# Prologue

Hello,

If you are reading this then you are about to embark on a wonderful exploration into space sciences with your cub scout den, patrol, or pack. I have put together this document to outline what you can cover, who you can reach out to, and how to make it fun. I hope your experience is a success and that the youth come out of this with a newfound love for science and the tools we use to explain the world we live in and beyond.

If you are new to the STEM/NOVA program with BSA, let me just cover some of the basics. STEM stands for Science, Technology, Engineering, and Mathematics. They are the core components in logic and deductive reasoning in our world today, a skill that has been lost by most. For generations the US was the leader in many of these fields, but we have begun to stray from this path and it only hurts us as a nation. Children, myself included, were raised to believe that science and math were hard and that they weren’t important and nothing could be further from the truth. The BSA has always incorporated STEM components in their merit badges and advancement criteria, and the NOVA awards utilize those existing awards as well as some additional steps. **Wild!** focuses on nature and the plants and animals in them. All NOVA awards follow these basic requirements:

1. Research for an hour. It doesn’t matter how (reading, video, movie etc), but it should be specific to the subject.
2. Earn one of the related rank’s elective Adventure loops or pin, or do a group activity supplied. Adventure Loops earned for another award should not count.
3. Engage in a learning activity. This may have one or more facets, but is designed to involve the youth in research, critical reasoning, and presentation of their discoveries.
4. Visit somewhere where the subject in question is being used or performed.
5. Follow up with the NOVA counselor on what was learned.

I have incorporated a slideshow presentation and handouts for the youth that will cover every requirement of every question. For **Wild!**, you will perform all of steps 1, 2, 3, two of the requirements of 4, and one of the requirements of 5. The following pages will help you to talk about the different subjects, provide questions that you can ask to get the youth thinking, and help to answer questions that may be asked.

NOVA awards, on average, should be accomplished in about a month’s timeframe. This gives the youth a chance to do their research, create their presentations, and discuss what they are learning along the way. Engage the youth in whatever activities you would like to in an environment that works for them, but they will learn best by doing. Follow the Leading EDGE and Teaching EDGE philosophies. I wish you the best of luck in your adventure.

Corey Peoples

Pack 455, NSC, C250-17-1

# Slide 1 - Beginning

Introduce yourself and the excitement with the youth. Why did you choose to lead this award? What’s your passion for nature?

# Slide 2 - Agenda

Read verbatim or paraphrase:

The goal of this STEM course is to teach us what wildlife is and what role we as humans play with it. We will start off by selecting a book from the library, or watch a movie [akela, you decide]. Then there is an adventure loop or group activity that we will earn later for your rank. We will then learn about wildlife, and dig into some of the different types of nature habitats for plants and animals. Finally, we will get to go on an adventure and explore a habitat. Throughout it all, let’s keep discussing what you are learning.

# Slide 3 – Learn for an Hour

Read verbatim or paraphrase:

Our first requirement is going to be to learn for an hour. I would like everyone to [Join me in watching a TV show or movie | Select a book from the library | select from some nature Youtube videos]. During this learning process, I want you to tell me about what wildlife sciences you see and how it benefits the animals and people in it.

# Slide 4 – Group Activity – Rank Adventure

If you are doing a rank adventure, use this slide. If the rank adventure does not work for your group because it was already earned for another award or your group is of mixed ages, move on to slides 5 or 6. Read verbatim or paraphrase:

We are also going to earn an adventure loop. There are a few to choose from, but the adventure loop we selected is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for you. That will be done (now, later, on another day, at home, etc). While we work on this adventure loop, I want you to keep in mind what nature science is used in it.

# Slide 5 – Group Activity – Water and Weather

IF a rank adventure is not an option, you can use this group activity. Read verbatim or paraphrase:

Our group activity this month will involve the water and the weather. Let’s start by talking about the water cycle. Since plants and animals need water for living, it is important to know about how water travels and what effects it has. Water comes in 3 forms: solid ice and snow, liquid water, and gaseous water vapor. As it sits in the lakes and rivers, the sun beats down on it and heats it up. Large bodies of water heat slowly, but small bits of the water heat up and evaporate into water vapor. This water vapor travels up in the air and bonds to other water vapor droplets in the form of clouds. As the clouds get larger and heavier, they begin to rain the moisture back down. This water then lands on the ground and either runs to the nearest stream or lake, seeps into the underground water tables, or evaporates again. Most plants absorb ground water from runoff of the underground water tables, but animals have to consume the water from above ground sources. Let’s draw that out now.

When there is too much water in the air, we get storms, but how can we predict the way that storms come? Meteorologists use tools to gauge the current state of the weather, and that can help to figure out what might be coming. Sudden drops in air pressure may mean that a storm is on its way. We are going to construct a device to measure \_\_\_\_\_\_ (see weather stations on the next few slides). Only one device is needed, but you are welcome to build more if you like at home. On your worksheet, you can keep track of your readings and compare them to the actual weather forecasts, and then compare the results after a week. Let’s take a look at the tool we are going to build.

# Slide 6 – Rain Gauge

Read verbatim or paraphrase:

The first actual tool we can build is a rain gauge. This collects water or snow from a storm and tells us how much fell. It is useful for predicting future events because we can tell if a rainstorm lasts for 2 hours, we can probably expect 3 inches of water. If it lasts longer, more water, and that can mean more flooding. To make this we will take a clear plastic cup with straight edges and a flat bottom, and cut the top off of it. We can either throw the top away or invert it so that it funnels the water down. Next, we put some tape up on the side, and we use a ruler and marker to mark the size from the bottom. Now, we can use this to see how much rain fell. Because it has straight edges, we can know the correct size because the opening is as large as the bottom, so it collects the same amount of water. All we have to do now is set it outside so it can collect rainwater.

# Slide 7 – Barometer

Read verbatim or paraphrase:

How strong are you? Do you think you can carry 30 pounds of weight on you for the rest of your life? You do that already! Our atmosphere is air, and air is “stuff.” The more stuff you have, the more it weighs. This marker is pretty light, but lift the bag of markers. Is it still light? Or does it feel a lot heavier? Between the ground we live on and the edge of space, the air is pulled down to the Earth’s surface and lands right on top of you, but it isn’t even. Sometimes we have what is known as low air pressure which means there is less air. Sometimes there is more. It’s based off of how much the sun has warmed the Earth and how much water is in the atmosphere, but these different pressure systems can affect our weather. When the air pressure is low, we are more likely to see stormy weather. High pressure gets rid of clouds and allows the sun to come out. Let’s build a barometer so that we can measure it.

We will start with our glass jar. It has to be sturdy so that the walls don’t bend with the changing air pressure. Next, we cut the bottom part of a balloon off and put the top part of the balloon over the jar. We want it as flat as possible. Since the elastic from the balloon can change with air pressure, it will be pushed in when the air pressure outside increases (but the air pressure in the jar doesn’t change), and low pressure will make it bulge up. We can then take our straw and using super glue or tape, attach it to the center of the jar. The longer the indicator is, the more accurate it is. Now that we have our indicator at our current position, let’s set up this indicator stand and mark where we are right now. That will be roughly our middle line. If it goes up then we can expect sun. If it goes down, we can expect rain. Keep in mind, this won’t change second by second, you are looking at hours or days to change, as the air systems move around.

# Slide 8 – Weather Vane

Read verbatim or paraphrase:

It’s pretty common, especially out in the countryside, to see a weather vane. This tells us which direction the wind is blowing. It’s very useful for places like an airport where the wind can make a difference in how the plane lands.

To do this, we need to take a straw and put two triangles on either side, both pointing in the same direction. This will help to direct the wind around it and thus make it easier to move. Next, we will stick a in through the exact middle, and that will go into the eraser of an unsharpened pencil. This will allow it to spin relatively freely.

The pencil should go into a cup which needs to be secured to a base plate. Use rocks or sand to make it heavy enough that it won’t blow away in the wind.

Also pick a point on it and mark that as North, then do south, east, and west. That way, when you set it up to take wind readings, you can look down over it and see what direction it is blowing.

# Slide 9 – Thermometer

Read verbatim or paraphrase:

A thermometer needs no introduction. Temperature is as universal as water. We know when it gets hot and when it gets cold, and we plan appropriately for clothing and activities. For this exercise, we are going to build a thermometer. To do this we need a jar. This jar will be filled about a quarter of the way with rubbing alcohol. Rubbing alcohol expands with changes to temperature, so it makes it easy to see. We will put some food coloring in so that it is easier to see it in the straw. Now, we put a hole in the lid, feed the straw through the hole, and seal the hole. This seal is airtight which means that the only opening is from the straw’s top. As the air temperature increases, the rubbing alcohol will expand and move up the straw.

Now, I do need to give you a warning. Rubbing alcohol is not the same as the alcohol in adult drinks. It is a cleaning solution and drinking it would be poisonous, so don’t do it. Let’s just leave it alone to be our thermometer.

# Slide 10 – Anemometer

Read verbatim or paraphrase:

Now here’s a funny word: Anemometer. This tool helps meteorologists measure wind speed. Wind speed is the difference between a nice cool breeze on a hike, and getting smacked in the face by things blowing in the wind. To make this, we are going to use 5 disposable cups. One will be at the center and act as a pivot point, and the other 4 will be out to catch the wind like a windmill. We will cross 2 dowel rods as an X through the pivot cup, and make a hole in the bottom of the pivot cup for the spindle. This can be put into a plastic bottle so that it is off if the ground. Since one of the outer cups is a different color, it will be easy to count how many times it spins in a 30 second window. Let’s test it with a fan!

# Slide 11 – Group Activity – Natural Resources

This group activity pertains to the rest of the presentation, so if the rank and other group activities aren’t an option, you can use this and I would recommend after the rest of the presentation is done. Read verbatim or paraphrase:

Let’s define now what Natural resources are. These are items that exist normally, so plants and animals, rocks and minerals, sun, wind, water, soil… can you think of anything else? What do we need to do protect them and why would we want to? How can we protect plants and animals? How about our minerals and water?

Let’s now draw out a food chain with at least 5 plants and animals. Show how the producers and consumers interact.

Finally, let’s look up one of Minnesota’s endangered species. I’ve got some books / Online Resources from The US Fish and Wildlife Service’s website. <https://www.fws.gov/midwest/endangered/lists/minnesot-spp.html>

# Slide 12 – Explore Wildlife

Read verbatim or paraphrase:

Let’s talk wildlife. This NOVA award focuses on life and biodiversity, and the role that we play in the environment. For this section, we will answer the questions what is wildlife? How does it differ from Domestication? What are the different ways that we classify plants and animals when it comes to understanding the environment. We will also draw out our favorite local animal and talk about how it fits into our ecosystems.

# Slide 13 – Wildlife Vs Domestication

Read verbatim or paraphrase:

(click for animation) Wildlife is defined as all living things, especially the animals, that are not human or domesticated, like this watermelon. This is how watermelons grow naturally. So to understand the full definition of wildlife then we need to define domestication, (click for animation) which is to adapt an animal or plant to life in association with or to the advantage of humans, like this image of watermelon shows. The red watermelon is tastier and juicer and we were able to cultivate it to make that feature the trait that stands out the most. We domesticated wolves so they will live with us and protect us as dogs. We domesticated other pets, animals for farms, cultivated plants for growing either in gardens or in farms, and made things that we wanted the dominant features.

# Slide 14 – Wildlife Vs Domestication

Read verbatim or paraphrase:

Let’s explore what we think is wildlife and what we think is domestication.

Call out the animal and click on it. Have the scouts guess which is truly wildlife and which we have domesticated.

# Slide 15 – The Food Chain

Read verbatim or paraphrase:

In nature sciences, a topic that is often talked about is food. Different plants and animals get categorized and drawn out how they get their energy. It begins (click for animation) with an energy source. In our case, all energy that every exists comes from the sun. Even the gas and oil that we use came from old life that was powered by the sun. The sun shines down its rays and heats our planet and our oceans, and (click for animation) producers find a way to convert that light into chemical energy through a process called photosynthesis. The green leaves soak up the sun and produce energy that goes to the rest of the plants. (click for animation) Then there are consumers. These are creatures that convert producers and consumers into chemical energy, by eating.

# Slide 16 – The Food Chain

Read verbatim or paraphrase:

So consumers get their energy from either producers or other consumers. Take this image here of a lion trying to eat a zebra. The (click for animation) predator in this case is the lion, who is looking to consume another animal. The (click for animation) prey is the animal that is being consumed. So a food chain here is Grass grows, Zebra eats the grass, Lion eats the zebra.

# Slide 17 – The Food Chain

Read verbatim or paraphrase:

But let me ask you this. (click for animation) Who is at the top of the food chain? In this fight, 2 predators are battling, but both have an equal chance of winning. And because animals can eat multiple other types of plants and animals, there isn’t a straight chain of consumption. That’s why (click for animation) we use a food web, to show that there isn’t a single animal on top. The apex predators, the best predators, can eat whatever they want, including other predators.

# Slide 18 – To Do

Read verbatim or paraphrase:

So on your worksheet, let’s define what wildlife is. And how do the different producers, consumers, predators, and prey interact with each other and fit in the food web?

There is a larger box on your worksheet. Draw out your favorite local animal, and how does it fit in the food web? Squirrels eat acorns and nuts from the trees, but they also burry the acorns which grows new trees to create new producers. The squirrels also make a tasty treat for the foxes and wolves in the area. Take 5 minutes to draw an animal out and then we will share.

# Slide 19 – Act Like a Naturalist

Read verbatim or paraphrase:

The last section we will do in the class is to select 2 different Naturalist blocks and work on the requirements for them. I have selected \_\_\_\_\_\_\_ and \_\_\_\_\_\_ for us to do.

Skip ahead to the slides to work on that you have selected, and do all of the requirements for each.

# Slide 20 – Threatened and Endangered Species

Read verbatim or paraphrase:

Most of the species of plants and animals that have ever lived are extinct, meaning they are no longer around. Some have evolved and adapted to a new way of life, whereas others have been killed off by changing environments. Today we track animals to see what their populations are at, and can see if they are dwindling or not. For this section, we are going to talk about the difference between a threatened and an endangered species, and what effects humans have on animal populations

# Slide 21 – Threatened Species

Read verbatim or paraphrase:

A threatened species is defined as a species which is likely to become an endangered species soon, meaning that we can see the population is getting smaller. This can happen from diseases like what is happening to the Elm trees and to the honeybees, or it could be from human intervention such pollution or as a concept called Urban Sprawl.

# Slide 22 – Endangered Species

Read verbatim or paraphrase:

An endangered species is one that is currently in danger of extinction, meaning the population is so small and spread out that it is more likely they will all die than regrow unless we can help them.

# Slide 23 – Humans Affect

Read verbatim or paraphrase:

How do humans affect the animal population? Many of the species that are or were endangered are at that because of hunting. Rhinos and Elephants have long tusks made of ivory, which has long been an expensive luxury. Hunters can make a lot of money from it, so they kill the rhinos and elephants and just take the tusks. Then they move on to the next one. This term is called Poaching and it is illegal in most countries. Another thing that humans do is live. We like to live in cities, and that requires us to develop new houses, parks, and shopping centers. These areas tend to need to get rid of trees and pave the ground, so all of the animals that had homes in these parts now need to find a new home. The further away they get, the less like what they are used to they have to live with. In this situation, animals need to adapt to the changes, or they won’t be able to get the food and water that they need to live. Pollution is another big way that humans affect populations. Littering and chemicals are a big problem. Gas that is used to make your car move might be beneficial to the car, but burning it creates smog in the air, and a lot of cars running together creates a lot of smog, which can make it harder for animals with small lungs to breathe. Gas also would be toxic for any animals that ingested it, or plants that absorb it from the ground. Plenty of other chemicals out there are bad for the environment too.

# Slide 24 – Humans Help

Read verbatim or paraphrase:

But unlike our past, we have tools and knowledge that can help us to be better with our environment and save endangered species. We do this by setting up national parks and nature preserves where we can ensure their safety. We can reduce the need for poaching. One of the coolest ways that this is done is to use pink dye on the tusks of elephants and rhinos. It isn’t harmful to the animal, and it makes the ivory worthless, so poachers won’t make any money from it. Most countries also make poaching and selling of poached goods illegal. Nature scientists also use tracking and tagging to study populations and migration patterns. We can keep our world clean, too, by reducing waste so that animals and plants can grow as healthily as they can. Why do you think visiting wildlife refuges would be helpful (funds operation, encourages learning, etc)

# Slide 25 – To Do

The youth worksheet document has 1 page dedicated to this topic. Print it out 10 times per scout. Read verbatim or paraphrase:

Now it is your turn. I have a lot of images of endangered species in Minnesota. Pick 10 and make a presentation with what they are and where they are found. Tell us about why these are endangered or threatened, and how the environment would change without them. Finally, how can we as Minnesotans help to preserve the species.

# Slide 26 – It makes you Wonder

Read verbatim or paraphrase:

Since most of the species that have ever existed have gone extinct over the millions of years life has been around, it can be hard to think about the effects. If the dinosaurs were still around today, do you think that we as humans would be able to become the dominant species? We are the first species to be able to see ecosystem changes, and have the ability to make changes to our environment to help, so we try to save what we can. The more we learn, the better we are. Do you think we will ever get to a point that we can save every species from going extinct?

# Slide 27 – Invasive Species

Read verbatim or paraphrase:

One of the more common things you will hear about when you hear about ecosystems is something called an Invasive Species. This is a plant or animal that is not native to the area, and its introduction to an area is going to be harmful to the plants or animals that do exist there normally. Sometimes this is done on purpose, and sometimes it is an accident. Let’s look at some examples

# Slide 28 – The Cane Toad

Read verbatim or paraphrase:

The Cane Toad was introduced into Australia in 1935. The goal was to have it eat the beetles that were affecting food growth. It worked, but there was a side effect that people didn’t know about. When the native creatures would eat the toad, their slime was poisonous and it would cause the animals to die. As a result, the animals stopped trying to eat it, and the toads multiplied and spread. Currently they live in the northern and eastern coasts of Australia and swarm around in the same way that birds flock in the sky here. Nothing native can control it, and so they eat and spread around.

# Slide 29 – Kudzu

Read verbatim or paraphrase:

Kudzu is a plan that was originally from Japan, but introduced to the USA in the 1930s for soil erosion control. This is because the vine has deep roots and can grow fast. The problem is it grows too fast, and soon it began to over compete for resources and take over all of the soil, water, and sunlight that other plants can. It grows up to 1 foot a day, so it is really hard to get rid of. Humans that work on kudzu control have to cut it at the root system daily so that it can’t keep growing and absorbing more sunlight.

# Slide 30 – Zebra Mussels

Read verbatim or paraphrase:

The land isn’t the only place where invasive species thrive. Minnesota has a serious problem with a clam called Zebra Mussels. These are hitchhikers that latch onto boats and spread from lakes and rivers that way. They eat, and they spread, and they repeat. This wasn’t done on purpose either. They are originally from eastern Europe, and they likely came to the US by hitching a ride on ocean ships. Once here, they would latch onto shipping and recreational boats and move around. The problem with these is they take over everything, like this shopping cart covered in hundreds of mussels. They clog drains, they cut plants and animals, and they eat all of the food that native mussels eat, which endangers the native mussels.

# Slide 31 – To Do

The youth worksheet document has 1 page dedicated to this topic. Print it out 5 times per scout. Read verbatim or paraphrase:

Now it is your turn. I want you to find 5 invasive animals and tell us about them. How do they spread? How do they damage the ecosystem? What can be done to get rid of them? And then, write down why humans should care about invasive species.

# Slide 32 – Makes you Wonder

Read verbatim or paraphrase:

It is necessary sometimes to introduce plants and animals to new environments, especially if we are trying to preserve them. We then have to ask if it is right or wrong to do it. Thanks to technology and science, we can understand how spreading plants and animals around can help or can hurt, but because so many things can impact the growth of animals it is still hard to see. We even have better tools that we can use to fix germs and invasive species from spreading. Why does this matter? Think about the future. We want to explore other planets. We already do that with some robots on Mars, but even the smallest germ could have huge impacts on the ecosystems we visit. We have to realize how our presence will affect the places we explore.

# Slide 33 – Visit an Ecosystem

Read verbatim or paraphrase:

We are going to visit a nearby wildlife ecosystem. While we are out, I want you to identify plants and animals in the area. Afterwards, using the worksheet provided you can draw a food web and mark the various producers, herbivores, omnivores, carnivores, decomposers, and scavengers. Afterwards, we will discuss how plants and animals fit into this food web, and how each gets their energy.

# Slide 34 – Investigate an animal

This section will require arts and crafts materials. It would help to have an example ready before the meeting, so the scouts can see and build off of an idea. Read verbatim or paraphrase:

We are going to look at a local animal now, learn about it, and create a habitat for the animal. We are also going to explain what we put in the habitat that it needs to survive.

# Slide 35 – Minnesota Fish

Read verbatim or paraphrase:

Minnesota is the land of 10,000 lakes, so we have a lot of fish to go out and catch. The most common ones are Bass fish, some of the sunfish varieties, Northern Pikes and Muskies, and Walleye. Pick a fish and do some research on what type of environments they thrive on. Think about the food that they eat and the places they like to hang out in.

# Slide 36 – Minnesota Birds

Read verbatim or paraphrase:

We’re no strangers to birds. Minnesota has many types of birds, from hawks and woodpeckers, to cardinals and blue jays. Think about all of the birds you have see in your life. What do birds do? Where do they live? What do they eat?

# Slide 37 – Minnesota Reptiles

Read verbatim or paraphrase:

Minnesota is ha tough place for a reptile or amphibian to live. We have a lot of snow that covers our area for several months, and it is cold for several more. Still, we have several types of reptiles that live in our area. Some frogs and toads, turtles and tortises, common snakes like the Gartner snake, and a few salamanders. What sort of areas do these animals like to live in? What do they eat? Where do they sleep? What do they do for the winter?

# Slide 38 – Minnesota Mammals

Read verbatim or paraphrase:

It’s hard to not think of mammals when you think of animal life in Minnesota. We have such an abundance because of the vast forests and prairies in the state. We see evidence of the mammals everywhere, from squirrels and rabbits, racoons and deer, and if you’re lucky you can see a moose or a bear from a distance. What do these animals have to do to live? Where do they like to live and what do they like to eat? How do they cope with the changing temperatures and city life.

# Slide 39 – To Do

Read verbatim or paraphrase:

Now it is your turn. Let’s make a diorama and show the animals habitat. I can scroll back if you want to look and pick an animal, or we can talk about it. Tell me what is needed for food and shelter for each of them, and what their weather plan is? Do they tough out the cold? Do they sleep for months? Do they move to warmer weather? Let’s design and share it.

# Slide 40 – Wild Neighbors

Read verbatim or paraphrase:

We are going to make a bird feeder and watch it for a week to see who visits it. I have the bird feeder kits here, and we are going to assemble it, keeping safety as the most important step.

Now that our birdfeeder is finished, we are going to fill it with birdseed and some water and you can put it up in your yard. Watch it for 2 or 3 weeks and keep a journal of what you see. Can you identify who visits it? Birds? Animals? Insects? When we meet back up, let’s discuss what we found.

# Slide 41 – World Conservation Award

Read verbatim or paraphrase:

The world conservation award is given to scouts who show an interest in preserving the environment. This involves working on a conservation service project, and then earning some elective adventures that highlight nature preservation. We are going to work on these awards.

# Slide 42 – Visit

Read verbatim or paraphrase:

Next week/ On this date, we are going to take a trip to \_\_\_\_\_\_\_\_\_\_\_\_\_’s nature preserve. While we are there, we are going to look at the wildlife that exists for both plants and animals. We are also going to want to talk to a naturalist and ask them about some of the work that they do. What do they do about endangered and invasive species within their park? How can park visitors help? Why did that person choose to get into Nature Sciences? And what schooling did they have to do in order to get into that role?

# Slide 43 – Discussion

Read verbatim or paraphrase:

Well, I had a ***wild*** time with you folks on this topic! Who learned something? Did you learn what wildlife is, and why having multiple plants and animals available is important? What things can happen with new species being introduced into an environment, or with old species being removed from an environment? What can we do to help?

# Final Thoughts

Akela,

Thank you so much for running this. I hope that you have had as much fun as the youth. Be sure to turn in whatever documentation is required to your advancement chair so that the youth earn both their NOVA award and their adventure rank.