



The Price of Survival

Adaptations; Economics

Time Frame: 2-3 hours

Grade: 7-8

Overview:

Many animals are successful in their environment because they have adapted over time to survive under those specific conditions. However, changes occur. Forests are clear cut and become grasslands. Wetlands have dried to become deserts. These changes can be costly, if not fatal, to the animals living in these areas. They have to move or quickly adapt to the new environment. In this lesson, students will identify some of the adaptations that help animals survive. Then, they will purchase adaptations that will help them best survive in an environment and struggle through natural and human-caused changes.

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Essential Questions

- What factors contribute to the survival of wildlife species?
- What are some common adaptations found in Arizona wildlife species?
- How does the perceived value of an object affect its purchase price?

Objectives

- Identify adaptations found in at least eight common Arizona mammals.
- Analyze and prioritize the “value” of specific adaptations for survival.
- Analyze the impact of three environmental changes on the survival of an animal.

Arizona Department of Education Standards

<u>7th Grade</u>	
Science	Social Studies
○ S3.C1.PO1	○ S4.C5.PO3
○ S3.C1.PO2	○ S4.C5.PO4
○ S4.C3.PO2	○ S4.C5.PO6
○ S4.C3.PO3	○ S5.C1.PO1
○ S4.C3.PO5	○ S5.C1.PO2

<u>8th Grade</u>	
Science	Social Studies
○ S3.C1.PO1	○ S4.C5.PO3
○ S4.C4.PO1	○ S5.C1.PO1
○ S4.C4.PO3	○ S5.C1.PO2
○ S4.C4.PO5	

Materials and Resources

- AZGFD bone box resource trunk
- *Adaptations Bidding Sheet* (one per person)
- *Draw an Animal* (one per person)
- *Survival Scenario Analysis* (one per person)
- *Survival Scenarios*
- *Adaptation Analysis*
- *Game and Fish Bucks* (at least \$250 per group)

Teacher Preparation

- Preview the items in the Bone Box.
- Prepare copies of the *Adaptations Bidding Sheet*, *Draw an Animal*, and *Survival Scenario Analysis*.
- Copy the multiple *Game and Fish Bucks* sheets. Cut out each of the bills. Organize into groups of \$250.
- Cut out the Survival Scenario cards, shuffle them, and place them in a pile.

Background Information:

All animals and plants have adaptations that help them survive in their environment. These adaptations can be physical or behavioral. Physical adaptations are usually visible features on the organism such as camouflage coloration

and sharp teeth. Behavioral adaptations are actions organisms do to survive. These include howling to communicate and migrating. While these adaptations are incredibly important to survival, they do come at a cost. Each adaptation takes time and energy to develop.

For successful organisms, the threat to survival without a specific adaptation will be greater than the biological cost to develop that same adaptation. Thus, an animal that does not need to communicate will usually not develop the ability to communicate. That animal will use the precious energy for more important adaptations.

In this lesson, students will have the opportunity to explore the concepts of physical and behavioral adaptations. In the process, they will participate in an auction that will highlight the idea of biological cost in terms that people can understand: money and the common rules of economics. Each team of students will have a limited budget to “purchase” adaptations that will help their imaginary animal best survive in the Sonoran Desert. Then, their animals will be challenged to survive as conditions within that environment change.

Procedures:

1. If students are not already familiar with the animals in the Bone Box Resource Trunk, provide time for the students to work with the materials.
2. Hand out the *Adaptations Bidding Sheet* to each student. Explain that this sheet identifies some common adaptations that can be found in Arizona wildlife species.
3. Explain that each adaptation is either physical or behavioral. If necessary, explain these concepts.
4. Inform students that they are to review the list of adaptations. For each one, they must identify it as a physical or behavioral adaptation. Then, they should identify one or more of the animals from the Bone Box Resource Trunk that display this adaptation. Students should record their answers in the

appropriate boxes on the *Adaptations Bidding Sheet*.

5. Inform the students that they will now be participating in an auction. If you wish, you may show short Internet video clips of real auctions to get students excited about the activity.
6. Divide the class into teams of four. Each team will need to create a team name and appoint a person to each of the following jobs:
 - *Bidder* – is the only member allowed to place a bid on behalf of the team.
 - *Banker* – is in charge of paying for the adaptations once the auction is complete.
 - *Accountant* – is in charge of keeping track of the team’s remaining monies.
 - *Adaptation Tracker* – keeps track of which adaptations the team has won during the auction.
7. Inform the teams that they will be designing an animal that has specific adaptations to survive in the Sonoran Desert. Provide a little background information on this ecosystem. Some points to include:
 - It is one of the hottest deserts in the world with summer temperatures that can exceed 120°F even in the shade!
 - It averages more than 300 days of sunshine per year.
 - It has mild winters, with evening temperatures rarely dropping below 32°F.
 - It is one of the wettest deserts in the world, with up to 15 inches of rain per year.

- There are two primary rainy seasons: the violent summer monsoon thunderstorms and the gentler winter rains.
8. Inform the students that not all teams will be able to get the adaptations they want. Instead, they will be given \$250 to spend on adaptations. They must determine how that money will best be spent.
 9. Allow the teams ten minutes to decide on how much money they are willing to spend and on which adaptations. They should document their budget on the *Adaptations Bidding Sheet*.
 10. Hand out the Game and Fish bucks. Each team should receive various denominations totally \$250.
 11. Begin the auction. It can be run in several ways:
 - Loud auction: The auctioneer/teacher shouts out a bid and the bidder for each team raises their hand to place the bid. This is a very high energy auction and is highly participatory. However, it can get chaotic and sometimes the bidders do not follow the wishes of the rest of the team.
 - Silent auction: As each item comes up for bid, each team is given 15 seconds to write their highest bid on a sheet of paper. When the auctioneer/teacher gives the signal, all the bids are raised. The highest bid wins the adaptation. This style takes less time and is much quieter. It does encourage team work.
 12. Once all of the adaptations have been purchased, students should record the final purchase prices for each of their

adaptations on the *Adaptations Bidding Sheet*.

13. Hand out the *Draw an Animal* sheet. Instruct students to be creative and draw a picture of their animal. It should include all of the adaptations they purchased. They should take care NOT to include adaptations from the list that they did not win during the auction.
14. Hand out the *Survival Scenario Analysis* worksheet. Students should write down each of the adaptations they purchased in the appropriate spaces.
15. Inform the students that, as is common, some changes have occurred recently to the Sonoran Desert habitat where their animal lives. They will determine if their adaptations help their animal survive in the modified environment.
16. Pull one of the *Survival Scenario* cards at random. Read the description and have the students discuss which adaptations they think will be the most beneficial for survival.
17. Use the *Adaptations Analysis* sheet to identify the beneficial and detrimental adaptations. Have students complete the *Survival Analysis* worksheet for this scenario.
18. Repeat steps 16 and 17 as appropriate using additional scenarios. Students should be exposed to at least three different scenarios but the total number is up to you.
19. When all of the scenarios are completed, students should complete the *Survival Analysis* worksheet.



Differentiated Instruction:*Extensions:*

- Rather than dictating which adaptations are beneficial and detrimental in each scenario, have students argue for or against each one. Accept responses that are well justified and supported.
- Eliminate the pre-determined adaptations on the *Adaptations Bidding Sheet* and provide students with the opportunity to identify animal adaptations.
- Require teams to research and develop their own survival scenarios and identify which adaptations would be beneficial and detrimental. Each team can run their scenario with the class.

Modifications:

- Students can complete each of the worksheets as a team rather than individually.
- If teams get carried away and all of them are out of money before the auction ends, you may consider an “economic stimulus” or “biological bailout” and give each team some additional money.
- Distribute the selected *Survival Scenarios* to the teams to work on independently rather than as a class.

Reflection:

Use the space below to reflect on the success of the lesson. What worked? What didn't? What changes would you make? These notes can be used to help the next time you teach the lesson. In addition, the Department would appreciate any feedback. Please send your comments to focuswild@azgfd.gov.



Adaptations Bidding Sheet

The table below lists some common adaptations found in various mammal species. For each one, determine whether it is an example of a physical or behavioral adaptation and identify some Arizona mammals that exhibit that adaptation. Then, based on the scenario presented in class, determine which ones you are willing to purchase and how much you are willing to spend in the adaptation auction. Once the auction has taken place, record the amount of money you spent for each of the adaptations you purchased.

Adaptation	Physical or Behavioral Adaptation?	Representative Mammals?	Your Budgeted Cost	Your Purchase Price
Diurnal				
Nocturnal				
Body size: large				
Body size: small				
Eye location: front				
Eye location: side				
Excellent sense of smell				
Runs fast				
Teeth: Mostly flat				
Teeth: Mostly sharp				
Has lots of babies				
Long parental care period				
Sharp claws				
Coloration: gray/black				
Coloration: tan/brown				
Fur: heavy coat				
Fur: light coat				
Lives in a community				
Able to communicate				
Large ears				
Hibernates				
Swims				



Draw an Animal

In the space below, draw a picture of your animal. Be sure to include the adaptations you just purchased during the auction and show how they help the animal survive in the Sonoran Desert.



Survival Scenario Analysis

In the column labeled “Your Adaptations,” write in each of the adaptations you purchased from the auction. Then, in the box labeled “Scenario #1,” write a brief description of the new survival scenario that was presented to you. With the help of your teacher, determine if each adaptation will be beneficial or detrimental for your animal’s survival in the new scenario. If it is beneficial, put a “+ 1” in the appropriate box. If it is detrimental, put a “- 1” in the box. If it has no impact, put a “0” in the box. Add up the scores and put your total in the box at the bottom of the column. Repeat for any additional scenarios.

Your Adaptations	Scenario #1:	Scenario #2:	Scenario #3:	Scenario #4:	Scenario #5:
Score					

Total the scores from all of the scenarios: _____

Based on this score, do you feel that your animal is well adapted to handle changes to the environment? Why or why not?

Select one of the adaptations you purchased. Describe the environments in which this adaptation would be the most beneficial.

Of all the original adaptations presented to the class, which one seemed to be the most valuable? Least valuable? How do you know?



Survival Scenarios

<p style="text-align: center;">Low Rainfall During Monsoons</p> <p>Most of the plants and animals have been in survival mode during the hot months of May and June, anxiously awaiting the arrival of moisture provided from the summer monsoon season. Unfortunately, this year provides very little relief. Less than a half an inch of rain falls, which significantly limits the primary growing season for the large shrubs and trees.</p>	<p style="text-align: center;">Monster Wildfire</p> <p>An extended drought, increased temperatures from climate change, and a collection of invasive grasses have come together for a potentially lethal combination. Lightning during a summer monsoon strikes ground, igniting a dry tree. The fire quickly spreads throughout the dry desert community, growing to a size larger than the Phoenix metropolitan area, and destroying most of the plants in the process.</p>
<p style="text-align: center;">Hotter Summer Days</p> <p>Climate change has resulted in more of the sun's energy to pass through the atmosphere. The result: hotter temperatures, particularly in the summer when the days are longer.</p>	<p style="text-align: center;">Frosty Winter</p> <p>This year there is a particularly cold winter. Temperatures repeatedly drop to below freezing, resulting in an abnormal number of frost days. These frosts threaten the survival of a number of plants that cannot tolerate extended periods of cold temperatures.</p>
<p style="text-align: center;">Early Spring</p> <p>Climate change has significantly altered the predictability of the seasons. Milder winters have resulted in the early onset of Spring. Flowers begin blooming earlier than expected.</p>	<p style="text-align: center;">Overpopulation</p> <p>Years of policies focused on the removal of large predators have been successful. Your species' primary predator has been completely eliminated from the environment. Combined with highly successful reproduction, your species has seen a significant increase in its population size. In fact, it has moved well beyond the carrying capacity for the area.</p>

<p style="text-align: center;">Chemical Pollutant</p> <p>A production plant, located on the banks of a local stream, has been storing their waste chemicals in an underground storage tank for many years. The plant recently learned that this tank has a leak and waste chemicals have been seeping into the nearby stream. The toxin is likely present in many plants, as well as the animals that eat them.</p>	<p style="text-align: center;">Dam Construction</p> <p>Demand for electricity during the hot summer months has caused power companies to initiate rolling blackouts around the Phoenix area. Without power, temperatures inside homes rise and cause a potential health risk for some people. The power company received a permit to dam a nearby river to be able to increase electricity during peak hours. The newly created lake increases recreation opportunities but has also flooded habitat.</p>
<p style="text-align: center;">Moves to a Higher Elevation</p> <p>Food has been scarce lately. As a result, your species is forced to look elsewhere. It has begun climbing a nearby mountain. The change in vegetation provides new opportunities for food. However, there are new challenges including different predators and weather.</p>	<p style="text-align: center;">Invasive Burros</p> <p>Brought by miners and early explorers, burros (wild donkeys) are not native to the area. However, there is political pressure to protect them. Burros are herbivores but they impact the habitat differently than our native deer. Plants lack the appropriate adaptations and are permanently damaged or killed when the burros browse. In addition, the burros' hooves can dramatically damage the soil.</p>
<p style="text-align: center;">Housing Development</p> <p>An increase in the number of people moving into Arizona has resulted in the development of two rather large housing communities. These developments have leveled thousands of acres of natural desert. With the roads, telephone poles, electric wires, water pipes and other infrastructure that comes with developments, most native wildlife have been displaced from the immediate area.</p>	<p style="text-align: center;">Disease</p> <p>A deadly disease has been discovered and is making its way through your species' local population. The disease causes muscle atrophy and major hemorrhaging. Death occurs within weeks. Although the exact cause is not known, it seems to be spread through fecal matter and is most prominent in larger animal communities.</p>



Adaptation Analysis

The table below identifies the common adaptations that have been used throughout this activity and how they could fare under the different survival scenarios. A “+” indicates that the adaptation will be beneficial to the animal in that particular scenario. A “-” indicates that it will be detrimental. A “0” indicates there is no apparent benefit or problem with that adaptation. Of course, these ideas are only speculation. Scientists still debate how different adaptations may impact an animal. It is possible that arguments could be made for different answers. These are simply guides to get you started. We encourage students be given an opportunity to argue for or against different adaptations.

Adaptation	Low Rainfall	Monster Wildfire	Hotter Summer	Frosty Winter	Early Spring	Overpop.
Diurnal	-	0	-	+	+	0
Nocturnal	+	0	+	-	0	0
Body size: large	-	0	-	+	0	-
Body size: small	+	0	+	-	0	+
Eye location: front	0	0	0	0	0	+
Eye location: side	0	0	0	0	0	+
Excellent sense of smell	+	+	0	+	+	0
Runs fast	0	+	0	0	0	0
Teeth: Mostly flat	-	-	0	0	+	0
Teeth: Mostly sharp	+	+	0	0	0	0
Has lots of babies	-	-	-	-	+	-
Long parental care period	-	-	-	+	0	+
Sharp claws	+	+	+	+	0	+
Coloration: gray/black	0	0	-	+	0	0
Coloration: tan/brown	0	0	+	0	0	0
Fur: heavy coat	0	-	-	+	0	0
Fur: light coat	0	+	+	-	0	0
Lives in a community	+	0	0	+	0	-
Able to communicate	+	+	0	0	0	0
Large ears	0	0	+	-	0	0
Hibernates	+	0	+	+	-	0
Swims	0	+	+	0	0	0

Adaptation	Chemical Pollutant	Dam Construct.	Moves Higher	Invasive Burros	Housing Develop.	Disease
Diurnal	0	0	-	0	-	0
Nocturnal	0	0	+	0	+	0
Body size: large	+	0	-	0	-	0
Body size: small	-	0	+	0	+	0
Eye location: front	0	0	+	+	0	0
Eye location: side	0	0	+	+	0	0
Excellent sense of smell	+	0	+	0	0	+
Runs fast	0	0	-	+	+	0
Teeth: Mostly flat	0	+	+	-	0	0
Teeth: Mostly sharp	0	0	0	+	0	0
Has lots of babies	0	0	0	0	0	-
Long parental care period	0	+	0	0	0	+
Sharp claws	0	0	+	+	+	0
Coloration: gray/black	0	0	+	0	-	0
Coloration: tan/brown	0	0	-	0	+	0
Fur: heavy coat	0	0	+	0	0	-
Fur: light coat	0	0	-	0	0	+
Lives in a community	+	0	0	+	0	-
Able to communicate	+	+	+	+	+	+
Large ears	0	0	-	0	+	0
Hibernates	0	0	+	0	-	+
Swims	-	+	-	0	-	0

ONE DOLLAR

1

GAME AND FISH BUCKS

FIVE DOLLARS

5

GAME AND FISH BUCKS

TEN DOLLARS

10

GAME AND FISH BUCKS

TWENTY DOLLARS

20

GAME AND FISH BUCKS