The Natural and Built Environment

Objective:

Students will be able to:

- distinguish between the natural and built environment.
- hypothesize about interactions among biotic and abiotic parts of the environment

Author:

Ecology Explorers Education team

Time:

50 min. class period

Grade Level:

6-9

Standards:

AZ Science Strands and Concepts:
Inquiry, Nature of Science, Changes in Environments, and Organisms

NGSS -Core Ideas
Interdependent Relationships in Ecosystems; Ecosystem Dynamics, Functioning, and Resilience; Biodiversity & Humans; Human Impacts on Earth Systems

Practices:
Developing and Using Models, and more

Crosscutting Concepts
Patterns, Systems & System Models, Cause and Effect, and more

Specific AZ, Common Core, and NGSS Standards on page 2.

Background:
As cities grow, the natural environment becomes transformed, from the native vegetation into a diverse assemblage of built materials, including buildings, parking lots and roadways. This has impacts on all organisms, native and non-native, including humans. One result is that concrete and asphalt increase mass density and heat-storage capacity, which increase the Urban Heat Island effect.

Vocabulary:
environment - surroundings made up of living and non-living items

natural - item not created by people (i.e. insects, soil, plants…)

built - item created by people (i.e. railroad, fence, storm drain…)

Advanced Preparation:
Cut apart the sheets of natural and built photos, keeping each set of four together. Observe school yard or environment where students will be exploring.

Materials:
- natural/built pictures, answer key version for reference
- butcher paper
- clipboards
- Student Worksheets: Natural and Built Environment Model, pages 1 and 2

Recommended Procedure:

Engagement:
1) Show pictures of one natural item and one built item. Ask students: Are you familiar with these items? What do you notice about them? How are they different? Discuss students' descriptions and comments. Guide them to identify living and non-living, built and natural items.

2) Have students brainstorm: How might these items interact in the environment?

Exploration:
3) Form groups of four students. Give each student one of the Natural and Built Photocards from each sheet, sheets 1-12. Have students identify their card as living or non-living, built or natural. Ask: Are each of the images on the same scale? Solicit explanations.

4) Have each student brainstorm how their item might interact with the other four items in their group. Use the Student Worksheets: Natural and Built Model, page 1, to have students organize their items and interactions.

5) Students can be given four new cards and a new page 1 worksheet to repeat steps 3 and 4.

6) Students then complete the Student Worksheets: Natural and Built Model, page 2, to brainstorm and label interactions between their four environmental elements and humans.

7) Using large sheets of paper, have students arrange their four cards on the paper and a 'Humans' card to represent how the items might interact with each other. After trying a few different configurations, ask them to decide on a permanent arrangement and tape their photos to the paper.

Explanation:

8) Guide students to use arrows or other symbols to represent the interactions. Ask them to label each arrow or symbol with a description of the interaction.

9) Ask students: Are the interactions desirable, undesirable or neutral from the perspective of each of the four items? Guide them to include symbols representing these relationships next to their interaction symbols.

Elaboration:

10) Have each group of four pair up with another group and compare their images and models.

11) Have each student swap their image with someone from the other group. Each group should then return to their own model and try to incorporate the new items, including interaction symbols.

12) Additional images can be incorporated as time allows.

13) Have each member of each group present one or two interactions in their model. Ask students to summarize the patterns they noticed and the main differences in interactions between built and natural items. Ask: How do natural and built items respond differently to heat? Why?

Evaluation:

14) Students follow the journal prompts on Student Worksheet 3: Built and Natural Journal Writing.

Extensions:

15) Introduce the photos from sheets 13 and 14 to the groups to discuss.

Standards

Arizona Science Standards

S1-C1-GR5-PO1
S1-C1-GR6-PO2
S1-C1-GR7-8-PO1
S1-C1-GRHS-PO1
S1-C2-GR5-HS-PO1, PO5
S1-C3-GR5-PO5
S1-C3-GR5-PO5
S1-C3-GR6-PO2
S1-C3-GR7-PO1, PO2, PO7
S1-C3-GR8-PO1, PO2, PO8
S1-C3-GRHS-PO1
S2-C2-GR6-7-PO3
S2-C2-GR8-PO1
S3-C1-GR5-PO1
S3-C1-GR7-PO1
S3-C1-GR8-PO1, PO2
S3-C1-GRHS-PO1-5
S4-C3-GR7-PO3
S4-C3-GRHS-PO1,PO2
S4-C4-GR8-PO1
S4-C4-GRHS-PO3,PO4

Arizona Science Standards cont'd
S4-C4-GR8-PO1
S4-C4-GRHS-PO3, PO4

NGSS Core Ideas:
ESS2.A: Earth materials and systems
ESS2.E: Biogeology
ESS3.C: Human impacts on Earth systems
LS2.A: Interdependent relationships in ecosystems
LS2.C: Ecosystem dynamics, functioning, and resilience
LS4.D: Biodiversity & Humans
LS2.B: Cycle of Matter and Energy Transfer in Ecosystems

NGSS Practices:
Developing and using models
Planning and carrying cut investigations
Constructing explanations
Obtaining, evaluating, and communicating information

NGSS Crosscutting Concepts:
Patterns
Cause and effect
Scale, proportion and quantity
Systems and system models
Energy and matter: Flows, cycles, and conservation
Stability and change

Common Core/ELA Literacy
RST7: Integrate content from diverse formats
WHTS1: Write to support claims
WTS2: Write to convey ideas and information
SL1: Participate in collaborations and conversations
SL2: Integrate oral information
SL4: Present effectively to listeners

Common Core/Mathematics
Domains:
Number and Quantity
Measurement and Data

Student Worksheet 1
Natural and Built Environment Model

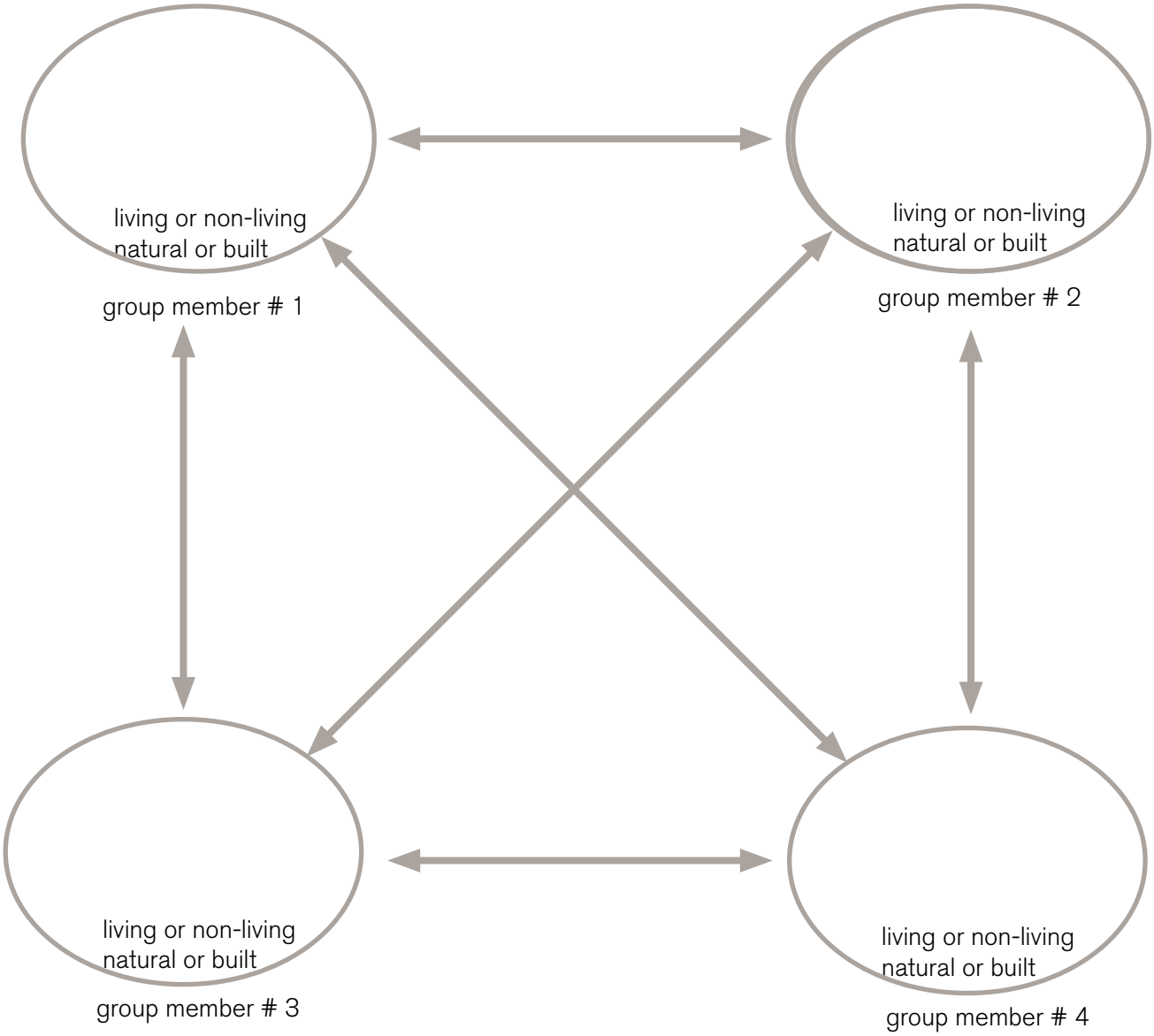
Learning Objective
Distinguish between the natural and built environment in photos.

Group Instructions
1) Your teacher will give you each a different picture. Identify the items of interest.

2) Write each group member's item on the diagram and circle whether it is living or non-living and built or natural.

3) Brainstorm with your group members how each of their items might interact with each other.

4) Label each interaction by writing a short description or explanation on the arrows.



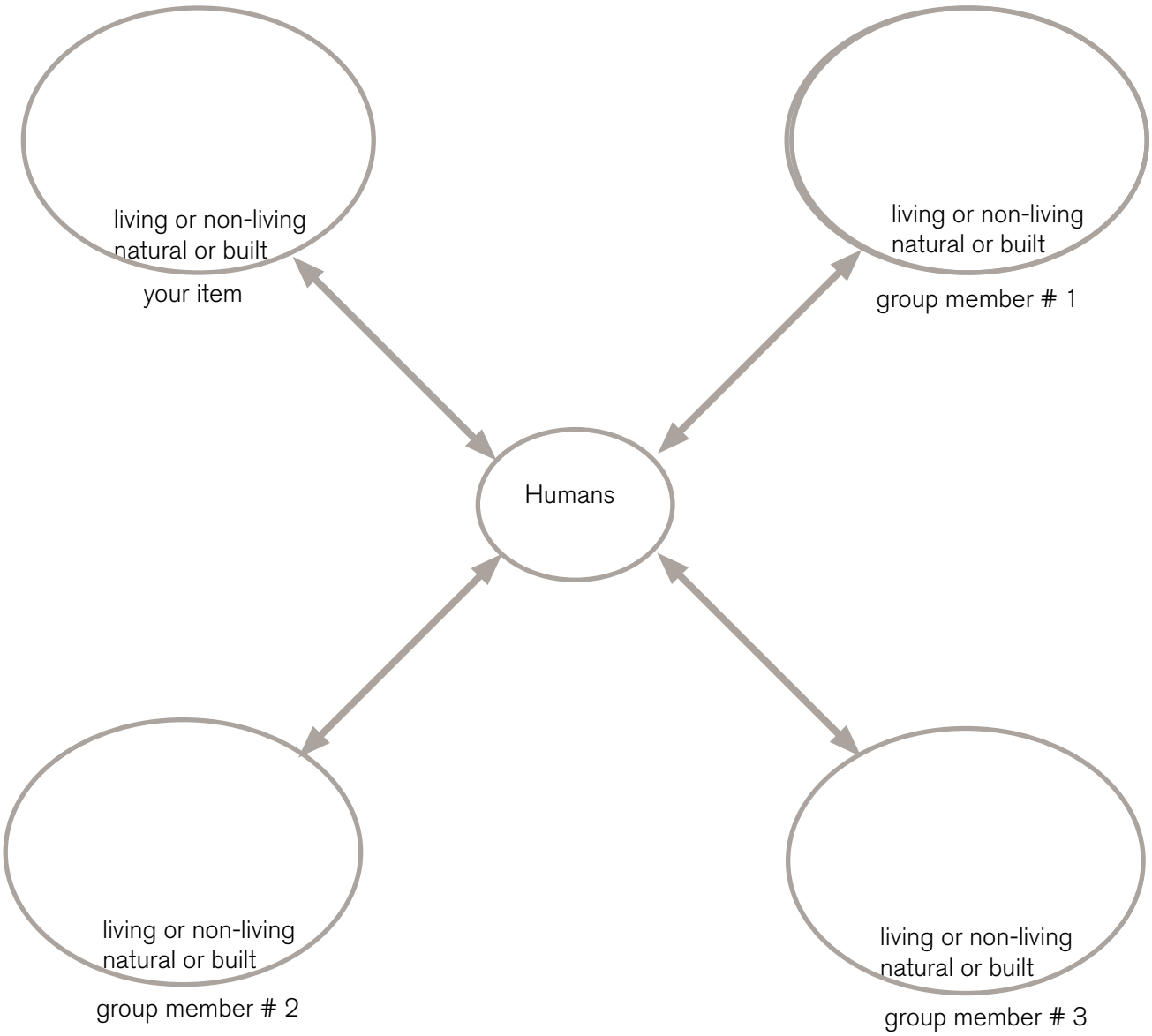
Student Worksheet 2
Natural and Built Environment Model

Group Instructions

1) Label the four objects in the outer circles of the model below.

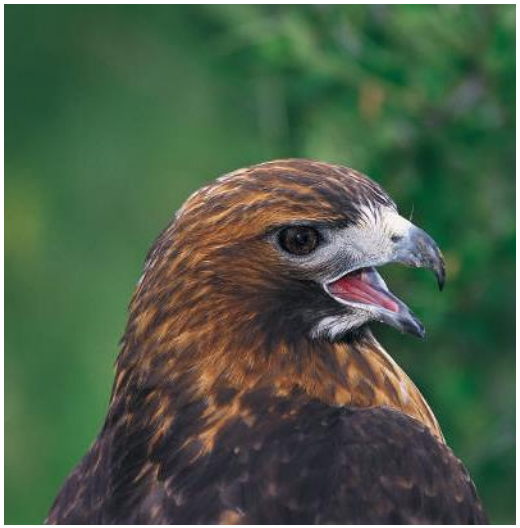
2) Brainstorm with your group members how each of their items might interact with yours.

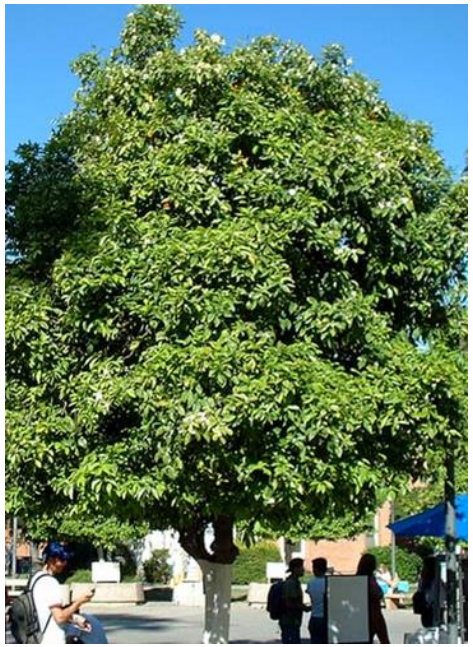
3) Label on the arrows to describe the interactions between each object and humans.

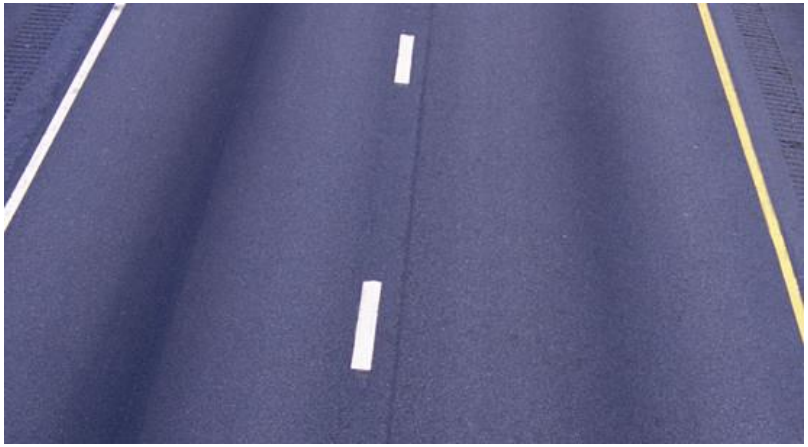


Student Worksheet 3
Natural and Built Journal Writing

Imagine and Explain:
Visualize an outdoor area near where you live, such as a front yard or park. Think about the natural and built items and how these items interact with humans and other living organisms. Then imagine something is eliminated from this environment. Describe the environment, the missing item, and possible consequences:








U.S.
MAIL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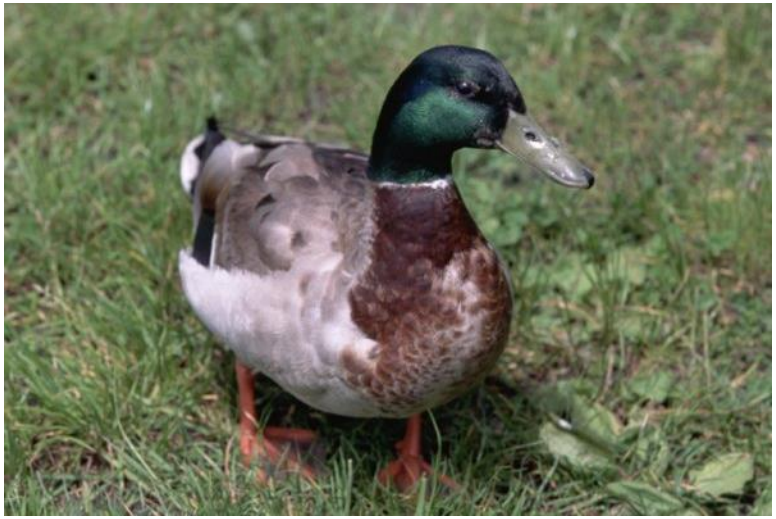
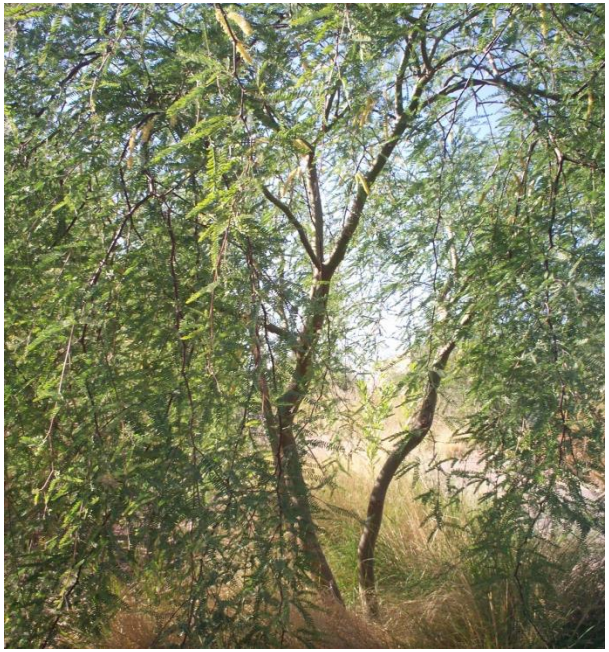
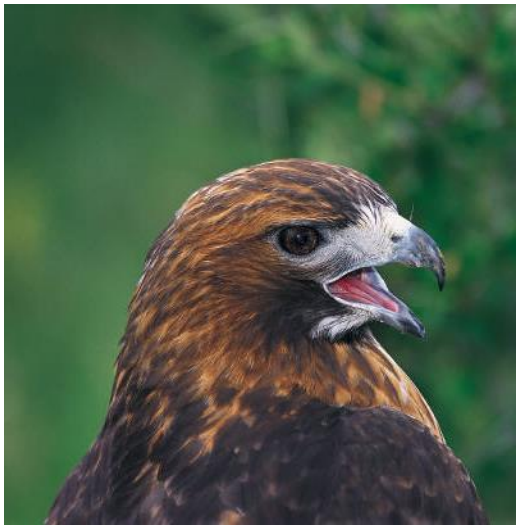


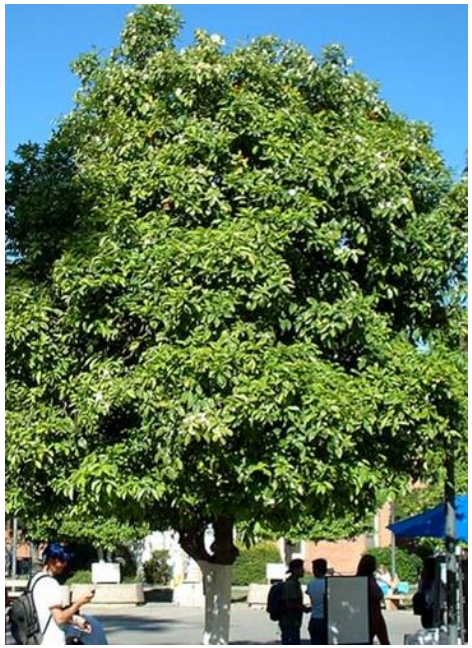




Role: eats other birds and mammals
Possible Interactions: nest on buildings or trees, reduce populations of prey animals

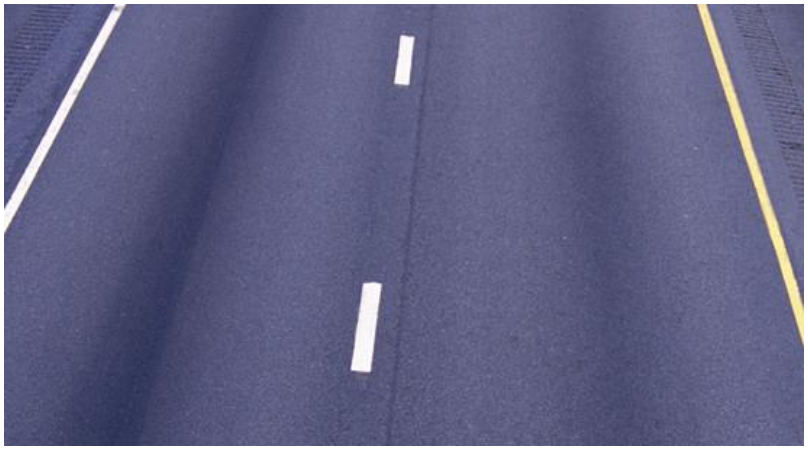
Role: shelter for people and other animals

Possible Interaction: contributes to heat island, decreased space for animals and plants



Role: stabilizes soil, converts suns energy to sugar, creates oxygen, uses CO_2

Possible Interaction: food and shelter for wildlife, aesthetics, food, and shade for people



Role: hard surface for vehicles, connects communities, allows movements of goods

Possible Interaction: can provide food for animals (road kill), decreases space for plants and animals, limits travel for animals, could help spread non-native plants & animals (by vehicles or along medians), indirectly air pollution causing health issues for plants and animals

Role: eats rodents

Possible Interaction: food for other animals, beneficial to people for rodent control

Role: shelter for people and possibly other animals

Possible Interaction: keeps out animals, decreased space for animals and plants, could provide shade for animals or plants

Role: stabilizes soil, converts suns energy to sugar, produces oxygen, uses CO_2

Possible Interaction: food and shelter for wildlife, aesthetics, and shade for people

Role: place to deposit mail, communication

Possible Interaction: if abandoned could become home for animals, resting spot (birds)

Role: eats vegetation, garbage, rodents, lizards, and other small animals

Possible Interaction: may help people by controlling , might also prey on domestic animals (chickens, lambs, small pets), , aesthetics, symbol of the West (howling at night)

Role: transport water from one place to another, decrease flooding

Possible Interaction: food, and shelter for animals, cooling, water for plants and animals

Role: stabilizes soil, converts suns energy to sugar, creates oxygen, uses CO_2

Possible Interaction: food and shelter for wildlife, aesthetics for people, spines deterrent for some animals

Role: allows travel for people and goods

Possible Interaction: can indirectly relate to food for animals (train kill), abandoned railroad beds have been converted to recreational use, can transport seeds and animals along routes

Role: eats insects, tadpoles, fish, and grains

Possible Interaction: food for other animals (raptors), can damage crops, population increases with human altered landscape

Role: shelter for people and possibly other animals

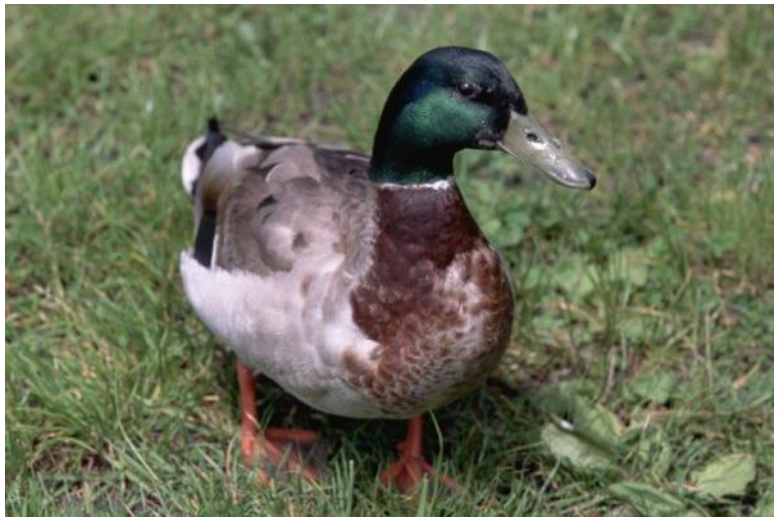
Possible Interaction: keeps out animals, decreased space for animals and plants, could provide shade for animals or plants

Role: stabilizes soil, converts suns energy to sugar, produces oxygen, uses CO_2

Possible Interaction: food for animals, shelter for small animals, aesthetics and place to play for people, cooling effect

Role: emergency water supply for fires,

Possible Interaction: perching spot for animals, marking spot for dogs,



Role: consumes insects and aquatic vegetation

Possible Interaction: food for other animals, hunted by people, aesthetics for people

Role: aesthetics for people, gathering place

Possible Interaction: cooling effect, water for birds and other animals to drink

Role: stabilizes soil, converts suns energy to sugar, produces oxygen, uses CO_2

Possible Interaction: food and shelter for wildlife, aesthetics, and food for people, shade cools buildings

Role: place to walk, separates pedestrians from road and private property

Possible Interaction: can indirectly relate to food for animals (people drop food while walking), decreases space for plants and animals (weeds might grow in cracks), could increase runoff.

Role: consumes arthropods

Possible Interaction: eaten by other animals, keeps some animal populations down through predation, burrowing species help aerate the soil, poisonous to people

Role: recreation for people, green space, gathering place

Possible Interaction: home for small animals, potential food from vegetation and garbage

Role: stabilizes soil, converts suns energy to sugar, produces flowers and seeds to reproduce

Possible Interaction: food for animals, aesthetics

Role: hold solid waste, keeps area clean so less chance of disease

Possible interaction: could provide food for animals if not properly closed

Role: eats insects (adult), eats algae (tadpole)

Possible Interaction: food for other animals. Night-time noises, beneficial to people for insect control

Role: decreases runoff so less flooding on roads

Possible Interaction: location of food, and shelter for animals, water for plants and animals

Role: stabilizes soil, converts sun's energy to sugar, produces oxygen, uses CO_2

Possible Interaction: food and shelter for animals, aesthetics for people, cooling, nesting site for birds

Role: controls traffic,

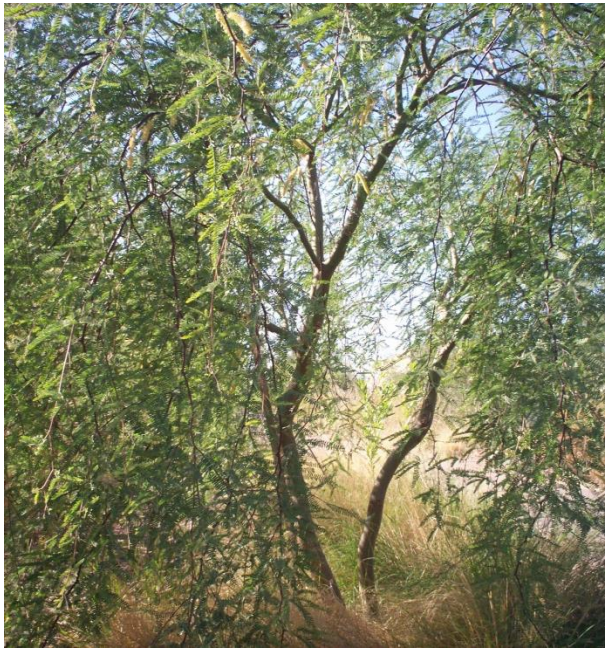
Possible Interaction: perching site for birds, safety

Role: Consumes other arthropods

Possible Interaction: may help people by controlling other arthropod populations, food for other animals such as birds

Role: hard surface for vehicles to park, access for shopping, hard surface for recreation (festivals, flea markers…)

Possible Interaction: can provide food for animals (dropped food), decreases space for plants and animals, can heat surrounding area, can increase runoff, runoff can have pollutants (oil from cars)



Role: stabilizes soil, converts suns energy to sugar, produces oxygen, uses CO_2

Possible Interaction: food and shelter for wildlife, nurse plant for other plants (provide shelter from sun)

Role: allows travel from one place to another

Possible Interaction: makes faster travel possible for people, can indirectly relate to food for animals (food dropped), decreases space for plants and animals, aesthetics for people

Role: eats plants (larval stage), pollinates plants (adult stage)

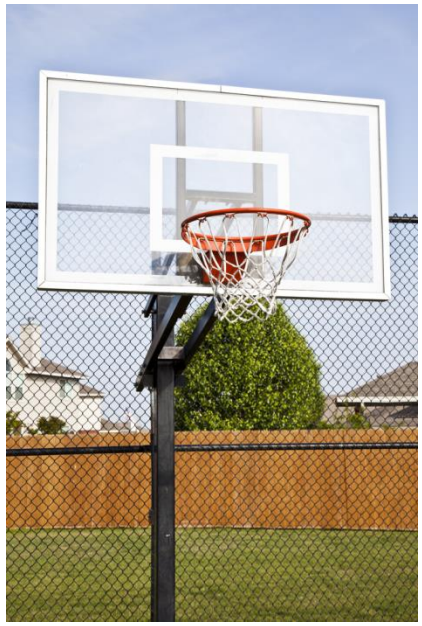
Possible Interaction: important pollinator (possibly for crops), food for animals, aesthetics for people, pest to plants –may cause people to use insecticides

Role: dissuade movement, defines boundaries

Possible Interaction: perching site for birds, could be barrier to migration route to animals, can be decorative or historic

Role: stabilizes soil, converts suns energy to sugar, produces flowers and seeds.

Possible Interaction: food and shelter for animals, aesthetics for people, may shade buildings



Role: recreation for people

Possible Interaction: perching site for birds, if net unravels could become part of a nest or place for nesting

Role: eats decaying organic material

Possible Interaction: food for other animals , people may not like them and may spray pesticides

Role: place for people to exercise relax and stay cool

Possible Interaction: cooling effect for animals in local area, water for birds and other animals to drink, wastes water

Role: stabilizes soil, converts suns energy to sugar, produces oxygen, uses CO_2

Possible Interaction: food and shelter for wildlife, nurse plant for other plants (provide shelter from sun), aesthetics

Role: measures energy for people

Possible Interaction: perching site for birds, electricity helps run electronics that can be beneficial such as keeping people cool, indirectly contributes to pollution that can affect animals and plants (air)

Role: consumes variety of wild seeds, grains, and insects

Possible Interaction: food for other animals, control insect populations, nests and droppings near people, aesthetics for people, attracted to water

Role: electric wires provides energy and lights illuminate street

Possible Interaction: perching site for birds, possible nesting place, improve street appearance & safety contributes to pollution that can affect animals and plants (light, air)

Role: stabilizes soil, converts suns energy to sugar, produces flowers and seeds to reproduce, uses water, takes up CO_2 and gives off O_2 and water vapor.

Possible Interaction: food for animals, aesthetics, ground cover prevents erosion and dust

Role: place to gather and rest

Possible Interaction: could provide shade /resting area for animals. Place to view nature for people