

Lesson Plan: Animal Architects (grades 6-8)

Aim:

To examine the functions and kinds of homes used by animals of the LAND and AIR

Instructional Objectives:

Students will be able to:

1. identify at least four functions of an animal home.
2. compare the homes of different land animals with the home of an aquatic animal.
3. describe how a bird's habitat and biological needs affect its choice of nesting materials.



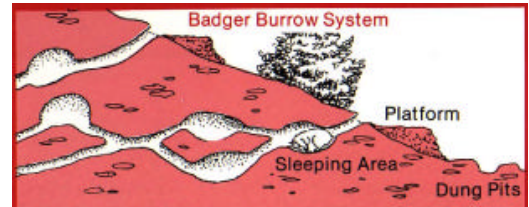
Hummingbird Nest

Motivation:

Land Unit: Are all of the rooms in your home alike? How do the rooms differ with respect to their functions?

Air Unit: Are the construction materials used for homes of native people around the world the same or different? Is the choice of materials influenced by the habitat?

Summary: Animals have many different kinds of homes. They are used for different purposes such as sleeping, shelter from predators and temperature extremes, food storage and raising young. The burrows of some land mammals and the nests of some birds are examined with reference to structure, function, and construction materials available in the habitat.



LAND UNIT

Materials: *Animal Architects* Discovery Card.

Lesson Procedure:

1. Discuss Motivation questions.
2. Have groups of students read the Discovery Card and answer the questions.
3. Direct students to make review chart of homes.
4. Have groups design burrows appropriate to the needs of the different assigned animals.

New Vocabulary:

lodge solitary
social territorial

Lesson Procedure Details

1. Have students discuss the *Motivation* questions. Encourage them to think about their homes and various rooms from a functional viewpoint.
2. Split the class into groups. Have students read the front and one-half of the first column on the back of the *Animal Architects* Discovery Card and answer questions one through seven. *Optional:* Have students compare the functions and designs of animal homes to those of human homes for the Discovery Card questions.
3. Have students make up short summary charts in their notebooks comparing the land homes of the badger and prairie dog to the aquatic home of the beaver. The chart should include the following columns: materials used for construction; problems that might be associated with that type of home; whether the home is year-round or seasonal; whether the home is designed for a single animal, a small group of animals, or a large group of animals; what functions the home serves for the animal; and what adaptations the animal has for building its home. Each of the group should briefly discuss *one* of the animal homes for which the chart was prepared. (See *Answers to Home Comparison Chart Activity*.)
4. Give each group one of the descriptions of the imaginary animals below. Each group should design a home for one of the assigned animals based on the animal's physical adaptations, biological and behavioral needs, and habitat. Each group should then present its design for the home (i.e., building material, method of construction, function of home and chambers/tunnels/rooms of the home, and other similar criteria based on those in the preceding chart activity), and defend the design, if challenged, with valid reasons for its components. (See *Suggestions for Imaginary Animal Homes*.)

Imaginary Animals

Animal 1: Reptilian predator. Only active for part of the year. Lays eggs that may be eaten by others of its kind (though the young can take care of themselves upon hatching). Animals are solitary except when breeding. Lives in a wet area with many tall trees. Food is easy to find. Has sharp claws.

Animal 2: Herbivorous (seed eating) mammal that lives in a very hot, dry habitat. Forms small family groups during breeding season, but lives in large social colonies during rest of the year. During latter part of year, food is scarce and chief predators (snakes) are common. These animals have strong claws and short front limbs.

Answers to Discovery Card Questions

Q1. Animals use their homes for a number of functions: breeding, raising young, storing food, and escaping from predators and bad weather (shelter).

Q2. Some adaptations include strong, sharp claws, dense fur, and short front limbs that give the animal more leverage for digging.

Q3. The polar bear: the female excavates a den in a snow bank during the winter and gives birth to her cub(s) during this time. Snow is excellent insulation, so the mother and baby are kept much warmer than one would expect.

Additional Information: You may wish to have students use this information as part of the *Home Comparison Chart Activity*.

Q4. As noted in the homework reading on prairie dogs, these rodents erect small mounds of earth around the entrances to their subterranean burrow systems. These mounds help to keep water out. However, if the water gets too deep, flooding of the lower chambers of their burrows will occur.

Q5. As the picture shows, the entrance to the badger burrow is located on a slope. This keeps the water from pouring into the tunnels and chambers that form this carnivores home.

Additional Information: Badgers live in the same burrow systems for years and may extend them to over 300 feet in length. Some burrows may have up to 50 exits, though not all are used at the same time. Such large burrows may be occupied by several families of badgers that tend to avoid each other. Other animals (particularly foxes) may also share these quarters, though they only live in walled-off and deserted parts of the extensive burrow system.

Q6. Beavers protect themselves and their young (who are born in the lodge) from predators by building their lodges in the middle of ponds. This anti-predator strategy is not effective in the winter. When the pond is frozen, large predators can reach the lodge. However, the lodge also “freezes.” The mud packing between the sticks that form the lodge freezes so hard (except in the ventilation shaft) that not even bears can break through into the inner living chamber. If a predator *did* break through, the beaver would still have its handy underwater escape route! (See *Beaver* heading under *Answers to Home Comparison Chart Activity*.)

Q7. Beavers can adjust the height of the dam itself to keep the pond at a protective (but non-flooding) level. If the water level in the pond gets so high that it enters the living chamber, the beaver can lower the dam and let the water spill out of the artificial pond to lower its level.

Answers to Home Comparison Chart Activity

Prairie Dog: The prairie dog uses its sharp claws to burrow beneath the earth. As described in the card, flooding is a potential problem as is the presence of burrowing or burrow-dwelling predators such as snakes, badgers, or burrowing owls. Prairie dog burrows are used for breeding, resting, raising young, shelter from bad weather and predators, sanitation, and some food storage.

Additional Information: Prairie dogs live in large colonies throughout the year, though small groups (called coterries) are formed within the colonies. Coterries tend to stay in their own parts of the interconnected underground burrow system (much like dwellers in a large apartment complex!)

Badger: Habits are similar to those of the prairie dog, except that the badger is frequently solitary (as are many carnivores), has an external latrine area, and does not have to worry about predators (except perhaps large bears or humans) because it is such a formidable animal. Badgers use the very strong claws on their front feet to build their burrow systems.

Optional:

Polar Bear. (see *Answers to Discovery Card Question #3*). Polar bears dig their dens in snow banks using their wide, strong, clawed feet. Snow is vulnerable to melting but offers excellent insulation from the cold. Females use the small dens during the few months it takes them to bear their young and raise the cub(s) to the point that they can survive outside – *with* the female's help and protection.

Beaver: The home (or lodge) is constructed of sticks and mud in the middle of the pond created by the dammed water. Flooding is a problem, along with the need for adequate ventilation and protection from predators. The beaver uses its large incisor teeth to cut and chisel wood, which is dragged through the water to build the lodge. Students can review the picture and information on the card.

Suggestions for Imaginary Animal Homes

(Use this information to provide hints, and as a guide for correcting students, if necessary).

Animal 1: This reptile needs a place where it can keep its eggs safe (if female) and where it can hibernate safely. Because the ground is wet, it probably does not burrow but may use its sharp claws to climb the trees, where it could build a safe and warm nest (much as a squirrel might) from leaves or other available vegetation. If students can explain how this animal transports mud up to the trees, a mud nest is fine! Females use the nest for shelter when hibernating, and then lay their eggs there and desert them. (Alternatively, females might use a tree nest for shelter and hibernation and build a high ground nest of mud and vegetation in which to lay and incubate the eggs. In this case, females would undoubtedly guard these nests from other animals.) Males only use the nest during winter to hibernate.

Animal 2: Probably very similar to the prairie dog or one of the desert rodents. This animal is almost certainly a burrower since there are few building materials available in its habitat, because it has burrowing adaptations (strong claws and short front limbs), and because an underground home is cooler and more humid than one built above ground in a hot and dry habitat. This animal probably uses its burrow to store seeds and to escape from both predators and daytime heat. It could be nocturnal. This would help it avoid extreme heat as well as predators, for the snakes which hunt it might be more sluggish at night because of the comparative cold. Sections of the burrow used for raising young are probably “snake-proofed” by being deep in the tunnel system. They may be surrounded by sharp loops, twists, and climbs to prevent snakes from reaching them. These animals probably cooperate with each other by watching for snakes outside of the burrow and sounding alarms.

AIR UNIT

Materials: *Animal Architects* Discovery Card (back only)

Optional: assorted “nesting materials”

Lesson Procedure:

1. Discuss Motivation questions.
2. Have student groups read the Discovery Card and respond to the questions posed.
3. If appropriate, have students conduct nest-building activities.
4. Have each group choose another material from which a nest could be built, determine the advantages and disadvantages of that material, and design and draw (and/or build) an appropriate nest.

New Vocabulary:

brood
clutch
insulation

Lesson Procedure Details

1. Have students discuss the *Motivation* questions. Encourage them to consider why different materials are used to construct homes worldwide and what benefits/limitations each material mentioned might have. (See *Answers to Motivation Questions*.)
2. Split the class into four groups. After students have read the back of the Discovery Card, elicit the answers to Question 8 for grass. Then have one group at a time present the answers to Question 8 for leaves, cobwebs, saliva, and clay.
3. Each of the four groups should then explain their conclusions to either Question 9, 10, 11, or 12 (as you assign them). (See *Answers to Discovery Card Questions*.)
4. *Optional:* If students have brought in nesting materials, have the groups build nests analogous to those described. Mimic as many of these as possible, preferably having groups work together on any one type. The purpose of these activities is to increase appreciation of the complexity of nest building. (See *Technical Information*.)
5. Have groups choose various materials from which birds could build nests (or assign these: twigs, pebbles, mud, seaweed). Using the responses to

Question 8 as a guide, have the students determine the materials' advantages and disadvantages. Also, have students describe the engineering possibilities and limitations of the materials. Then, students should describe or sketch (or even build) a home made out of a specific material. (See *Technical Information*.)

Answers to Motivation Questions – Air

Choice of building materials is dictated by habitat and by what materials are available. Eskimo hunters in the Arctic used packed snow, a readily available material that needs few special tools to work, is strong, and is good insulation. The Masai, a nomadic East African people, use cattle dung and mud as their major construction materials. Since they herd cattle and are nomadic, they need to build homes quickly and easily – and similarly discard them. The fact that their habitat is dry for a large part of the year makes these materials usable. In Japan, many homes are built with paper panels, which are safe and easy to rebuild in case one of the (frequent) earthquakes strikes.

Answers to Discovery Card Questions – Air

Q8. Some advantages/disadvantages of:

Grass (African weavers): abundant, strong, flexible, good camouflage, can be converted into a hanging structure / not waterproof, can be brittle when dry, grass must be gathered in great quantities, birds need a lot of time and skill to weave the grass properly.

Leaves (tailorbird): readily available, excellent camouflage capacity, fairly waterproof / size of nest greatly limited, leaves are fragile and flimsy, easy to tear.

Cobwebs (hummingbird): strong and soft (no inner lining necessary), good insulation, good camouflage / can absorb water, may be difficult to find and gather, fragile.

Saliva: (swiftlet): may be only material available, strong / takes time, energy, and stored body resources to construct, no protection against predators, could dissolve if not used in a protected area such as a cave. (Note: Most of the birds use saliva to build their nests early in the year, before the rainy season. If these nests are collected by people for soup, or destroyed by natural causes, the replacement nests may be constructed of mud that the opportunistic birds have gathered!)

Clay (ovenbird): dries strong and hard (good protection against predators and mildly bad weather), readily available / not good in very hot or wet weather, clay is not available in some locations.

Q9. African weavers live in grasslands. (This is one reason that they use grass as a nest-building material.)

Q10. Placement of nest entrance holes varies between species. The placement illustrated (i.e., at the bottom) is an effective way of preventing snakes from making their way into the nest and eating eggs and/or developing chicks. This works because most snakes cannot easily crawl downward headfirst and then make the sharp upward turn into the nest itself. The entrance is relatively easy for a flying weaverbird to enter.

Q11. The tailorbird uses its sharp bill as a needle. It drills small holes into the edges of the leaf, and then uses its feet and beak to lace the “thread” through these holes.

Q12. Since there is virtually no ventilation, extreme heat could cause the ovenbird’s hollow clay nest to get nearly as hot as an oven. The birds abandon their nests immediately after the chicks are fledged. This occurs just prior to the onset of the hot season. Furthermore, they only use the nest when it is comparatively dry. Although these homes can protect against occasional light rain, storms could dissolve (or at least seriously damage) them.

Q13. Grebes build their floating nests out of reeds and other relatively hollow forms of aquatic vegetation. Because the floating nest is surrounded by water, the brooding birds, eggs, and developing chicks are somewhat protected against (non-aquatic) predators. This is comparable to the beaver’s anti-predator strategy of surrounding its lodge with water.

Technical Information – Air

Nest Building

Weaverbird: Use grass, straw, yarn, string, twigs, etc. Students should try to knot, twist, weave and/or knit these materials into as close a semblance of the nest pictured on the card as possible. You may wish to draw some of these typical weaverbird knots and stitches on the board for students to follow, though the students do not *have* to use the stitches in their nests. Remind the students that these birds have only the use of their beaks and feet to help them build their homes!

Tailorbird: Use real leaves, cut-out paper leaves, or pieces of cloth, and sew them together with needle and thread OR grass lacing. If possible, students should then stuff the nests with cotton, bits of yarn, or some other soft material.

Hummingbird: Use torn-apart cotton balls or separated pieces of absorbent cotton batting. To mimic the natural stickiness of the cobwebs (as well as the bird’s adhesive saliva), use either a paste or white glue. If possible, students

should attempt to build these nests in the same size as does the hummingbird (about 1 inch in diameter!).

Cave swiftlet: Due to the nature of the material, this is *not* recommended for construction. However, you may have students try using glues of various sorts.

Ovenbird: Using modeling clay, students should attempt to construct a hollow nest split into two inner chambers of different sizes. Small openings (into the smaller chamber from the outside and between the two chambers) should also be incorporated into this design.

Nest Design/New Materials

Twigs: similar to grass, but less flexible; possibly too heavy to be used in building a weaver-type nest. Robins and many other common birds build their nests from twigs.

Pebbles: strong and protective but not flexible. Nests built from pebbles (plovers, gulls, penguins) are usually built on the ground due to the weight of the materials. Pebbles are also waterproof and well camouflaged, but nests cannot be shaped into more than simple mounds.

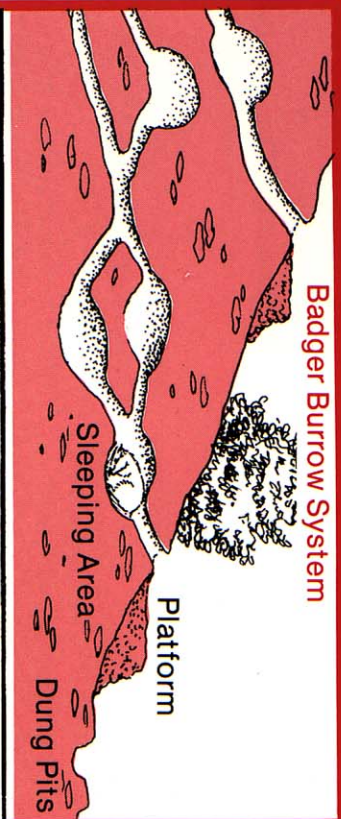
Mud: May be used like clay or saliva, though it is not as self-adhesive and (unless mixed with other materials) is generally weaker and more brittle than those materials when dry. Swallows and many swifts build mud nests.

Seaweed: only usable when dry (wet seaweed is a poor insulator). Also, seaweed is somewhat flimsy and highly compressible (i.e., it takes a lot of seaweed to build a satisfactory nest). However, seaweed is fairly easy to find in some habitats and is used by a variety of marine birds (gannets and some auks) to build large mounded nests. Although excessive rain can compact the nests and cause them to lose their value as insulators, a finished nest of dry seaweed can be an effective temporary home for a bird's eggs and chicks.

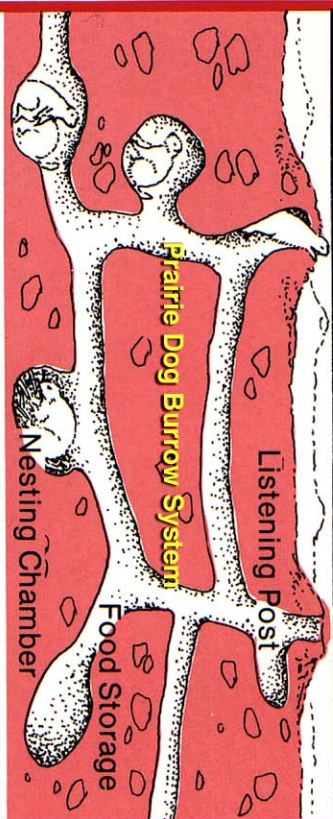


Animal Architects

Badger Burrow System



Prairie Dog Burrow System



Living Chamber



Beaver Lodge and Dam

- From hanging globes of grass stems to bundles of twigs, from hardened mounds of mud to tunnels in soft soil, animal homes display an amazing variety of building materials and styles. Have you ever wondered why some animals spend much time and energy building their homes? To answer this question, think first about the purposes of animal homes.
- 1 What functions do animal homes serve?**

Some animals need homes all year. Others use homes for one season only. Some animals build their own homes using natural materials in the environment. Others move into places made by nature. Hollow logs, caves, and tree cavities require little or no effort from the animal that moves in. Burrows, leaf nests, and dens of mud and sticks, however, are built by animals that possess special building abilities.
 - 2 What are some of the physical adaptations that make certain animals well suited to building homes such as burrows?**

While some burrows are simple holes dug in soft soil, others are made of complex networks of tunnels and rooms with two or more entrances. Burrows can be dug beneath the ground, in rotting wood, and even in deep snow.
 - 3 Can you think of a large North American animal that might dig a temporary home in the snow?**

Burrows offer certain advantages because they cannot be damaged by high winds, heavy snows, hail, or lightning which can affect homes above the ground. On the other hand, flooding due to heavy rain could be a danger to burrow dwellers. Look at the picture of the prairie dog burrow illustrated here.
 - 4 How do prairie dogs prevent flooding of their homes?**
 - 5 How do badgers keep their homes dry during a flood?**

Although the beaver, an aquatic mammal, is not a true burrower, its home resembles a burrow. The beaver's home, or *lodge*, is located in the middle of a pond. The beaver itself creates the pond by damming a stream.
 - 6 What is the advantage of**



Weaver Nest

having a home in the middle of a pond?

7 How can the beaver adjust the level of the water in the pond to prevent its lodge from being flooded?

Some burrowers, like the badger, are **solitary** and will not let other animals of the same species near their homes. Others, like prairie dogs, are **social**, and large groups of them live together peacefully. Beavers are neither strictly solitary, nor very social. One family shares a lodge for a period of time.

A bird nest is a special type of home. Most nests are designed to shelter eggs and young, and are used as homes for only a part of the year. Nests can be built from a variety of materials which are usually found in the bird's habitat. These materials determine how the nests will be constructed and how they will look. All of the nest materials used by different birds have certain benefits and drawbacks.



Tailorbird Nest

8 What are the advantages and disadvantages of the nesting materials used by the birds illustrated here?

Like many other birds, the African weaver builds its nest out of grasses. Nest construction is the job of the male, who uses a variety of knots and loops in his design. With only his feet and beak, he laces together flexible strips of grass until the hanging nest is completed.

9 In what sort of habitat do you think the weaver lives?

10 Why is the entrance to its nest located at the bottom?

An Asian bird known as the tailorbird makes its nest from a different material. The tailorbird actually sews the edges of a large leaf together to form its nest. For sewing "thread," it may use bark or cotton fibers, discarded string, or spider silk.



Hummingbird Nest

11 What does the tailorbird use as a needle?

After the leaf is sewn, sheep's wool or some other soft warm substance is found and placed inside. The tailorbird's chicks are perfectly hidden by the green leaf that forms their temporary home.

Spider silk (in the form of cobwebs) forms an important part of the nest of another bird: the hummingbird. The ruby-throated hummingbird makes a cup-shaped nest with this material, and then plasters it to a twig with its sticky saliva.

Saliva is the only ingredient making up the nests of cave swiftlets. To construct their unusual nests, the swiftlets attach sticky drops of saliva to a cave's hard rock walls and wait until the saliva dries and hardens. Layers of saliva are gradually added to this base until a sturdy nesting ledge is built. The Oriental delicacy "Bird's Nest Soup" is



Ovenbird Nest

made from these nests, which people collect in great numbers for this purpose.

The ovenbird of South America also builds a nest from soft material that dries to form a hard structure. This bird uses clay to build a hollow nest with two chambers that protect young from bad weather and predators.

12 Can you think of any problems that such a nest might present in either very hot or very wet weather?

The examples described here show how animals building homes depend on the materials available in their habitats. Grassland animals, for example, cannot build many homes using large tree branches for construction. Habitats determine the variety of materials used by animal builders.

13 What materials would an aquatic bird, such as a grebe, use to build a floating nest?