# 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. **Down and Dirty** focuses on Earth Sciences: Geology, environmental sciences, weather, and others like 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. Perform a group activity. This could include a rank based elective, or if that is not an option then one of 2 possible group activities related to the award. Electives earned for another award cannot 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 **Down and Dirty**, you will perform all of steps 1 and 2, 3, 4, and 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 technology?

# Slide 2 - Agenda

Read verbatim or paraphrase:

The goal of this STEM course is to teach us how technology is used in everything and our everyday lives. We will start off by selecting a book from the library, or watch a movie [akela, you decide]. Then there is an adventure loop that we will earn later for your rank. For number 3, we will discuss a topic of earth sciences. [Next week/another timeframe], we will visit a location where earth sciences are being done and talk to someone who works in that career. Through it all we will discuss the importance of earth sciences.

# Slide 3 – Learn for an Hour

There is an attached page in the Youth Worksheets document that covers the questions to follow up with reading. Be sure to print this out for each of the youth. 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 earth science Youtube videos]. During this learning process, I want you to tell me about what science you see and how it affects people.

# Slide 4 – Group Activity – Rank Adventure

If your group is a den or patrol, or all youth is of the same rank, then this is an option for you to do. 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 science is used in it. How does what the book covers relate to you?

# Slide 5 – Group Activity – Geology

Choose this if slide 4 is not an option for you. This consists of slides 5 and 6. Read verbatim or paraphrase:

For our group activity, we are going to look at Geology overall. Geology is the study of the Earth, and the way that we study the Earth is by the rocks and minerals. Rocks are classified by how they are formed. Let’s move to the Rock On section to learn about these (Slides 13-16). Ok, now that we have learned about them, lets collect some rocks. Find 3 different types of rocks and tell me what they are based on how they formed. Let’s also collect 3 minerals and tell about these.

Now, let’s pick a mineral and we can do a test for hardness on it. For this test, we need a penny, an iron file, and a piece of glass. First, we try to scratch our mineral with our fingernail. Does it scratch? Then this has a hardness value of 1 to 2 and is considered fairly soft.

Now, let’s take our penny and try to scratch it. Does it scratch easily? Then this has a hardness value of 3.

Let’s take our file and try to scratch the mineral with it. Does it scratch? Well then, this has a hardness value from 4 to 5.

Finally, let’s try to scratch the glass with the rock. If the glass does not scratch, it is a 6. If the glass does scratch, it is a 7.

Hardness values 8, 9, and 10 are unlikely to be found as those tend to be the more rare and expensive minerals like diamonds.

# Slide 6 – Explore Earth Sciences

Choose this if slide 4 is not an option for you. This consists of slides 5 and 6. Read verbatim or paraphrase:

We could also use chemistry to study rocks and learn about their composition. There is a famous story of the Carthage General Hannibal who took an army from North Africa and invaded Romain Italy by walking up through Spain and France. The Romans never expected Carthage to attack from this way, since they were much more likely to sail up across the Mediterranean Sea. The problem when moving an army through mountains is that many of the pathways were blocked, especially for their “Calvary” which used elephants instead of horses. Huge boulders of Limestone would block their path. What Hannibal did was use chemistry to weaken the rocks. Knowing that the limestone boulders would fizzle and break down when vinegar was poured on them, he and his army would heat the rocks and weaken them, then they could be pushed out of the way. It was a long and slow process, but he was able to get into Italy and take the roams completely off guard. His ingenuity and knowledge gave him a distinct advantage in his battle. Today, chemistry is used to identify specific rocks and minerals, as well as learning about the composition of the atmosphere from thousands to millions to billions of years ago.

# Slide 7 – Group Activity – Paleontology

Choose this if slide 4 is not an option for you. Read verbatim or paraphrase:

For our group activity, we are going to study the past. Life has been around for millions of years, in the form of simple single cell life, all the way to the great Dinosaurs, and now to us. Each time life has come and gone, records of it are left. We call these records Fossils and they are what remains when life slowly turns into stone underground. Usually this is just the bones, but some of life’s soft tissue can imprint on the stone around it. Let’s look at one way that paleontologists can view fossils.

(Option 1 of 2. This will require making a mold ahead of time, and then using something like Plaster for a permanent mold, or chocolate or gelatin for a delicious edible mold).

We are going to make a fossil cast. A cast is a recreation of the object that was fossilized. These are made from fossil molds, which is the shape of the object that was fossilized. I have already prepared a mold of a fossilized \_\_\_\_\_\_\_\_\_\_\_\_. Let’s begin by preparing our mold solution. In this case, we are going to use \_\_\_\_\_\_\_\_\_\_. Now that it has been prepared, let’s pour it in the mold. This will take some time to dry, so let’s come back later!

(Option 2 of 2. This will require a bucket, sand or dirt, and small toys or items inside of it. Fill the bucket slowly and put the toys or items in random places. The scouts can then use tools like spoons and hard-tipped brushes to excavate).

We are going to do a dinosaur dig. We will start with this patch of land that has been approved for us to dig at, and let’s see what we can find. Use this shovel to scoop away the land, and when we find something we can switch to a lighter tool. Remember, fossils can be fragile and break really easily, so we aren’t looking to dig it all out, just brush it away slowly to find our fossils.

# Slide 8 – Explore Earth Sciences

Read verbatim or paraphrase:

Now it is time to cover our learning adventure. For Down and Dirty, there are a few topics to choose from. We are going to cover [pick one from the list, and click on it to go to that topic].

# Slide 9 – Volcanoes Erupt

Read verbatim or paraphrase:

Volcanoes can be big and scary, but we learn a lot about how our planet works from them. Volcanoes can form from all sorts of conditions, and they create and destroy land. How does this impact us? Let’s have a look!

# Slide 10 – Formation of Volcanoes

Read verbatim or paraphrase:

Scientists have found 4 different common types of volcanoes and they all have different properties. The first is a lava dome. These small volcanoes release very thick magma slowly that creates a build up. If you’ve ever poured pop into a cup and it started to overflow, that would be similar to how lava domes work. Over time, they build up into a very roundish blob of mountain.

The next type is a shield volcano. This type gets its name from the fact that it looks like a shield from far above. The lava flows very quickly and erupt often, but the eruptions are small so it is unlikely to cause damage. The Hawaiian islands are shield volcanoes.

The third type is Composite volcanoes. These are the volcanoes we always hear about and see in movies. They grow tall with steep sides, and they rarely explode but when they do, the pressure from the magma chamber releases thousands of tons of ash into the atmosphere and lava onto the ground. If you’ve ever heard of Mount Saint Hellens or Pompeii, those are composite volcanoes.

The last common type we will talk about is a cinder cone. These are small volcanoes that erupt blobs of lava and that lava creates circular mountains with a crater at the top. They don’t grow very tall but can be dangerous if you are close to them when they explode.

Nearly every volcano matches one of these categories, both above water and below.

# Slide 11 – Terminology

Read verbatim or paraphrase:

In the last slide when we talked about types of volcanoes, there were 2 terms that are often used with volcanoes. Lava and Magma. Both of these represent the same thing, hot molten rock, but why do we say two words for the same thing? It has to do with where the molten rock is located, and it is easier to understand potential versus imminent danger because of it. Magma is the term used for molten rock that is below ground. We refer to it in magma chambers and magma vents. Since it is under ground, magma does not pose a risk to people, animals, or buildings. Lava is the cooling molten rock that is above ground and will burn or melt anything it touches. That’s the only difference.

# Slide 12 – Create and Destroy Land

Read verbatim or paraphrase:

Volcanoes are one of the most powerful things on the planet. Their eruptions have the ability to shape our entire world. Most commonly when we think of volcanoes, we think of volcanic islands, where a deep-sea volcano sprouted up through centuries of eruptions and created an island or an island chain, like the Hawaiian islands. Volcanoes that erupt with a huge explosion also have the ability to destroy everything in their blast radius through not only the lava, but the ash as well. It blocks out the sun making it hard for plants to consume light. It hangs in the air and makes it hard to breathe. It’s made of sulfer which mixes with the water in the air and on the ground to make acid. You never want to be near an actively exploding volcano.

# Slide 13 – Draw a Volcano

Read verbatim or paraphrase:

Now it’s time to show what you have learned. Using this paper, draw a volcano. Any type will do. Tell me about the parts of the volcano, where they are, and what the volcano is capable of doing. Let’s give everyone 5 minutes to draw it out and we will share after.

Akela, This completes the requirements for 3a. Click on the icon to move ahead to part 4 when finished.

# Slide 14 – Rock On

This topic will cover rock and mineral creation right here in Minnesota. Part of the requirement can include demonstrating how the rock types are formed. I’ll have a couple of suggestions for those if you want to include them, otherwise I would recommend having the youth draw out the process.

Read verbatim or paraphrase:

For this exercise, we are going to learn about Rocks and Minerals here in Minnesota. We’ll start by talking about rock types and how they are formed, we will discuss what minerals are and how they are found, and we will share what we draw/build.

# Slide 15 – Rock Types

There is a demonstration that you can do at this part with chocolate, foil, kitchen tongs, and hot and cold water

Read verbatim or paraphrase:

Let’s talk rocks! We see rocks all over: They’re on the hiking paths we take, they’re used for decoration in landscaping, They’re at the top of the tallest mountain and the bottom of the ocean, so what are rocks? Simply put, they are a collection of minerals and chemicals with similar patterns that we have classified by their properties. Overall, the classification happens by how the rock has formed.

The first formation classification is Igneous rocks. These are cooled lava rocks. Usually they are darker colors and shiny, but they all have similar properties. They are hard and they can be very sharp. We don’t see a lot of these rocks in Minnesota because we don’t have active volcanoes here, but some always find their way to different locations.

[If doing the chocolate rock demonstration]: Let’s see how igneous rocks are formed. First, we will take a small chunk of chocolate as our rock and put it in foil. Now, we will add it to this very hot water for a minute so that it melts into molten “rock.” Now, using tongs, we will extract the molten “rock” and as you can see from squeezing it, this is completely liquid inside. Now, I will add it to cold water to cool it down. After a while, I can take it out and we see that it has completely solidified. This molten to solid conversion is our igneous rock origin story. (Don’t eat yet, wait for the final type).

The second type is called Sedimentary. Sediments are small grains of rock and sand that are pushed into a solid by high pressure. The sediments are typically found at the bottom of lakes, rivers, and oceans, so that is most often where we find this type of rock. Since the continents shift around and water levels change, most of the Midwest used to be at the bottom of an enormous lake. As a result we have a lot of sedimentary rock here like Sandstone, Limestone, and Gravel.

[If doing the chocolate rock demonstration]: Now it’s time to see how sedimentary rocks are formed. First, we will take our “rock” and we will erode it down with this “rock grate”. [as grating into a sheet of foil] This represents waves smashing into the rock and chipping it away, other rocks hitting it from tumbling, or chemicals eating away at it. Now our rock has turned into small pellets of sand, and now we will put an ocean’s worth of water over it [fold the foil over it and push down with all of your weight, trying to keep it all together]. This pressure goes on for thousands of years, so let’s wait a couple of thousand years and check on our progress ok? No? You want to check it now? Ok. Look at that! The sand has formed back into a clump of rock, but it isn’t as strong as it once was, is it? If I add too much pressure, you can see that it falls apart!

The last type of rock in our example is Metamorphic. This origin story takes an existing rock either igneous or sedimentary, and adds heat and pressure to turn it into a stronger rock than sedimentary ever could be. Just like how diamonds and coal are both chemically the same, slate is formed when heat and pressure is applied to clay (sedimentary) or volcanic ash (igneous). These types of rocks are typically found deep underground, but make their way to the surface as the continents shift and change.

[If doing the chocolate rock demonstration]: And finally, it’s time to see how Metamorphic rocks are made. Let’s take our foil and put our igneous and sedimentary rocks in it, and dump it back into this now medium-warm water. After a while, it has started to get squishy, so let’s take it out and apply pressure to it. As we apply pressure from everywhere (top/sides/roll in a ball), it gets more and more solid than just our sedimentary rock ever could. We can drop it in the cool water now to let it fully solidify, and as we take it out we can see that it is almost as solid as the igneous rock was! It’s still not unbreakable, though, as my teeth show (take bite)…. Mmm! Delicious rocks!

# Slide 16 – Minerals

Read verbatim or paraphrase:

We often will hear about life as “organic” which means that life or the items life leaves behind have an element in them called Carbon. Minerals are the opposite of that. They are solid substances of stuff that occurs on its own. Most of the time, it is a single chemical or element that makes it up, like Iron. The important thing to remember about minerals is that they are not produced by life, but sometimes can be essential to life.

Have you ever looked at the contents of your breakfast cereal? One of the items in the ingredient list is Iron. It’s the same chemically as the iron that is mined out of the ground, but in microscopic flakes. That seems odd, right? That we would eat metal? It turns out that all life needs iron to keep itself going. The iron acts as an energy and chemical conductor inside the body, and in humans we find the largest concentrations in our red blood cells, the cells that bring food and oxygen to the cells of the body. There is about 3 to 4 grams of iron inside an average adult human body. To compare, your bowl of cereal this morning had 12 grams of sugar in it, so overall there is not a lot of iron in you, but you still need it. There are over 5,000 known items identified as a mineral. Let’s talk about some of the minerals that we find here in Minnesota

# Slide 17 – Minerals – Where are they found?

Read verbatim or paraphrase:

One of the most known minerals to come out of Minnesota is Iron or Taconite. In the United States, all iron ore comes from either Minnesota or Michigan. The iron ore is dug out of the ground in the iron range region, transferred by train cars to Lake Superior, loaded up into ships, and set to sail to Michigan and Ohio where it is processed and refined to turn into Iron and Steel.

Another very common mineral is Quartzite. This mineral is also a metamorphic rock formed by heat and pressure. Because it is solid and able to resist weather erosion, it is used as decoration for countertops, roofing tiles, road and rail construction, and much more. In Minnesota, this is mined out of the southwest region of the state.

The final mineral is called Peat. Peat is fossilized plant material that did not fully decay out, so many of the minerals that the plants had when they died are released into this soft wet clay. Most Peat bogs were formed when the glaciers of the last ice age melted. About 10% of Minnesota’s land has some form of peat on it, concentrated mostly north of Upper Red Lake, and there are only 10 farms that are allowed to take it out. Because it is full of minerals that plants eat, it is most often used for potting soil so that new plants can grow quickly.

# Slide 18 – Minerals – Your Turn

Read verbatim or paraphrase:

Now it is your turn to show you’ve learned something. Explain the 3 different categories for rocks based on formation. Next, tell me what types of rocks we find most often in Minnesota? Finally, tell me what the difference is between a rock and a mineral.

Akela, this marks the end of section 3b. You can move on to another topic if you need to choose one.

# Slide 19 – Weather Changes our World

Read verbatim or paraphrase:

Every day, there is a 100% chance of weather happening. One of the most well known Earth Sciences out there is called Meteorology, or the study of weather. Changes in our atmosphere can give us bright sunny days, cold snow days, and everything between. Meteorologists use tools and probability to predict what the weather will do. For this exercise, we are going to make some weather reading tools and keep a journal of the measurements for a week. Using the data we collect, we can then predict what the weather is going to do, and we can compare it to what meteorologists predict.

# Slide 20 – Weather Rock

Read verbatim or paraphrase:

This is the weather rock. It can tell us the current conditions with 100% accuracy. For example, if the rock is wet, then it is raining. If the rock is cold, then it is winter. If the rock is gone, then there’s probably a tornado. Jokes like this are fun, but this isn’t a great tool for us to use to predict the weather, is it?

# Slide 21 – 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 22 – 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 23 – 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 24 – 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 25 – 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 26 – Your Turn

Read verbatim or paraphrase:

So your homework for the next week is to keep a journal of the measurements you take for the next 7 days. Based on what you read, do you think you can guess what the weather is like? What did the weather report say? If you differed, how do you think you could make your predictions more accurate? We will meet back up at our next meeting to share and discuss.

Akela, this marks the end of section 3b. You can move on to another topic if you need to choose one.

# Slide 27 – Animal Habitats

Read verbatim or paraphrase:

This section of our learning adventure deals with understanding the different climate zones that plants and animals can live in, and how they adapt. We are going to look at two different zones, visit a habitat for one of those zones, and share our findings.

# Slide 28 – Prairie

Zone Start: Read verbatim or paraphrase:

Prairie zones are ones we are familiar with here in Minnesota. This consists of large open fields of grass and small shrubs for plant life, and insects, small rodents, and herd animals like cows and buffalo for animal life.

For your project with this zone, draw a food web with at least 5 plants and animals you would expect to see in the prairie land. How do they interact with each other. Who are the predators and who are the prey. If you picked one plant or animal and removed it, what would happen to the rest in the food web?

# Slide 29 – Temperate Forest

Zone Start: Read verbatim or paraphrase:

Forests are another place in Minnesota that we are all too familiar with. Minnesota has lush forests to the north and east. These regions are populated with trees of all types. There are two types of temperate forests, Coniferous and Deciduous, and the leaves and the seeds tell us what type of tree it is. In general, these forests have warm summers and cool winters, so the plant and animal life has to adapt. These areas also have access to plenty of water sources, so they can keep growing.

# Slide 30 – Temperate Forest

Read verbatim or paraphrase:

The first type of tree is a Coniferous, or Pine tree. The coniferous forests tend to be further north. If you ever go up past Duluth, the trees turn mostly pine. These trees prefer short summers and long winters, and are well prepared for the cold. Their leaves are needle-like, and they stay on all year long. What about the seeds? That’s right, it’s our friend the pinecone. The seeds are protected in a shell and group together so they have a better chance of spreading around.

Some other fun facts about pine trees: their leaves are coated with wax to protect the water inside from evaporating away when the sun comes out, or freezing when the winter comes. Their branches are also very soft and flexible, so that when the snow falls on them, they can shake around a lot without snapping.

# Slide 31 – Temperate Forest

Read verbatim or paraphrase:

Although we have a lot of pine around us, we have far more Deciduous trees, or leafy trees. These types of trees are the opposite, they prefer long summers and short winters. They also throw their leaves off of themselves once a year, at a time we call Fall. These trees tend to be tall with very ridged branches. For their seeds, some are produced as nuts, fruit, or just an individual seed that moves around. One type of seed from around here has a light feather on it, and spins around as it falls. The wind can blow it so that it can spread around and grow new trees away from directly underneath the parent tree.

# Slide 32 – Temperate Forest

Read verbatim or paraphrase:

Now it is your turn to learn and do some experiments. Pick two twigs, one from a Coniferous tree and one from a deciduous tree. Put a little splash of water in each, and put them into a bag. Observe it for a week and write down what you see occurring. Make a guess as to what is happening. (Akela, the pine tree will not change much, maybe absorb the water a bit. The deciduous tree will breath quite a bit and create a lot of condensation).

# Slide 33 – Aquatic Ecosystem

Zone Start: Read verbatim or paraphrase:

The aquatic zone is what we call any under or near water areas. It’s possible to have different types of water, fresh water and salt water, and it is possible to have both running and stagnant water. Because of this, aquatic ecosystems are full of both simple and complex life. Think about all of the times you’ve seen green algae floating on a lake, or the number of birds swimming around and trying to get fish. Because the sun can heat the water and it evaporates, the areas also provide moisture for the rain and the water of rivers and lakes fuses with the water tables that are nearby. Those two factors are reasons why we should keep our lakes and rivers clean. Let’s look at some in detail

# Slide 34 – Aquatic Ecosystem

Read verbatim or paraphrase:

Simple life such as Plankton and Algae are the producers of the environment. They grow from sunlight and if the conditions are right, overtake the water surface. Insects, worms, and fish all eat this simple life, which is then eaten by the frogs, birds, and reptiles. Shoreline mammals include everything from muskrats and beavers all the way up to moose and bears. These shoreline creatures are at the top of this food web.

# Slide 35 – Aquatic Ecosystem

Read verbatim or paraphrase:

One important type of water habitat is a river. Rivers come in all shapes and sizes. What’s the largest river is North America? Our homegrown Mississippi river starts right here at Like Itasca. It is small enough that you can walk across it. As it starts its journey south to the Gulf of Mexico, it grows little by little. Different rivers feed into it to provide it additional water. As it moves down, it picks up rocks and sediments, and various types of life. All rivers do this as they flow, but they flow in a very unique way. When the river is deep, the water tends to flow calmly. That means that if sand and other sediments are being carried by the fast currents, they will fall down and sit at the bottom of the river. Eventually there will be too much at the bottom and the river won’t be deep anymore, so the current picks up again and makes it run faster. As the fast currents hit the side of the rivers, they will eat away at the banks. Eventually the rivers will eat enough of the banks to change the flow of their water and make new canals for the rivers. Sediments can start to block old paths and create ponds and new rivers from these. They can also eat down into the ground, just like the Grand Canyon. Every river ends somewhere, and that water feeds larger rivers or lakes.

# Slide 36 – Aquatic Ecosystem

Read verbatim or paraphrase:

Water from the lakes and rivers also affects the way that the area around it works. There is water underground, vast amounts that help to feed all of the plants around. We call this the water table. It is often used as wells for us to drink from when public water is not available. The thing we have to remember is that not only does life use this water to spread and grow, but the chemicals we dump into the water do too. Pesticides that people use for gardening and farming might help to keep the bugs off of the plants, but at what cost to the area around?

In nature science, one of the goals is to help protect the environment. This means using either no chemicals, or friendly chemicals that won’t adversely affect life around it. Rigorous testing and mixing with different environmental scenarios helps us to understand how chemicals can interact with nature.

# Slide 37 – Aquatic Ecosystem

Read verbatim or paraphrase:

Now it is your turn. We are going to visit an aquatic ecosystem, and I want you to draw the area that you see. Tell me about a plant or animal that you saw, and tell me about plants or animals that you saw evidence of. Then, let’s talk about what humans do that affects the water systems, and how we can improve them.

# Slide 38 – Rainforest

Zone Start: Read verbatim or paraphrase:

Much like the temperate forests, rainforests are vast and full of life, but these trees happen where it rains for most of the year, so around the equator. There are 3 different zones where different forms of life exist. We are going to take a look at those zones and talk about how animals have adapted to live in them.

# Slide 39 – Rainforest

Read verbatim or paraphrase:

The first zone is the top zone, called the canopy. This zone receives the most sunlight and allows for the most room to move, but only if you are able to fly or swing from branch to branch. The bulk of the life that you will find here is birds, but sloths also live up here. Because of how slow sloths move, they would be targeted by predators if they were any lower. This zone is the safest zone.

# Slide 40 – Rainforest

Read verbatim or paraphrase:

The next zone is called the Understory. It exists between the ground and the canopy. It only receives up to 60% of the sunlight, so the leaves on the plants have to be large to collect as much as they can. Animals here are abundant because they can climb trees, move around freely, and hide. They range from insects, birds, amphibians, reptiles, and mammals.

# Slide 41 – Rainforest

Read verbatim or paraphrase:

Finally we have the floor, the last zone type of the rainforest. This ground receives little to no sunlight and so there isn’t much green here in the way of grass and other small plants. Most plants that do exist here are dying or decaying. Where plantlife can’t survive, though, decomposers like Moss and Mushrooms thrive. They make up a significant portion of what is seen growing in the understory. Since animals are in danger on the ground level, most animals here are burrowing creatures, meaning they hide in tree roots or dig holes in the ground. The exception here is the larger predators, though. At the top of the food web, who is going to eat the leopard?

# Slide 42 – Rainforest

Read verbatim or paraphrase:

Now let’s do our activity. For the rainforest, draw out the 3 zones and include some animals in them, at least 1 per layer. For each animal, I want you to tell me how the animal survives too.

# Slide 43 – Deserts

Zone Start: Read verbatim or paraphrase:

Desert zones are defined as little to no precipitation. As such, these places are usually sparse for life, but that doesn’t mean that life doesn’t exist here. Far from it, some of the strangest life is from here. Since water is scarce, life has to adapt to finding and holding onto as much water as it can, and deal with the drastic high and low temperatures.

# Slide 44 – Deserts

Read verbatim or paraphrase:

For our desert activity, pick and research a desert plant or animal. The common ones are the cactus, but several types of wolves, birds, and lizards exist here too. Once you have research an animal, tell us how it has adapted to living in the desert, and how would its removal from the Desert’s ecosystem would affect the other plants and animals?

Want to know a fun fact? Who can tell me what the largest desert in the world is? Most people would say “The Sahara,” but that is the 2nd largest. The largest desert is Antarctica. The Antarctic region only gets 2 inches of snow, on average, whereas the Sahara desert gets up to 8 each year.

# Slide 45 – Polar Ice

Zone Start: Read verbatim or paraphrase:

Polar zones are the northmost and southmost areas of our planet, and are covered in this snow and ice sheets. Much like deserts, these areas get little precipitation. They are always cold and covered in snow, The ground itself is frozen meaning no plants can grow in the hard frozen soil. Still just like in other areas, life adapts and finds a way. One of the best ways for predators and prey to hid from their enemies is to cover themselves in white fur. This fur makes it hard to see any other animals off in the distance. The polar bear, for example, originated as a brown bear in Ireland and during the last ice age had a mutation that turned the fur white. Because they were white and blended in with the snow, they could get food whereas others couldn’t sneak up on their prey in time.

# Slide 46 – Polar Ice

Read verbatim or paraphrase:

Some animals also have multiple colors so that they can hid easily while swimming. Now it’s your turn. Pick up book or read online about a polar animal, and tell us 3 things about how it survives in the cold polar regions.

# Slide 47 – Tide Pools

Zone Start: Read verbatim or paraphrase:

The last zone we can talk about is Tide Pools. Tides are the rising and lowering of the ocean twice a day due to the gravitational pull of the moon. As we spin around, the moon pulls the oceans and great lakes towards it, and they rise. Lake Superior has a tide with about 11 inches that it rises, however the rise for the ocean can be as high as 30 feet! Sometimes the land is hollowed out in such a way that when the water recedes, to low time, the tide creates pools of water and life grows in it. That is known as a low tidal zone. A high tidal zone always occurs after the tide goes out and the land is dry. This area’s water loss creates salt planes. These are generally sandy salty shoreline that isn’t covered well by plants. Both of these zones get lots of sunlight and the water comes back every 12 hours. Because these areas are on the shore, they are protected from many of the deep sea predators but still susceptible to shoreline predators such as birds and mammals.

# Slide 48 – Tide Pools

Read verbatim or paraphrase:

The high tide zone tends to be the hearty durable creatures with a tough outer shell. These creatures can survive in and out of water, which is good as a high tide zone is always left to dry. Look at some of the creatures that we see: clams, crabs, sails, and barnacles. These are all rock solid on the outside which helps to protect them.

# Slide 49 – Tide Pools

Read verbatim or paraphrase:

Low time zones are always underwater. When The tide goes out, these pools are created for life to thrive in completely outside of the ocean. These will always be saltwater ponds, because their main feed is from the ocean water. The rocks that keep the ocean and creatures out also protect these from wave bombardments, which could be destructive to shoreline areas. As a result, life thrives here. Soft tissue creature such as fish, sponges, starfish, and many more going to be found here.

# Slide 50 – Tide Pools

Read verbatim or paraphrase:

Now it is your turn. Draw out what the high and low tide zones look like. What kind of animals would we find in each zone. How have these animals adapted to the environment they are in.

# Slide 51 – Visit

Read verbatim or paraphrase:

Now it is time for the last part of our award. The Nature Science field is vast, so we are going to either visit a nature area or research a nature science career. For this course, I have selected \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. (visit to 52, research to 53)

# Slide 52 – Visit

Read verbatim or paraphrase:

There are many places we can go to in order to research what nature sciences do. I have arranged a trip for us to go to \_\_\_\_\_\_\_\_\_\_\_. On this trip we are going to look at how they use Earth Sciences. How does what they do make our world a better place? We will also talk with a scientist who works there and found out what they had to learn in order to get their job, and why they do what they do.

# Slide 53 – Research

Read verbatim or paraphrase:

Since it isn’t convenient for us to get out I have some books on Earth sciences. Select a career that studies the earth. I’ve listed the main 4 out here. As you research, find out how this role uses Earth Sciences and who benefits from the work that they do? Find out what schooling is required for that job, and once new knowledge is gained from their science, who uses that knowledge? Earth Scientists studying volcanoes in Hawaii may not benefit us here in Minnesota, but how many other areas can learn from the Hawaiian volcanoes? I’ll give us the rest of the time to research and report.

# 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.