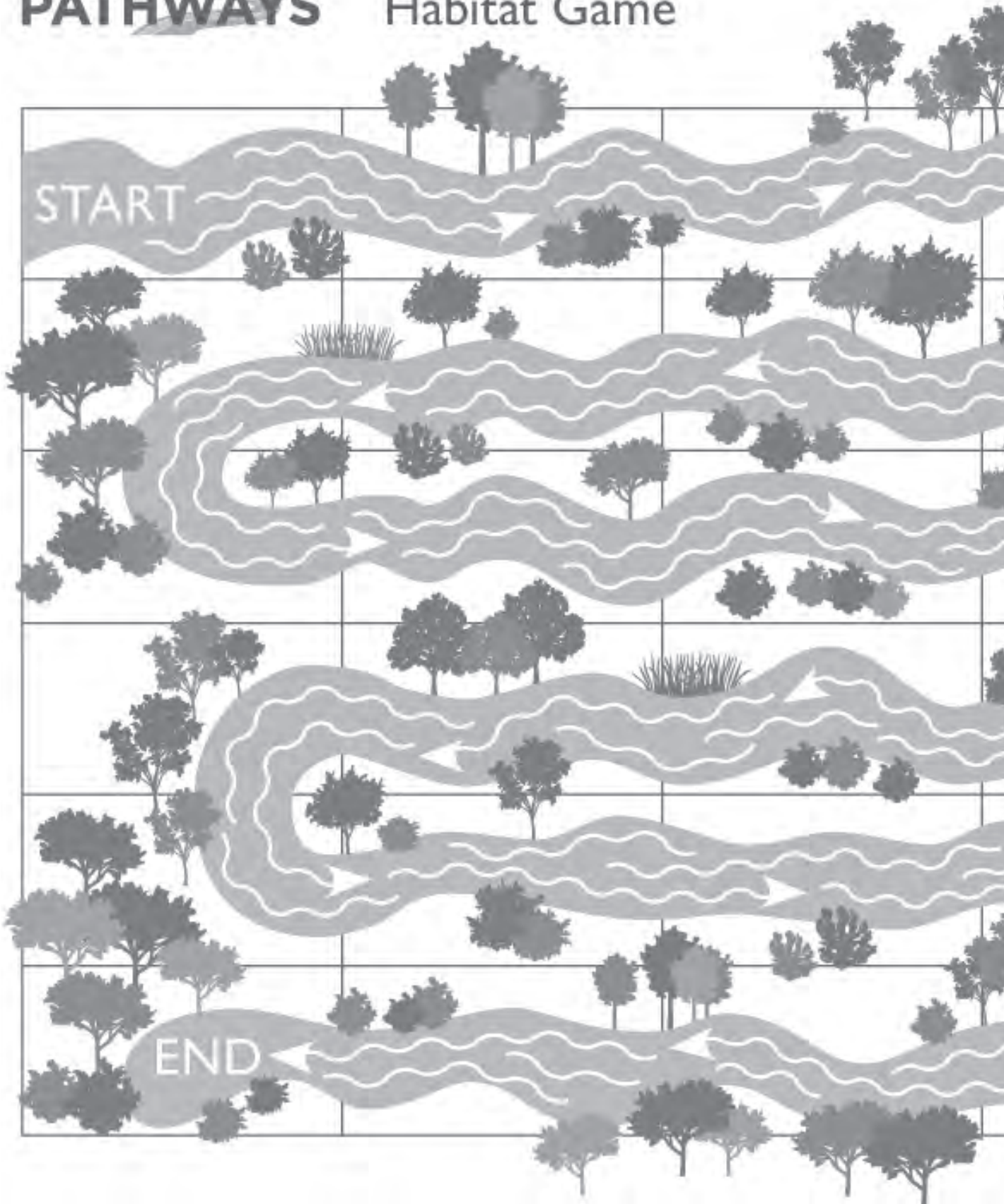
#### River Pathways: Habitat Game

#### How to Play

1. Each group of 4 players should have a Game Board and 36 “NO HABITAT” pieces, Animal pieces, Scenario cards and game markers.
2. Each player chooses a role to play: Rancher, Farmer, Recreationalist, or Miner.
3. Each player takes a game marker, the appropriate set of scenario cards and 10 animal pieces. Turn the sets of scenario cards face down.
4. Select a player to go first, second, etc.
5. Player 1 picks a scenario card from his or her stack. The card presents a scenario and two options.
  - a. One option enables the player to move forward several spaces, but results in loss of habitat. The other option provides for less forward progress but leaves more habitat unharmed.
  - b. Player 1 moves his/her game marker the number of spaces designated by the option selected. Place a “No Habitat” card on as many spaces as required by the option.
6. Play continues, rotating among the players.
  - a. When a player lands on a space marked “NO HABITAT,” all players must give up an animal.
  - b. When a player loses all of his or her animals, he or she is disqualified from the game.
7. The first player to successfully arrive at the end of the river wins the game.

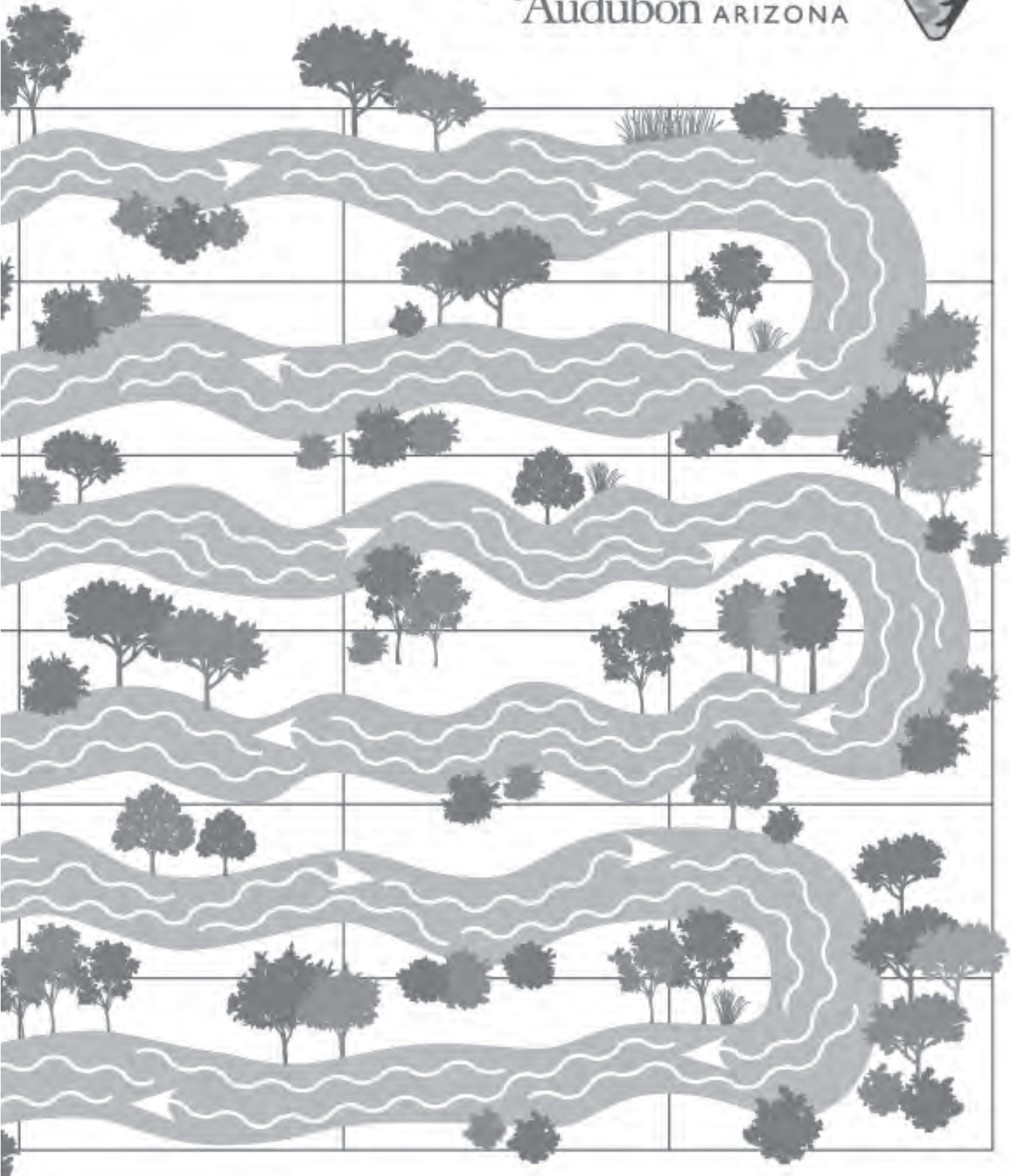
# RIVER PATHWAYS

## Habitat Game



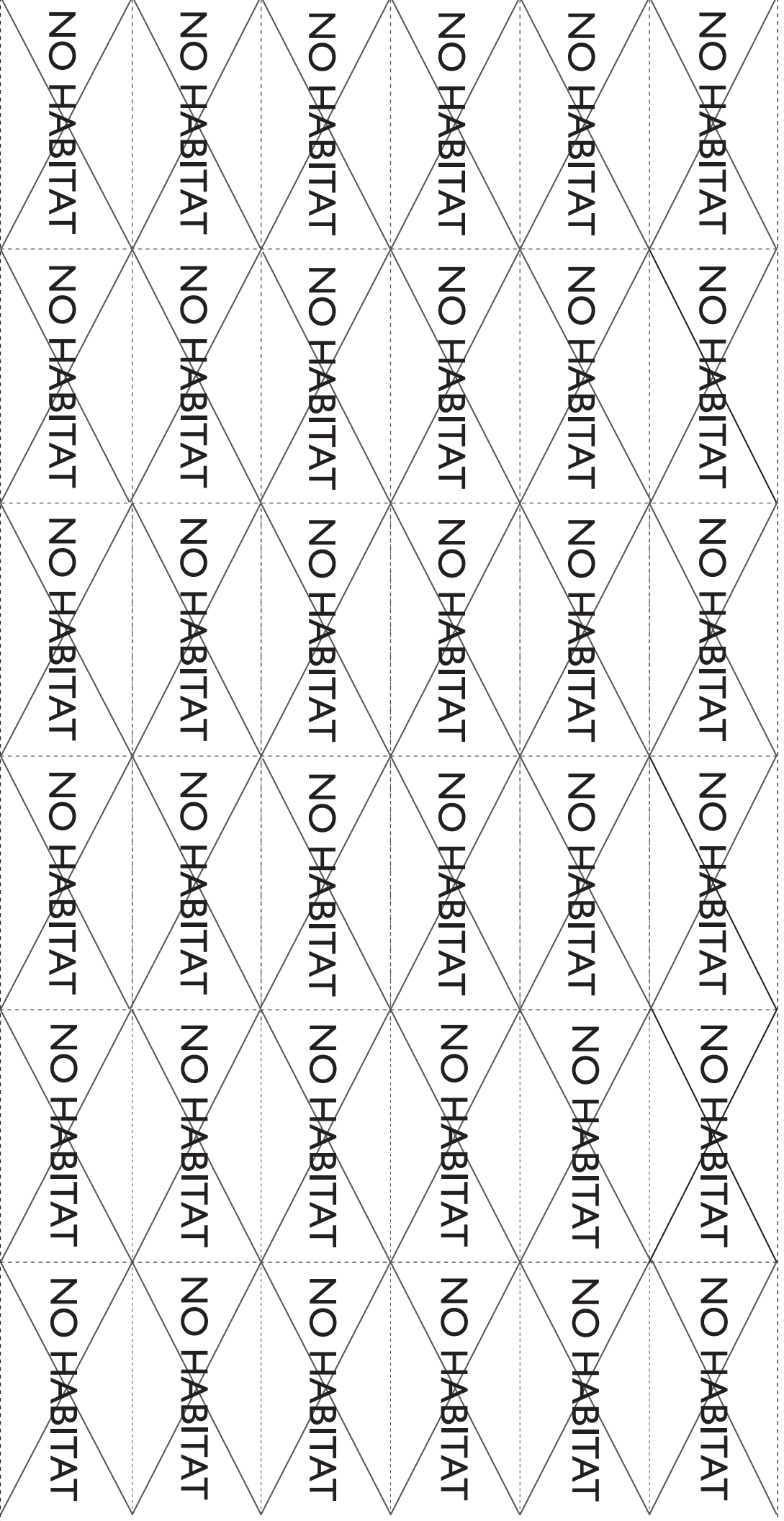


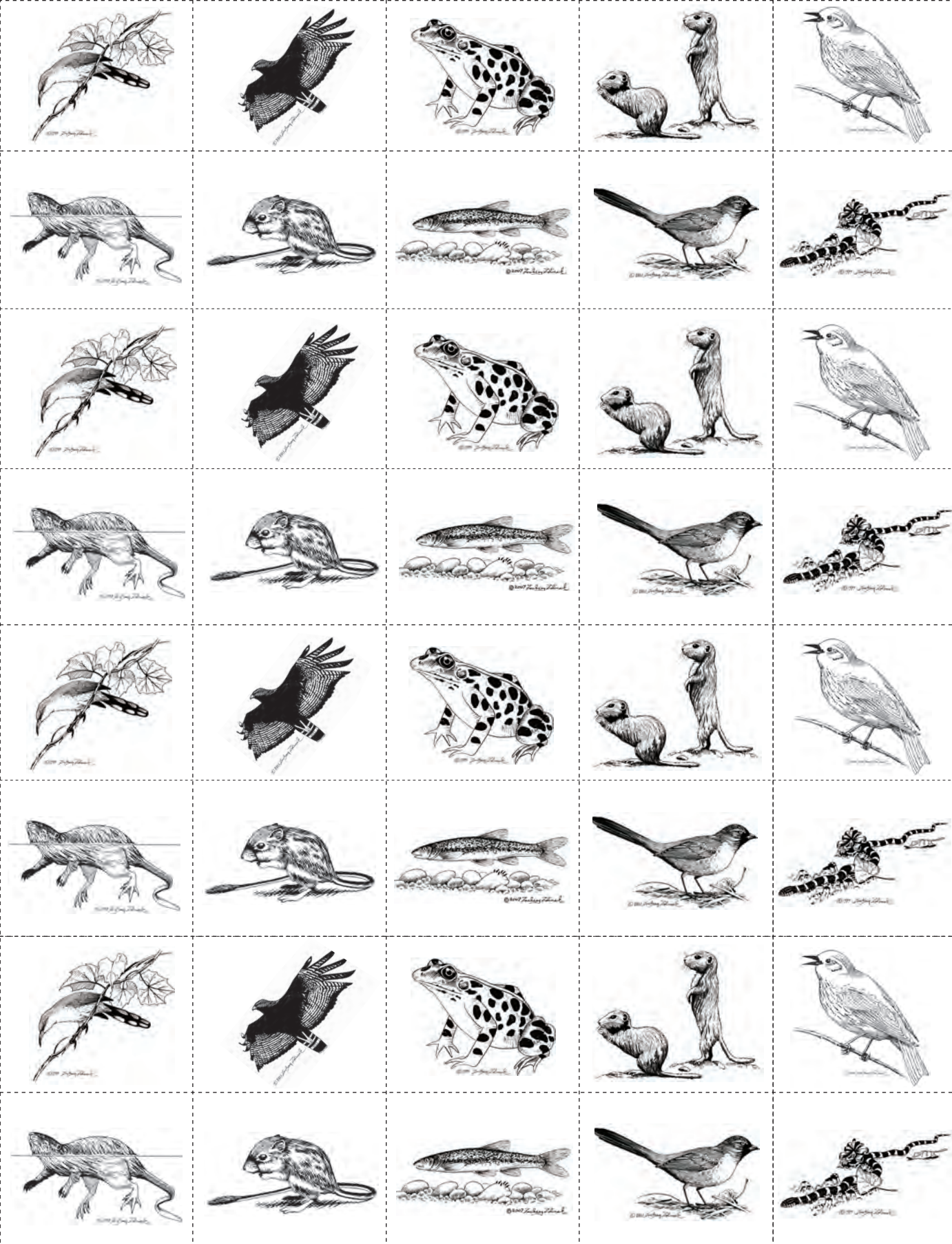
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Line up the two sides of the board so that you see a flowing river. Tape the seam.

# RIVER PATHWAYS Habitat Game







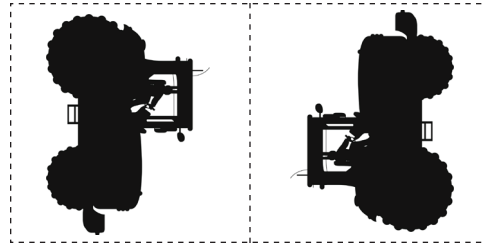
RIVER PATHWAYS  
Module 4: Managing Riparian Areas for Multiple Uses

Habitat Game Markers

(Cut and fold to make a tent shaped marker)



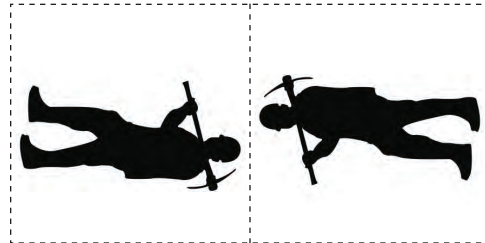
Rancher



Farmer



Recreationalist



Miner

cut here

## MINER

You discover a leak in your wastewater runoff system. Waste from your mine is leaking directly into the stream!

**Choice A:** Ignore the leak and continue mining.

- Move 3 spaces
- Lose 2 squares of habitat

**Choice B:** Temporarily stop mining to fix the leak.

- Move 1 space
- Gain 3 squares of habitat or 1 animal

cut here

## MINER

Your mining team discovers a new deposit of copper beneath an area that scientific monitoring has shown to be important for native wildlife.

**Choice A:** Begin mining the area by bringing in drills to discover the size of the copper deposit.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Continue mining where you have been, leaving the important wildlife area untouched.

- Move 2 spaces
- Lose 0 squares of habitat

cut here

## MINER

Business is good! You are pulling copper from the earth at a steady pace with relatively little environmental impact.

- Move 3 spaces
- Lose 1 square of habitat

cut here

## MINER

Despite your efforts to run a clean mine, hydrologists have discovered that there is arsenic present in the nearby stream. Arsenic is poisonous both to wildlife and humans who depend on the stream's water.

**Choice A:** Continue mining as usual, until environmental regulations force you to fix the problem.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Stop mining until the source of the arsenic is discovered and repaired.

- Move 1 space
- Lose 0 squares of habitat

cut here

## MINER

Operations are running smoothly! Your mine is putting out a profitable amount of copper and scientific monitoring shows little sign of environmental harm.

- Move 3 spaces
- Lose 1 square of habitat

cut here

## MINER

Mining copper requires a large amount of water, which you pull from the nearby stream. Fish biologists have determined that because of the amount of water you are using, there is not enough flow for native fish to breed.

**Choice A:** Continue mining as usual.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Slow your mining operations until the end of the fish's breeding season.

- Move 2 spaces
- Lose 0 squares of habitat

cut here

## MINER

During a fish survey, biologists discover high levels of copper in the stream. High levels of copper are toxic to fish.

**Choice A:** Continue mining despite the leak.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Stop mining until the source of the copper leak is discovered and repaired.

- Move 1 space
- Lose 1 square of habitat

cut here

## MINER

The federal government provides you with funding for a reclamation project. This project will allow large tracts of mined land to be restored.

- Move 4 spaces
- Gain 2 squares of habitat or 1 animal

cut here

## MINER

Business is good! You are pulling copper from the earth at a steady pace, with relatively little environmental impact.

- Move 3 spaces
- Lose 1 square of habitat

cut here

## MINER

Your mine dumps waste minerals into the creek. Although these minerals are not toxic, they fill pools and riffles which native wildlife depend upon for habitat.

**Choice A:** Investigate alternative means of disposing of waste minerals.

- Move 2 spaces
- Lose 0 squares of habitat

**Choice B:** Continue disposing of waste minerals into the stream.

- Move 4 spaces
- Lose 3 squares of habitat

cut here

## MINER

In order to access copper deposits, you must first remove trees and other vegetation from the land under which the copper lies. The removal of this vegetation leads to increased erosion and causes pools and riffles—which fish depend on for habitat—to fill with sediment.

**Choice A:** Expand your mine by removing vegetation from land near your existing site.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Do not expand your mine and continue mining on your existing site.

- Move 2 spaces
- Lose 0 squares of habitat

cut here

cut here

## MINER

During a recent survey, biologists discover high levels of heavy metals in the stream's wildlife.

**Choice A:** Reduce the amount of copper you mine in order to reduce the amount of runoff being poured into the stream.

- Move 2 spaces
- Lose 1 square of habitat

**Choice B:** Continue mining as usual, ignoring the biologists' discovery.

- Move 4 spaces
- Lose 2 squares of habitat

cut here

## MINER

In the summer months, the stream receives very little water. During these periods of low flow, the stream cannot handle as much runoff as during periods of high flow.

**Choice A:** Slow your mining operations to limit the amount of runoff you put into the stream until high flows return.

- Move 2 spaces
- Lose 0 squares of habitat

**Choice B:** Continue mining at your usual rate.

- Move 4 spaces
- Lose 2 squares of habitat

cut here

## MINER

Business is good! You are pulling copper from the earth at a steady pace, with relatively little environmental impact.

- Move 3 spaces
- Lose 1 square of habitat

cut here

cut here

## RANCHER

A fence has broken and your cattle have escaped from your range! They are now grazing along a stretch of protected stream.

**Choice A:** Ignore the break in the fence and allow your cattle to continue grazing.

- Move 3 spaces
- Lose 2 squares of habitat

**Choice B:** Round your cattle up, return them to your range, and fix the fence.

- Move 1 space
- Gain 3 squares of habitat or 1 animal

cut here

## RANCHER

You are given the option of expanding your range into an area known to be important for native wildlife.

**Choice A:** Expand your range into the new area.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Continue ranching on your original land, leaving the important wildlife area untouched.

- Move 2 spaces
- Lose 0 squares of habitat

cut here

## RANCHER

Business is good! High levels of rainfall have produced enough vegetation to allow your cattle to graze without significantly damaging the environment.

- Move 3 spaces
- Lose 1 square of habitat

cut here

## RANCHER

Despite your efforts not to harm the riparian area on your ranch, resource managers have discovered high levels of stream bank disturbance within your range. Hoof prints and cattle trails are causing large amounts of soil to be pushed into the stream, destroying habitat for native fish.

**Choice A:** Continue ranching as you have been, ignoring the signs of environmental harm.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Remove your cattle from the disturbed area in order to give it time to recover.

- Move 1 space
- Lose 0 squares of habitat

cut here

## RANCHER

Operations are running smoothly! Heavy winter rains have produced incredible amounts of new vegetation. Your cattle can graze freely without risk of environmental harm.

- Move 3 spaces
- Lose 1 square of habitat

cut here

## RANCHER

Spring is an important time for plants. During this time, seedlings begin to sprout. If these seedlings fail to grow, there will be no new trees to replace the mature ones, and eventually there will be no mature trees along the stream.

**Choice A:** Continue ranching through the spring.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Only graze your cattle during the winter in order to allow seedlings to establish during the spring.

- Move 2 spaces
- Lose 0 squares of habitat

cut here

## RANCHER

During a vegetation survey, biologists discover that the cattle are primarily eating the native trees along the river and leaving only non-native trees behind. The non-native trees do not provide quality habitat for native wildlife.

**Choice A:** Continue ranching as usual despite the biologists' discovery.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Move your cattle to a new area in order to allow populations of native plants to recover.

- Move 1 space
- Lose 1 square of habitat

cut here

## RANCHER

Thanks to a federal easement program, you receive a large tax break in return for setting aside a piece of your range for wildlife conservation.

- Move 4 spaces
- Gain 2 squares of habitat or 1 animal

cut here

## RANCHER

Business is good! High levels of rainfall have produced enough vegetation to allow your cattle to graze without significantly impacting the environment.

- Move 3 spaces
- Lose 1 square of habitat

cut here

## RANCHER

During the summer months, your cattle seek shade and water along the stream more frequently than during cooler months. This increases the amount of grazing, and leads to increased stream bank disturbance along the stream.

**Choice A:** Install a fence to keep your cattle off the stream banks during summer months.

- Move 2 spaces
- Lose 0 squares of habitat

**Choice B:** Continue to allow your cattle to graze directly along the stream.

- Move 4 spaces
- Lose 3 squares of habitat

cut here

## RANCHER

Since cattle ranges are so large in the West, you often use a helicopter to locate your cattle prior to rounding them up. The noise and disturbance from your aircraft have the potential to cause breeding birds to abandon their nests and the area.

**Choice A:** Use alternate scouting methods to locate your cattle until the end of breeding season.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Disregard the breeding birds and scout for your cattle as usual.

- Move 2 spaces
- Lose 0 squares of habitat

cut here



cut here

## RANCHER

During a recent survey, biologists discover that your cattle have grazed on more than half of all the streamside vegetation. Native wildlife depends upon this vegetation for habitat.

**Choice A:** Use fences to restrict your cattle from grazing along the stream until the vegetation recovers.

- Move 2 spaces
- Lose 1 square of habitat

**Choice B:** Continue ranching as usual, ignoring the biologists' discovery.

- Move 4 spaces
- Lose 2 squares of habitat

cut here

## RANCHER

Erosion caused by a lack of streamside vegetation has filled the riffles and pools—the habitat of native fish—with soil.

**Choice A:** Move your cattle to a new area to allow the streamside vegetation to recover.

- Move 2 spaces
- Lose 0 squares of habitat

**Choice B:** Continue ranching as usual.

- Move 4 spaces
- Lose 2 squares of habitat

cut here

## RANCHER

Business is good! High levels of rainfall have produced lush vegetation, allowing your cattle to graze without significantly impacting the environment.

- Move 3 spaces
- Lose 1 square of habitat

cut here

cut here

## RECREATIONALIST

While exploring the river on your ATV, you discover that the vehicle is leaking oil. Motor oil can be harmful to native wildlife.

**Choice A:** Ignore the leak and continue exploring.

- Move 3 spaces
- Lose 2 squares of habitat

**Choice B:** Cut your day short and return home to repair your vehicle.

- Move 1 space
- Gain 3 squares of habitat or 1 animal

cut here

## RECREATIONALIST

You discover a pristine area of river that appears to be only rarely visited by people.

**Choice A:** Enjoy this new area by riding your vehicle through the riverbed and along the banks.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Return to an area that has already been disturbed by off-road vehicles so that you do not spread disturbance to the newly discovered, untouched area.

- Move 2 spaces
- Lose 0 squares of habitat

cut here

## RECREATIONALIST

It is a good day! You spend the day hiking and cause only a very small amount of environmental disturbance.

- Move 3 spaces
- Lose 1 square of habitat

cut here

## RECREATIONALIST

After a fishing trip, you have a small bucket of live baitfish left over. If these fish are introduced into the stream, they could reproduce and cause problems for native fish populations.

**Choice A:** Release the fish into the stream, ignoring the risk of them establishing as an invasive species.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Carry the bucket of fish home.

- Move 1 space
- Lose 0 squares of habitat

cut here

## RECREATIONALIST

You spend the day riding your ATV. You avoid riding in the streambed and stick to established trails.

- Move 3 spaces
- Lose 1 square of habitat

cut here

## RECREATIONALIST

While hiking, you come across an area closed to the public for vegetation recovery. Hiking around the area would force you to hike a much greater distance than originally planned.

**Choice A:** Continue hiking through the restricted area.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Hike around the restricted area.

- Move 2 spaces
- Lose 0 squares of habitat

cut here

## RECREATIONALIST

During a biological survey, scientists discover that people driving off-road vehicles through the stream bed are causing extremely high levels of erosion. This is causing riffles and pools—areas on which fish depend for habitat—to fill with sediment.

**Choice A:** Continue riding your off-road vehicle through the streambed, ignoring the biologists' discovery.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Avoid the streambed and only ride your off-road vehicle in less impact-sensitive areas.

- Move 1 space
- Lose 1 square of habitat

cut here

## RECREATIONALIST

While hiking, you discover an area that recently has been trashed by campers. You take the time to pack up the garbage and bring it out of the habitat with you.

- Move 4 spaces
- Gain 2 squares of habitat or 1 animal

cut here

## RECREATIONALIST

It is a good day! You spend the day hiking and produce only a very small amount of environmental disturbance.

- Move 3 spaces
- Lose 1 square of habitat

cut here

## RECREATIONALIST

After camping, your campsite contains large amounts of trash. Packing all of your waste to carry it out of the area will take up most of your day.

**Choice A:** Take the time to pack out your waste.

- Move 2 spaces
- Lose 0 squares of habitat

**Choice B:** Leave your trash behind, allowing you to get home quickly and enjoy the rest of your day.

- Move 4 spaces
- Lose 3 squares of habitat

cut here

## RECREATIONALIST

You grow tired of never catching any fish on fishing trips. Instead of using a pole, you consider using a large net, called a seine, to catch large quantities of fish with little effort. This method of fishing is illegal in Arizona.

**Choice A:** Use a seine to catch fish, ignoring fishing regulations.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Be patient and fish as you have been.

- Move 2 spaces
- Lose 0 squares of habitat

cut here

cut here

## RECREATIONALIST

During a recent survey, biologists discover that off-road vehicle use has destroyed much of the vegetation along the stream banks. As damaged plants recover, the root masses that hold soil together begin to fall apart.

**Choice A:** Ride in a different area to give your usual area's vegetation time to recover.

- Move 2 spaces
- Lose 1 square of habitat

**Choice B:** Continue riding your off-road vehicle in your usual location.

- Move 4 spaces
- Lose 2 squares of habitat

cut here

## RECREATIONALIST

In the summer, many species of birds breed in riparian areas. The noise from your off-road vehicle could disturb these birds, causing them to abandon their nests and the area.

**Choice A:** Do not use your off-road vehicle along the stream during the birds' breeding season.

- Move 2 spaces
- Lose 0 squares of habitat

**Choice B:** Continue using your off-road vehicle despite the presence of breeding birds.

- Move 4 spaces
- Lose 2 squares of habitat

cut here

## RECREATIONALIST

It is a good day! You spend the day hiking and produce only a very small amount of environmental disturbance.

- Move 3 spaces
- Lose 1 square of habitat

cut here

cut here

## FARMER

You discover that pesticide from your farm are running directly into the stream.

**Choice A:** Ignore the problem and continue farming as usual

- Move 3 spaces
- Lose 2 squares of habitat

**Choice B:** Seek other means of pest control that do not require the use of large amounts of pesticide.

- Move 1 space
- Gain 3 squares of habitat or 1 animal

cut here

## FARMER

Biologists discover that large tracts of unused farmland are providing habitat for a great number of brown-headed cowbirds. These invasive birds parasitize the nests of native birds.

**Choice A:** Ignore the problem and your unused tracts of land.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Take the time to restore your unused tracts of land by planting native vegetation.

- Move 2 spaces
- Lose 0 squares of habitat

cut here

## FARMER

Business is good! Your crops are healthy and you are causing relatively little environmental harm.

- Move 3 spaces
- Lose 1 square of habitat

cut here

## FARMER

Despite your efforts to run an environmentally friendly farm, hydrologists have discovered that pumping is draining the water table to dangerously low levels. The water table feeds the stream, providing water for wildlife and downstream users.

**Choice A:** Continue farming as usual, until environmental regulations force you to pump less water.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Reduce the amount of water you pump by reducing the size of your crop or by switching to a more drought-tolerant crop.

- Move 1 space
- Lose 0 squares of habitat

cut here

## FARMER

Operations are running smoothly! You have harvested a profitable crop and scientific monitoring shows little sign of environmental harm.

- Move 3 spaces
- Lose 1 square of habitat

cut here

## FARMER

Farming requires large amounts of water to be drawn for irrigation from the water table. Fish biologists have determined that due to the amount of water you are using, there is too little water flow for native fish to breed.

**Choice A:** Continue farming as usual.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Slow your farming operations until the end of the fish's breeding season.

- Move 2 spaces
- Lose 0 squares of habitat

cut here

## FARMER

During a fish survey, biologists discover high levels of pesticide in the stream. High levels of pesticide are toxic to fish.

**Choice A:** Stop farming until the source of the pesticides is discovered and repaired.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Continue farming despite the biologists' discovery.

- Move 1 space
- Lose 1 square of habitat

cut here

## FARMER

The federal government compensates you for restoring your unused tracts of farmland for native wildlife.

- Move 4 spaces
- Gain 2 squares of habitat or 1 animal

cut here

## FARMER

Business is good! Your crops are healthy and you are causing relatively little environmental harm.

- Move 3 spaces
- Lose 1 square of habitat

cut here

## FARMER

Your farm uses large quantities of herbicide to kill unwanted plants in the fields. Despite efforts to reduce runoff, these chemicals inevitably wind up in the stream.

**Choice A:** Investigate alternative means of controlling weeds.

- Move 2 spaces
- Lose 0 squares of habitat

**Choice B:** Continue using herbicides to manage your fields.

- Move 4 spaces
- Lose 3 squares of habitat

cut here

## FARMER

In order to create additional farmland, you must first clear trees and other vegetation from the land to make a wide open area. The removal of this vegetation leads to increased erosion and causes pools and riffles—which fish depend on for habitat—to fill with sediment.

**Choice A:** Expand your farm by removing vegetation from land near your existing fields.

- Move 4 spaces
- Lose 2 squares of habitat

**Choice B:** Do not expand your farm and continue farming on your existing fields.

- Move 2 spaces
- Lose 0 squares of habitat

cut here



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RIVER PATHWAYS

Habitat Game  
Scenario Cards

RIVER PATHWAYS Module 4 ■ 24



cut here

## FARMER

During the dry summer months, there is less water present in the water table to replenish the stream.

**Choice A:** Reduce the quantity of water you pump from the water table until the summer monsoons come.

- Move 2 spaces
- Lose 1 square of habitat

**Choice B:** Continue farming as usual, ignoring the seasonal lack of water.

- Move 4 spaces
- Lose 2 squares of habitat

cut here

## FARMER

During periods of low flow, the stream cannot handle high levels of pesticides and herbicides.

**Choice A:** Investigate alternative means of controlling weeds.

- Move 2 spaces
- Lose 0 squares of habitat

**Choice B:** Continue using your usual amount of pesticides and herbicides.

- Move 4 spaces
- Lose 2 squares of habitat

cut here

## FARMER

Business is good! Your crops are healthy and you are causing relatively little environmental harm.

- Move 3 spaces
- Lose 1 square of habitat

cut here

## RIVER PATHWAYS

### Module 4: Managing Riparian Areas for Multiple Uses

#### Habitat Game – Post Game Discussion Guide

1. What types of activities destroyed habitat?  
What types of activities didn't harm habitat?  
What types of activities helped to restore it?
  
2. How did your choices affect your ability to complete the game?
  
3. How did the choices that other players made affect your ability to complete the game?  
How did your choices affect the other players?
  
4. In this game, you have seen several types of problems that can result from human activities.  
What activities do you think scientists should be monitoring in order to preserve riparian habitats for all?

## RIVER PATHWAYS

### Module 4: Managing Riparian Areas for Multiple Uses

#### Homework

#### Teacher Instructions

#### Arizona Standards

- Strand 3: Concept 1 - PO 1, 2, and 3

The purpose of this assignment is to:

- Review the concept of public lands management for multiple use
- Reinforce the message that scientific monitoring is essential to responsible land management
- Encourage students to think about the challenges presented by multiple demands on riparian environments.

This assignment extends the concepts presented in the River Pathways Habitat Game. Students will be asked to consider various ways that people utilize riparian areas and brainstorm about the impact(s) of these uses AND how different uses can conflict with one another. Then, students will identify components of a riparian habitat that they would recommend monitoring and determine why data that they would collect would be valuable for land management.

#### Materials:

- Land-use management worksheet

#### Before the lesson:

Distribute copies of the worksheet to the class.

## RIVER PATHWAYS

### Module 4: Managing Riparian Areas for Multiple Uses

#### Homework

##### Instructions:

Tell the students to imagine that they are land managers assigned to monitor a riparian area in Arizona. As managers of public land, they must be careful to accommodate multiple uses. In other words, there are many different activities that people engage in riparian areas, and it is the land manager's job to make sure that one group's activities do not prevent other groups from using the land as they wish.

Consider the following activities, and brainstorm the kind(s) of impact that they might have on a riparian area. Identify those features of the riparian area that you would monitor in order to control those impacts. How will the data that you collect be useful for guiding decision-making about how best to manage the land?

##### Activities:

- Camping
- Fishing
- Hiking
- Hunting
- Mining
- Off-road vehicle use
- Ranching
- Scientific research
- Wildlife viewing
- Other activities that you can think of!

Assign a due date for the homework.

When students return with the completed assignment, discuss their answers in class.

# RIVER PATHWAYS

## Module 4: Managing Riparian Areas for Multiple Uses

### Homework Worksheet

#### Instructions:

Consider the following activities and brainstorm the kind(s) of impact that they might have on a riparian area. Identify those features of the riparian area that you would monitor in order to control those impacts.

How will the data that you collect be useful for guiding decision-making regarding how best to manage the land?

#### Activities:

- Fishing
- Hunting
- Ranching
- Mining
- Wildlife viewing
- Hiking
- Camping
- Scientific research
- Off-road vehicle use
- Any other activities you can think of!

Pick three activities to consider:

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_



# RIVER PATHWAYS

## MODULE 5: Riparian Birds

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# RIVER PATHWAYS



## MODULE 5: Riparian Birds

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\*PowerPoint and video presentations are available as a DVD from Audubon Arizona, or online at [http://az.audubon.org/Education\\_RiverPathways-Curriculum.html](http://az.audubon.org/Education_RiverPathways-Curriculum.html).



# RIVER PATHWAYS

## Module 5: Riparian Birds



### Teacher Instructions

#### Introduction

This module is designed to instill good observational and descriptive skills in River Pathways participants. These skills will be necessary if students plan to pursue careers in resource management and habitat monitoring. The module consists of two activities.

The first, Science Takes Wing, is based on a PowerPoint presentation that introduces students to 10 of Arizona's most common riparian birds and the sounds they make. After viewing the presentation, the students will be challenged to identify each bird by its song and call alone.

The second, Bino Blitz, activity introduces students to binocular use. Audubon Arizona allows educators to borrow our binocular boxes free of charge for up to a week at a time. These boxes contain a classroom set of binoculars and field guides. They can be picked up at five convenient locations throughout the state. For more information regarding free binocular loans, visit our website at <http://az.audubon.org/Education.html>

#### Teacher Instructions:

##### Science Takes Wing:

- Hand out the Science Takes Wing Answer Sheet (2 pages).
- Show the Science Takes Wing presentation. It is contained on your disk in the folder entitled "Science Takes Wing Presentation" that includes all of the files associated with the presentation. You can also find this material on the Audubon website at [http://az.audubon.org/Education\\_RiverPathways.html](http://az.audubon.org/Education_RiverPathways.html). To play the presentation, open the PowerPoint file entitled pptview.
- Have the students complete their worksheets as they watch — and listen to — the presentation. To try an additional Science Takes Wing module, visit our website at <http://az.audubon.org/Education.html>.

##### Bino Blitz:

- Distribute binoculars to individuals or teams of students.
- Print the 10 bird cards and place them in locations around the room that will be visible from your students' desks.
- Instruct the students how to use and focus their binoculars. Directions are available in the "Bino Blitz" folder on your disk in the "Science Takes Wing" folder. You can also find this material on the Audubon website at [http://az.audubon.org/Education\\_RiverPathways.html](http://az.audubon.org/Education_RiverPathways.html).
- Challenge the students to find the birds and then use their binoculars to read their names.
- Ask the students to record the bird names on their answer sheets. The first student to find all 10 birds and record their names yells "Blitz!" and is the winner of the game.






RIVER PATHWAYS  
Module 5: Riparian Birds

Science Takes Wing Answer Sheet

Name \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

Picture	Bird Name	Song Description (Some helpful words: cooing, chirping, whistling)
	Abert's towhee	
	Brown-crested flycatcher	
	Bell's vireo	
	Bewick's wren	
	Canyon wren	

RIVER PATHWAYS  
Module 5: Riparian Birds

Science Takes Wing Answer Sheet

Name \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

Picture	Bird Name	Song Description (Some helpful words: cooing, chirping, whistling)
	Ladder-backed woodpecker	
	Lucy's warbler	
	Song sparrow	
	Summer tanager	
	Yellow warbler	

RIVER PATHWAYS  
Module 5: Riparian Birds

Science Takes Wing Answer Quiz

Name \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

Bird Sounds Quiz

	LETTER
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

# RIVER PATHWAYS

## Module 5: Riparian Birds

### Bino Blitz Instructors' Sheet

#### Directions

Before class, cut out the 10 bird pictures provided and either paste them on a poster board or hang them around the room.

Distribute binoculars and the Bino Blitz answer sheets. Remind students how to focus binoculars. Make sure that everyone can see clearly through their binoculars, and assist as necessary. Ask the students to use their binoculars to view the bird pictures/names and to write the correct bird name on the "Bino Blitz" answer sheet. This is a race — you may wish to reward the winner with a small prize.

#### Field Marks

Following the "Bino Blitz" activity, lead a discussion about "Field Marks".

Field marks are visual characteristics such as size, color, beak and tail shape and special markings on birds such as eyebrows or spots that enable people to identify them.







Have each student select one of the 10 pictured birds and describe it in terms of the birds' field marks. The "Mystery Bird" Worksheet. Next have students partner up and exchange papers. Partners must identify which bird has been described, based on its field marks. Repeat this activity several times if time allows. Then have students pick one bird to research in a field guide or other resource.

#### How to Focus Binoculars

1. Place the strap around your neck.
2. Close your left eye and look only through your right. Turn the right eyepiece until you can see clearly through the right eye.
3. Open both eyes and adjust the binoculars (lifting them up or crunching them down) so that they fit your face and you can see through both eyepieces.
4. Use the center wheel focus to sharpen your view.

RIVER PATHWAYS  
Module 5: Riparian Birds

Bino Blitz Cards

<p>1</p>  <p>Abert's towhee</p>	<p>2</p>  <p>Brown-crested flycatcher</p>
<p>3</p>  <p>Bell's vireo</p>	<p>4</p>  <p>Bewick's wren</p>
<p>5</p>  <p>Canyon wren</p>	<p>6</p>  <p>Summer tanager</p>

RIVER PATHWAYS  
Module 5: Riparian Birds

Bino Blitz Cards

7



Song sparrow

8



Lucy's warbler

9



Ladder-backed woodpecker

10



Yellow warbler

RIVER PATHWAYS  
Module 5: Riparian Birds

Bino Blitz Worksheet





Name \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

Birds of Rio Salado: Bino Blitz Game

1. Focus your binoculars with your teacher's help.
2. Use your binoculars to view 10 birds hidden around the room and read their names.
3. Write the bird's name in the blank below. Shout BLITZ when you have named all the birds. The first student to name them all is the winner.

1 	
2 	
3 	
4 	








RIVER PATHWAYS  
Module 5: Riparian Birds

Bino Blitz Worksheet

Name \_\_\_\_\_





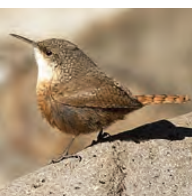

Date \_\_\_\_\_

Period \_\_\_\_\_

5 	
6 	
7 	
8 	
9 	
10 	

RIVER PATHWAYS  
Module 5: Riparian Birds

Bino Blitz Answer Key

1		Abert's towhee
2		Brown-crested flycatcher
3		Bell's vireo
4		Bewick's wren
5		Canyon wren
6		Summer tanager

RIVER PATHWAYS  
Module 5: Riparian Birds

Bino Blitz Answer Key

7 	Song sparrow
8 	Lucy's warbler
9 	Ladder-backed woodpecker
10 	Yellow warbler

RIVER PATHWAYS  
Module 5: Riparian Birds  
Mystery Bird Activity

Describe one of these birds on your worksheet by identifying its field marks.



Canyon wren



Bell's vireo



Ladder-backed woodpecker



Summer tanager



Bewick's wren



Yellow warbler



Brown-crested flycatcher



Lucy's warbler



Abert's towhee



Song sparrow

RIVER PATHWAYS  
Module 5: Riparian Birds  
Mystery Bird Worksheet

Name \_\_\_\_\_  
Date \_\_\_\_\_  
Period \_\_\_\_\_

**Directions**

Pick one of the birds pictured here and describe it to your partner without stating the bird's name. Make your partner guess! Use the clues below. Trade papers with your partner and see if you can identify each others' birds. If you have time, repeat the activity with another partner.

My mystery bird's color is primarily: \_\_\_\_\_

My bird's beak is: \_\_\_\_\_

My bird's tail is: \_\_\_\_\_

My bird's eyes are: \_\_\_\_\_

My bird probably eats: \_\_\_\_\_

My bird probably lives (where?) \_\_\_\_\_

**After the Mystery Bird Activity, do some research!**

Use a bird book called a "field guide" to answer the following questions:

My mystery bird was: \_\_\_\_\_

Scientific Name: \_\_\_\_\_

Size: \_\_\_\_\_

Habitat: \_\_\_\_\_

Other Comments: \_\_\_\_\_