

WILD at Schools: Build the Best Nest

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Target Audience: 1st - 5th Grade

Time: 1 hour

Location: Classroom / maker lab if available / outdoor classroom if weather suitable

Pre-material:

If available within the schoolyard, you may take students to gather nest materials in advance of the program including small twigs, dried grass, pine needles and plant fibers. These materials should be stored in paper bags in a dry place to ensure the materials don't become moldy.

Books to introduce students to:

- the variety of nests and animals that build them: 'A Nest is Noisy' by Dianna Hutts Aston & Sylvia Long. Chronicle Books (March 14, 2017). (K-3).
- the lifecycle of American robins and how they care for their young: 'Robins! Robins: How They Grow Up' by Eileen Christelow. Chronicle Books (March 14, 2017) (1-4).
Look Up!: Bird-Watching in Your Own Backyard by Robert F. Sibert. Informational Honor Books (March 12, 2013).

Teacher resources, lesson plans and downloadable videos:

- <https://mpt.pbslearningmedia.org/resource/nat15.sci.lisci.nests/birds-designers-engineers-and-builders-of-nests/?#.Wg8tylWnHIU>
- Video of hummingbird building a nest (1-5th grade):
<https://mpt.pbslearningmedia.org/resource/nat15.sci.lisci.humming/hummingbird-surveyor-architect-and-builder/?#.Wg8wBVWnHIU>
- Video of engineers testing the structural strength of nests (5th grade):
<https://mpt.pbslearningmedia.org/resource/nat15.sci.lisci.structnest/the-structural-engineering-of-nests/?#.Wg8x3VWnHIU>

Background Information

More than 700 bird species breed in North America, ranging in size from tiny hummingbirds to endangered California Condors which have a wing span of almost 10 feet. Combine this diversity with the huge variety of habitats where birds breed, and the result has been an incredible range of solutions to the problem of finding mates, building **nests**, laying eggs and raising young.

Most birds time their breeding so they will be feeding their young when food is most abundant. For songbirds in Maryland, this time is usually spring and early summer. The first step in nesting is to establish a breeding **territory**, and this task is usually done by males. Non-migratory species such as mockingbirds or chickadees either maintain a territory throughout the winter or select a new territory in the spring. In contrast, migratory birds such as the Baltimore Oriole begin looking for and defending a

territory as soon as they arrive in the spring. Good territories provide potential nest sites, reliable food sources and protection from predators.

Once territories are claimed, birds try to attract mates. In most species, females do the choosing, assessing males on their quality and fitness. Males advertise their suitability with bright **plumage**, **courtship displays**, bringing food, demonstrating their nest-building abilities, singing, drumming or calling.

Once paired, females typically take on the duty of building the nest. However, in some species, both parents, or the male will build the nest. Nests provide a safe place for eggs and young birds to develop. Nests can be found almost anywhere; on the ground, in trees, in burrows, on the sides of cliffs, in and on man-made structures. Bird nests are extremely diverse, though each species typically has a characteristic nest style. Some birds such as Killdeer, do not make nests at all and instead lay their eggs in a simple **scrape** in the ground. Other birds construct nests from natural materials such as grass, leaves, mud, moss, **lichen**, fur and occasionally from man-made materials.

The total number of eggs that a female can lay in one nesting attempt varies depending on the species. Many migratory birds lay **clutches** of only 2 or 3 eggs while waterfowl, such as Wood Ducks, can lay up to 15 eggs. Ovulation and egg laying take about 24 hours, so female birds typically lay 1 egg per day. Clutch size will also be impacted by food and calcium availability, age of the female, weather and time of year. Size, shape, color and texture of bird eggs also varies greatly.

Birds **incubate** the eggs to keep them at the proper temperature for development, having a **brood patch** for this purpose. Songbirds begin incubation after they have finished laying all their eggs so they will hatch at approximately the same time. Herons and raptors among others begin incubation as soon as they lay the first egg so their eggs hatch in order. Typically, the larger the bird, the longer the incubation period.

Some species like the American Robin, can have up to 4 or 5 nests during a single **breeding season** but 2 is more common for migratory species. After leaving the nest, fledglings typically remain close to their parents for a short period while they learn to survive on their own. The first year is the toughest; in nearly all bird species, more than half of the first year birds perish.

This program will introduce students to the adaptations and lifecycles of birds, focusing on nest building and raising young, including why many tropical migrants chose Maryland as a breeding location. The program integrates STEAM objectives as students choose different materials for construction and test their properties for strength, flexibility and adhesion.

Learning Objectives

As a result of this program students will be able to:

- Explain why birds build nests and describe their different locations and types.
- Understand that different materials exhibit different strengths and weaknesses for construction.
- Understand that some birds migrate to Maryland to reproduce.

As the program is aimed at a wide age range, the focus of the program changes slightly across grades:

- 1st focus: how birds construct nests and how individuals can vary.
- 2nd focus: diversity of birds and different approaches to nest construction.
- 3rd focus: bird life cycles with a focus on breeding.
- 4th focus: birds have external structures to support reproduction.
- 5th focus: engineering a nest design that passes multiple tests.

Curriculum Standards and Science & Engineering Practices Addressed

Grade	Standard	Detail	Program Feature
1 st -2 nd	K-2-ETS1-2	Develop a simple physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.	Students design and build a bird nest that will safely hold eggs and an incubating bird.
1 st	LS1.A: Structure and Function LS3.B: Variation of Traits	Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Individuals of the same kind of animal are recognizable as similar but can also vary in many ways.	Students learn how birds use different body parts to construct their nest. Students recognize that male and female birds look different.
2 nd	2-LS4 1	Make observations of animals to compare the diversity of life in different habitats.	Students learn about the diversity of bird life.
3 rd -5 th	3-5-ETS1-1 3-5-ETS1-2	Define a simple design problem that can be solved through the development of an object and includes several criteria for success and constraints on materials and time. Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.	Students design and build a bird nest that will safely hold test 'eggs', within a limited time period and using only natural materials. Students each generate a solution and build one. Nests are tested and students suggest modifications.
3 rd	3-LS1-1	Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.	Students explore the lifecycle of birds and their unique solutions to nest building.
4 th	4-LS1-1	Construct an argument with evidence that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.	Students learn about the external structures of birds that help them build nests and reproduce.
Engineering and Science Practices		Use a model that represents a concrete event	Create a model of a bird nest.

Key Program Vocabulary

Breeding season: the period of time during each year when a species reproduces (mates and has young).

Brood patch: an area that develops on the lower abdomen of birds where the feathers drop off and the skin thickens and becomes densely populated with blood vessels; used in incubation to keep eggs and young warm. Also known as incubation patch.

Clutch: all the eggs laid in a nest.

Courtship display: specific bird behavior intended to attract a mate or to bond with a mate when both sexes display together.

Fledgling: chicks that have started leaving the nest for short periods, or have just left the nest; usually still getting parental care; starting to fly.

Habitat: the natural home of a living organism considered to have four elements: food, water, shelter and space.

Incubate: to sit on eggs in order to keep them warm and bring them to hatching.

Lichen: a fungus and a form of algae or special bacteria living together; typically forms a low crust-like, leaf-like, or branching growth on rocks, walls and trees.

Migratory: an animal that moves seasonally from one region to another.

Nest: a structure birds use as a shelter for laying eggs and raising their young.

Plumage: a bird's feathers, including the colors and patterns.

Territory: an area that an animal or group defends from other animals of the same species and uses for breeding.

Common types of bird nests:

Bracket nest: a nest built against a cliff or wall usually cup shaped.

Burrow nest: a hole or excavation in the ground or dirt cliff. Birds may excavate themselves or use an existing hole.

Cavity nest: a nest in a hollowed out opening in the trunk of a tree.

Cup nest: a cup-shaped nest; the outside is made with thick materials and the inside is usually soft to protect the eggs.

Pendulum nest: a nest built into a pendulum shape, or hanging saclike shape, usually suspended from a small tree branch.

Platform nest: a nest that is mostly flat and supported by tree limbs.

Scrape: a type of simple bird nest that is little more than a shallow depression on the ground.

Spherical nest: a nest built into a globe or ball shape with a single opening on one side.

Equipment / Materials

- Assorted balls for shaping nests
- Bird nest follow-up activities ([download](#))
- Example eggs (optional)
- Feather
- Map showing migration routes (optional)
- Nest building supplies: natural materials (such as twigs, pine needles, leaves, dried grass, bark strips and corn husks) and clay in golf ball sizes.
- [Nest support frames](#) – wire circles for grades 1-4 and pipe cleaners for 5th grade; suggest making 6 looped wire circles for younger students and 5 loops for older students.
- Paper plates for collecting nest materials and building nest (1 per group)
- Birds, nests and eggs picture pack ([download](#))
- Nest and bird matching cards ([download](#))
- Ruler
- Sets of 3 clay eggs, rulers and 3 marbles for testing nest construction and four 70 g weights for older students
- Sheets for constructing nests in a regular classroom
- STEM Sheet for [Grades 1-2](#) or [Grades 3-5](#) (download 1 per group)
- Test station signs (optional [download](#))
- True-False quiz (at end of lesson)

Before activity begins, set up nesting materials in containers and lay down sheets for easy clean-up (optional). Sort students into teams of 2 or 3 students in advance.

INTRODUCTION: 5 minutes

1. Explain to students that there are over 700 different species of birds that build nests in North America from tiny hummingbirds to the majestic bald eagle. Ask student which adaptations or traits do all birds have in common. Suggestions can include: wings, beaks, 2 legs, vertebrates, warm blooded, lay eggs and have feathers. Many birds (but not all) also have hollow bones, build nests and sing.
2. Explain that other animals also have many of these traits but only birds have feathers. Explain that any animal that has feathers is a bird. Show off an example of a feather.
3. Explain that today we are going to learn more about birds and their nests and that you are going to read some statements about birds. After each statement, students should decide if they think that fact is true or false and raise their hand accordingly as you offer the two options. Explain that we will see who is 'the last person standing'. If they guess the wrong answer they have to sit down. Have students stand before you ask the questions.
4. Use the age appropriate questions from the True/False Quiz at the end of the lesson. After the last question, explain why eagles have such large nests. Before they leave their nest, young eagles have to learn to fly so the nest needs to be big enough for them to flap their wings – and their wing span is 6-7 ft. Most birds build a new nest every year, but eagles reuse the same nest each year and just

add on another layer of sticks. Eagles live a long time, 20-30 years, so eventually the nests can get very big. Show pictures 1 and 2 of Bald Eagle and nest in Picture Pack.

HOW AND WHY OF NESTS: 5-10 minutes

5. Birds use strong but flexible materials for the structure of their nest, materials that will act as a glue to hold it together and soft material to line the nest and keep the chicks warm. Ask students for examples of each category.
 - a. Strong materials: examples include sticks, leaves, grass, vines, bark and even human-made materials such as string or plastic.
 - b. Glue: to stick these materials together, many birds use mud as a glue while smaller birds may use spider silk (and some spit).
 - c. Soft, insulating materials: moss, feathers, plant fluff and fur all make a soft lining materials.
 - i. Hummingbirds build their nest with fluffy plant fibers and spider web which are both strong and stretchy, enough for their tiny nests. They also camouflage their nests with lichens. Show students pictures 3-6 in Picture Pack to compare a cardinal nest to a hummingbird nest.
6. Ask students when do birds build their nests. Almost all North American birds raise their young in spring and summer. Ask students why they think that is. Explain that food availability is highest during this time and it takes a lot of insects to feed baby birds.
7. Many birds migrate thousands of miles to Maryland from Central and South America to nest and raise their chicks here because there are so many caterpillars and other insects available in spring and summer. Show map to illustrate distances or use picture 7 in Picture Pack. Explain that the birds spend their winters in countries like Mexico, Honduras, Ecuador and Columbia where it is warm and there is plenty of food. (If appropriate ask if any of the student's families come from these countries.) These birds are dual citizens of countries like Mexico and the United States as they spend $\frac{1}{2}$ of each year in each country. About 75% or $\frac{3}{4}$ of the different species that nest in Maryland migrate here including our state bird, the Baltimore Oriole. Show pictures 8-11 in Picture Pack.

Grade 1 extension: *Explain to students that usually just the male birds have such brightly colored feathers in order to attract female birds. In comparison, the female birds have much duller feathers. Ask the students if they can guess why this is. Answer that it is to provide camouflage especially when she is sitting on the nest incubating eggs. Show pictures pack with examples. Show pictures 12-15 in Picture Pack.*

Grade 3 & 4 extension: *Ask students why do birds have such bright plumage (their feathers)? It is usually just the male birds that have the bright colors. Female birds will choose their mate by how bright their feathers are. They do this because they want to choose a male who will be good at feeding the baby birds. Male birds need to collect more food to grow brightly colored feathers so the birds with the brightest colors will be good fathers and gather lots of food for the baby birds. Other birds sing to attract a female, while woodpeckers drum on trees with their beaks.*

BIRD NESTS: TYPES AND LOCATIONS: 10 minutes

8. Explain that although they all serve the function of keeping eggs and young safe, there are many very different kinds of nest depending on the size of the bird, where it lives and how good the bird is at flying.
9. Ask students where do birds make their nests. Explain that birds make their nests in many places. For grades 1 & 2, show pictures of eggs in trees and eggs on the ground (Pictures 16 & 17 in the Birds, Nests, and Eggs Picture Pack).
10. Have older students work in groups at their tables and give each table a set of cards of birds and their nests (For Grade 3, use numbers 1-6, for Grades 4-5, use numbers 1-8). Explain that they have to match the birds with the picture of the nest they build. Give students time to work in their groups, then check that they made the correct pairs.
11. Ask students where the different birds made their nests. Which birds made their nests:
 - a. On the ground? (Numbers 1, 5 and 8). Number 1 was 'in a mound on the ground'. Lots of water birds like ducks and geese make nests next to or even floating on lakes and ponds. Birds that live by the ocean like seagulls and the oystercatcher (number 5) often just make a scrape in the sand and hide their eggs with camouflage. Older students have the example of a kingfisher that digs a burrow in sand (number 7).
 - b. In a tree or shrub? (Numbers 2, 3, 4 and 8). Nests can be on a branch hidden among leaves like the Cardinal nest (Number 2), in a tree hole or 'cavity' that the woodpecker pecks with its strong beak (Number 2), at the top or 'the canopy' of the tree like Number 4 which is easier for big birds like the Osprey (and Bald Eagles). (Older students) Orioles (Number 8) make a special nest at the tip of a branch. This location makes it hard even for animals like squirrels to get to the nest. Orioles are skillful fliers and weavers to build these amazing nests using just their feet and beaks.
 - c. Other places?: (Number 6) Many swallows and swifts make a ½ cup bracket nest out of mud on the sides of buildings or cliffs. They are skillful fliers which allow them to build intricate nests in a place that is very difficult for a predator to reach. They have to make hundreds of trips to build the nest carrying a mouthful of mud each time.
12. Many other birds use the tree cavities made by woodpeckers or in dead trees such as owls, chickadees and bluebirds. There is sometimes a shortage of these cavities which is why these birds will use nest boxes that people hang out.

STEM CHALLENGE: DESIGN A BIRD NEST: 30 minutes

13. Tell students that their challenge is to work in groups to build a nest that can safely hold 3 robin-sized eggs. Give each student team the grade appropriate Bird Nest Challenge sheet and a plate with a sample of each nest building material (leaves, bark, sticks, dried grass, corn husks and pine needles). Give each group the grade appropriate base structure for their nest (6 looped wire nests for younger students, 5 looped wire nest for older students and/or challenge 5th graders to make a frame using pipe cleaners. Remind students that birds can only use their feet and beak to build a nest, but they are going to have the advantage of using their hands.
 - a. **For Grades 1-2:** Have students make nests that will safely hold 3 eggs.
 - b. **For Grades 3-5:** Challenge students to make a nest large enough to hold 3 eggs and deep enough to both keep them safe and to allow a female bird to sit on the eggs while they are being incubated so the eggs must sit below the rim of the nest. The nest should also be self-

- supporting and should not let the eggs fall through. They can also test that the nest will hold the weight of 4 birds (3 young + 1 parent) each weighing 70 g.
- c. Explain that as a group, they should test the properties of each material for strength, flexibility and ability to fill the holes to decide which materials they will use to build their nest. They can then send one of their team members to collect the materials on their list on their plate. Emphasize they will not need many materials – less than a plateful!
- 14.** Explain to students that birds use their rounded bellies to help shape the nest as they build. As a human alternative, students may use a ball to help shape their nest. They will need to share the ball with other groups.

Grade 4 extension: *Mention that female birds have a special brood or incubation patch, an area on their tummy without feathers, to keep their eggs warm during incubation.*

- 15.** Nests should be built on a base structure:
- a. **Grades 1-4:** Wire frame - demonstrate to students how to shape the wire, they should use this to build on top of a paper plate. Suggest making 6 looped wire circles for younger students and 5 loops for older students.
 - b. **Grades 5:** Build their own frame with 5 pipe cleaners.
- 16.** Once students have completed their nest, they should bring it on the paper plate/bowl to the testing stations (set up 1-2 sets depending on class size). Give the students a 10 and 5 minute warning for when their nest must be ready for testing.
- a. **Station 1:** Students check the nest to see if it is large enough to hold 3 eggs. The eggs must sit below the rim of the nest so they can't easily fall out (students should put a ruler across the top of the nest and make sure the eggs don't touch it).
 - b. **Station 2:** Students test if the nest is self-supporting by lifting off the paper plate/bowl.
 - c. **Station 3:** Students check if the nest will hold eggs securely. Add a marble to nest and gently rock to make sure they don't fall through.
 - d. **Station 4:** Older students check if the nest will support the weight of the 4 birds.
- 17.** If students have completed and tested their nest, they should clean up their supplies and can start to complete the back of their nest challenge sheet while any remaining groups complete their nests. Students should reflect on the design process, whether their nest was successful and how they might modify it.
- 18.** If student teams are keeping their nests, have a designated place for all the nests to be placed. If students choose not to keep their nests, encourage them to disassemble to reuse parts for future activities.

CONCLUSION: 5 minutes

- 19.** Ask students if it was easy or hard to build a nest. A real bird would only be able to use their beak. Show students an example or picture of a real bird's nest. Explain that a bird nest contains at least 400 small twigs and pieces of grass. Ask students how long they think it takes birds to build their nest. Explain that most birds take 2-6 days (compared to the 30 minutes they had). Even for birds, the first nest that they make may not be very good. However, a bird may build 10 or more nests during their life, so they get lots of practice to improve!

- 20.** Ask the students what a bird would need to consider about where they choose to build their nest. Suggestions might include: a strong branch, out of the wind and rain (shelter), hidden from predators. Explain that the parents will also need to find lots of food for their growing family so there needs to be a good source of food. Each baby chickadee needs 1000 caterpillars in the 2 weeks that it is growing so lots of bushes and trees are important.
- 21. *Optional extension:*** Ask if their schoolyard is a good place for birds to nest. Does the schoolyard provide the food, water, space, and cover that birds need? Ask the students if they have seen birds in the schoolyard. If they have, then it is providing the habitat they need. Some birds like the American Robin are well adapted to living close to people so they may nest there. Large grass fields provide robins with lots of opportunities to find worms.

Student Assessment

Students should complete the STEM challenge sheets.

Follow- Up Activities

[Bird Nest Follow-Up Activities](#) (PDF).

Extra Information

Answers to common questions with nest program.

Q. If you return a baby bird (that is featherless or still growing its feathers) to its nest, the parents will smell your scent and reject it.

Parent birds do not recognize their young by smell. If you find a nestling on the ground, it's okay to return it gently to its nest, which is almost certainly nearby.

Q . If you find a baby bird hopping on the ground and crying, you should try to feed it.

If you find a tiny nestling, try to put it back in the nest as soon as possible. If you find a **fledgling**, unless there is some immediate danger such as a cat about, it is actually best to leave it alone. The parents are probably close by waiting for you to leave. Keep your pets away from it.

Inform students that while nests are being used, the nests are protected by law. It is not a good idea to touch even an old nest though as they might contain mites or lice.



Larry Hogan, Governor

March 2019
Wildlife and Heritage Service
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Annapolis, MD 21401
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Jeannie Haddaway-Riccio, Secretary

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Build the Best Nest 1-3

True or False Quiz Questions

Have students practice 'True or False'. Q. All birds have feathers. A. Is true so all students should raise their hands and stay standing.

A. True or False? **All birds lay eggs.** (True –All baby birds hatch from an egg.)

B. True or False? **Most birds live in their nests year round.** (False - Nests are built to keep eggs safe and raise their young and are not usually used after the breeding season is over.)

B. True or False? **All birds build nests.** (False - Some birds don't build a nest. Ask students if they know where penguins who live in the Antarctic keep their eggs – someone usually knows that Emperor penguins hold their eggs on their feet as they stand on the ice.)

D. True or False? **Most birds build their nests in spring.** (True – they have their young in spring because that is when there is the most food available, especially caterpillars and other insects.)

E. True or False? **The smallest bird eggs are laid by hummingbirds.** (True – They are as small as a jelly bean.)

F. True or False? **A nest can weigh as much as a car.** (True – Bald eagles reuse the same nest and keep adding more sticks year after year until it can weigh as much as a car.)

Build the Best Nest

True or False Quiz Questions 4-5

- A. True or False? **All birds lay eggs.** (**True** –All baby birds hatch from an egg.)
- B. True or False? **Most birds live in their nests year round.** (**False** -Nests are used for laying eggs and raising young and are not usually used after the breeding season is over apart from some birds that make holes in tree trunks that will also use nests for winter shelter.)
- B. True or False? **All birds build nests.** (**False** - Some birds don't build a nest. Emperor penguins hold their eggs on their feet; the Peregrine Falcon will lay its eggs right on a ledge; the Brown-headed Cowbird lays its eggs in the nests of other birds.)
- E. True or False? **The egg yolk (yellow part) grows into a baby bird.** (**False** - The yolk provides food for the growing baby bird, which is at first just a small dot of cells attached to the yolk.)
- F. True or False? **Chicks can breathe inside their eggs before they hatch.** (**True** - The eggshell is porous and the growing chick needs to breathe air. Gas exchange happens through the shell.)
- G. True or False? **A nest can weigh as much as a car.** (**True** – Bald eagles reuse the same nest and keep adding more sticks year after year until it can weigh as much as a car.)