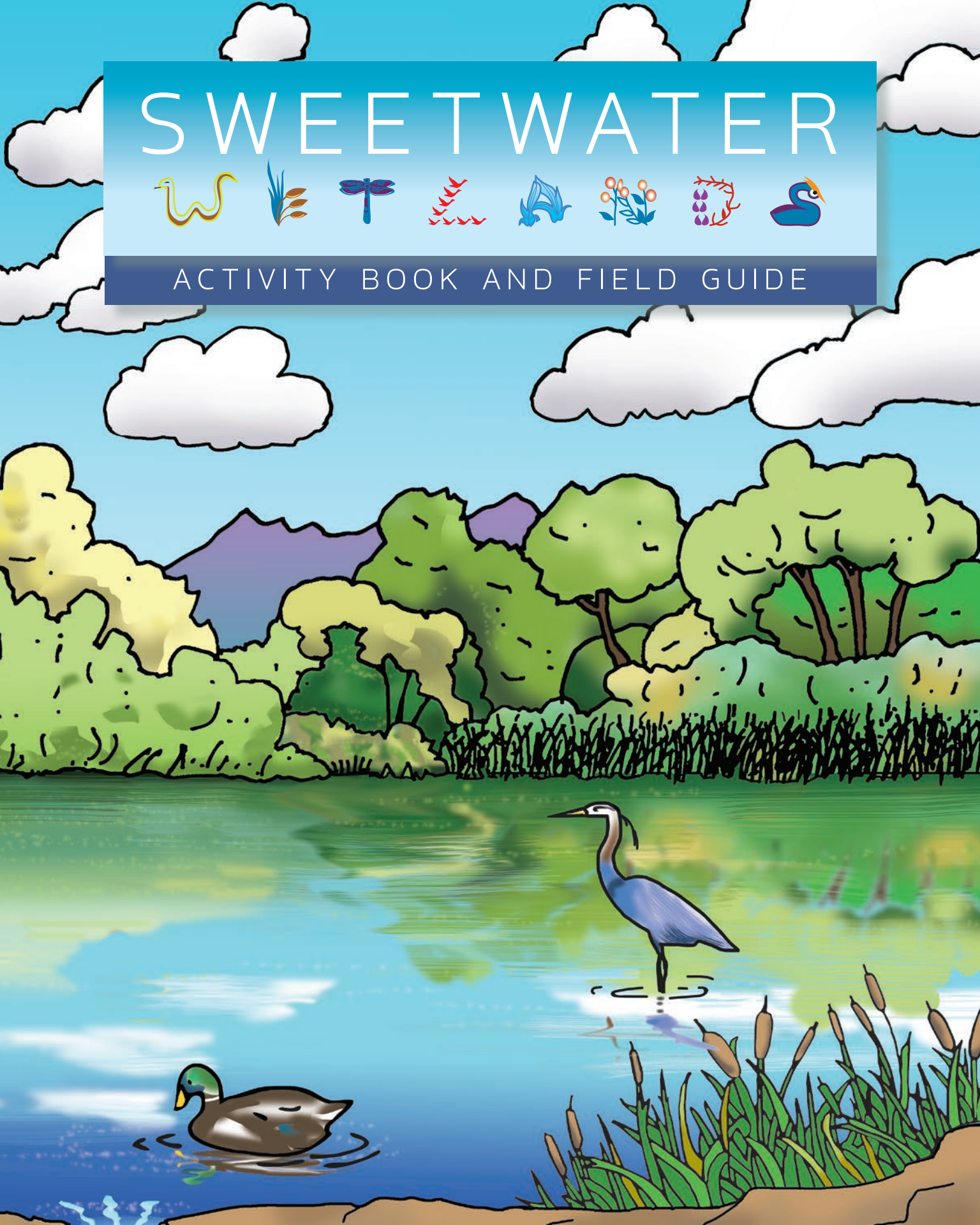


# SWEETWATER



ACTIVITY BOOK AND FIELD GUIDE



# DISCOVERING SWEETWATER WETLANDS STUDENT ACTIVITY BOOK AND FIELD GUIDE

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# WELCOME TO SWEETWATER WETLANDS

## WELCOME!

In our desert community, it's not often that we have the chance to see the type of animals and plants that depend on open flowing water and lush vegetation. But that's exactly what visitors to Tucson Water's Sweetwater Wetlands can enjoy every day of the year! From desert rodents to majestic raptors, tiny waterbugs to wandering bobcats, dozens of species of animals make the Sweetwater Wetlands their full or part-time home.

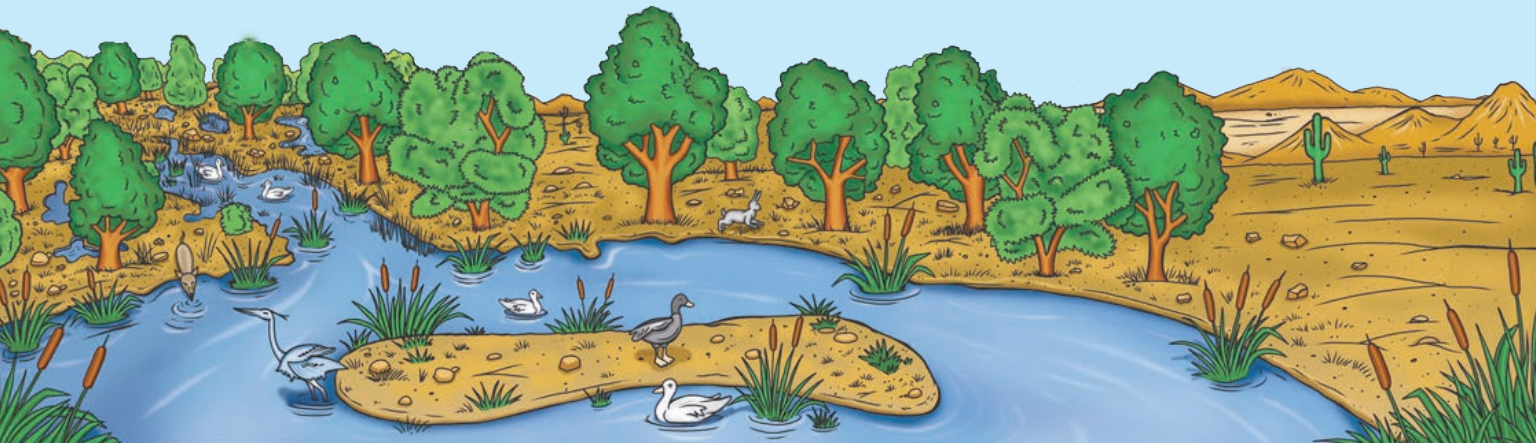
The Sweetwater Wetlands recreates one of the most endangered habitats in our desert region – a water-rich streamside riparian zone that supports a huge variety of wildlife. The Wetlands also helps treat wastewater so that it can be reused in our community to irrigate parks, schoolyards, golf courses, and other landscapes. Using this reclaimed water means that we can have a “greener” community without using our drinking water to keep the grass and other plants alive.

Another important step in helping protect our environment is learning about the plants and animals that live here, so that we better understand what they need to survive. This Activity Book and Field Guide is designed to enrich your experience at the Sweetwater Wetlands and help you identify the many species that inhabit this unique environment. Along the way, you'll learn about the importance of wetlands and their role in recycling a critical natural resource – water.



# OUR WATER CYCLE

## AND SWEETWATER WETLANDS



## WATER— THE MOST PRECIOUS RESOURCE ON OUR WATER PLANET

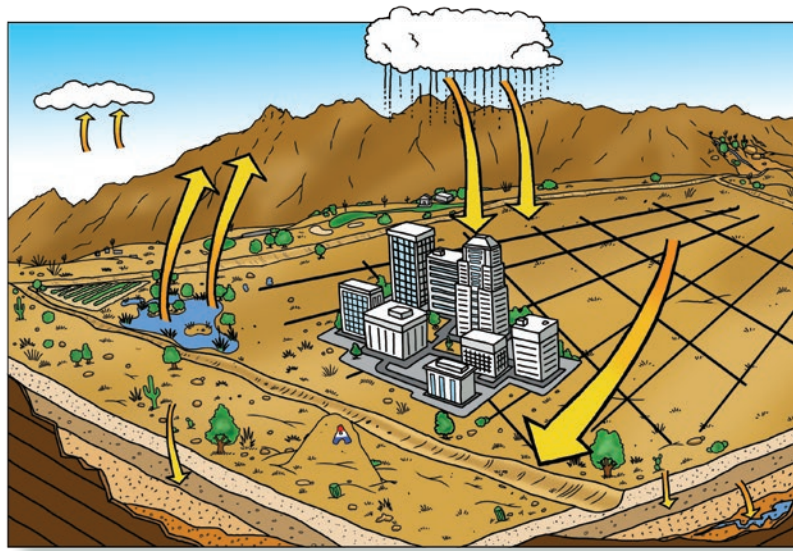
**W**ater is a renewable, but limited, resource. It is renewable because water is constantly circulating through the global water cycle. It is limited because its availability and form are always changing. Water's availability in the form we most rely on—fresh liquid—varies greatly and is not evenly distributed throughout the earth. Water is continuously changing its form but the total amount of water on Earth remains constant. Water exists in three forms: solid (ice), liquid (lakes, oceans, rain, etc.), and gas (water vapor).

The Earth has often been called the “water planet” because nearly three-fourths of our planet’s surface is covered with water. Ninety-seven percent of the earth’s water is in our oceans and seas. The rest is in our polar ice caps and glaciers, rivers and lakes, and groundwater. A small amount is in water vapor and soil moisture. Thus, even on a water planet, only a tiny portion of our water is available for our use at any particular time or place. Water is indeed a precious resource.



# THE WATER CYCLE

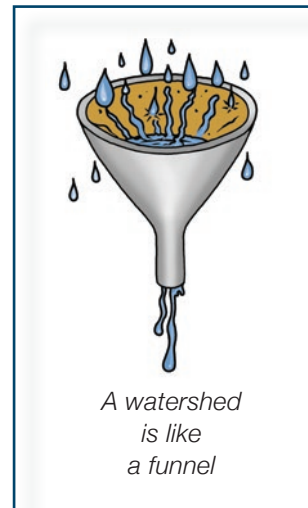
The water cycle is the continual circulation of water, in its various forms, occurring in a predictable pattern. The pattern we are most familiar with includes **evaporation** (water rising from the earth in the form of a vapor), **condensation** (water vapor changing into liquid water to form clouds), **precipitation** (water falling as rain or snow), and **runoff** (water flowing downhill over the earth due to gravity). The global water cycle is more complex than this model but the same basic processes are constantly occurring all around the earth. Water also cycles on different time scales— it might take one year or it could take millions of years for water to cycle.



## WATERSHEDS

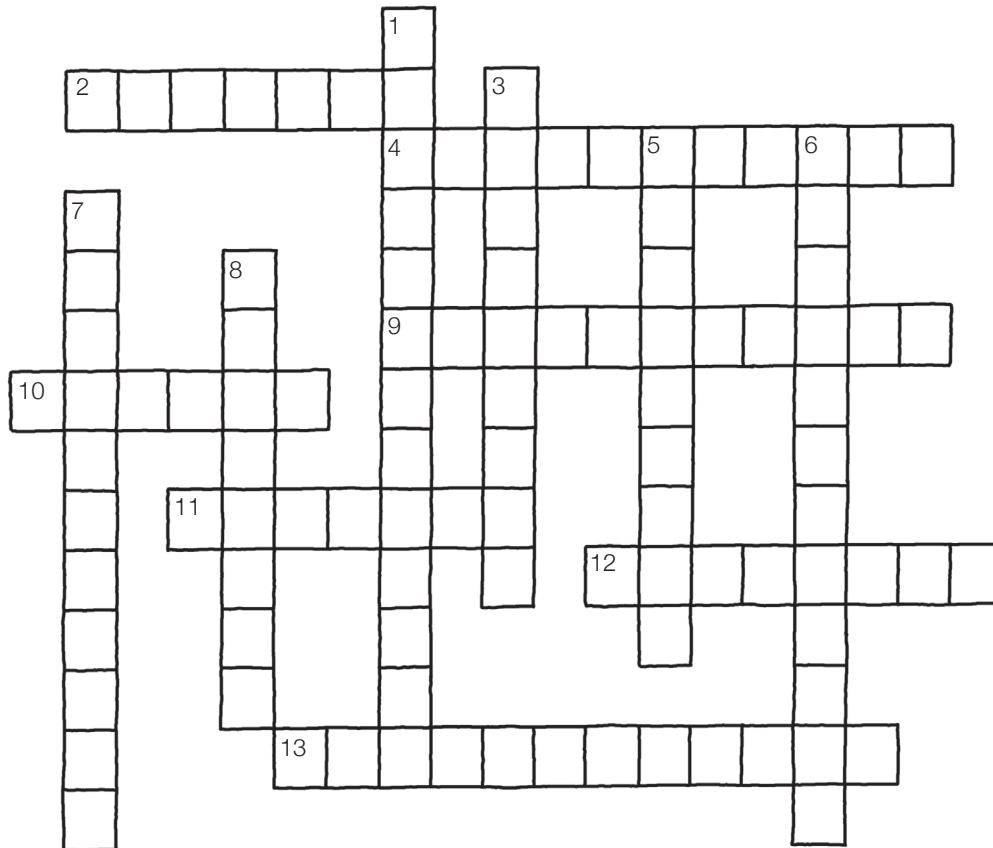
While the water cycle is a global system, smaller cycles also occur on local levels. To better understand the movement of water on a local scale, it helps to understand our watersheds. The total land area that contributes water to a particular drainage channel (wash, arroyo, or stream) is called its **watershed**. For example, the rain or snowmelt from Mount Lemmon that flows into Sabino Canyon belongs to the Sabino Creek watershed. On a larger scale, a community's watershed includes all the land area around it that contributes water to any of its water sources (be they rivers, lakes, or groundwater aquifers). Unless a system is established that imports water from outside a local area (e.g., Colorado River water via the Central Arizona Project canal), the water supply of a community comes from the immediate watershed. Because the water cycle is continual, water is constantly being added to a community's watershed and thus its water supply. In Tucson, we have long relied on water from our watershed to percolate through the earth to **recharge** (add to) our groundwater aquifer. An **aquifer** is an underground geologic formation that contains water.

To understand a watershed, consider a particular watershed to be like a funnel. Any water that falls in the area of the funnel will be channeled into the funnel. Any water that falls beyond the edge of the funnel, flows somewhere else and is outside the "watershed" of the funnel. In nature, the sides of the funnel are like mountain sides and ridgelines which shed water downhill toward a particular drainage.



## ACTIVITY – WATER CYCLE WORDS CROSSWORD PUZZLE

**DIRECTIONS:** Complete the crossword puzzle using the clues below. All answers can be found in the text or glossary.



### CLUES

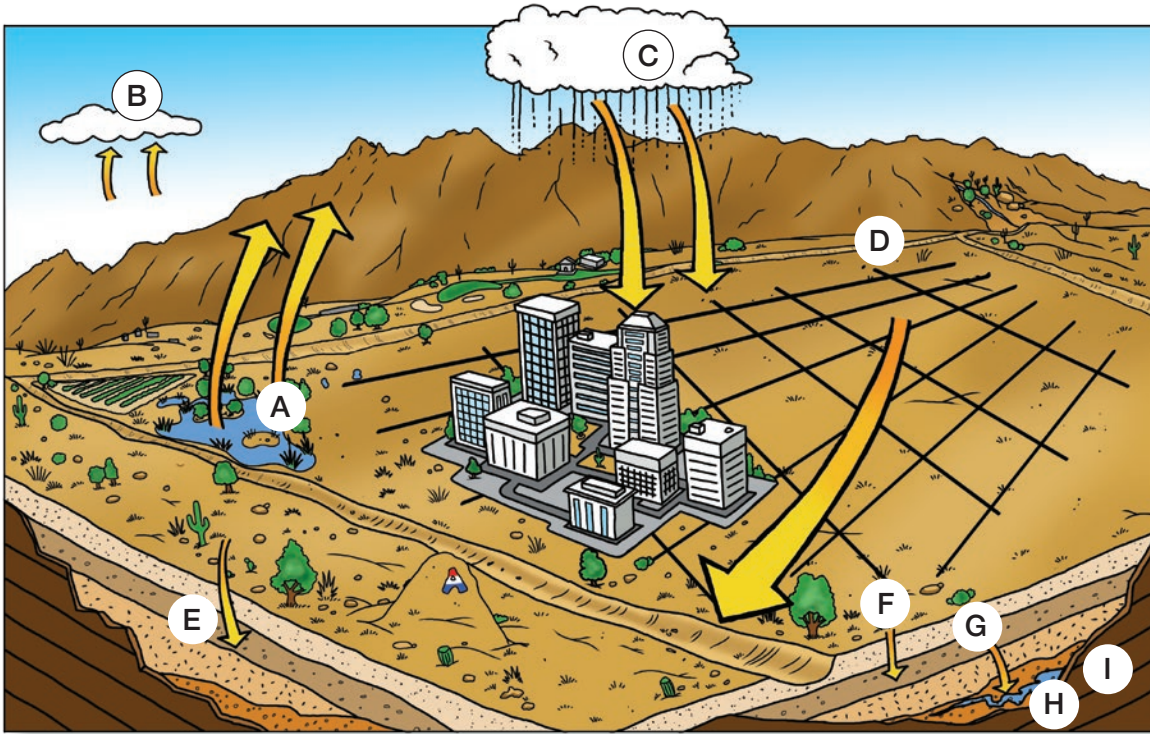
#### ACROSS

2. an underground geologic formation that contains water
4. the process of a liquid changing to a vapor
9. the process of water moving down through layers of soil and rock
10. water that flows downhill over the earth's surface
11. water found on the earth's surface (as in runoff, rivers, or lakes): \_\_\_\_\_ water
12. the addition of water to an aquifer
13. the process of a vapor changing to a liquid (as when clouds form)

#### DOWN

1. water that falls to the earth in such forms as rain or snow
3. the total land area that drains to a specific river, wash, or lake
5. effluent that is highly treated and can be used again: \_\_\_\_\_ water
6. the process of water seeping into the soil and moving through cracks and pore spaces
7. water found below the earth's surface
8. water that is treated and released by a wastewater treatment facility

# ACTIVITY – WATER CYCLE DIAGRAM



**DIRECTIONS:** Use the clues and answers from the crossword puzzle to find which water cycle words are needed to correctly label the water cycle diagram. Write the correct letter beside the water cycle word to indicate its location in the diagram. As an example, the first one is done for you.

crossword clue	water cycle word	letter location in diagram
6 down	<i>infiltration</i>	<i>E</i>
9 across	_____	_____
4 across	_____	_____
13 across	_____	_____
1 down	_____	_____
12 across	_____	_____
10 across	_____	_____
7 down	_____	_____
2 across	_____	_____



# TUCSON'S WATER SOURCES

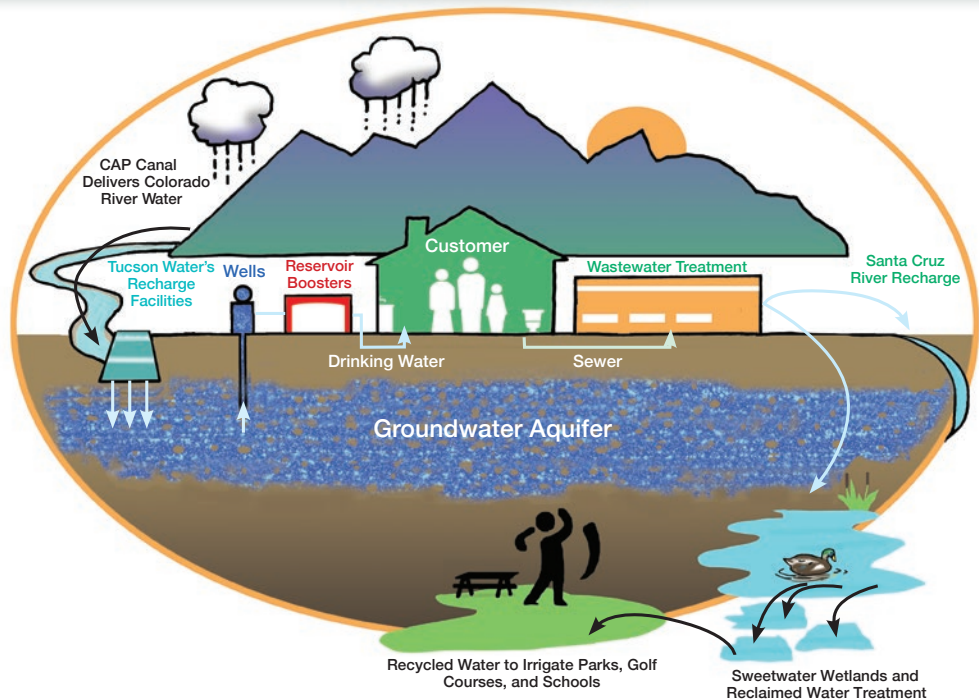
In our local water cycle, precipitation delivers water to our watershed. The runoff **infiltrates** (moves through) the surface of the soil. Once in the soil, the water slowly **percolates** down to **recharge** the **groundwater** (water occurring below the surface of the earth) in the aquifer.

Tucson's water supply was originally **surface water** (water on the earth's surface) flowing primarily in the Santa Cruz River. The level of our groundwater, along with yearly runoff, kept the Santa Cruz River flowing pretty much year-round.

Extensive human use caused surface water in our valley to largely disappear. Instead of river water, groundwater — which was pumped up with wells — became Tucson's primary water supply. As the population of Tucson grew, our increased use of water caused the groundwater table to drop as much as 200 feet in some areas. In the late 1990's, Tucson began importing water from the Colorado River via the Central Arizona Project (CAP) canal. Today, our main sources of drinking water are a mix of Colorado River water and groundwater.

Tucson also has a third water source: **recycled water**. Recycled water is water that has been used and then treated for reuse. As our population grows, we use more and more water. That also means we produce more and more wastewater. **Wastewater** is the water that goes down our drains after use in our homes and businesses. Water is such a valuable resource that it is only natural that we find ways to recycle and reuse this water. Recycled water is sometime called reclaimed water because we have reclaimed it for use.

## TUCSON'S URBAN WATER CYCLE



In an urban setting such as Tucson, our reliance on water means that we must engineer ways to move, use, and reuse our water. Thus, Tucson's **urban water cycle** includes human actions and uses of water in the water cycle. All cities have an urban water cycle. However, here in Tucson our urban water cycle is unique because of our use of recycled water — and Sweetwater Wetlands plays a role in that cycle.

## HOW TUCSON'S URBAN WATER CYCLE WORKS

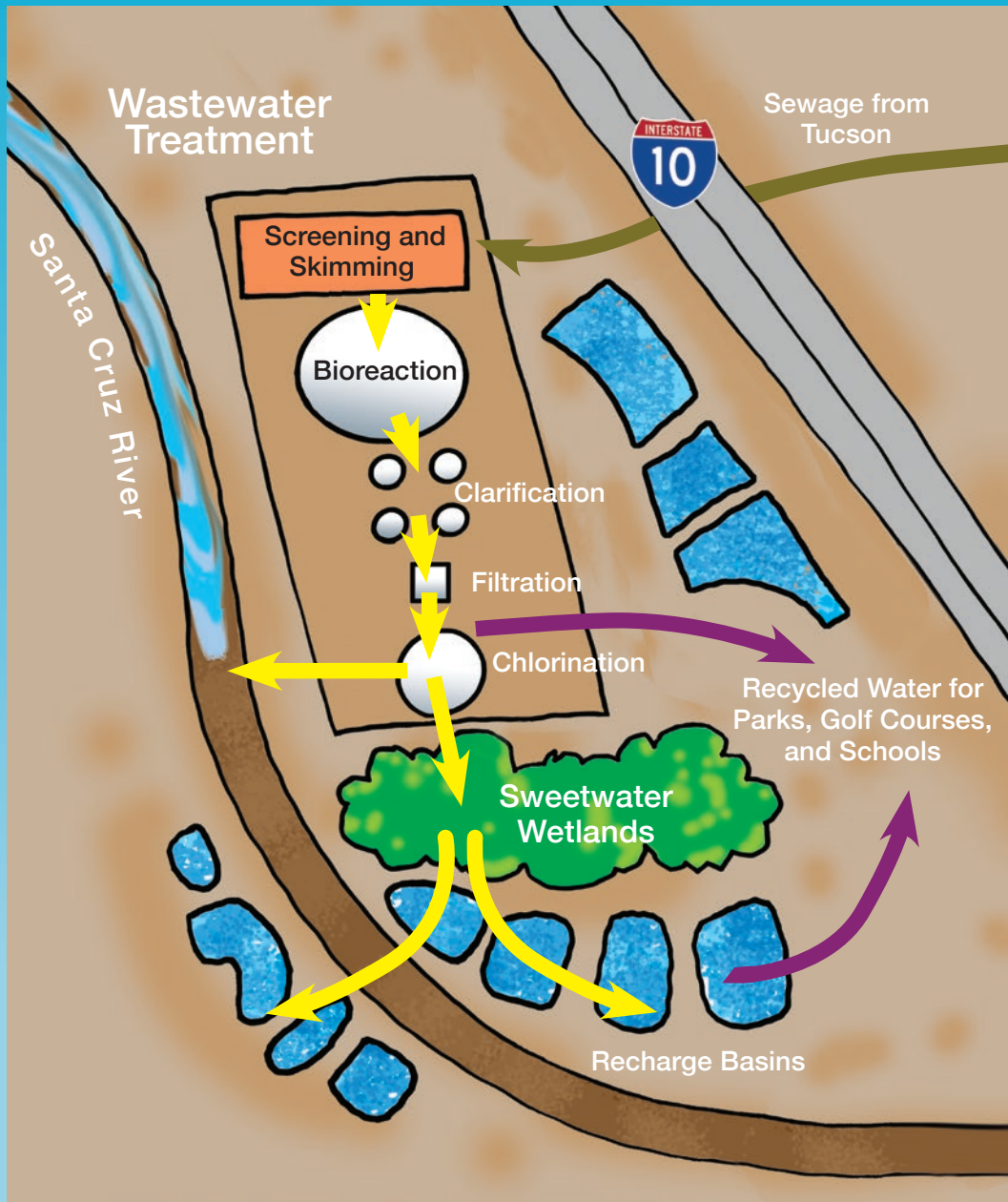
Water (a mix of groundwater and Colorado River water) is delivered to our homes and businesses throughout Tucson. After use, the wastewater (also called primary effluent) is piped to the Agua Nueva Water Reclamation Facility for treatment. After treatment, the water is discharged in three ways. Some of the water is released into the Santa Cruz River where it supports a **riparian habitat** and eventually infiltrates the soil and percolates down to the aquifer. Some of the water becomes part of our reclaimed water system and a separate system of pipes delivers this recycled water directly to parks, schools, and golf courses for landscape use. Additionally, a small portion of Agua Nueva's treated water is piped to Sweetwater Wetlands where it supports the wetlands system. After moving through the wetlands, the water is delivered to the nearby recharge basins where it slowly infiltrates to join the aquifer. The water is then pumped up and delivered to city parks, schools, and golf courses. It is important to note that although mostly used by plants, some of that water again seeps into the soil and eventually reaches our aquifers. And the cycle continues.

## RECYCLED WATER

The reclaimed water system through which we recycle water is an important part of our urban water cycle. Additionally, our reclaimed water is cycled on a time scale for immediate human use. Using recycled water for irrigation and other activities saves groundwater and Colorado River water for uses such as drinking and bathing.

Water is a valuable resource, especially in our desert town. As Tucson's population grows, demand for water increases. While we have seen declines in our groundwater table and drought effects on the Colorado River system, we are constantly producing wastewater. Recycling water is a sensible and sustainable solution to help meet our water demands.

# HOW SWEETWATER WORKS: AN AMAZING DESIGN FOR RECYCLING WATER







**S**weetwater Wetlands was originally constructed to naturally treat backwash water from the filters at the now decommissioned Roger Road Water Reclamation Facility. Because that facility used older technology, Tucson Water was required to filter the water before delivering it to reclaimed water users. The wetlands were used to treat water from the backwash process that was used to clean the filters. Today, the Wetlands receive higher quality treated water from the new Agua Nueva Water Reclamation Facility, and frequent backwashing of the filters is no longer necessary. However, water from Agua Nueva is continually added to maintain the wetlands and the wildlife supported by the wetlands.

Water arriving from the Reclamation Facility is first piped to settling basins at Sweetwater Wetlands where suspended solids drop out of the water and become trapped in the wetland plants and soil of the basin. The water then flows to the large wetland ponds for further polishing. The water slowly filters through the wetland vegetation to the west end of the ponds. Throughout this process— which might take several weeks —more solids settle out and microbial transformations occur which remove a variety of contaminants including pathogens and heavy metals. The water is then directed to the recharge basins where it filters through soil sediments and replenishes the groundwater in the aquifer below. The flow of the water from the settling basins through the recharge basins is entirely directed by gravity as the water gradually moves downhill. When needed, this now recycled water is pumped up through extraction wells and delivered through a series of special distribution pipes to Tucson parks, schools, and golf courses.

The quality of the water that is reclaimed at the Agua Nueva Water Reclamation Facility is very high. It meets or exceeds Environmental Protection Agency (EPA) standards and is considered safe for plants and wildlife. This is important because through this water, a habitat is created at Sweetwater Wetlands— a wetland habitat that supports a diversity of plants and animals once common along the Santa Cruz River.



A  
These mountains to our north are the main contributor of water in our watershed.

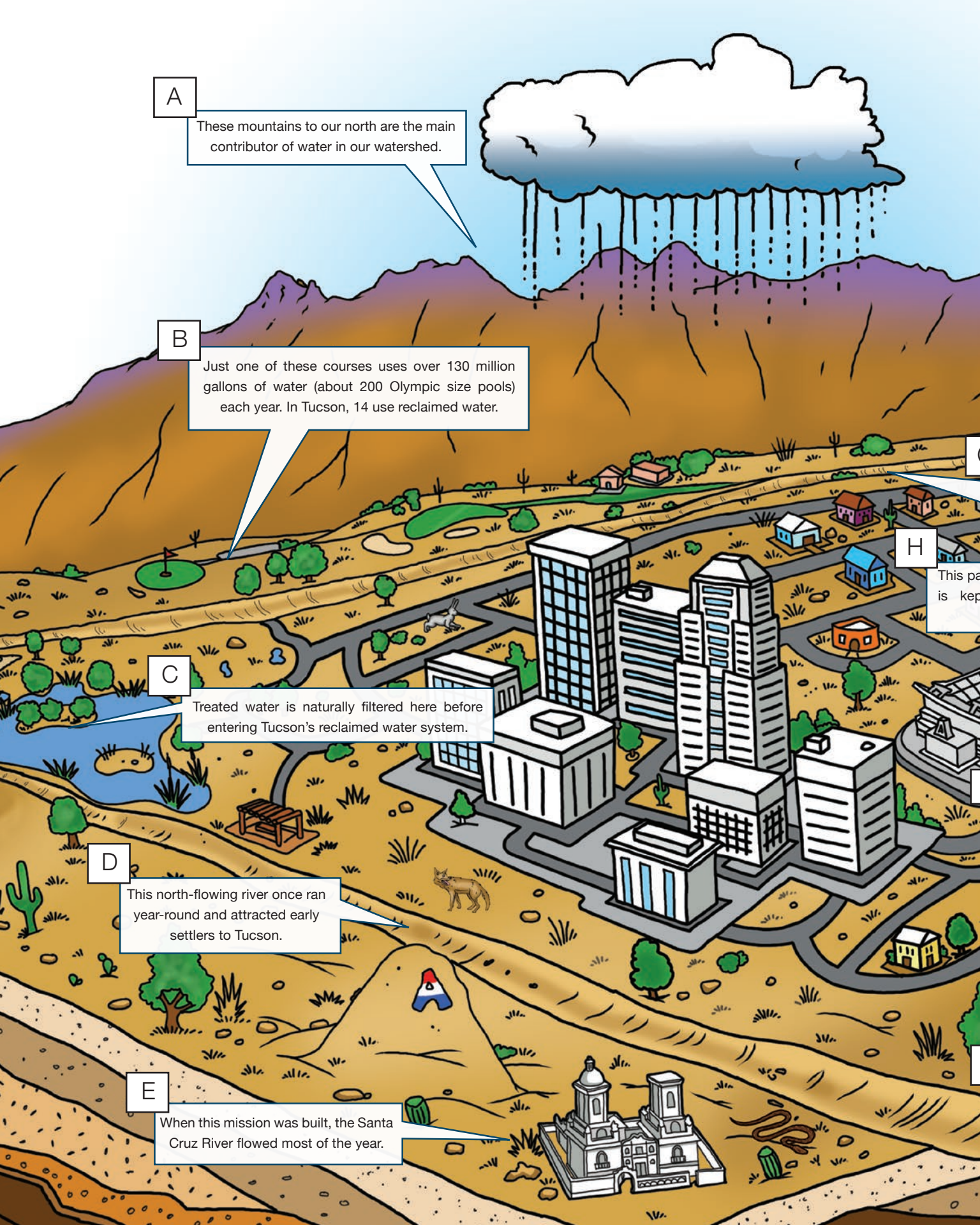
B  
Just one of these courses uses over 130 million gallons of water (about 200 Olympic size pools) each year. In Tucson, 14 use reclaimed water.

C  
Treated water is naturally filtered here before entering Tucson's reclaimed water system.

D  
This north-flowing river once ran year-round and attracted early settlers to Tucson.

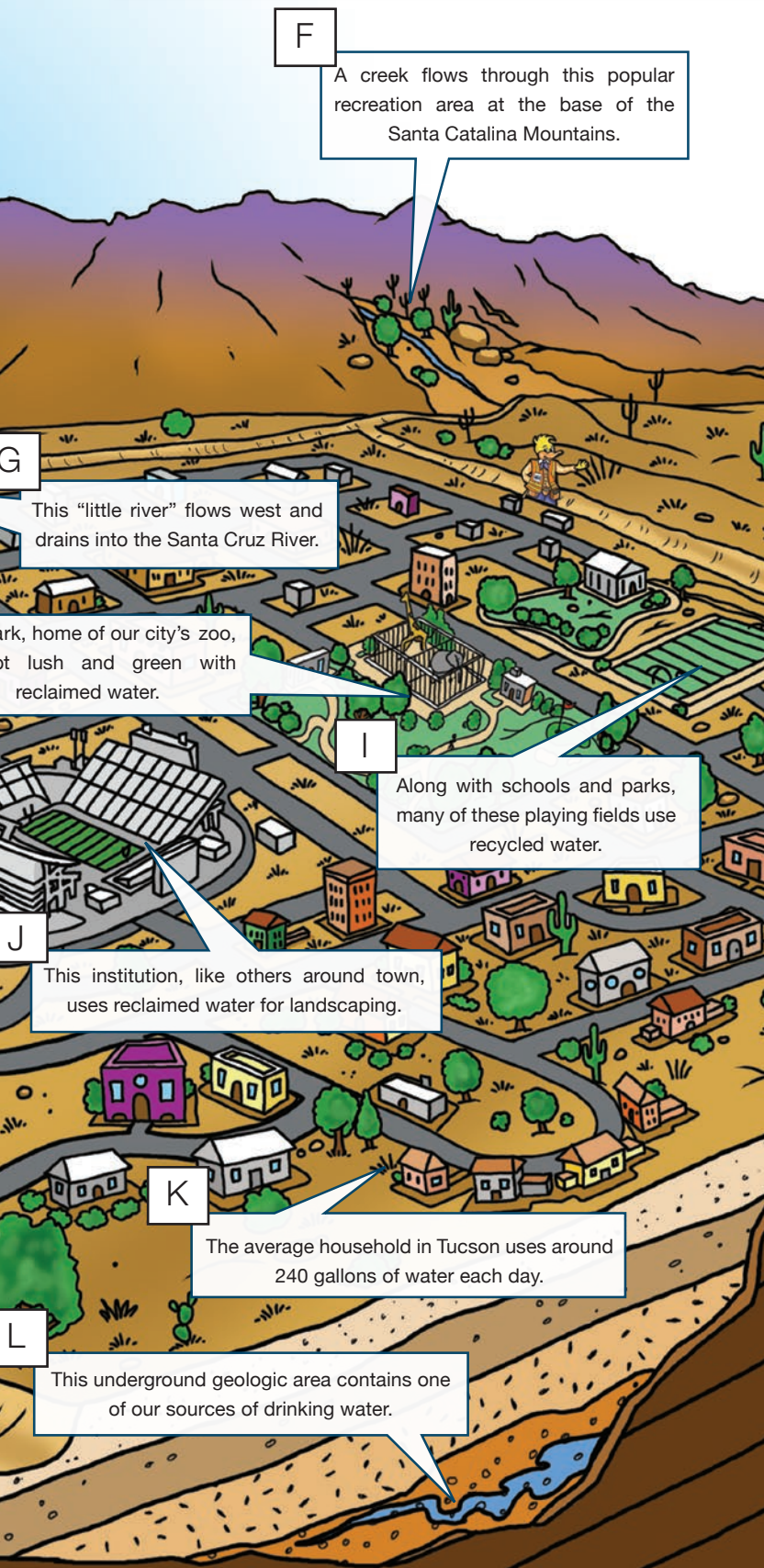
E  
When this mission was built, the Santa Cruz River flowed most of the year.

H  
This page is kept





# ACTIVITY – TUCSON BASIN DIAGRAM: FINDING AND USING WATER IN THE DESERT



**DIRECTIONS:** *It looks like a desert but water is actually everywhere in Tucson. Can you find the following items in this diagram of the Tucson basin? Place the letter describing the site on the map beside its place name below. Some items do not have identifying letters – can you find those as well?*

- Santa Catalina Mountains
- Santa Cruz River
- Sabino Canyon
- Sweetwater Wetlands
- U of A
- jackrabbit
- golf course
- Rillito River
- San Xavier Mission
- Pete the Beak
- Reid Park
- soccer field
- houses and apartments
- saguaro cactus
- rattlesnake
- Finger Rock
- groundwater aquifer
- coyote



## ACTIVITY – RESTORING HISTORICAL LANDSCAPES: HISTORY OF THE SANTA CRUZ RIVER AND SWEETWATER WETLANDS

**S**weetwater Wetlands is located on the banks of the Santa Cruz River. Although it is mostly a dry riverbed today, the Santa Cruz once flowed year-round. Construction of Sweetwater Wetlands restored some of the native habitat that once occurred along the Santa Cruz River. Although it is a constructed wetlands, the plants and animals found at Sweetwater Wetlands are typical of the species that were once common along the Santa Cruz River.

**DIRECTIONS:** *The scenes to the right show changes along the Santa Cruz River over time. Can you put the pictures in order? Use the images and descriptions below for clues! Write the correct date by each picture. When you are done, answer the questions at the bottom of this page.*

**1500s** - Long ago, the Santa Cruz River flowed year-round in Tucson. The water table was close to the surface. Beautiful riparian and wetland habitats were found along the river. Many birds and other animals lived in these lush habitats.

**1700s - 1800s** - The river was a reliable water source. Native Americans and later, Hispanic and Anglo settlers relied on the river for drinking and to water crops. These early settlers did not use very much water. The water table stayed close to the surface and the river continued to flow year-round.

**1900s - 1940s** - More people moved to Tucson. They used river water and dug wells. The area began to noticeably change near the middle of this century. People began using more groundwater than was replaced by rainfall. The water table dropped. The river stopped flowing regularly. Riparian and wetland habitats shrunk.

**1950s - 1990s** - Tucson grew into a large city. More water was needed for the growing city, and people drilled many deep wells. Over time, the water table dropped 200 feet in some areas. The riparian and wetland areas were almost gone. The beautiful river became a dry, barren channel. Many plants and animals were lost.

**early 2000s** - Tucson began using Colorado River water. Many parks, golf courses, and school grounds started using recycled water. Less groundwater was used. Some wells were turned off allowing the water table to rise. Paths, parks, and Sweetwater Wetlands were built on the banks of the Santa Cruz River. This constructed wetland was built to further treat effluent and provided wildlife habitat.

### Answer these questions:

1. Describe two differences and two similarities between the scene from the 1500s and the scene from the 2000s.

Differences: \_\_\_\_\_

Similarities: \_\_\_\_\_

2. Why is there very little difference between the first two scenes? \_\_\_\_\_

3. Which illustration shows the most drastic change from the scene before it? Describe why you think the change is so drastic. \_\_\_\_\_

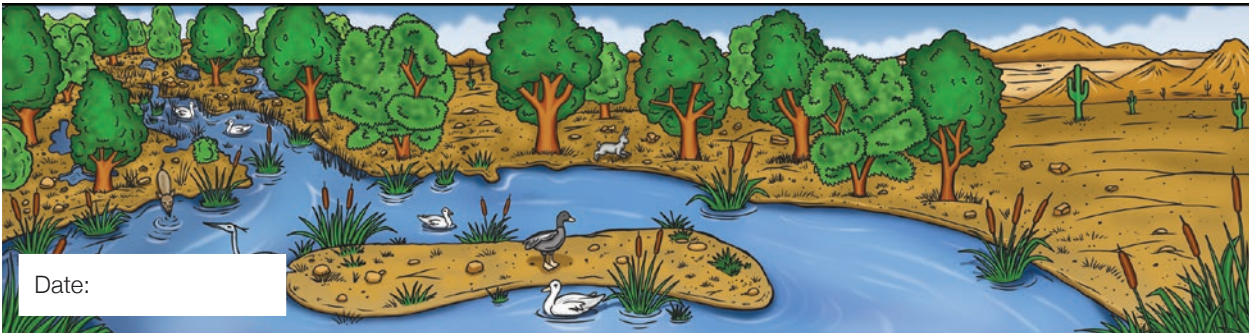
4. Describe how the scene might look 50 years from now and explain why it might look like this.

\_\_\_\_\_

\_\_\_\_\_



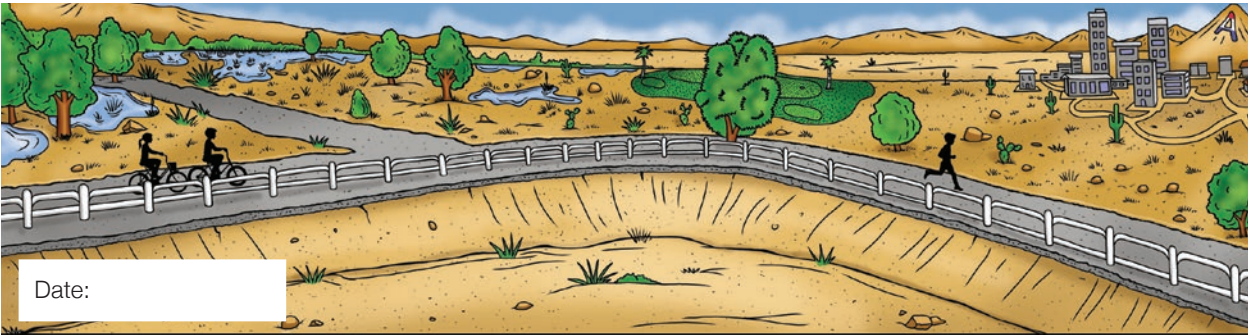
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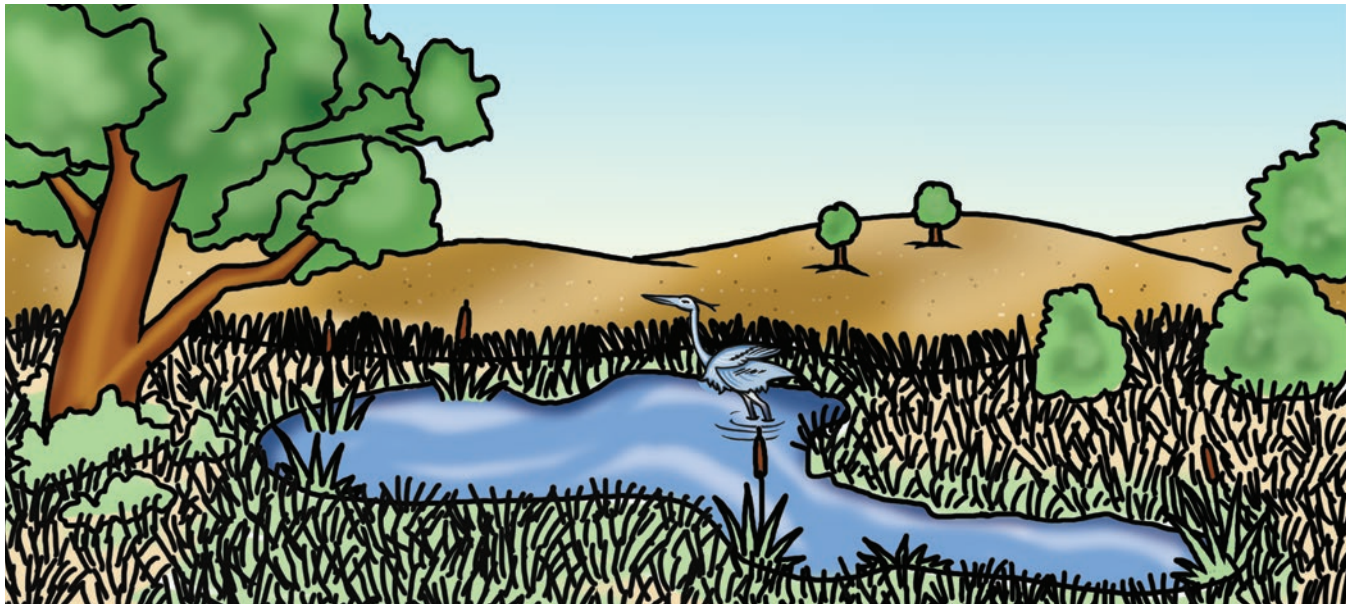
Date:



Date:



# INTRODUCTION TO WETLANDS



## WHAT ARE WETLANDS?

Living in the desert, it's difficult to imagine a wetland. Unlike our hard, dry desert soils, a wetland is a place with soggy ground, pungent smells, and lush vegetation. In the desert, wetlands are rare. Regardless of where they occur, all wetlands have three main characteristics: 1) the soils are saturated; 2) there are hydrophytic (water-loving) plants present; and 3) water occurs there. These conditions do not need to be year-round or constant. Some wetlands change dramatically through the seasons or even (in the case of intertidal marshes) through the day. There may be periodic flooding or drying-up. Some places are considered seasonal wetlands and only exhibit wetlands conditions during certain times of the year. Sometimes water is very obvious with a large pond full of fish and ducks. Sometimes the water is just below the surface of the soil and not obvious at all. As the name implies however, it is the presence of water that makes a wetland what it is.

## TYPES OF WETLANDS

There are many different kinds wetlands occurring all around the world. There are salt water, coastal wetlands associated with marine estuaries and coastlines. There are also freshwater, inland wetlands associated with rivers, lakes and ponds. Pond wetlands include bogs and seeps. The kinds of wetlands that might occur in the desert



include a seasonal pond, a seep or spring, a marshy cienega, or a backwater beside a desert stream. All these wetlands occur naturally and are influenced by such things as topography, climate and geography.

## WETLAND FUNCTIONS

**W**etlands are special because they serve several very important roles in the environment. Scientists call these “wetland functions.” Wetland functions contribute to the physical, chemical, or biological health of the environment. Wetlands also have an economic value to humans.

Wetlands serve important **physical** functions in the water cycle.

- Wetlands naturally slow and control flooding.
- Wetlands contribute to groundwater recharge.
- Wetlands trap sediments that might otherwise impede water flow.
- Wetlands provide carbon storage.

**Chemical** functions refer to a wetland’s ability to clean up water.

- Wetland plants filter pollutants from water.
- Wetland plants help settle toxic residue.
- Over time, wetlands soils chemically neutralize pollutants.
- Wetland bacteria break down some pollutants, making them less harmful.

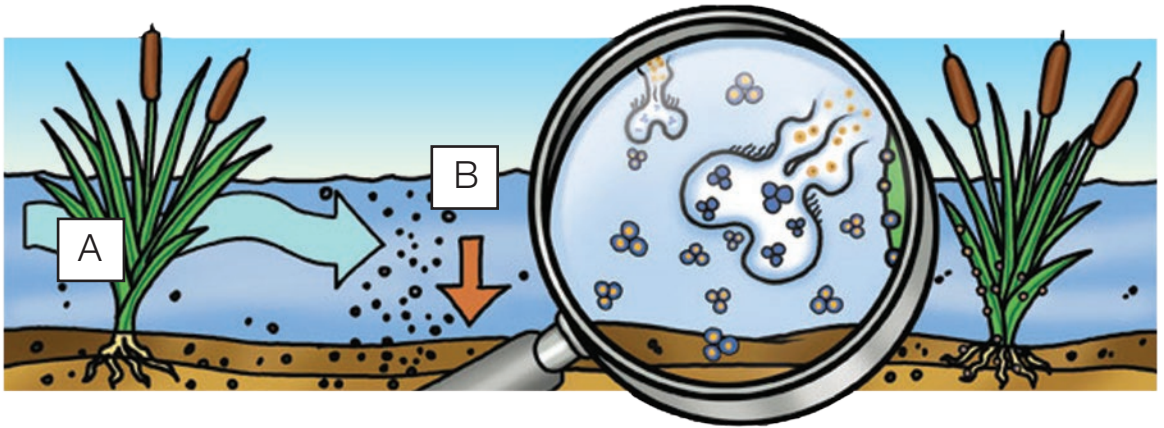
Wetlands are very productive habitats that perform several **biological** functions.

- Wetlands provide resources and nutrients that support a diversity of living organisms.
- Wetlands provide important habitat to a myriad of species, including many that are endangered.
- Wetlands serve as productive nurseries for a diversity of aquatic species.

Humans too, rely on wetlands. Foods such as rice and cranberries are grown in wetlands. In some countries, wetland plants such as peat, reeds, and trees are harvested for fuel, fiber, or timber. People also value wetlands as places for recreational activities such as bird watching, canoeing, or fishing. It is important to remember that humans benefit from all the functions of wetlands: physical, chemical, biological, and economic.



## HOW WETLANDS CLEAN UP WATER



As water moving through the wetland vegetation slows down (A), suspended solids fall out of the water (B) and settle to the bottom. Wetlands microbes transform contaminants into less harmful forms.

**A** very important function of wetlands is their natural ability to filter and clean water. Water entering a wetland slows down as it moves through the wetland vegetation. As the water slows, various particulates begin to fall out of the water and settle into the soil at the bottom of a wetland or become trapped among the vegetation. These solids can be a variety of debris including soil or effluent particulates. Often, various chemical pollutants are attached to these solids. Fertilizers, pesticides, heavy metals, and other harmful compounds are examples of pollutants that find their way into wetlands.

Besides slowing the flow of water, wetland plants are able to take up wastewater pollutants into their cells. They also create the perfect environment for other processes that cleanse water. The dead plants at the bottom of a wetland pond help trap solids and provide conditions for the growth of important microbes. Microbes also attach themselves to the stems of living plants. Through various processes such as decomposition, predation, and neutralization, these microbes are able to transform contaminants into less harmful forms. Microbes also convert various nitrogen compounds into usable forms. The microbes that thrive in the wetland environment literally gobble up pollutants.

## CONSTRUCTED WETLANDS

**H**uman-made wetlands are called *constructed wetlands*. Wetlands are primarily constructed to clean up wastewater and create wildlife habitat. Constructed wetlands naturally filter and treat wastewater and are often less expensive than traditional treatment plants. Constructed wetlands are also more appealing than other treatment plants because of the habitat they create and because of their ability to reduce odors.

Sweetwater Wetlands is one of several constructed wetlands in Arizona. Besides further treating water from Agua Nueva, it also provides valuable wildlife habitat, supporting numerous species of birds, mammals, amphibians, and reptiles. The wetlands also serve as a recreational and educational site for area visitors and residents. Just like a natural wetlands, Sweetwater provides numerous important functions that benefit us and our environment.

## ACTIVITY - WETLAND WORD SEARCH

**DIRECTIONS:** Find the wetland words in this word search puzzle. Be sure to look forward, backward, up, down and diagonally in all directions.

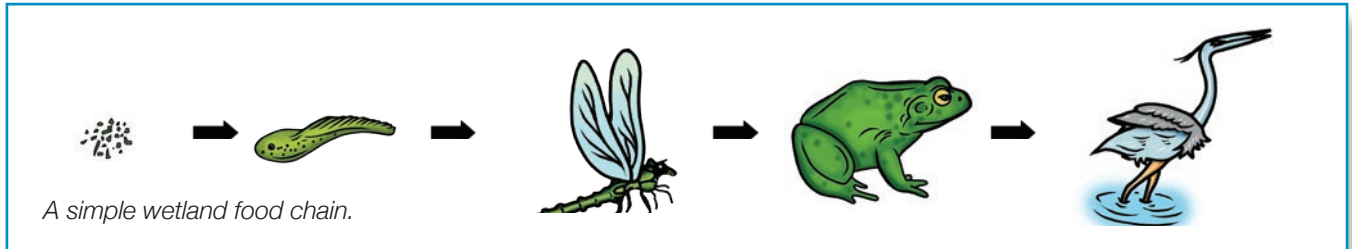
ANAEROBIC  
BACKWASH  
CATTAIL  
CONSTRUCTED  
CYCLE  
DECOMPOSITION

EFFLUENT EMER-  
GENT  
FOODWEB  
INVASIVE  
MICROBES  
NEUTRALIZATION

RECLAIMEDWATER  
RUNOFF  
SANTACRUZ  
SUBMERGENT  
SWEETWATER  
WATERSHED



# WETLAND ECOLOGY



## WEBS OF LIFE IN THE WETLANDS

**T**here is an abundance of water and nutrients in wetlands. With plenty of sunshine (the ultimate source of energy), plants thrive in this environment. As plants grow, die, and decompose, they become the basis of the wetland food chain. Bacteria, fungi and other tiny organisms feed on these decomposing plants (also called detritus). In turn, these microorganisms feed small invertebrates such as insect larvae, snails, and worms. Animals such as frogs, small fish, and birds consume these invertebrates. The small animals become food for larger animals such as raccoons, foxes, herons, and hawks.

Energy travels through food chains and food webs. What makes wetlands unique is the sheer productivity of energy at the primary level. The constant growth of plants, which are the primary level of the food chain, leads to an abundance of energy all the way up the food chain. Wetlands are literally teeming with life.

## ADAPTATIONS TO LIFE IN THE WETLANDS

**E**ven with its abundance of water and nutrients, the wetland environment is a challenging place to live. Survival in the wetlands means adapting to periods of both flooding and drought. It means dealing with

reduced oxygen in both the soil and water. Organisms must often contend with accumulated salts or other pollutants. Additionally, the day to day tasks of finding food and shelter as well as mating must also be accomplished to ensure a species' survival. Wetland plants and animals have developed a variety of physical and behavioral adaptations to deal with the particular set of challenges presented by life in the wetlands.

*A cattail stem provides a good example of an emergent wetland plant using air spaces (called aerenchymas) for moving oxygen to its roots. In cattails, these spaces not only transport oxygen, they provide a strong yet light-weight structure, an adaptation which helps the plant support itself as it grows in the water and as it emerges above the water.*

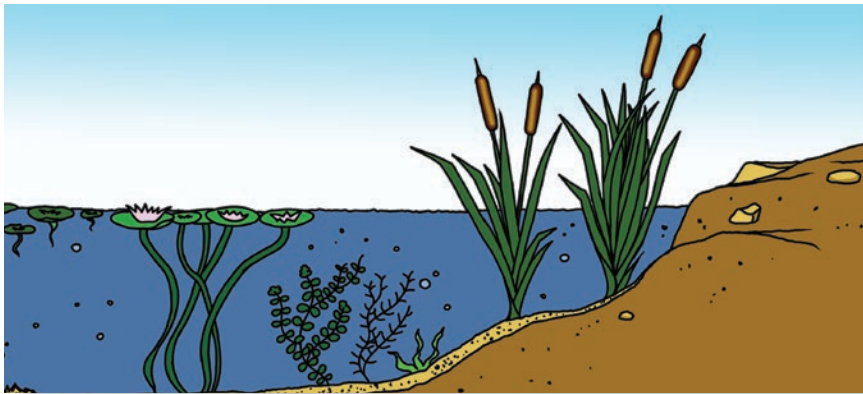




One of the biggest challenges organisms face in the wetlands is surviving in an oxygen-deprived environment. The sediment and soil in a wetland is often **anaerobic** — that is, there is very little available oxygen. This is a big challenge for wetland plants that need oxygen for respiration and nutrient exchange. Wetland plants have developed several strategies to deal with this condition. Many plants have developed air spaces throughout their structures to move oxygen from the emergent parts of the plant (the part above water) to the roots. Other plants have developed above-ground roots and other structures which enable them to literally “come up for air.”

Wetland bacteria have a unique way of dealing with anaerobic conditions. Instead of using oxygen for respiration, they use sulfate. The by-product of their respiration is hydrogen sulfide which is what causes the rotten-egg smell in the muck of many wetlands.

## WETLAND HABITAT



*Wetland plants generally fall into three categories. Emergent plants are those that are rooted in the soil but extend above the water's surface. Submersed plants are those that live completely underwater. Floating plants are just that – they float on the water's surface and may or may not have their roots in the soil.*

**A** habitat is a place where an organism finds the food, water, and shelter that it needs to survive. In other words, a habitat is a home for plants and animals. Wetlands are home to a diversity of plants and animals specifically adapted to wetland conditions. Also, within wetlands are a variety of “microhabitats” which offer very specific conditions for animals and plants. A **microhabitat** is an area within the habitat that presents a different set of living conditions from the area right next to it.

In wetlands, some specific microhabitats include the open water zone, the emergent zone, the zone where the soil is sometimes wet and sometimes dry, and the dry uplands. There are plants and animals that are perhaps abundant in one of these areas but couldn't survive in an adjacent zone. For example, cattails are found in shallow water at the edge of the wetlands but cannot survive either in deeper water or on dry land. Floating plants need open water. Most ducks can be found both in open water and along the shore of wetlands, but they rarely range to the dry uplands. Wetland plants and animals are uniquely adapted to life in one or more particular microhabitat.

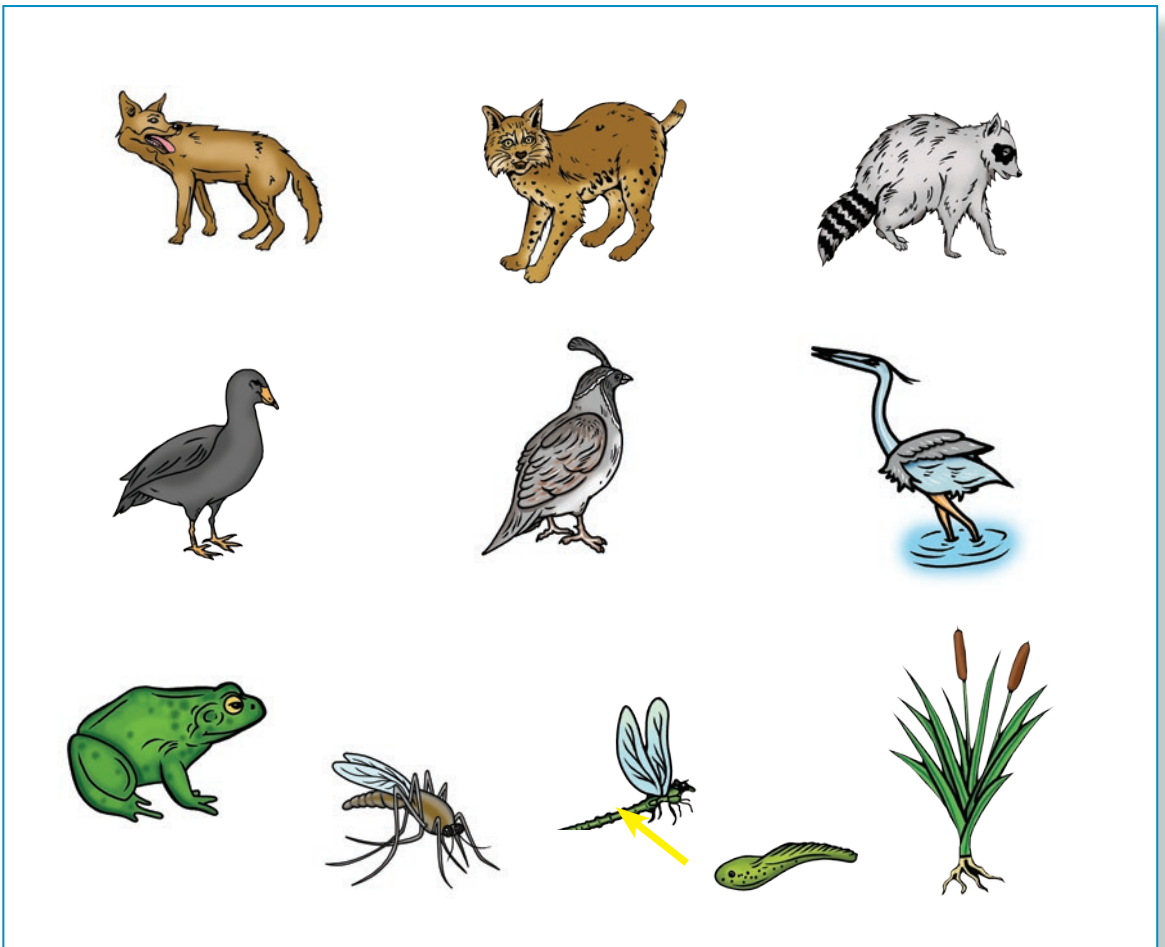
## RIPARIAN HABITAT

**A**lthough sometimes used interchangeably with wetlands, the term **riparian** refers to the habitat that is adjacent to and influenced by a body of water or wetland. Sweetwater Wetlands support a thriving riparian habitat that includes cattails, bulrushes, and large cottonwood and willow trees. In turn, this vegetation attracts and supports a diversity of wildlife that cannot survive without wetland and riparian habitat.

## ACTIVITY – WETLANDS WEBS

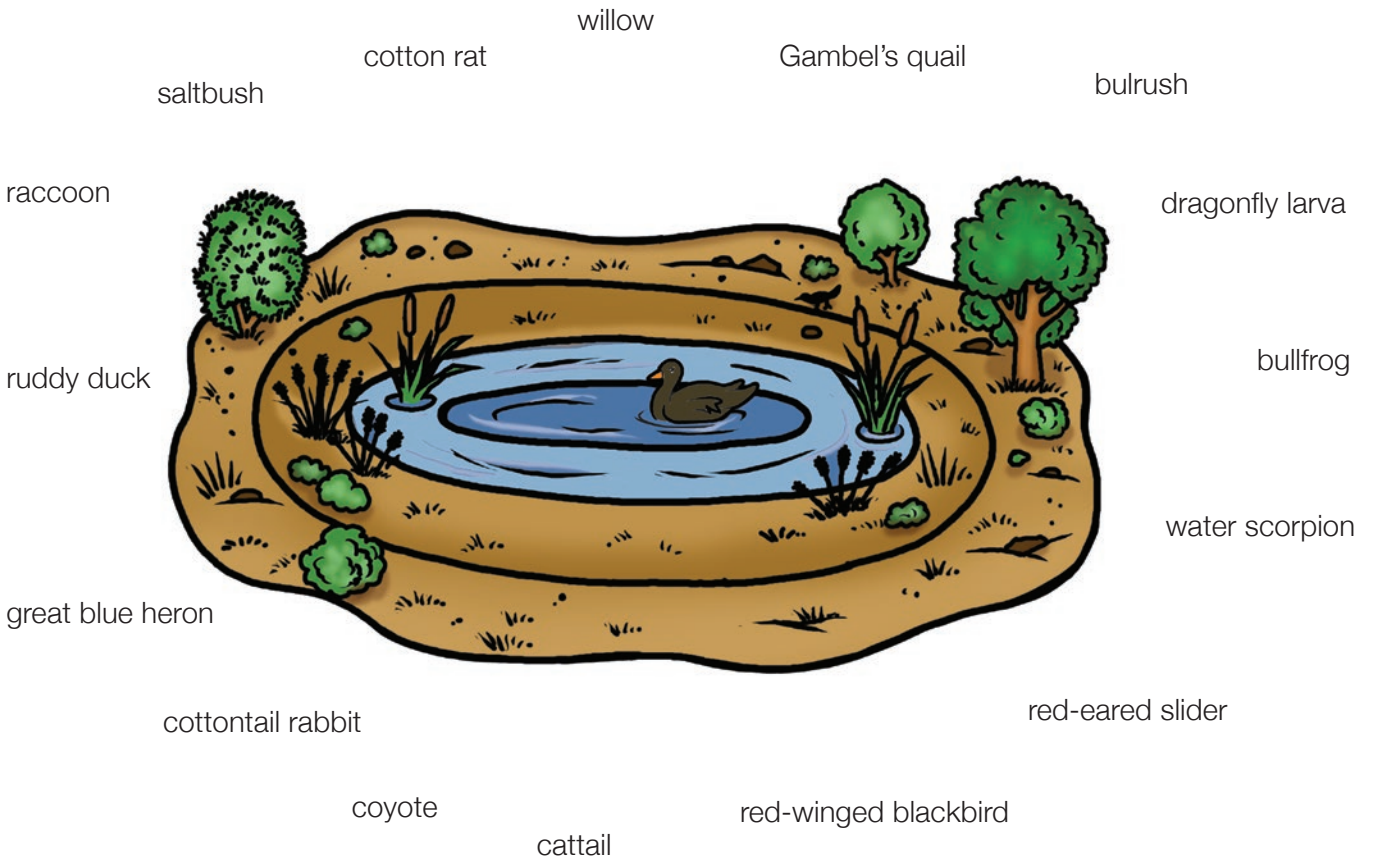
**S**weetwater Wetlands supports a thriving community of wetland plants and animals. Plants such as cottonwoods, cattails, and bulrush produce energy through photosynthesis. They are the primary producers of energy in the community. Animals such as northern shovelers, coots, cotton rats, and round-tailed ground squirrels eat the plant material found at Sweetwater. They are the primary consumers. The variety of carnivores that inhabit the wetlands are the secondary consumers. These include raccoons, rattlesnakes, Cooper's hawks, and even bobcats! Within the wetlands and the surrounding desert habitat there is an abundance of food for the variety of wildlife that occur there.

*Directions: In the illustrations below, draw arrows to show who eats whom in the Sweetwater Wetlands food web. The arrows should point in the direction the energy flows. For example, energy flows from the tadpole to the dragonfly. You can find out what these animals eat in the **Field Guide to the Common Plants and Animals of Sweetwater Wetlands** section of this book.*



## ACTIVITY - HOME IN THE HABITATS

**DIRECTIONS:** Label the four microhabitats in the picture below (uplands, wet/dry, emergent, or open water). Use the **Field Guide to the Common Plants and Animals of Sweetwater Wetlands** section of this book to find out the preferred habitats of the plants and animals listed. Draw a line from each plant or animal to the habitat zone in which it would be found. Some organisms may be found in more than one zone.



# WETLAND

# CONSERVATION



It is estimated that from 60 to 75% of Arizona's wildlife are dependent on wetland and riparian habitats for survival. However, wetland habitats are extremely rare in Arizona, comprising less than 1% of Arizona's total land area. As rare as they are, wetland and riparian areas are extremely important. In addition to supporting a diversity of plants and wildlife, they support important hydrologic functions including water storage, recharge, and reduction of floodwater runoff.

Over the past century, most of Arizona's wetland and riparian areas (estimates range from 33 to 90%) have been lost due to human impacts. Wetlands are lost when they are drained for agricultural or industrial purposes. They are lost when dams block their water source. Wetland losses also occur from dredging, filling, diking, logging, mining, and construction.

We also lose wetlands to habitat degradation. Although wetlands have a natural ability to clean water, they can take only so much pollution. Excessive runoff, air and water pollution, and toxic chemicals can all harm a wetland to the point that it loses its ability to function as a healthy ecosystem. Wetland habitats can also be degraded by overgrazing of domestic animals and by the invasion of non-native plant and animal species.

Fortunately because of our growing awareness of the value of wetlands, we have reduced wetland losses both here in Arizona and across the country. There are now laws that protect our remaining wetlands including the Clean Water Act and Endangered Species Act (which protects habitat for threatened and endangered species). However, wetlands are still threatened. Understanding wetlands will help in their conservation.

Places like Sweetwater Wetlands help by providing a wetland habitat and educating people. Sweetwater Wetlands is a refuge for wildlife. Besides the wildlife that live there year-round, it is an important rest stop for many wetland birds (including ducks and shorebirds) during their migration.

Additionally, as an outdoor classroom, Sweetwater Wetlands is the perfect place to observe and learn about water, wetlands, and wildlife.



## ACTIVITY – SPY THE INVADERS

In Tucson and the surrounding Sonoran Desert, several invasive, exotic species have moved in and taken hold. An exotic species is a plant or animal that is not native to a particular area where it is found. Sometimes called “introduced” or “invasive” species, these plants and animals often wreak havoc in their newly acquired homes, outcompeting native species for food, water, and shelter. Some of these plants and animals can be seen at Sweetwater Wetlands. The managers of the wetlands work hard to keep these species from taking over and negatively affecting the native species at Sweetwater Wetlands. The invasive plants and animals of most concern at Sweetwater Wetlands include the bullfrog, tamarisk, buffelgrass and yellow star thistle.

**DIRECTIONS:** Review the natural history information about each of the invasive species at Sweetwater Wetlands. In the diagram below, find the invaders. Circle each invasive species and note where it is in the scene. On your visit to Sweetwater Wetlands, see if you can find this scene and spy the invaders in real life!



**Bullfrog** (*Rana catesbeiana*) – Although they occur throughout the United States, bullfrogs are not native to Arizona. They were introduced as a game animal (for food) and are now abundant statewide. Bullfrogs are so ravenous and produce so many young, that they can wipe out entire populations of small, native wetland species. Since showing up at Sweetwater Wetlands, bullfrogs have reduced the populations of other amphibians.



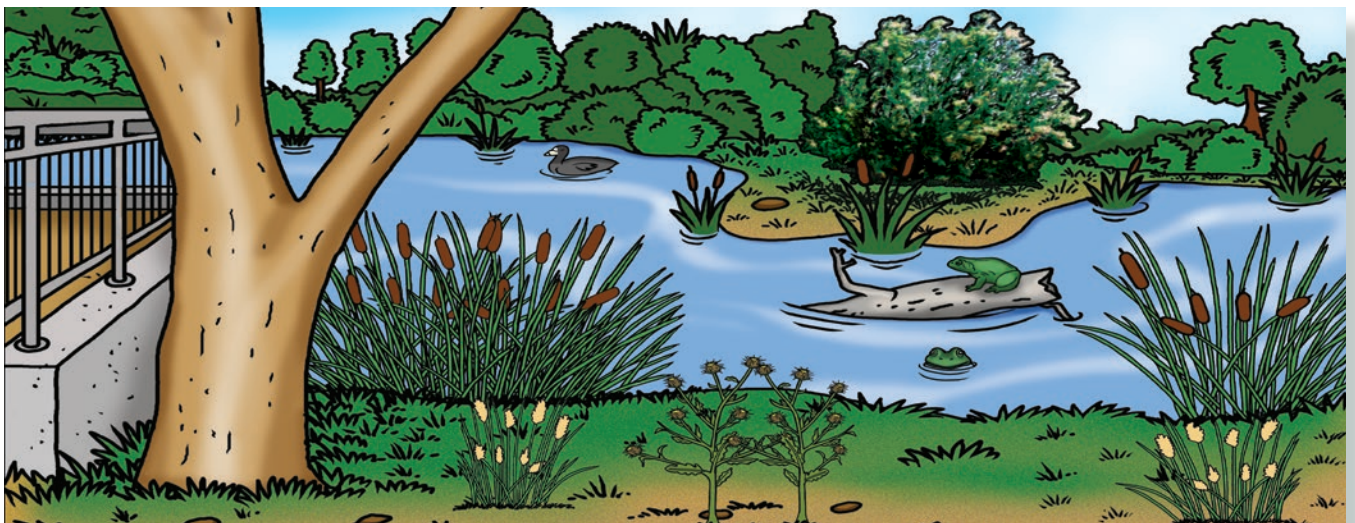
**Tamarisk** (*Tamarix ramosissima*) – Tamarisk trees originally came from Asia. Tamarisks are known to invade riparian areas where they take up space and water and otherwise “out-compete” native riparian species such as willow and cottonwood. Tamarisk trees often sprout up on the islands at Sweetwater Wetlands. Although some have grown to tree size, most new sprouts are immediately removed.



**Buffelgrass** (*Pennisetum ciliare*) – Originally from Africa, buffelgrass is now widespread in the Sonoran Desert. Originally introduced as a pasture grass for cattle to graze, it has now taken over many stretches of desert, changing the habitat into a grassland. Buffelgrass can be found in neighborhoods throughout most of Tucson. When found at Sweetwater Wetlands, it is removed immediately.



**Yellow Star Thistle** (*Centaurea solstitialis*) – The star thistle, a small herb native to Europe and Asia, has become a successful weed in many areas of the United States. It out-competes other plants for space and water and will degrade a habitat if left to spread. It produces small, yellow, thistle-like flowers in the late spring. At Sweetwater Wetlands, yellow star thistle plants are removed as soon as they are detected.



# SWEETWATER WETLANDS TRAIL MAP

## ACCESS AND TRAILS

**HOURS** – The gates to Sweetwater Wetlands are open from one hour before sunrise to one hour after sunset, seven days a week. On Mondays, gates do not open until 8:30 A.M. to allow for early morning mosquito control treatment.

**TRAILS** – There are over 2.5 miles of trails in Sweetwater Wetlands. This includes a 1,000 feet concrete path that is ADA-approved for wheelchair access. The rest of the paths are covered with gravel or decomposed granite and provide a secure walking surface. All paths are generally flat.

**COURTESY** – Dogs and bikes are not allowed on Sweetwater Wetlands trails to avoid disturbance of park inhabitants and visitors. Bike racks are provided at the entrances.



paved trail



dirt trail



ramada/  
observation  
deck



interpretive  
signs



weir



restrooms







# MANAGING SWEETWATER WETLANDS

## FOR WATER, WILDLIFE, AND PEOPLE

### MANAGEMENT PRIORITIES

**S**weetwater Wetlands' management priorities are to maintain the characteristics that support wildlife habitat, environmental education, and water reclamation. Sweetwater Wetlands is modeled after wetland systems in nature. In addition to maintaining visitor facilities, this includes maintaining areas of deeper open water, shallow water, shorelines, and uplands. Each of these areas serves a particular purpose and provides specific habitat qualities for the variety of plants and wildlife supported by the wetlands. Thus, the wetlands cannot become overgrown with vegetation, the basins must be kept from filling up with muck, the shorelines must be regularly thinned, and water levels must be maintained.

Managers work both on site and remotely at computer stations to keep the wetlands, recharge basins, and reclaimed system operating smoothly. The amount of water that moves into and out of the wetlands is regulated by opening and closing special gates, called "weirs." Computers monitor and control the amount of water that is extracted from the groundwater and delivered to schools, parks, and golf courses throughout the Tucson Basin.

### THE ANNUAL BURN

**O**ne of the more noticeable management practices at the wetlands is the annual burn. Each spring (usually in March), wetland managers from Tucson Water, together with the Tucson Fire Department, conduct a controlled burn at Sweetwater Wetlands to remove dead vegetation and facilitate mosquito control. The burn keeps vegetation from getting out of control at the wetlands, reduces mosquito habitat, and allows improved application of mosquito larvicides.

Bulrush and cattail roots are unharmed in the burn and grow back within a few months. The burn is also timed to avoid the nesting season of birds (such as redwing blackbirds) that nest among the wetland vegetation. Waterfowl and other wildlife at the wetlands typically leave during the burn and return when the fires subside that afternoon. Only one-third of the vegetation is burned each year to allow for plenty of healthy habitat for birds and other wildlife.

## MOSQUITO CONTROL



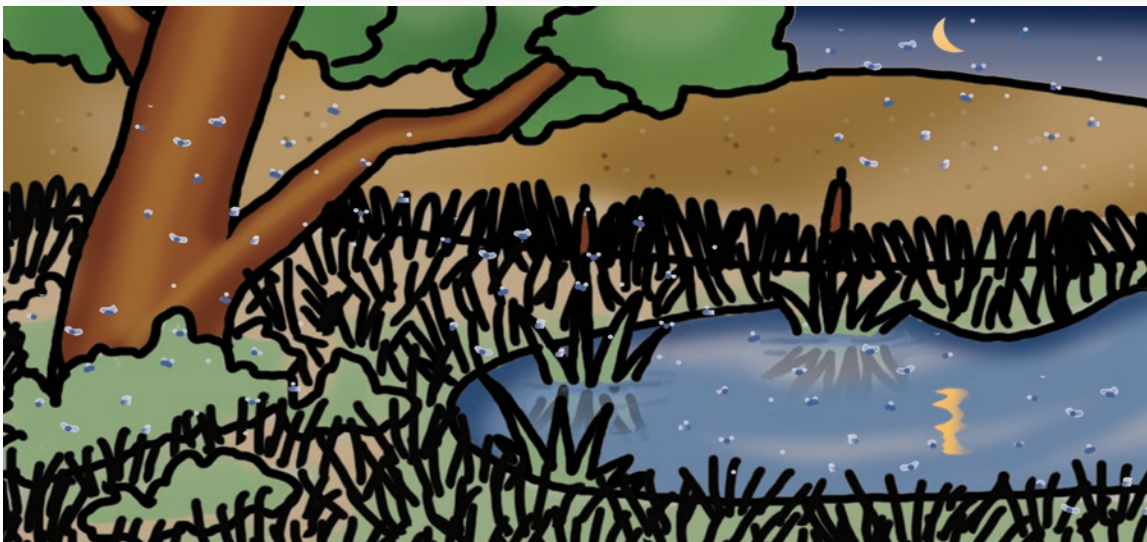
It is widely known that mosquitoes breed in wetlands. This is also true at Sweetwater Wetlands, where the slow moving water amid the bulrush offers habitat for mosquitoes. The most prevalent type of mosquito that breeds at Sweetwater Wetlands is *Culex tarsalis*, which is known to be a vector (or carrier) of encephalitis, a disease which inflames the brain. *Culex spp.* are also known to carry West Nile virus. Also, although rarely occurring at Sweetwater Wetlands, the species of mosquito that can potentially carry the Zika virus, *Aedes aegypti*, are also attracted to this kind of habitat. Because of these health risks, mosquito control at Sweetwater Wetlands is taken very seriously.

The managers at the wetlands have a very rigorous program for controlling mosquitoes. The Mosquito Abatement Program includes weekly mosquito counts, annual vegetation removal (the yearly controlled burn), weekly applications of a larvicide during warmer months and when mosquito numbers are highest, and chemical fogging with a low-toxicity pesticide. The bacteria-based larvicide that is used targets mosquito larvae and does not affect other organisms (including the larvae of other aquatic insects such as dragonflies). The pesticide used for fogging is approved by the EPA for use in aquatic environments.

This aggressive mosquito abatement program has greatly reduced mosquito populations at the wetlands, and the weekly mosquito count data show that populations have stabilized at or below the levels observed before the wetlands were constructed. However, managers are constantly working to find new and improved ways for controlling mosquitoes.

### WHAT YOU CAN DO TO AVOID MOSQUITOES:

- *Culex tarsalis* mosquitoes are nocturnal. During the day they are hiding out among the bulrush and cattails. Avoid going out at dusk or night near any mosquito breeding habitat.
- If you must go out at night, wear mosquito repellent.
- Wear long pants and long sleeves.
- When visiting Sweetwater Wetlands in the summer, do not enter the ponds or the shoreline vegetation. This is where mosquitoes hide during the day.



## ACTIVITY – THEY'RE DROPPING LIKE FLIES – MOSQUITOES THAT IS!

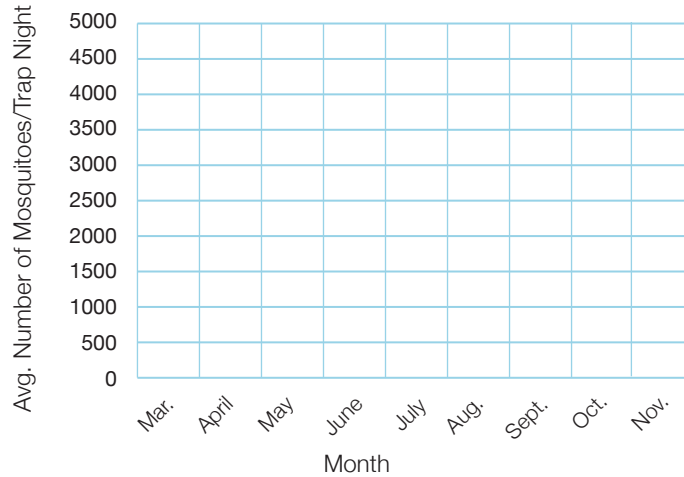
**DIRECTIONS:** *Adult mosquitoes have been trapped year-round at Sweetwater Wetlands since before the Mosquito Abatement Program began. This table shows the average number of mosquitoes trapped per trap night, each month before the program, five years later, and fifteen years later. Use the data in the table to complete the bar graphs below. Compare your completed graphs, then answer the questions on the next page. (Notes: 1. Data is typically not collected for December, January, and February because there are so few mosquitoes during the winter months. 2. Monthly data is 2-year average, ie. 1998-1999 represents the average of the data for 1998 and 1999.)*

Month	Before Program Average Number of Mosquitoes per Trap Night <b>1998–1999</b> (2-year average)	After Program Average Number of Mosquitoes per Trap Night <b>2004–2005</b> (2-year average)	After Program Average Number of Mosquitoes per Trap Night <b>2015–2016</b> (2-year average)
March	868	61	217
April	823	150	239
May	3415	720	181
June	4655	585	928
July	623	401	1576
August	280	454	433
September	501	963	144
October	1075	309	46
November	292	18	44

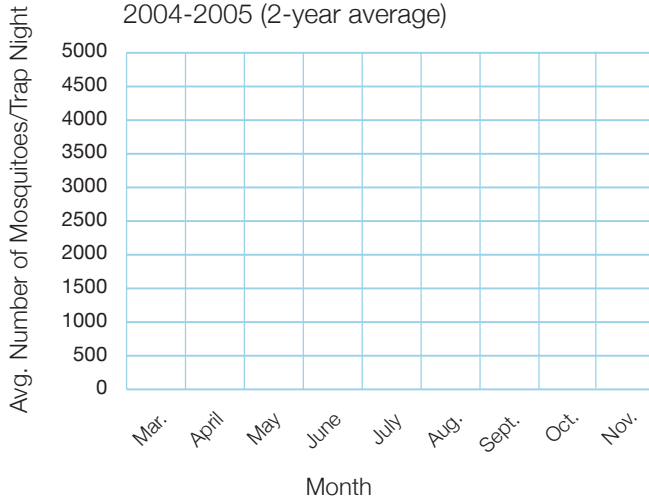




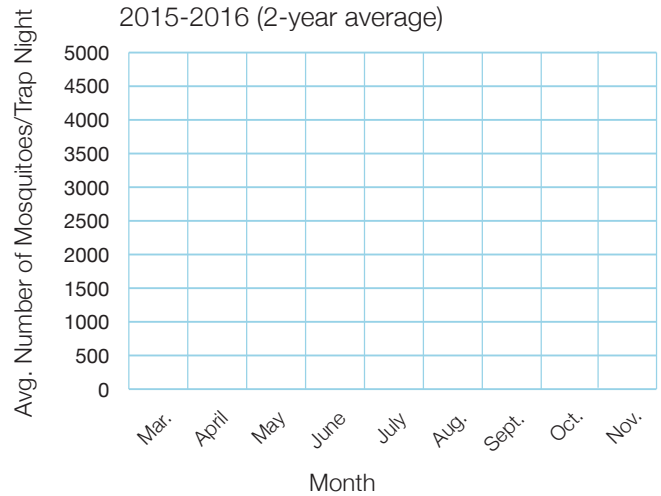
Before Mosquito Abatement Program  
1998-1999 (2-year average)



5 Years After Mosquito Abatement Program  
2004-2005 (2-year average)



15 Years After Mosquito Abatement Program  
2015-2016 (2-year average)



1. The mosquito control program began in 1999. How did the population change five years later? How did it change 15 years later? Overall, does the number of mosquitoes appear to have increased or decreased?

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2. Does the mosquito control program appear to be working? Why or why not?

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3. During which months are mosquitoes most prevalent?

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# VIEWING WILDLIFE

## AT SWEETWATER WETLANDS



**O**ur presence in the outdoor environment is very obvious to the local animals. We may not see them, but they are quite aware of us. Our movement, behavior, and even our smell influence how animals react to our presence. When visiting Sweetwater Wetlands and other outdoor sites there are some very simple things we can do to be more successful in observing nature.

**USE YOUR SENSES.** Most humans rely on their sense of sight to gather information about their environment. Try adjusting the way you look at things. Instead of looking for specific shapes, relax your eyes a bit and try to detect motion. Can you spot a well-camouflaged animal hiding in the vegetation? Anything under water? Try using your other senses. Some animals can be detected by smell. Also, listen carefully. Many birds at the wetlands hide among the cattails and bulrush. However, these birds can be very vocal! Listen carefully for the metallic call of the red-winged blackbird or the chattering trill of the marsh wren. You might hear the wings of a dove as it flies overhead or the splash of a turtle slipping into the water. Or you may hear a bird or small mammal rustling in the dry leaves under a shrub. Remember, your own silence will help you better detect the sounds in nature.

**BE AN ANIMAL.** Imagine what you would be doing if you were an animal at this location. Where would you hide? What would you eat? What kinds of things would frighten you? If you think like an animal, chances are you will be more sensitive about where to look to see one. You might also realize that your own human presence is potentially frightening — how can you be more considerate of the animals? Remember: you are now in *their* habitat!

**SLOW AND STEALTHY.** In nature, animals primarily run to escape danger or chase prey. When they detect another creature moving quickly, it's only natural that they would run away or try to hide. Move slowly and be conscious of how you step. Do you tromp along or can you be stealthy? When approaching a pond or going around a blind corner, slow down and approach quietly. Remember, stay calm and quiet and you could see some amazing wildlife behavior.



**WHAT ARE THEY DOING?** When you do see wildlife, take your time to observe its behavior. It's one thing to see a coot swim by but it's quite another to watch as it drags a piece of cattail all the way across a pond to build its nest. Animals exhibit all kinds of nesting, courtship, territorial, and feeding behaviors. They do all these incredible things right in front of our eyes! But we must be still and observe and see not only the animal, but also what it is doing.



## ACTIVITY – LOOK FOR SIGNS

**M**ore often than not, wildlife remain quiet and hidden. But we know they're there. Looking for signs of wildlife is fun and challenging. Each species has its own distinct tracks and scat (feces). You can learn these and identify wildlife by its signs! Look for other signs like grasses matted down that might show where an animal rested. Chewed prickly pear is often a sign of javelina or pack rats. How many different animals can you detect by their signs alone?

**DIRECTIONS:** *Can you match the animals with the signs they leave? Draw a line from each animal to its tracks and/or scat. Check the **Field Guide to the Common Plants and Animals of Sweetwater Wetlands** for clues. Look for these signs at Sweetwater Wetlands!*



great blue heron



duck



roadrunner



raccoon



coyote



bobcat





## ACTIVITY – SWEETWATER THROUGH THE SEASONS

**A**re you ready to visit Sweetwater Wetlands? One way to prepare for any field trip is to study the plants and animals you might see there. Sweetwater Wetlands, like anywhere, changes through the seasons. What you might or might not see during your visit depends on the time of year you go. This will help you know what to look for and where in the habitat to look for it. Use field guides such as the **Field Guide to the Common Plants and Animals of Sweetwater Wetlands** at the back of this book. Develop a mental image of that plant or animal and you just might recognize it when you see it, even if you have never seen it before! Below are just some of the things to look for during the different seasons of the year.



### Spring

- catkins on cottonwood and willows
- birds building nests
- courtship displays
- blooming plants
- insect activity
- migrating birds

### Summer

- trees fully leafed out
- young coots
- dragonflies
- baby rabbits
- mosquitoes
- quail in pairs with young
- breeding frogs and turtles
- aquatic insect activity
- snakes
- lush vegetation
- red-winged blackbirds
- lizards
- lots of insects

### Fall

- eclipse (drab) plumage in ducks
- quail in coveys
- leaves falling from trees
- lots of dragonflies
- insect behavior
- lots of bullfrogs
- migrating birds

### Winter

- small wintering birds
- yellow-headed blackbirds
- cattail going to seed
- sunning turtles
- leafless trees
- saltbush in seed
- brown and downed rushes
- lots of northern shoveler ducks



**DIRECTIONS:** Refer to the *Sweetwater Through the Seasons* lists on the previous page and the *Field Guide to the Common Plants and Animals of Sweetwater Wetlands* to help you determine which plants and animals you might see during your visit to Sweetwater Wetlands. In the space below, make a list of ten organisms (plants and/or animals) that you are likely to see during your visit. What season is your visit? Be sure to consider the time of year you are going. Beside each plant or animal, list where in the habitat you expect it might be found.

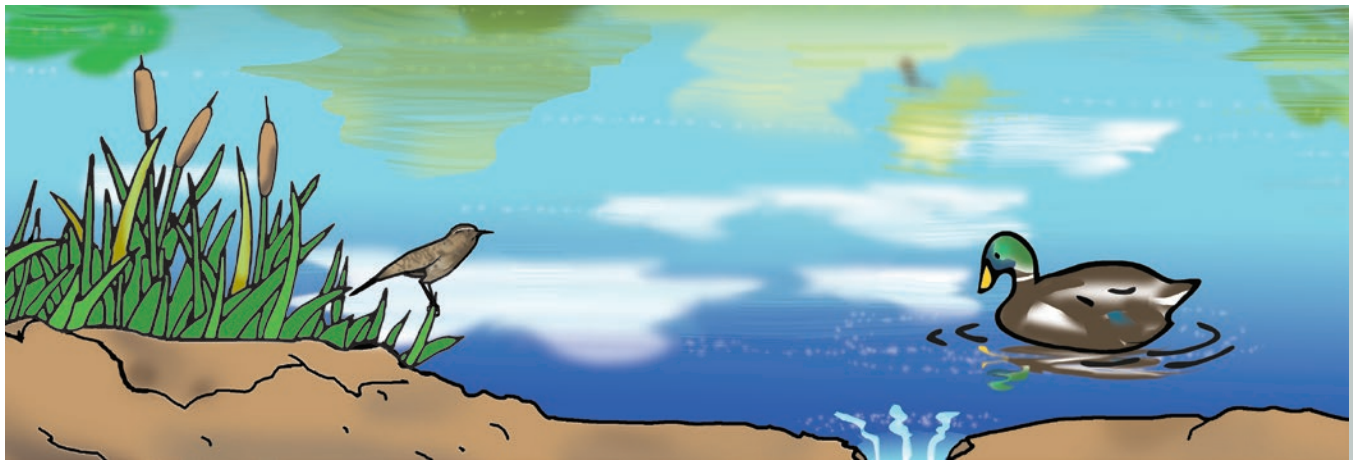
Season you are visiting: \_\_\_\_\_

NAME OF ORGANISM:

PREFERRED HABITAT:

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_
- 3 \_\_\_\_\_
- 4 \_\_\_\_\_
- 5 \_\_\_\_\_
- 6 \_\_\_\_\_
- 7 \_\_\_\_\_
- 8 \_\_\_\_\_
- 9 \_\_\_\_\_
- 10 \_\_\_\_\_

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# FIELD GUIDE

## TO COMMON PLANTS AND ANIMALS OF SWEETWATER WETLANDS

### PLANTS OF SWEETWATER WETLANDS



Photo: Greg Clark

#### **Fremont Cottonwood – *Populus fremontii***

**Range** – Riparian areas of Arizona and throughout the southwestern states from Texas to California.

**Habitat** – Found near water primarily in desert, woodland, and prairie riparian habitats. Often occur with willow trees.

**Characteristics** – These large, broad trees can grow to 60 feet high. Their seeds are covered with a soft “cotton” and are wind-carried. During the late spring at Sweetwater Wetlands, look for the cottony seeds flying through the air.

**Other** – Cottonwood trees need lots of water for their survival and reproduction. They have extensive roots for obtaining water. They provide important habitat for birds, insects, lizards, snakes, and small mammals. They lose their leaves in the fall.



Photo: Bruce Prior

#### **Gooding Willow – *Salix gooddingii***

**Range** – From Texas to California north to Utah and south into Mexico.

**Habitat** – Found near water in desert, grassland, and woodland riparian habitats. Often occur with cottonwood trees.

**Characteristics** – These are fast growing trees to around 50 feet high. Like cottonwoods, these willows have a “cottony” seed that becomes airborne in the spring.

**Other** – They are also deciduous, losing their leaves in the fall. Along with cottonwoods, these trees line the banks of Sweetwater Wetlands.



Photo: Greg Clark

#### **Saltbush – *Atriplex spp.***

**Range** – Depending on the species, saltbush may range west to California, east to Kansas, north to Washington, and south into Mexico.

**Habitat** – Desert shrub to juniper shrub habitats. Some species thrive in salt flats and coastal plains.

**Characteristics** – There are four species of saltbush at Sweetwater Wetlands. All are medium to large bushes. They are called saltbush because they can tolerate “salty” soils and because they exude salt onto their leaves, making them salty.

**Other** – Saltbush provides great habitat and forage for birds and other wildlife.



### American Three-square Bulrush – *Scirpus americanus*

**Range** – Across most of the U.S. except the extreme north central states. North into Canada and south into Mexico.

**Habitat** – The edges of ponds, lakes, and wetlands. Grows mostly in the water but can tolerate some dry spells.

**Characteristics** – Bulrush is an emergent plant. It is rooted in the soil at the water's edge and grows up through water with its leaves and seeds "emerging" above the water. This bulrush is called three square because its stems are triangular in cross section.

**Other** – Bulrush are an important part of the wetland food chain. Their underwater stems (both when alive and when decomposing) provide important food and habitat for aquatic organisms. Many wetland birds eat the seeds of the bulrush.



Photo: Bruce Prior

### Soft Stem Bulrush – *Scirpus validus*

**Range** – Widespread across the U.S. and into Canada and Mexico.

**Habitat** – The edges of ponds, lakes, wetlands, and ditches. Grows in shallow water and wet soils.

**Characteristics** – Soft stem bulrush can reach 8 feet high and tend to droop with the weight of their brownish flowers and seeds.

**Other** – Their seeds are important food for many wetland birds.



Photo: Bruce Prior

### Giant Bulrush – *Scirpus californicus*

**Range** – Across all the southern U.S. as far north as Kansas.

**Habitat** – Grows in shallow water along wetlands and marshes and shorelines of waterways.

**Characteristics** – This is the tallest bulrush at Sweetwater Wetlands, reaching 10 feet in height.

**Other** – These tall, emergent plants provide important habitat and forage for a variety of wetland wildlife.



Photo: Bruce Prior

### Cattail – *Typha spp.*

**Range** – Throughout the U.S. into Canada and Mexico.

**Habitat** – Standing water and wet soil of wetlands, marshes, ponds, and ditches.

**Characteristics** – There are several species of these tall, wetland grasses. They are named for their long, brown seed heads (resembling a cat's tail) which mature through the summer. In winter, they begin to release the individual seeds in cottony clusters that become windborne.

**Other** – Cattails are important food and shelter for many wetlands animals. Humans also use them as a food source. Like many emergent plants, cattails cannot grow in water more than three feet deep so are found at the water's edge.



Photo: Bruce Prior

### Velvet Mesquite – *Prosopis velutina*

**Range** – Through Arizona, into New Mexico and south into Mexico.

**Habitat** – Although mainly a desert and grasslands dweller, mesquites also live in moist areas just up from the water edge, forming thick forests called "bosques."

**Characteristics** – These trees can grow to 30 feet. They have tiny, feather-like leaves. Mesquites also have very long "tap" roots which grow very deep into the soil to reach water.

**Other** – Mesquites provide food and shelter for a variety of animals. They bloom in the spring, attracting numerous species of insects. By summer, the pollinated blossoms produce the protein-rich, yellowish bean pods which are eaten by many animals. During the winter and times of drought, the mesquite will drop its leaves.



Photos: Bruce Prior



Photo: Bruce Prior

### **Wolfberry – *Lycium berlandieri***

**Range** – Southern Arizona east to Texas and south into Mexico.

**Habitat** – Desert scrub, rocky desert slopes, and desert plains.

**Characteristics** – A large, thorny shrub reaching over four feet in height. Wolfberry blooms sporadically and produces red berry-like fruits.

**Other** – Wolfberry produces its leaves in response to rain. It may be leafless during times of drought. Its fruit is eaten by a variety of desert birds and other animals.

## BIRDS OF SWEETWATER WETLANDS



Photo: Paul Berquist

### **Cinnamon Teal – *Anas cyanoptera***

**Range** – From southwestern Canada, through the western U.S., and into Mexico.

**Habitat** – Ponds, small lakes and wetlands.

**Food** – Cinnamon teal eat a variety of aquatic plants and insects. They also eat snails and other aquatic invertebrates and some grains. They skim the water with their bills and also dip below the water to reach food items.

**Other** – The males of these striking ducks are easy to identify with their dark chestnut plumage. The females are a mottled brown color. Males go through an “eclipse plumage” stage in late summer during which they resemble the females. They are seen at Sweetwater Wetlands mostly during migration and through the winter.



Photo: Paul Berquist

### **American Wigeon – *Anas americana***

**Range** – Breeds in Alaska, Canada, and the northern U.S. Winters in the southern U.S. and into Mexico.

**Habitat** – Ponds, lakes, wetlands, bays, and shorelines.

**Food** – These dabbling ducks mainly eat plant material, but will occasionally eat aquatic invertebrates.

**Other** – Male wigeons go through their “eclipse plumage” stage during late summer and early fall. Wigeons are seen mostly during the winter at Sweetwater Wetlands.

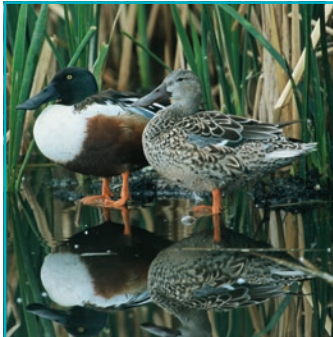


Photo: Paul Berquist

### **Northern Shoveler – *Anas clypeata***

**Range** – Throughout western North America. Winters in the southern states across the U.S. and into Mexico.

**Habitat** – Ponds, lakes, and wetlands. Sometimes winter in saltwater bays.

**Food** – Shovelers use their large bills to strain the water for plant matter and aquatic insects.

**Other** – Their large, shovel-like bills are distinct on both sexes. Males go through an “eclipse plumage” stage in late summer during which they resemble the females. During the winter, these ducks can be seen all over Sweetwater’s ponds as well as resting on the islands.



### **Mallard – *Anas platyrhynchos***

**Range** – Throughout most of North America south into Mexico. Also in Africa and India.

**Habitat** – Ponds, lakes, rivers, and wetlands. Common in ponds of city parks.

**Food** – Mallards eat plant material and some aquatic insects.

**Other** – These very common ducks are seen year-round at Sweetwater Wetlands. Males resemble females in the late summer during their “eclipse plumage” stage.



Photo: Paul Berquist

### **Ruddy Duck – *Oxyura jamaicensis***

**Range** – Breeds in the western U.S. and Canada. Winters in the southern U.S. into Mexico. Some populations occur in South America.

**Habitat** – Lakes, ponds and wetlands.

**Food** – Ruddy ducks are diving ducks, diving underwater to find their food. They eat aquatic invertebrates and plant material.

**Other** – These ducks have a distinct, perky tail. In breeding plumage during the spring and summer, the bills of the males are bright blue. Ruddy ducks are seen year-round at Sweetwater Wetlands.



Photo: Paul Berquist

### **American Coot – *Fulica americana***

**Range** – Throughout North and South America except in the coldest regions.

**Habitat** – Ponds, lakes, wetlands and urban parks with water.

**Food** – Coots mainly eat aquatic vegetation. They can be seen with their tails in the air as they forage in the water. They also dive deeper for aquatic invertebrates and some fish and amphibians.

**Other** – Coots are not ducks but are in the rail family. Instead of webbed feet, their toes are separated. They are year-round residents at Sweetwater Wetlands. They nest in the tall bulrush and cattails. Young coots with their red-orange heads can be seen in the spring.



Photo: John Sartin

### **Common Moorhen – *Gallinula chloropus***

**Range** – Locally in southern Arizona and New Mexico, and along the coast of California. Also in southern Gulf states of Texas, Louisiana, and Florida. South to South America.

**Habitat** – Freshwater wetlands and marshes, ponds and lakes usually with emergent vegetation.

**Food** – Moorhens primarily eat aquatic vegetation. They also eat a variety of invertebrates including insects and snails.

**Other** – Moorhens, like coots, are rails, not ducks. They can be seen year-round walking over fallen emergent vegetation and swimming in the ponds at Sweetwater Wetlands.



Photo: Paul Berquist

### **Cooper's Hawk – *Accipiter cooperii***

**Range** – Breeds throughout the U.S. and southern Canada. Winters throughout the southern part of its breeding range, through Mexico, and into northern Central America. Found year-round in most central and southern states.

**Habitat** – Wooded areas from deep forest to parks and neighborhoods in suburban landscapes.

**Food** – Cooper's hawks mainly eat birds, which they catch on the wing. They will occasionally eat small mammals.

**Other** – Over the years, Cooper's hawks have nested in the tall cottonwoods at Sweetwater Wetlands. Their piercing cries can often be heard during their nesting season in the spring.



Photo: Francis Morgan





Photo: Earle Robinson

### Harris's Hawk – *Parabuteo unicinctus*

**Range** – In the U.S., found only in southern Arizona and south-western Texas. South into mainland Mexico and Baja California.

**Habitat** – Desert scrub, cactus and mesquite forests, brushy fields, and open woodlands.

**Food** – These birds of prey eat small mammals, birds, and reptiles. They are known to hunt cooperatively, taking turns to chase down prey until the kill is made.

**Other** – Harris hawks are frequently seen at Sweetwater Wetlands. They often perch on the tallest trees in the area.



Photo: Paul Berquist

### American Kestrel – *Falco sparverius*

**Range** – Throughout most of North America, through Mexico, and into South America.

**Habitat** – Open country, farm fields, roadsides, and urban parks.

**Food** – Kestrels eat small rodents, reptiles, birds, and large insects. They are also known to eat frogs and bats.

**Other** – These small falcons can be seen perched on fence posts and wires. They will bob their tails while perched. They often hover while hunting. Kestrels are cavity nesters (they nest in holes) and will use large nest boxes. They can be seen year-round at Sweetwater Wetlands.



Photo: AZ Game and Fish Department

### Peregrine Falcon – *Falco peregrinus*

**Range** – Nearly world-wide but only in suitable habitat.

**Habitat** – Open country with nearby cliffs, rocky canyons, cities with tall buildings, and cliff faces along seashores.

**Food** – Peregrines primarily eat other birds, which they catch on the wing. They prefer ducks, quail, pigeons, doves, and other medium to large birds.

**Other** – Peregrines are known to reach speeds of up to 175 mph in a dive. They can be seen hunting around Sweetwater Wetlands during migration and in the winter.



Photo: Paul Berquist

### Gambel's Quail – *Callipepla gambelii*

**Range** – Throughout the southwest deserts in Arizona, New Mexico, and Texas. Also in desert habitats of southern Nevada and Utah.

**Habitat** – Desert grassland and desert scrub.

**Food** – These quail feed on seeds, grains, some insects, berries, and succulent green vegetation. Gambel's quail also feed on the buds of mesquite flowers.

**Other** – In fall and winter, Gambel's quail can be seen in large coveys (groups) of up to 40 birds. In spring, the birds break up into pairs for courtship and nesting. They are ground-nesting birds, preyed upon by snakes, birds of prey, and coyotes.

### Greater Roadrunner – *Geococcyx californianus*

**Range** – Southwestern U.S. from north-central California to east Texas. South to Mexico and Baja California.

**Habitat** – Desert scrub, chaparral, brushy areas, and some oak woodlands.

**Food** – Roadrunners are predators. They eat a variety of prey including snakes, lizards, mice, and insects. They typically chase down their prey. They will eat some seeds and cactus fruit.

**Other** – Roadrunners seldom fly. When surprised or startled, they usually run away. Roadrunner tracks are easy to identify. They have two toes facing forward and two backward, which helps them run fast. They build their nest of twigs in small trees or sometimes in cholla cactus.



Photo: Paul Berquist

### Great Blue Heron – *Ardea herodias*

**Range** – World-wide in suitable habitat of temperate and tropical regions.

**Habitat** – Along the shorelines of most bodies of water including wetlands, seashores, lakes, and rivers.

**Food** – Great blue herons stand very still while hunting for fish, frogs, and large invertebrates. They jab their long bills suddenly into the water to catch their prey.

**Other** – These large herons are seen occasionally at Sweetwater Wetlands. Their tracks can be up to 8 inches long and can be seen on the muddy banks. Their tracks show three toes facing forward and one back.



Photo: Paul Berquist

### Killdeer – *Charadrius vociferus*

**Range** – From Canada, throughout the U.S., and south into Mexico.

**Habitat** – Open fields, mudflats, airports, golf courses, grassy lawns, and flat, rocky shores.

**Food** – Killdeer primarily eat insects.

**Other** – They are named for their call which sounds like a loud “killdeer, killdeer.” They will pretend to have a broken wing in order to lure intruders away from their nests. Killdeer are common at Sweetwater Wetland’s recharge basins.

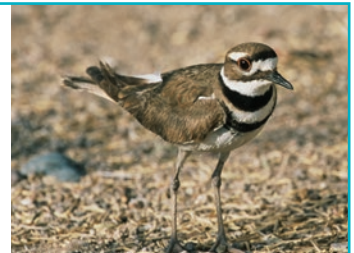


Photo: Paul Berquist

### Mourning Dove – *Zenaida macroura*

**Range** – Throughout the U.S. into central Canada and south through Central America.

**Habitat** – In a variety of habitats including desert scrub, grasslands, farms, cities, parks, and open woodlands.

**Food** – These doves eat a variety of seeds.

**Other** – Mourning doves are year-round residents at Sweetwater Wetlands. Their mournful “cooo coo coo” is frequently heard.



Photo: Paul Berquist

### White-winged Dove – *Zenaida asiatica*

**Range** – In the extreme southern portions of the U.S. Throughout Mexico to Central America.

**Habitat** – Saguaro forests, mesquite forests, fields, urban areas, and riparian woodlands.

**Food** – White-winged doves mainly eat seeds. They also eat berries and cactus fruit.

**Other** – These large doves are only seen during the warmer months as they fly south for the winter.



Photo: Paul Berquist



Photo: Paul Berquist

### **Gila Woodpecker – *Melanerpes uropygialis***

**Range** – Southern Arizona to Nevada and south into western Mexico and Baja California.

**Habitat** – Desert scrub mainly in habitats that include saguaro cactus. Also around riparian woodland and urban areas.

**Food** – Gila woodpeckers are primarily insect eaters, searching for prey on a variety of desert trees.

**Other** – Gila woodpeckers are cavity nesters. They use their strong, pointy bills to make holes primarily in saguaro cactus. They are the most common woodpecker in the desert and can be seen year-round.



Photo: Earle Robinson

### **Black Phoebe – *Sayornis nigricans***

**Range** – From northern California across the southwestern U.S. to west Texas. South into Mexico and Baja California.

**Habitat** – Streams, rivers, lakes, wetlands, and urban ponds. Often seen perched on branches by the water's edge.

**Food** – Black phoebes mainly eat flying, aquatic insects. They have keen eyesight and catch the insects in the air.

**Other** – Black phoebes are year-round residents at Sweetwater and are often seen near "Hidden Pond." Their nests are made of mud attached to a rock face near water. Their song is a repetitious "fee-bee".



Photo: Francis Morgan

### **Vermillion Flycatcher – *Pyrocephalus rubinus***

**Range** – In the U.S., found only in the southern parts of the western states from California to Texas. Also found year-round in Mexico and parts of South America. Winters in eastern Mexico and central South America.

**Habitat** – Prefer scrub habitat, cultivated lands, and riparian areas. Also, frequents suburban parks.

**Food** – As their name suggests, they eat insects, which they mainly catch on the wing.

**Other** – Vermillion flycatchers have increased in Tucson and are now commonly seen in city parks and at Sweetwater Wetlands.



Photo: Greg Clark

### **Cactus Wren – *Campylorhynchus brunneicapillus***

**Range** – Southwestern U.S. to central and northeastern Mexico, including Baja California.

**Habitat** – Desert flatlands and foothills where large cacti are found. They also occur in urban areas within their range.

**Food** – They feed on insects and other arthropods, fruits, and seeds.

**Other** – Cactus wrens are very busy and inquisitive birds. They usually build their nests among the spiny stems of cholla cacti but may use palo verde, acacia, or saguaro. They are known to build "decoy" nests, which may distract predators from the real nest with the young.



Photo: Earle Robinson

### **European Starling – *Sternus vulgaris***

**Range** – Across the U.S. north into Canada and south through Mexico. Also in Europe and Asia.

**Habitat** – Urban settings, fields, woodlands, grasslands, and farms.

**Food** – Starlings eat a variety of insects, fruits and seeds.

**Other** – Starlings were introduced into the U.S. from Eurasia. They have now spread across the country and are considered an invasive species. They are a cavity nester and will take nest holes that would otherwise be used by native species.



### Red-winged Blackbird – *Agelaius phoeniceus*

**Range** – Across the entire U.S. through Canada and into western Mexico.

**Habitat** – Among the vegetation in wetlands, riparian areas, and fields near water.

**Food** – These blackbirds eat seeds, grains, and some fruits. They also eat insects and spiders.

**Other** – Red-winged blackbirds can be seen in large flocks, year-round among the cattails and bulrush at Sweetwater Wetlands. Their calls are very distinctive, sounding gurgling and metallic. The black males have prominent, red wing patches.



Photo: Paul Berquist

### Yellow-Headed Blackbird – *Xanthocephalus xanthocephalus*

**Range** – Breeds in the mid-western U.S. into Canada. Winters in the southwestern U.S. and Mexico.

**Habitat** – Wetlands, ponds and lakes with lots of reeds, and agricultural fields.

**Food** – They eat seeds, grains, insects, and some snails.

**Other** – Yellow-headed blackbirds hang out in large flocks. They are mainly a spring, fall and winter visitor to Sweetwater Wetlands and can be seen on emergent vegetation.



Photo: Paul Berquist

### Great-tailed Grackle – *Quiscalus mexicanus*

**Range** – Southwestern U.S. from California to Louisiana. North to Nebraska and south through Mexico.

**Habitat** – Fields, farms, riparian areas, wetlands, and urban parks. Common around neighborhoods and parking lots.

**Food** – Grackles are opportunistic feeders, eating insects, small birds, a variety of invertebrates, and even small fish and frogs. They also eat seeds and berries.

**Other** – These large black birds have an iridescent purple sheen to their feathers. Males have long tails that they fold length-wise like a keel.



Photo: Paul Berquist

### Song Sparrow – *Melospiza melodia*

**Range** – Across the U.S., through Canada and into southern Alaska.

**Habitat** – Riparian scrub, thickets, woodland edges, and brushy areas.

**Food** – Song sparrows eat a variety of insects, seeds, berries, and grains.

**Other** – Song sparrows are commonly seen and heard at Sweetwater Wetlands. They forage around the base of bushes and sometimes hop into the open on a higher perch to belt out their melodious tunes. Their distinct song starts with two or three clear whistles followed by a loud trill.



Photo: Doug Backlund

### Abert's Towhee – *Pipilo aberti*

**Range** – Southern and western Arizona, north to southern Nevada.

**Habitat** – Brushy areas and thickets in desert scrub, riparian areas, and woodlands. Often near water.

**Food** – Abert's towhees forage on the ground by raking at underbrush to uncover seeds and insects.

**Other** – A shy, somewhat secretive bird that is usually detected by its call which is a high pitched “peek”. They are usually alone or in pairs.



Photo: Earle Robinson

# MAMMALS OF SWEETWATER WETLANDS



Photo: Paul Berquist

## Coyote – *Canis latrans*

**Range** – Throughout the U.S. and into Canada and Mexico.

**Habitat** – Found in just about every habitat type, including suburban areas of cities. Prefer open desert plains, grasslands, high mesas, and open forests but are known to adapt to open, natural space in urban settings.

**Food** – Coyotes hunt both day and night. They are important predators of rabbits and rodents but will feed on larger mammals such as young deer. They will also eat small reptiles, insects and carrion. In early summer, they feed heavily on saguaro fruit, mesquite beans, and other vegetable matter.

**Other** – Coyotes may live alone, in pairs, or in small, territorial packs. Their dog-like tracks, showing four toes with toenails, can be seen along the paths at Sweetwater Wetlands. Coyote scat usually contains hair and bones and is often tapered at one end.



Photo: Young Cage

## Bobcat – *Felis rufus*

**Range** – Throughout North America from mountains to deserts.

**Habitat** – Found in all kinds of habitats but prefer rocky hillsides with lots of vegetation.

**Food** – Bobcats are solitary predators. They eat small mammals including mice and other rodents, rabbits, bats, ground squirrels, and even newborn deer. They also eat birds such as doves and quail. They have been known to take domestic animals such as poultry and newborn livestock.

**Other** – Bobcats have been seen and even photographed at Sweetwater Wetlands. Their tracks, showing four toes and no toenails, are frequently seen on the trails at the wetlands. Bobcat scat is segmented into several small pieces. They are said to look like “Tootsie Rolls.”



Photo: Earle Robinson

## Black-tailed Jackrabbit – *Lepus californicus*

**Range** – Throughout the western U.S.

**Habitat** – Deserts, prairies, pastures, and brushy areas.

**Food** – Jackrabbits eat a variety of plant matter including grasses, herbs, forbs and small bushes. They will eat woody material and dried plants during droughts and in winter.

**Other** – They are eaten by hawks, coyotes, bobcats, and owls. Because they have so many predators they are very wary. They produce several litters each year. The black-tailed jackrabbit has distinctive long ears tipped with black and a prominent black stripe that runs from its rump to the top of its tail.



Photo: Paul Berquist

## Raccoon – *Procyon lotor*

**Range** – Fairly common throughout Arizona and across North America.

**Habitat** – Prefer brushy areas, almost exclusively near some type of water source. Also found in urban areas.

**Food** – They eat just about anything including crayfish, fish, insects, frogs, and the eggs of any animal they can find.

**Other** – Raccoons are nocturnal and usually solitary. At Sweetwater Wetlands, look for their distinct, hand-like tracks in the mud near the water's edge. Their scat is usually dropped in tubular pieces with blunt ends.



### **Desert Cottontail Rabbit – *Sylvilagus audubonii***

**Range** – Deserts and plains throughout the western U.S.

**Habitat** – Deserts, grasslands, and woodlands in areas with lots of brushy vegetation and hiding holes.

**Food** – They primarily eat grass but will eat other vegetation.

**Other** – Desert cottontails are an important prey species for many predators including hawks, foxes, owls, bobcats, snakes, and coyotes. They line their burrows with grasses and fur as bedding for their young. Cottontails are smaller than jackrabbits.



Photo: Earle Robinson

### **Round-tailed Ground Squirrel – *Spermophilus tereticaudus***

**Range** – Common inhabitants of the Sonoran Desert and throughout desert areas of the southwestern U.S. into Mexico.

**Habitat** – Found in desert flatlands where the soil is good for digging burrows.

**Food** – These squirrels feed on plant parts, including seeds. They are known to eat insects and even roadkill.

**Other** – They build underground burrows, tunneling into the desert soil. There may be several small openings to their burrows. Look for their burrows in the upland, desert areas around the wetlands at Sweetwater. They have many predators including hawks, snakes, bobcats, and coyotes.



Photo: Paul Berquist

### **Javelina – *Tayassu tajacu***

**Range** – Desert scrub areas throughout central Arizona, east to Texas, and south to South America.

**Habitat** – Brushy habitat along creeks, stream beds and canyons within desert mountains.

**Food** – Javelina are opportunistic feeders. They feed on flowers, roots, grasses, forbs, tubers, fruits, mesquite pods, and most succulent plants. They eat a lot of cacti, especially prickly pear.

**Other** – Javelina live in herds and mark their territories with their scent and droppings. Mountain lions and bobcats are the most common predators of javelina although coyotes, golden eagles, and even foxes are known to prey on young javelina.



Photo: Paul Berquist

### **Arizona Cotton Rat – *Sigmodon arizonae***

**Range** – Central and southern Arizona.

**Habitat** – Desert areas primarily along canals and stream banks thick with weeds, grasses and brush. They are strongly associated with the drainages and waterways of the southwest.

**Food** – Cotton rats mostly eat green plants and grasses and are known to occasionally eat insects. Unlike some rodents, they do not store their food.

**Other** – They are active both day and night throughout the year. At Sweetwater Wetlands, they can be seen scurrying between patches of cattail and bulrushes. They can have up to twelve young in a litter with numerous litters per year. They are important prey species for many predators including coyotes, foxes, hawks, and owls.



Photo: Paul Berquist

### **Mexican Free-tailed Bat – *Tadarida brasiliensis***

**Range** – Most free-tailed bats live in the western U.S. and Mexico.

**Habitat** – Occur in a variety of habitats from low-elevation deserts to pine-oak forests at 9,000 elevation. They live in colonies in caves, large hollow trees, abandoned mines, tunnels, under bridges, and in buildings. They will also use bat houses.

**Food** – They eat a variety of insects, especially moths. Free-tailed bats play an important role in reducing agricultural pests such as cotton boll moths and cut-worm moths.

**Other** – Their colonies can reach numbers in the millions.



Photo: AZ Game and Fish Department



# REPTILES, AMPHIBIANS, AND FISH OF SWEETWATER WETLANDS



Photo: Earle Robinson

## Western Diamond-backed Rattlesnake – *Crotalus atrox*

**Range** – Across the warm southern states from Arkansas west to California.

**Habitat** – Prefer deserts, rocky canyons, and foothills but found in a variety of habitats from the plains to the mountains.

**Food** – They feed mainly on small mammals such as rats, mice and even small rabbits. They will also eat small birds such as quail. They feed mostly at night. They have potent venom which they use to help subdue prey.

**Other** – Western diamond-backed rattlesnakes average 3 to 5 feet in length and are the largest rattlesnakes in the west. Like most rattlesnakes, they will lay in the sun to warm up their bodies and seek shade under rock crevices when they get too warm.



Photo: Paul Bernquist

## Sonoran Desert Toad – *Bufo alvarius*

**Range** – Mostly occur in the Sonoran Desert but range west to California, and into central Arizona.

**Habitat** – Deserts and grasslands near a water source.

**Food** – These predators will eat just about anything they can catch including large insects and other frogs and toads.

**Other** – They spend winter underground and dig to the surface to become active throughout the summer. Sonoran Desert Toads lay their eggs in water, with the first weeks of their lives spent as tadpoles. The glands on their backs contain a toxin that can be harmful to animals (including humans). They are the largest native toad in the U.S.



Photo: Dennis Caldwell

## Tree Lizard – *Urosaurus ornatus*

**Range** – From Arizona east to Texas, north to Wyoming and south into Mexico.

**Habitat** – Lives on trees and rocks in riparian, woodland, semi-desert, and urban areas.

**Food** – These small carnivores feed primarily on insects and spiders.

**Other** – Look for tree lizards doing “push-ups” on tree branches at Sweetwater Wetlands.



Photo: Paul Bernquist

## Red-eared Slider Turtle – *Trachemys scripta elegans*

**Range** – From Georgia to New Mexico north to Illinois and Indiana. Not native to Arizona and those at Sweetwater Wetlands were introduced.

**Habitat** – Lives in fresh water ponds, lakes, and slow moving streams. Prefers muddy bottoms.

**Food** – They eat aquatic vegetation, invertebrates, and small fish. They also eat decaying vegetation.

**Other** – These turtles love to bask in the sun and are commonly seen on logs and on the banks of Sweetwater Wetlands.

### Western Box Turtle – *Terrapene ornata*

**Range** – Across the mid-western grassland states north to South Dakota and in the southwestern states from Texas to Arizona.

**Habitat** – Grasslands, plains, and deserts. Prefers sandy soils for digging its shallow burrows. Although this is a land-loving turtle, it occasionally wades into water.

**Food** – These omnivores eat a variety of plant matter and insects.

**Other** – The western box turtle hibernates during the colder months.



Photo: xxxx

### Sonoran Gopher Snake – *Pituophis catenifer affinis*

**Range** – Gopher snakes occur across North America into Canada and Mexico. The Sonoran subspecies occurs in the Sonoran Desert.

**Habitat** – Found in a variety of habitats from deserts to forests. Also found in cultivated fields and urban, open space. Prefers grassy and brushy areas.

**Food** – These predators kill their prey by constriction (squeezing). They eat small mammals, birds, lizards, and even other snakes.

**Other** – Gophers snakes are eaten by a variety of predators including hawks, coyotes, and foxes. They resemble rattlesnakes and even mimic rattlesnake behavior by coiling and shaking their tails.



Photo: Paul Bernquist

### Bullfrog – *Rana catesbeiana*

**Range** – Native to the eastern and central states but now occur throughout most of the U.S.

**Habitat** – Warm ponds, lakes, wetlands, and watercourses. The bullfrog is purely an aquatic species.

**Food** – These voracious predators eat other amphibians, reptiles, fish, insects, and almost anything they can catch.

**Other** – This frog has been introduced in numerous states as a food source. It is hunted for its leg meat. It has become an invasive species, killing off native species through predation and competition.



Photo: Dennis Caldwell

### Red-spotted Toad – *Bufo punctatus*

**Range** – East to Central Texas and Kansas and west to California. Also occur south into Mexico.

**Habitat** – Prefer riparian areas (near streams and small water courses) in otherwise arid habitats. Often hides among streamside rocks.

**Food** – They primarily eat insects.

**Other** – The cricket-like call of the males can be heard in desert riparian areas during the summer rainy season. They are prey to a variety of predators.



Photo: Dennis Caldwell

### Western Mosquitofish – *Gambusia affinis*

**Range** – Native to south central U.S. but introduced into sporadic drainages and waterways across the U.S. Have also been introduced worldwide to control mosquitoes.

**Habitat** – Found in shallow waters that have sufficient hiding places from larger predators. Able to tolerate harsh conditions such as low oxygen and high temperatures and salt concentrations.

**Food** – Feed on tiny invertebrates, including larvae, at the top of the water column.

**Other** – These small fish (~2.5 inches) were indiscriminately introduced into Sweetwater Wetlands by an unknown source. They give birth to live young. They are thought to control mosquito populations because of their ravenous consumption of mosquito larvae.



Photo: NOZO – Wikimedia Commons

# INSECTS OF SWEETWATER WETLANDS



Photo: Steve Prchal - ASAI

## **Dragonfly – Order: Odonata, Suborder: Anisoptera (dragonflies)**

**Habitat** – Larvae are purely aquatic, living in ponds, lakes, wetlands, and slower moving streams. The adults occur both near water and around fields and grassy areas, including urban parks.

**Food** – Dragonfly larvae eat tadpoles, tiny fish, and the larvae of smaller insects. They grab prey with an extendible jaw. Adult dragonflies feed on other flying insects, including mosquitoes.

**Life Cycle** – There are many species of dragonflies. Most deposit their eggs on the surface of water or wet mud. The larvae that hatch are aquatic, living underwater and breathing with gills. After completing all its growth stages, the larva leaves the water (usually by crawling up an aquatic plant stalk). The adult emerges from the larval skin and flies away with newly formed wings. Adults leave the water and return only to mate and deposit eggs to continue the cycle.



Photo: Steve Prchal - SASI

## **Damselfly – Order: Odonata, Suborder: Zygoptera (damselflies)**

**Habitat** – Ponds, wetlands, lakes, and streams.

**Food** – Damselflies are predaceous in both adult and larval stages. Like dragonflies, they catch prey with an extendible jaw. They eat other insect larvae, tadpoles, and small fish.

**Life Cycle** – Eggs are deposited in the water on aquatic plants. The larvae are aquatic, going through several growth stages before emerging from the water to molt into adults. Adults may fly away or stay near the water to mate.



Photo: Steve Prchal - SASI

## **Predaceous Diving Beetle – Order: Coleoptera (beetles), Family: Dytiscidae**

**Habitat** – Ponds, wetlands, and slow moving water.

**Food** – Both the adults and larvae are voracious predators. They feed on other aquatic insects (including mosquito larvae), small fish, tadpoles, and even adult frogs. They inject a digestive fluid into their prey and suck out the juices.

**Life Cycle** – Eggs are laid in water, usually attached to an aquatic plant. The larvae, called water tigers, live entirely in the water until digging into mud at the water's edge to pupate into adults. Adults primarily live in the water but can emerge and fly to other ponds. Adults capture an air bubble behind their wings as their underwater air supply.



Photo: Steve Prchal - SASI

## **Giant Water Bug – Order: Hemiptera (true bugs), Family: Belostomatidae**

**Habitat** - Slow moving streams or standing water habitats such as wetlands and ponds.

**Food** – The larvae eat mainly other aquatic insect larvae. The adults eat insects, small fish, tadpoles, and snails. Adults wait at the water's surface for their prey which they ambush and then subdue with a toxin.

**Life Cycle** – Eggs are laid by the females directly onto the male's back. The male will carry and care for these until they hatch. Larvae breathe air through a small snorkel-like device on their backs. Larvae go through several molts until they become adults. Adults are also aquatic but breathe air which they capture as a bubble under their wings.



**Water Scorpion — Order: *Hemiptera* (true bugs), Family: *Nepidae***

**Habitat** – Among vegetation in slow moving water such as wetlands and ponds. Some are found under rocks in slow moving streams.

**Food** – Water scorpions are ambush predators, capturing their prey with their forelegs. They eat insect larvae, worms, and other invertebrates.

**Life Cycle** – Eggs are laid on aquatic vegetation and floating objects. Larvae molt through several stages before becoming adults. Adults tend to stay near the water's surface attached to some vegetation. They will breathe using a snorkel-like siphon and trapped air bubble. They are not great swimmers and instead tend to crawl around on aquatic vegetation.



Photo: Steve Prchal

**Backswimmers – Order: *Hemiptera* (true bugs), Family: *Notonectidae***

**Habitat** – Ponds, wetlands, and other aquatic habitats, usually in slow moving water.

**Food** – Backswimmers prey on other aquatic invertebrates including the larvae of mosquitoes and other insects.

**Life Cycle** – Eggs are laid on the stems of aquatic vegetation. Larvae go through several stages before becoming adults. As their name suggests, they swim upside-down. As air breathers, they capture a bubble as an underwater air supply.



Photo: Steve Prchal

## ADDITIONAL RESOURCES AND REFERENCES

### **Tucson Water**

<https://www.tucsonaz.gov/water>

Tucson Water's webpage offers more information on Sweetwater Wetlands, Reclaimed Water, Drought Preparedness, Conservation, and a variety of other water related topics, listed on the left-hand side of the page. This booklet is also available in PDF format on the Sweetwater Wetlands page.

### **Sweetwater Wetlands Birding Checklist**

[https://www.tucsonaz.gov/files/water/docs/Sweetwater\\_Wetlands\\_Bird\\_Checklist.pdf](https://www.tucsonaz.gov/files/water/docs/Sweetwater_Wetlands_Bird_Checklist.pdf)

A downloadable checklist of birds seen at Sweetwater Wetlands.

### **Sweetwater Wetlands' Facebook Page**

<https://www.facebook.com/Sweetwater-Wetlands-189523357744967/>

Like us on Facebook. See recent photos of wildlife seen at Sweetwater. Learn about upcoming events at the Wetlands.

### **Tucson Audubon Society**

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

Tucson Audubon inspires people to enjoy and protect birds through recreation, education, conservation, and restoration of the environment upon which we all depend. This includes offering free, regular bird walks through Sweetwater Wetlands. Join their staff and volunteers for an easy walk through the Sweetwater Wetlands to see waterfowl in the hundreds, regular and visiting warblers, and several exciting species hiding in the reeds. Birders of all experience levels welcome! Contact Tucson Audubon Society for more information.

### **Arizona Game and Fish Department's HabiMap™**

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

HabiMap™ is a user-friendly, web-based, interactive data map that allows users to access information contained in the State Wildlife Action Plan. Users can see the occurrence and distribution of a variety of wildlife-related parameters including the locations of wetlands and riparian habitat. HabiMap™ was developed by The Arizona Game and Fish Department.

### **Pima County Mosquito Information**

[http://webcms.pima.gov/health/preventive\\_health/disease\\_control/mosquitoes](http://webcms.pima.gov/health/preventive_health/disease_control/mosquitoes)

Useful information on mosquito related disease outbreaks and tips to prevent bites. For more information, call (520) 724-7908.

## GLOSSARY

**Anaerobic** – A condition with little or no available oxygen.

**Aquifer** – An underground geologic formation that contains water.

**Condensation** – The process of a vapor changing to a liquid (as when clouds form).

**Constructed wetlands** – Human-made wetlands.

**Effluent** – Water that is treated and released by a wastewater treatment facility.

**Evaporation** – The process of a liquid changing to a vapor.

**Groundwater** – Water found below the earth's surface.

**Infiltration** – The process of water seeping into the soil and moving through cracks and pore spaces.

**Microhabitat** – An area within the habitat that presents a different set of living conditions from the area right next to it.

**Percolation** – The process of water moving down through the ground between the spaces of soil and rock particles.

**Precipitation** – Water that falls to the earth in such forms as rain or snow.

**Recharge** – The addition of water to an aquifer.

**Reclaimed water** – Effluent that is highly treated and can be used again.

**Riparian** – On or relating to the land just beside a river, stream, or wash.

**Riparian habitat** – The typically lush area next to a river or stream that is home to a variety of plants and wildlife.

**Runoff** – Water that flows downhill over the earth's surface.

**Surface Water** – Water found on the earth's surface (as in runoff, rivers, or lakes).

**Water Table** – The highest level of groundwater.

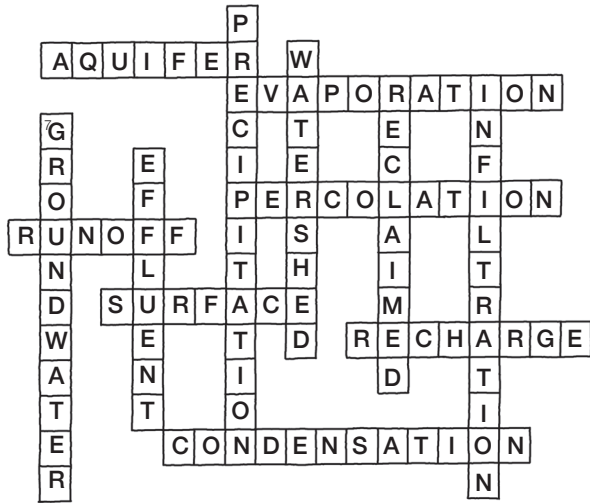
**Watershed** – The total land area that drains to a specific river, wash, or lake.

**Wetland** – Land that is covered with water for at least part of the year; only plants adapted to very wet soils can live in wetland habitats.



# ANSWERS

## Page 4: Water Cycle Words Crossword Puzzle



## Page 5: Water Cycle Diagram

crossword clue	water cycle word	letter location in diagram
6 down	<i>infiltration</i>	<u>E</u>
9 across	<i>percolation</i>	<u>F</u>
4 across	<i>condensation</i>	<u>A</u>
13 across	<i>evaporation</i>	<u>B</u>
1 down	<i>precipitation</i>	<u>C</u>
12 across	<i>recharge</i>	<u>G</u>
10 across	<i>runoff</i>	<u>D</u>
7 down	<i>groundwater</i>	<u>H</u>
2 across	<i>aquifer</i>	<u>I</u>

## Pages 10-11: Tucson Basin: Finding and Using Water in the Desert

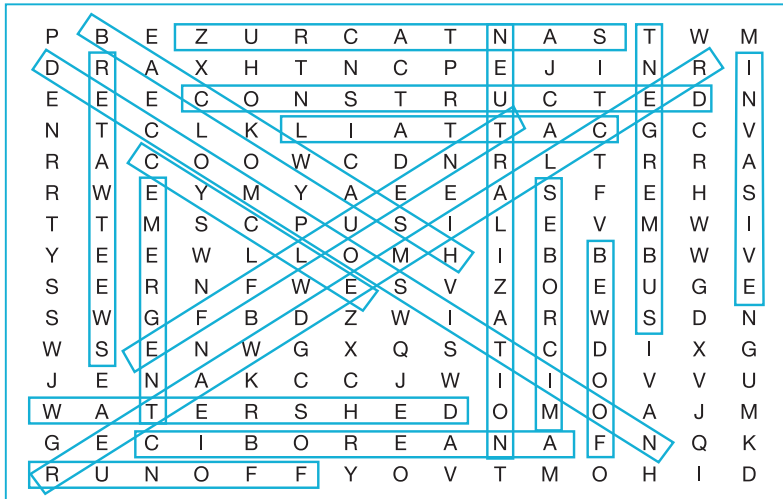
- A Santa Catalina Mountains
- D Santa Cruz River
- F Sabino Canyon
- C Sweetwater Wetlands
- J U of A
- B golf course
- G Rillito River
- E San Xavier Mission
- H Reid Park
- I soccer field
- K houses and apartments
- L groundwater aquifer

## Pages 12-13: Restoring Historical Landscapes: History of the Santa Cruz River and Sweetwater Wetlands

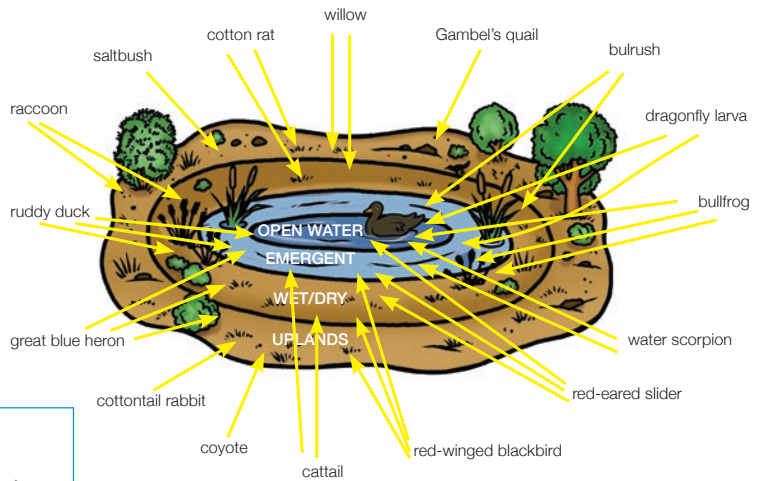
- 1st picture: 1950s - 1990s
- 2nd picture: 1500s
- 3rd picture: 1900s - 1940s
- 4th picture: early 2000s
- 5th picture: 1700s - 1800s

# ANSWERS

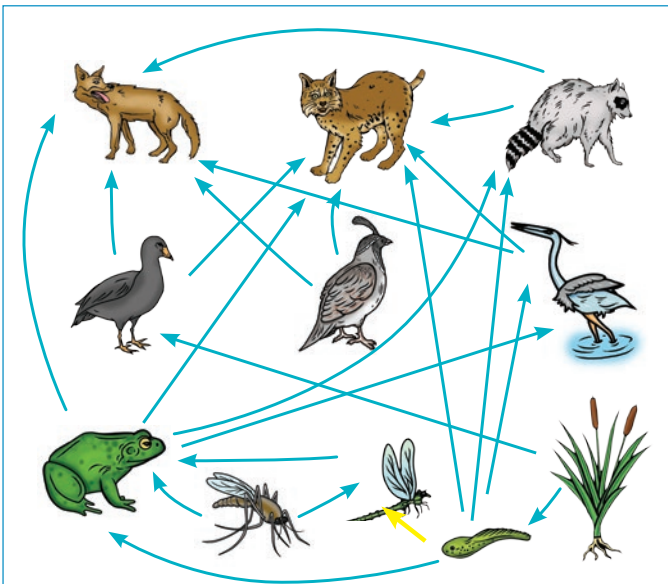
Page 17: Wetlands Words Wordsearch



Page 21: Home in the Habitats



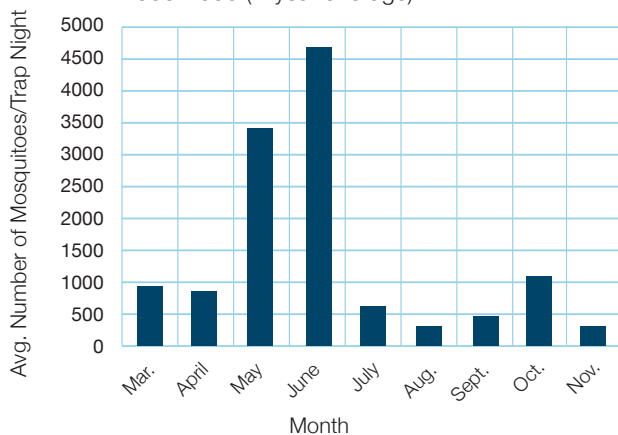
Page 20: Wetlands Webs



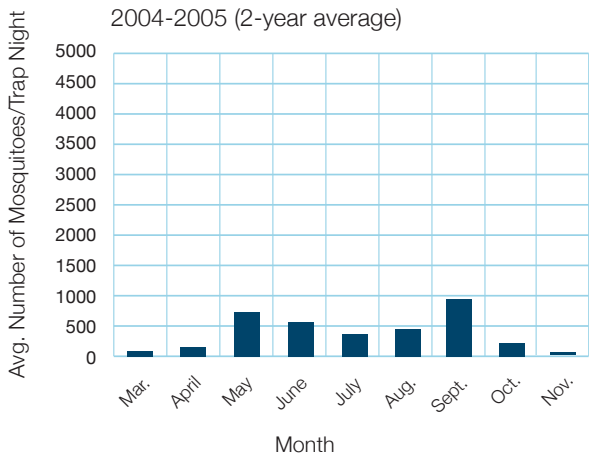
# ANSWERS

Page 22: Dropping Like Flies – Mosquitoes That is!

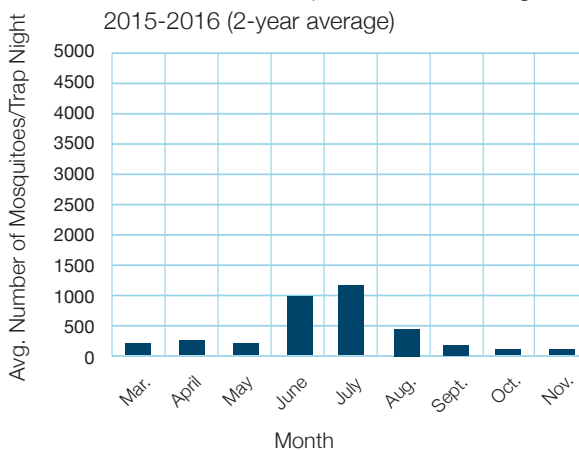
Before Mosquito Abatement Program  
1998-1999 (2-year average)



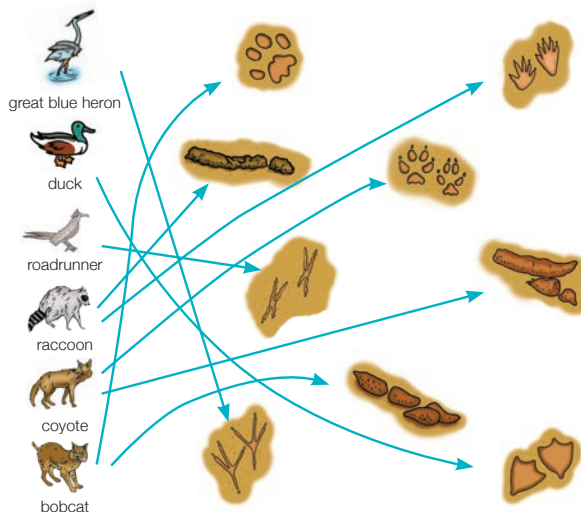
5 Years After Mosquito Abatement Program  
2004-2005 (2-year average)



15 Years After Mosquito Abatement Program  
2015-2016 (2-year average)



Page 31: Look For Signs





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# SWEETWATER



Directions: From I-10, exit at Prince Road and travel West over the freeway. Turn right onto Business Center Dr., left onto River Park Dr., then right onto Commerce Dr. Turn left onto Benan Venture Dr. (before the Emissions Facility) and then turn left onto Sweetwater Dr. Travel about 500 feet to the Sweetwater Wetlands parking lots on both sides of the street.

For more information call (520) 791-4331.

