

Why Does Where Matter? Using Story Mapping as Informative Text

Janet B. Zegna

Introduction/Rationale

Like many across the country, our district's initiatives have been to increase time for play and social-emotional learning in addition to reading, writing and math.¹ Classroom teachers are finding it difficult to have time for deep instruction of science and social studies topics.² Therefore, we are looking for ways to integrate these core subjects into our reading and math instruction. This unit fits perfectly into that process because it deals directly with making and reading maps as informational text. This unit's purpose is to have students create and use maps to convey meaning about the world in which they live. They will be using critical thinking skills as well as developing an understanding of spatial relationships. They will be using reasoning skills to analyze and evaluate the information embedded in the maps. They will be asking and answering questions about "where animals live and why they live there."³

Our district has both suburban and urban schools with some being in the city of Wilmington, DE (with a high rate of poverty and minority students) and the rest being in the suburbs of Newark, DE and within miles of the University of Delaware. There is a high prevalence of private and charter schools as well as school choice across our county. This trend has resulted in our public schools having a high percentage of students from minority groups.⁴ Of our school's 787 students that attended the 2019-2020 school year, 76% are designated minority, 15% are from low-income households, and 14% are ESL students.⁵ We have several extracurricular avenues to enrich our students' educational experience and address certain educational and emotional deficiencies. We recently became a *Leader in Me School*[®] and our students, staff, and families are learning how the "7 Habits of Highly Effective People" can empower us to be leaders in many ways which satisfies the ten minute per day, social-emotional learning requirement. We have *Advanced Academic Programs* for those students who need more

¹ Stephanie M. Jones and Suzanne M. Bouffard, "Social and Emotional Learning in Schools: From Programs to Strategies," *Social Policy Report* v. 26 no. 4 (2012): 3, <https://files.eric.ed.gov/fulltext/ED540203.pdf>.

² Chrys Dougherty, PhD, and Rael Moore, PhD, "Educators' Beliefs about Teaching Science and Social Studies in K-3," *ACT Research & Policy*, Issue Brief (2019): 2-6, <https://www.act.org/content/dam/act/unsecured/documents/R1787-early-ed-beliefs-2019-11.pdf>.

³ NGSS, "Kindergarten Storyline," *DCI Arrangements of the Next Generation Science Standards*, <https://www.nextgenscience.org/sites/default/files/NGSS%20DCI%20Combined%2011.6.13.pdf>

⁴ DelawareCan, "Diversity in Delaware Public Schools: An Interactive Look" <https://delawarecan.org/diversity-in-delaware-public-schools-an-interactive-chart/>.

⁵ "Marshall (Thurgood) Elementary School", *Delaware Report Card*, Delaware Department of Education, 2020, <https://reportcard.doe.k12.de.us/detail.html#aboutpage?scope=school&district=33&school=312>.

academically because they are considered gifted or talented. We have band and orchestra for our fifth grade students as well as chorus for fourth and fifth graders. Many outside groups have their extra-curricular programs implemented at Marshall due to the enthusiastic participation of our families (Soccer Shots, Young Rembrandts, Mad Science, and Jitterbugs). Of our six hours and forty-minute school day, all students are allotted half an hour for recess time, and they participate daily in 45 minutes of expressive arts (Computer Lab, Library, Art, Physical Education, Music, and Guidance). In our district, we spend a half hour a day on “Response to Intervention” (RTI) for both reading and math each, for our lowest academic achievers.

Content Objectives

My plan for this unit is to have students integrate the information they have learned by reading and writing about animals. One of the first grade social studies units focuses on using maps and globes to locate different landforms and bodies of water. One of our science units is on organisms. Two of our math units provide information about penguins, their heights, and where they live. One of our summative assessments for the students’ writing is an animal report (which includes where the animal lives). Therefore, this curriculum unit is designed to have students ask why certain animals live in certain places and to then create a story map published to the web to share with other first graders.

In planning this unit, I have noticed that I can incorporate K-2 ELA, social studies, and science standards. Obviously we want our students to come away with those “enduring understandings.” For ELA, students will be able to use the illustrations and details in a text to describe its key ideas, and to be able to integrate and evaluate content presented in diverse media to include maps.⁶ For Social Studies, students will understand the nature and uses of maps, globes, and other geo-graphics.⁷ For Science, students will understand there are many different kinds of living things in any area⁸, and they exist in different places on land and in water, as well as understanding that all animals need food in order to live and grow⁹. They obtain their food from plants or other animals.

Essential Questions

Students will have learned that plants and animals need five things to thrive, namely: food, water, sunlight (energy), air, and space (their environment). They will also need to know that ecosystems are biological communities of interacting organisms and their physical environment. This prior knowledge will be necessary to answering these essential questions:

1. Can you use media (like maps) to obtain scientific information to determine patterns in the natural world?

⁶ “Common Core State Standards Initiative,” Dec. 5, 2020, <http://www.corestandards.org/>.

⁷ “Delaware Recommended Curriculum,” Dec. 5, 2020, <https://www.doe.k12.de.us/Page/2548> Geography link.

⁸ “Next Gen Science Standards,” Dec. 5, 2020, <https://www.nextgenscience.org/pe/k-ess3-1-earth-and-human-activity>.

⁹ “Next Gen Science Standards,” Dec. 5, 2020, <https://www.nextgenscience.org/search-standards?keys=&tid%5B0%5D=98&page=2>.

2. Can you use a model to represent relationships in the natural world?
3. Can you make a map (with support) to share scientific information to show patterns in the natural world?

Using maps to get information

As a first grade teacher I frequently reflect that we have to teach all subjects in the actual four hours that we provide instruction (that's the six-and-a-half-hour day without an expressive arts class, lunch, recess, and all of the transitions). This can be daunting as districts all over the country add more curriculum to the instructional day like social-emotional learning, mindfulness, RTI for both reading and math, and any other initiatives that catch administrative attention¹⁰. So what's a teacher to do? Integrate, integrate, integrate!

Maps are literary tools to be used to gain information just like any informative text that students might read or write. Just as you would have students read a book about an animal to learn about that animal, maps can also be read to learn about that animal. We need to teach students how to analyze what they see in those maps and look for relationships rather than having them simply point to symbols on a map.¹¹ As with any piece of text, a map can invite query and generate discussion if it has features that are of high interest. If the map has high aesthetic value and high quality data, it will lead the reader to make sense of the relationships presented. There are many different ways that information can be presented to readers in maps.

First and foremost, the data must be geo-referenced which means it must be anchored to a place.¹² As an example, if you were going to have your students read about different types of forests, you would first need to know where those forests are located in the world. This gives students the opportunity to ask questions about why there are different types of forests because forests are influenced by the place they grow (think boreal forest v. rainforest). In order for students to hone their critical thinking skills, we have to present information with rich data that requires analysis. Simply learning that a rainforest grows where it rains a lot is not enough.

Once our topic of information is geo-referenced, we want to take a look at how information is presented on a map. We could simply look at a very simple map with an outline of a continent, country, state, city/town, or neighborhood with symbols of different trees and call it a day. What information would your students be getting from this map? There are different kinds of trees and they can be found in different places. And that's that. Was that a purposeful lesson? Maybe as an introduction to maps and map keys (and map vocabulary like symbol). But how much more of a lasting impact would students have if the map not only showed where the trees are located within a given area, but what the climate is as well? This is called layering. You would now have two data points (types of trees and climate) that are connected to a geographical area (geo-referenced) and you could now have a discussion about why certain trees grow in certain climates. Still simple enough for first graders to understand. Additionally, they are learning how

¹⁰ Jones and Bouffard, "SEL in Schools."

¹¹ Gersmehl, Phil. "What Do We Mean by "Reading" Maps?" *Education Weekly* v. 32 no. 37 (2013): 3

¹² Christian Harder and Clint Brown. *The ArcGIS Book: 10 Big Ideas about Applying the Science of Where* (Redlands, CA: ESRI Press, 2017), p. 9.

to read a map with an authentic purpose (geography). They are learning to make sense of informational text (literacy). They are becoming spatially aware and making connections with what they may have already learned about forests (math and science).

Layers

So what about layering? What is it and how do we use it to help students to become better at analyzing what they read? There are so many ways to display information but to organize your understanding I will break this into a few categories: basemaps, operational layers, data attributes which is the information about which we are learning (like trees or climate) and, symbology, (how we display the data).

A basemap is just what it sounds like. It provides the background geographic context.¹³ Are we looking at the whole world, a continent, a country, a state, a city, a town, a neighborhood, your backyard? Basemaps can be simply outlines of a land mass or body of water, or they may provide more information like roads, or political borders. They may provide topographical information like mountains, hills, streams. Basemaps may even use imagery. With the technology available to us these days, we could use a satellite image as a basemap and overlay that with symbols representing geospatial data! Basemaps may be kept quite simple to be sure that the data is more visible, or can be rather detailed so that the data melds into the map. Basemaps can be colored to add that aesthetic value, or be kept in grayscale to be just the background to our data. The basemap is the first point of analysis because it is where our students will begin their spatial awareness of our topic.

Operational data layers come next. These are the layers that will overlay the basemap. We have a point of reference (geographically speaking) and then we add more detail to better understand what is happening at that place. These layers provide the purpose for the map as they give the information that you are wanting to share.¹⁴ Operational layers are as infinite as your imagination. If you can think of it and can create a georeferenced data layer, you can layer it on a basemap. Some types of layers are called discrete and continuous. Discrete layers have definite feature boundaries. Examples would be outlines of land (a state park), streets or highways which have a definite length and width, rivers or glaciers which again have a definite number or measurement. Continuous layers show more of a range of values. Examples would be an infrared image of heat in a certain area (say forest fire), or the elevation of a mountain range, or the radar image on a weather map. These operational layers map discrete and continuous features using either vector or raster models. Vector layers are presented in points, lines, or areas of geographical features. Raster layers are presented in pixels. So the vector is more precise, whereas the raster captures the variation of geographical features. As you can see in the figure, the raster model gets a more blurred look.¹⁵

¹³ Ibid, p. 27

¹⁴ Ibid, p.28

¹⁵ "Arc Map: Raster Basics," *ArcGIS Desktop*, Dec. 5, 2020, <https://desktop.arcgis.com/en/arcmap/latest/manage-data/geodatabases/raster-basics.htm>

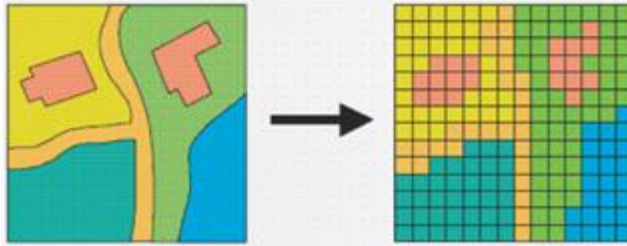


Figure 1:

Once you have considered the operational layers used to show data, we can then have different ways of representing the data in terms of colors and symbols on a map (symbolology) as well as data attributes. Data can be presented as categories (names of groups of similar things like types of tree). They can be presented in ranks (ordered from high to low or visa-versa, like the health of trees - good to poor. Data can be a count (how many trees in a forest) or amount (rainfall). Data can also be presented in ratios (relationship of one type of data to another, coniferous/deciduous trees). The symbolology used to display your data really depends on what you are showing. Do you want colors to pop off a dark basemap? Do you want circles or squares of varying size and transparency to exhibit quantities as well as qualities of the data? There are a myriad of ways to present the data. Features with more defined boundaries may be better to display in vector format and those that are continuous across the surface like topography may be better in raster format (because all types of data can be shown in either format, the type of format you choose will depend on what you are trying to show).

While all of this information may make your head spin, there's really nothing new here. The point of my providing this information is to help you to see how we can help our students analyze maps. Think of the difference between a street map you have looked at while on a trip away from home and the weather map you may look at on your phone. The basemap is the location where you are in the world. The operational layers are the information given and the way it is presented. But our students won't intuit this, we have to help them learn it. Another point to make is that our students need to learn why there are so many different kinds of maps and using them to gain real information about the world and analyze relationships between points on maps can help them understand this better than just looking at two different kinds of maps.

Using maps to give information

Our first grade students are learning to become writers and as such should "try-on" different types of writing. With anything they write (or read) there should be two main focuses: what is the purpose of the text and who is the audience of that text. For this unit our purpose for creating a map is to provide factual information about a place and its relationship to the places around it. I will have my students focus on the woodland ecosystem, but the beauty of this unit is you can have your students create maps that fit your curricular requirements. My students will have learned about woodland animals and plants through their science unit on Organisms. While completing this unit, we will create a story map to share with other first graders. A story map is actually a specific kind map.¹⁶ According to Christian Harder and Clint Brown, editors of *The ArcGIS Book*, "maps are the visual representation of where events happen." So before the students can begin to create a map, they would have to decide on an event. For my purposes, we

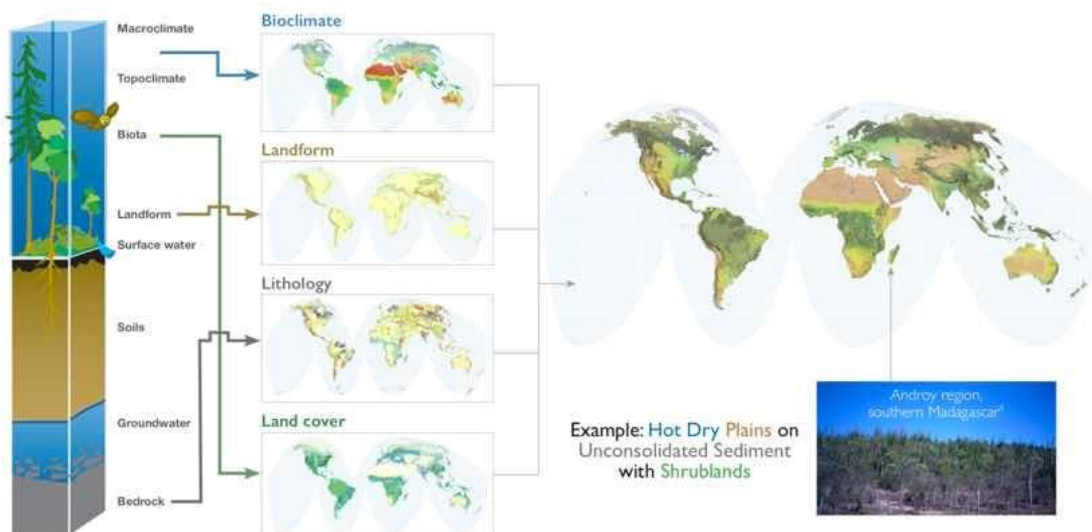
¹⁶ Harder and Brown. *The ArcGIS Book*, p.39.

will investigate if woodland ecosystems are found in only certain places on Earth. My students will have to learn what and where woodlands are (the “edges” of forests where trees (woodland plants are less dense). Because there are so many forests all over the world, we will take a look at the many different woodlands as well. Once my students have explored where woodlands can be found, we can write a story to tell about the differences or similarities of those places.

Once we have the event and the place, we can do research to find what type of data we would like to include in our map. Students will have learned how plants grow (from seeds) and repopulate. They will have learned that there are animals that live in these ecosystems and how they rely on the plants and each other for their survival. They will have learned how there can be change over time in these ecosystems and that change is due to the growth and death of the organisms within that ecosystem. I give you all of this information to show that maps won’t happen just like that. They need data. Data is the basis of the story and the children will have to have a clear understanding of what the data represents.

An important consideration is how much detail do you want in the map? Do you want to focus on just one data point or several? This question needs to be answered prior to designing the map. Once we have our data, we can then choose the basemap with which our story begins. We can then choose the data layers that will overlay on the basemap. One caveat about data layers; some of the data layers can be changed to show only certain data while other data sets cannot be changed. This may mean changing the maps that you want to present. We need to consider how we will present that data. This can all be done manually, and you could certainly have the students determine the method of delivering this information. But allow me to present some more information that I have recently learned, that of GIS (geographical information systems). Below is an example of using data layers in GIS to show the world’s ecosystems.¹⁷

Figure 2:



¹⁷ Dawn Wright, “Mapping the World’s Ecosystems” *ESRI blog*, Jan. 10, 2019, Accessed Nov. 27, 2020, <https://www.esri.com/about/newsroom/blog/mapping-the-worlds-ecosystems/>.

In our twenty-first century instruction, we should include technology and there are some pretty nifty online tools available to our students. Since they are “systems,” a multitude of data has already been collected and this data can be used by anyone in any product they wish to create. These technological tools are of high interest and data can be manipulated by our students (with support) to provide a more practical reason for learning about maps. You may have already used Google Earth (an app) to show your students their place on Earth. Google Earth uses satellite imagery and layered datasets. The imagery may be one to three years old and is not updated in total each time it is updated. According to Google’s support website “you can create customized maps and stories about places around the world. Mark spots you care about, and add text, photos, and videos to complete your stories. You can also share your maps and stories with others to collaborate.”¹⁸ Another easily accessible GIS platform is ArcGIS Online created and maintained by ESRI. ESRI began its work in 1969 as Environmental Systems Research Institute and has evolved into an international supplier of GIS software, web GIS, and geodatabase management apps. With ArcGIS you can create web maps and story maps. According to ArcGIS Online, “with a free public account, you can create, store, and manage maps, scenes, and apps, and share them with others. You also have access to content shared by ESRI and GIS users around the world.”¹⁹ An organizational account allows access to more data and analysis tools. How cool would it be for your students to create a map that other first grade students can use to understand a place on Earth?

Story maps represent one of ESRI’s web-based mapping applications. The beauty of using story maps is that not only can there be a map(s) that readers can analyze, but you could have photographs and a narrative to go along with the map(s). In order to create the maps that drive the story, your data would have to be georeferenced. For example, if one were to create a story map about woodland plants or animals, the information (data) that you want to present through the story must be about specific plants or animals. For the purposes of this curriculum unit, my students will focus on specific trees - gymnosperm (we call them tree seedlings) which look like miniature pine trees. Because these trees are found in temperate forest or boreal forest biomes, we can geo-reference them (because we can find these forests in many places on the planet).²⁰

So your students could write a report, create a map or maps with the data as the graphic feature of that report, collect images from the web, or draw their own pictures to upload, and once completed, publish the whole story to the web to share with others. I intend to do this as a whole class project to sum up our science unit on Organisms. But there are other ways story maps could be used by your students for every content area, again, connecting geography to whatever it is they are learning at the moment. If you want to see some incredible story maps, ESRI has a WordPress blog called Maps Daily where there are over 100 story maps on all sorts of topics.²¹

¹⁸ “About Google Earth Projects,” *Google Earth Help*, Dec. 6, 2020, <https://support.google.com/earth/answer/9394923?hl=en>

¹⁹ “What is ArcGIS Online?” Dec. 6, 2020, <https://doc.arcgis.com/en/arcgis-online/get-started/what-is-agol.htm>

²⁰ “Gymnosperm,” *Encyclopaedia Britannica*, 2020, <https://www.britannica.com/plant/gymnosperm>.

²¹ “Maps Daily,” Dec. 6, 2020, <https://mapsdaily.wordpress.com/>

When creating a story map, you want to begin with some eye-catching hook. Something that will express to your reader what the story will be, but also draw them in to the story to want to learn more about (sounds an awful lot like “regular” writing). Generally, a good image will help with this, but you also want to give your story a title (as with all stories). You want to keep your content simple and understandable to the audience. Your maps should be a graphic summary of the content of the text. If a reader looks at the map, the information you are sharing should be obvious. Web maps can also have pop-ups to give more detailed information if that is something that you need. The text written about the map/topic should also be short and to point.²² I could not find a way to make it appropriate for first grade, but if you are using ArcGIS to build an online map, there are also tools for you to analyze the data provided in a map. The analysis that first graders would do would be to simply find useful information about the place that is highlighted in the map. But as the teacher guiding the students in using this tool, there are several databases that can be used to place the data layers on your map(s). One of them is called the “Living Atlas.”²³ According to the website powered by ESRI, “ArcGIS Living Atlas of the World is the foremost collection of geographic information from around the globe. It includes maps, apps, and data layers to support your work.” With the Living Atlas you would have to search through many data layers to fit your needs. Once a layer is placed on a map, you are able to open the Analysis tool and add or remove data to make the layer more appropriate for you. Some of this analysis may not be available on the free version of ArcGIS, but odds are you can find what it is you want to display from the Living Atlas. You will also need to decide what type of story map to make as there are several “layouts” you can choose from, some of the most popular are a journal, a series, a tour, and a swipe or spyglass.²⁴

One more consideration for my specific use of this unit is understanding what a woodland is. Just as there are many different types of forests, there will be that many different types of woodland environments because a woodland is defined as the environment in between forest and open space.²⁵ When my students are looking for woodlands on maps, they must understand that we are looking for the borders of forests where the trees thin out. In many developed areas, woodlands are those collections of trees within urban and suburban areas as well. My students will have to analyze what they are seeing on maps to determine if they are looking at forests, woodlands, or smaller park areas within cities. They will need to use the symbology of the maps to determine this.

In summary, maps are informative text that can be used by writers to present geo-referenced information and analyzed by readers to learn about the world. Informative texts use features like bold text, visual representation, and labels that help a reader to easily find information within the larger text. Readers use informative texts to learn about a specific topic and therefore these texts should be presented with accurate information organized into categories of facts. By using maps

²² Kathryn Keranen and Lyn Malone, *Instructional Guide for the ArcGIS Book* (Redlands, CA: Esri Press, 2016).

²³ “Living Atlas,” ESRI, 2020, <https://livingatlas.arcgis.com/en/home/>

²⁴ “Choosing the Right Story Map,” *ArcGIS Blog*, ESRI, (2015), <https://www.esri.com/arcgis-blog/products/story-maps/mapping/choosing-the-right-story-map/>.

²⁵ “Forest and Woodland Habitats,” *The School Run*, Dec. 7, 2020, <https://www.theschoolrun.com/homework-help/forest-and-woodland-habitats>.

in the first grade classroom, we are able to dig deeper into content areas, teach geography, and continue to teach our new readers how to be critical thinkers.

Teaching Strategies

Making a story map should be considered a performance task and therefore requires lots of prior learning. There are many strategies teachers can use to help students acquire the type of knowledge needed to be successful at completing that task. Of course, all along the way the teacher will provide support through scaffolding and re-teaching. Below I will define some of the strategies that make learning engaging and motivating to younger elementary students.

Accessing Prior Knowledge

Teachers have been using KWL charts for a very long time, but there are other means for students to show and share their prior knowledge. Concept maps show relationships to the concepts that students have been learning or will learn. An anticipatory guide could be an article or piece of text that students read to get them to connect with the material that will be learned. An alphabet chart can be used by students to show what they know about a topic at the beginning, middle, and end of a unit of study. It is simply a grid with each letter in its own box. Students write a word or phrase that begins with each letter. (The entire grid does not need to be completely filled in.) Alphabet Charts are great for collecting vocabulary words learned during a unit (like all the words connected to maps and globes). “Discover the Mistakes” is a fun way to see if students can figure out what is wrong with a passage on the topic. False information is given intentionally in a piece of text and students have to find the mistakes. This is a great partner activity.

Songs and Games

The rhythmic, fun nature of songs promotes vocabulary acquisition and makes it easier to remember concepts. Games provide an opportunity for authentic social interaction. Both can help lead students to a deeper understanding of the topic being learned. They are both purposeful for building self-esteem, especially when the songs or games are connected to students' lives.

Gallery Walk

The nature of this unit is visual so it would be most effective to use photographs as well as maps when teaching students how to look more closely at what they are reading. A gallery walk would be an opportunity for the teacher to share lots of different types of maps and then to have a discussion in Whole Group for the students to share out what they noticed. Another means of sharing would be to take a graphic organizer on the gallery walk and to look for certain features of maps. Then the discussion could be focused around those features. Some that come to mind are the scale of the map (are we looking at the whole world or a town?). Colors used in maps also provide information so perhaps the teacher could focus the students on that. Different ways of using symbols or different purposes for the maps (is it a street map, a map to show landforms or bodies of water, a map to show where there is the most of something)?

Wordsplash

This would be a great strategy for collecting all of the new vocabulary that the students are learning. You could work as a whole class if the vocabulary is new, or in teams of 2-4 students if they have been working with the vocabulary for a while, or even individually by posting a word that you learned. Each method would provide the teacher with information of what the students have learned and what they still may need time with. For example, a teacher could have students use Jamboard, a Google add-on (especially during remote learning) to post a vocabulary word from the unit. If the same word keeps coming up, that teacher knows that most of the students have learned that word (or can spell it). But if there is a big variety of words, then students have an even better grasp of all of the vocabulary from the unit.

Exit Tickets or Quick-writes

Teachers are using exit tickets more frequently because again, they are useful to getting the pulse of the students' learning. Quick-writes are similar but rather than having students respond in bullet points (like with a 3-2-1 exit ticket), they would write a bit more on a focused question. Some question ideas are: what did you find most interesting about _____?, what was confusing?, how does this connect to _____? what do you still wonder?

Signals

Similar to exit tickets and quick-writes, signals are an easy way to take the class pulse on a topic. Thumbs up, thumbs level, thumbs down (next to your heart) gives the teacher a quick glance into who may still need some time on a topic or more support. 1, 2, or 3 fingers held up has the same result (put up one finger if you are just starting to get it, 2 if you feel like you understand, or 3 if you could teach it to someone else).

Jigsaw

This is a great strategy for students to collaborate once they have worked independently to gather knowledge on a topic. For example, students can read a text, watch a video, listen to a lesson given by the teacher. They are then asked to respond to what they have read or heard individually. After a period of time, the students then work with a group to bring their ideas together. After a period of time, those groups come together as a whole class and share out what they have discovered. This strategy would be very purposeful for a performance task such as this unit because you could divide up the information to be gathered amongst different groups and then when they come together they build the total picture. One example that I am sure to use is to divide my class into six groups (one for each of the continents with forests OR for the different types of forests).

Criteria for Success

Probably the most important teaching strategy is telling the students what they should know when the learning is all done. Giving them the "answers" before they even begin to learn about a topic, is not cheating. If you tell them ahead of time what the expectation is for their learning, students have a much better shot at reaching the goals set before them. They also have a chance to let you know how they want to reach the goals making learning more personalized and differentiated. Teachers should also use I Can statements at the beginning and throughout the lesson so that students can decide if they have learned what they should.

In closing, teachers need to provide opportunities for all of the students in the class to connect with the material being taught. A Fairness Cup ensures that teachers will call on every student at some point throughout a lesson. This is simply a cup with each student's name on a craft stick that can be pulled at any time there's a question to be answered, a point to be argued, or a question to be asked. (This can also be done with a randomizer app.) Breaking a project, like creating a story map, into smaller parts, will help all students to grow their understanding of the topic. Using models throughout the science or social studies pieces of a unit like this will also give students the opportunity to show their understanding of the topic.

Classroom Activities

Activity #1: Use Maps to Find Patterns of Ecosystems

Enduring Understanding

Students will understand how to locate woodland ecosystems on maps of the world using the symbols.

Essential Question

Can you use a map (model) to obtain scientific information to determine patterns in the natural world?

Objective

The objective is to have students simply be able to understand the information that maps are giving about ecosystems, specifically the edges of forests. Students will be looking to see if the different maps provide similar information and what they can infer from the patterns that they find from the maps.

Materials and Setup

Students can work in small groups (3-4 students) or pairs depending on your class size and whether your students are in person or using breakout rooms for remote learning. This activity could also be done using Jamboard, and maps would have to be uploaded for students to be able to collaboratively analyze them. (There are a few links in the Student Resources to web maps for this activity).

I will use the same collection of four maps for each group. Each map will have different base maps and symbology, but my intent is for each map to have similar data layers with regards to forests in the world. Please look in the resources section for the maps that I will use for this activity.

Procedure

Students will look at several maps to determine where woodlands occur in the world. This will be a broad scale view of the world as a whole. We will not be zooming in to our local view for this activity. Students will look to see where there are forests in the world using the symbols that

the maps provide. They will discuss their findings and then report back to the whole class. They should be using vocabulary learned in the prior maps and globes units (named continents, named oceans, land or water, north, south, east, west, equator, North Pole, South Pole). Their discussion should be focused around how do we know where the woodlands are located? Provide students fifteen minutes to examine all four maps. Have a group discussion based on their findings. Ask leading questions like “How do you know?” “How can we find _____?” “Tell us more about that.”

Activity #2: Looking more closely at the forest areas of the world

Enduring Understanding

Students will need to see that not all forests are the same and that similar forests can be found in certain places on earth.

Essential Question

Can you find differences in the forests on earth using maps?

Objective

Once the students are able to locate forests (and woodlands) on the maps provided, they need to have a chance to look more closely at these forests in order to see that there are several types of forest ecosystems. (For first graders we want to limit the number of ecosystems that they are working with, because forest ecosystems can be categorized by many different criteria making the number of different ecosystems quite large.²⁶ (This can be done by choosing a more broad view of ecosystems.)

Materials and Setup

I will use a map that I created in ArcGIS that shows just four types of forest ecosystems on a base map of the world. It shows the equator so that you can generate discussion about what types of trees are found in the different parts of the world. (The link to this map can be found in Student Resources.)

Procedure

As a whole class we will investigate what we can understand from this map. We will begin at the world view and increasingly shrink the scale in order to better see what types of forests are where. We won't necessarily zoom in to a local area (unless the students request it) because we want to see what patterns we can see. One of the most important patterns I want my students to see is the evergreen forests. On this map they can be found almost everywhere in the world. And I want to use this to generate a discussion about evergreen trees. Are they always “Christmas trees?” How can we find out? Where do we see these types of trees in the world? What do we

²⁶ “World Ecophysiological Land Units Map 2015,” *ESRI*, 2020, https://landscape7.arcgis.com/arcgis/rest/services/World_Ecophysiology_Map_2015/MapServer.

know about the temperature at the top and bottom of the maps? How do we know that? What about the temperature in the middle (near the equator)? How do we know that?

Continue the discussion until students have many questions of their own. And then this is where their research can begin to create their story map. It is important to record their questions so that once their research begins they can have an accounting of what they wanted to find out and what they can check off as new knowledge. (The research that the students will be doing will be during their writing block so that lesson is not provided here in this unit. Their research will most likely be about the animals that live in the particular forest that their group was assigned.)

Activity #3: Use Maps to Investigate Relationships in the Natural World

Enduring Understanding

Students will come to understand that different ecosystems have different needs that can only be met in certain places in the world.

Essential Question

Can you use maps to investigate why there are not forests in some places in the world?

Objective

The objective is to have students make conjectures as to why forests are not found everywhere in the world and to come to the conclusion that different ecosystems have different needs which can only be met in certain places in the world.

Materials and Setup

Choose a couple of the maps from the first activity. Begin as a whole group to discuss what students can see on these maps. Then break into small groups to hypothesize. Come back together as a whole group to investigate those hypotheses.

I have created a new map with the world ecological land units (takes precipitation, temperature, and soil into consideration) as the basemap and the four types of forests as a layer. By changing the colors of the types of forests to grayscale, it makes the “climate” more prevalent and therefore the students will be able to better see the areas of the earth where trees don’t grow. (A link to this map can be found in Student Resources.)

Procedure

Students will once again look at two of the maps showing where forests are located. The teacher will pose a question as to why the forests don’t appear everywhere, focusing students’ attention on those areas of the map that are devoid of forests (especially the oceans). By focusing on the oceans, the students should be able to determine that there is no soil for the trees to grow. At that point the teacher will direct the students’ attention to those places where there is land (the arctic areas as well as the equatorial regions. Students may decide that the poles are too cold and that

can lead to a discussion of what trees need to grow (temperature and soil). There's one more thing that students need to decide and that is precipitation.

Share the new map with students and discuss their observations as a whole class. What can we infer from this new map? Help students to examine the legend and the changes to the colors. We want the students to come away with an understanding that trees don't just need sunlight, water, and soil, but that specific trees need specific soil, amounts of sunlight and water. In our state, this information will be learned in second grade, but this unit will serve to "front-load" that type of information.

Once again, it is important to keep a record of what the students discover and what questions have been answered from previous activities and what new questions might arise. To be sure, there may be some questions left unanswered even once this unit is done, and that is okay!

Activity #4: Building a story with maps

Enduring Understanding

Students will understand that they can present scientific information in informative text like reports and maps.

Essential Question

Can you give information through a story map?

Objective

The objective is to have students share their new understanding of forests (woodlands) through a report and maps for others.

Materials and Setup

Using the information that the students have learned by analyzing maps and their research done (during writing) on the different types of forests and the animals that live there, we will begin to build a story map as a class. This will be done using ArcGIS (again you will need to create an account before beginning). If you are not going to create a web map, you will complete this step manually so you will need to find a method to create a base map of the world. Students can then determine how they will add their data to the map whether that be photos printed from the internet or drawings that they have created themselves, speech bubbles as pop-ups, and where their narratives will be placed in relation to the map (how will they show that a specific place on the map is where they are referring to?).

My preference is to use the technology and make web maps. Using ArcGIS, we will meet in small groups to decide how to best present the information the students want to share in order to create a map. Because we write animal reports as our summative piece for instructional writing, the students will need to gather data about these animals through the Living Atlas. This will be done in small groups with me. Before beginning this process, it's probably best to look through what the available data is in the Living Atlas. This may take some time because there are many,

many data layers and you want to be able to find the most informative for the students' level of understanding while also addressing their needs for data.

Procedure

The first step to creating a story map is to make a map. This can be done in one of two ways. You can create one map with the entire class or you could create a different map for each type of forest in small groups. I think because it will be more clear to first graders reading the story map, we will use the second method. So with each small group you will have to gather them to create their map. We will use the Living Atlas to add data after deciding which base map to use. We will find our data on the type of forest there (this is the teacher's part of the project as first graders will not be able to locate the appropriate data). So as an example, if the students are going to focus on the tropical evergreen forest, you will have searched for data layers that can help them pinpoint these forests. If you use the map referred to in Activity two, the tropical, evergreen forest layer was created using ArcGIS Pro to select out only this one forest type from Living Atlas Global Landcover 2015 dataset using Project Raster and Raster Con function, and then the evergreen forest (raster) layer was hosted on ArcGIS Online. A separate layer can be created for each forest type of interest. So each group will have their web map, their reports of the animals or trees from that place, and any photos or drawings that they want to include in the story map.

Next step is to bring it all together. The fun part about using ArcGIS is once you have your pieces, the online tool helps you bring them all together. Again, I recommend doing a bit of research prior to beginning this piece by taking a look at different story maps in the Maps Daily blog. I intend to use the Storymap Journal template to help my students to build their story map. Again, I will follow through the online tool, so I will not provide the detailed steps here as you can find this information in Teacher Resources.

In closing this activity, my students will have learned how to read maps more closely, use the data from those maps to learn about their world while also using this new knowledge to do further research, and finally, they will bring that new learning to other first graders all over the world through their story map published to the web! And, I intend to use this story map as a beginning for future classes to add more data about those places about which we have learned.

Resources

Resources for Teachers

"About Google Earth Projects." Google Earth Help. Accessed December 11, 2020.

<https://support.google.com/earth/answer/9394923?hl=en>.

Provides information about Google Earth app.

"ArcGIS Help." Raster Basics-ArcGIS Help | ArcGIS Desktop. Accessed December 11, 2020.

<https://desktop.arcgis.com/en/arcmap/10.3/manage-data/geodatabases/raster-basics.htm>.

Figure 1 source

Borsari, Kristen A. *Regions and Habitats*. Yale National Initiative Curriculum Unit. New Haven:

Yale National Initiative, May 02, 2005.

A curriculum unit written to help fourth grade students learn about the relationship between living organisms and habitat. I read it for background information and to be sure I wouldn't duplicate efforts when writing my unit.

Brooks, Raymond W. *Ecosystems, Can I Help?* Yale National Initiative Curriculum Unit. New Haven: Yale National Initiative, May 02, 1992.

A curriculum unit to teach 7th graders about ecosystems and how we affect them. I read it for background and to see that I didn't duplicate efforts with my unit.

Bybee, Rodger W. *Next Generation Science Standards. for States, by States: Appendixes.*

Washington, D.C.: National Academies Press, 2013. Accessed May 2020.

<https://www.nextgenscience.org/sites/default/files/K-2DCI.pdf>.

Quote from the Kindergarten Storyline from the NGSS Disciplinary Core Ideas

Crowther, T., H. Glick, and K. Covey. "Mapping Tree Density at a Global Scale." *Nature*, no. 525 (2015): 201-05. Accessed November 27, 2020. doi:10.1038.

A briefly read this article to get an understanding of tree cover worldwide. This article included maps to show where trees are located on earth as well as how many types of trees and where they can be found. Not to be used in my unit, but rather to gain an understanding of my topic.

Delaware Can. "A Look at Student vs. Teacher Diversity in Delaware's K-12 Schools." Chart. In *Diversity in Delaware Public Schools: An Interactive Look*. 2017.

An interactive chart to see the diversity of Delaware's public (including charter) schools which supports my point that our public schools have a high percentage of minority students.

Delaware Report Card. Pdf. Dover: Delaware Department of Education, December 10, 2020.

This report card of our school provides the demographic data stated in the introduction of this paper.

Delevoryas, T. "Gymnosperm." Accessed December 05, 2020.

<https://www.britannica.com/plant/gymnosperm>.

an encyclopaedic definition of gymnosperm - the most populous tree on the planet (includes conifers and other evergreen species).

Dougherty, Chrys, PhD, and Rael Moore, PhD. *Educators' Beliefs about Teaching Science and Social Studies in K-3*. November 2019. ACT Research & Policy Issue Brief

An article to support the claim that K-3 teachers don't have the time to include Science and Social Studies in the school day.

"English Language Arts Standards." English Language Arts Standards | Common Core State Standards Initiative. Accessed December 11, 2020. <http://www.corestandards.org/ELA-Literacy/>. The guide to the ELA standards used in this curriculum unit.

Gersmehl, Phil. "What Do We Mean by "Reading" Maps?" *Education Week* 32, no. 37 (July 22, 2013). Accessed May 01, 2020. <https://www.edweek.org/teaching-learning/opinion-what-do-we->

mean-by-reading-maps/2013/07.

An article we read, early in our seminar, which led me to create this unit. In first grade, so much of our curriculum is about building literacy so rather than creating a unit specifically about geography, I wanted to create a unit that met teachers' needs to do that.

Harder, Christian, and Clint Brown. *The ArcGIS Book: 10 Big Ideas about Applying the Science of Where*. 2nd ed. Redlands, CA: Esri Press, 2017.

This is the book that we used to learn all about GIS and using maps to analyze what takes place in the world. We also used the online version which has more online resources.

Jones, Stephanie M., and Suzanne M. Bouffard. "Social and Emotional Learning in Schools: From Programs to Strategies and Commentaries." *Social Policy Report* 26, no. 4 (2012): 1-33. Accessed December 05, 2020. doi:10.1002/j.2379-3988.2012.tb00073.x.

Supports the information that school across America are including SEL as mandatory curriculum.

"K-ESS3-1 Earth and Human Activity." K-ESS3-1 Earth and Human Activity | Next Generation Science Standards. Accessed December 11, 2020. <https://www.nextgenscience.org/pe/k-ess3-1-earth-and-human-activity>.

This webpage provides the information for the kindergarten ESS-1 standard about creating a model to show relationships between organisms and their habitat.

Keranen, Kathryn, and Lyn Malone. Redlands, CA: ESRI Press, 2016. Accessed May 2020. <https://esripress.esri.com/display/index.cfm?fuseaction=display&websiteID=303&moduleID=0>. As the title implies, this is a guide to the lessons we worked on in seminar to learn how to create web maps and story maps.

"Living Atlas of the World." ArcGIS. Accessed December 11, 2020. <https://livingatlas.arcgis.com/en/home/>.

This is a webpage that tells you about the Living Atlas database.

"MapsDaily." Accessed December 5, 2020. <https://mapsdaily.wordpress.com/>. An incredibly cool collection of over 100 story maps!

Perry, C. H., and G. M. Domke. "Forest Atlas of the United States." Map. United States Department of Agriculture Forest Service. Accessed November 27, 2020. <https://forest-atlas.fs.fed.us/grow-introduction.html>.

A story map created by the USDA Forest Service to educate readers of the importance of our trees and the different types of climates and trees that grow there.

"Read the Standards." Read the Standards | Next Generation Science Standards. Accessed December 11, 2020. [https://www.nextgenscience.org/search-standards?keys=&tid\\$5B0\]=98@page](https://www.nextgenscience.org/search-standards?keys=&tid$5B0]=98@page).

Find the K-2 Next Gen Science Standards here.

Simmon, Robert. "Global Land Cover Classification." Map. In *NASA Visible Earth: A Catalog of*

NASA Images and Animations of Our Home Planet. NASA, 2011.

A world map with land cover images taken from the MODIS instrument aboard Terra.

"Social Studies / Standards for Social Studies." / Standards for. Accessed December 11, 2020. <https://www.doe.k12.de.us/Page/2548>.

The website to access Delaware's Social Studies standards.

Szukalski, Bern. "Choosing the Right Story Map." *ArcGIS Blog* (blog), December 29, 2015. Accessed December 5, 2020. <https://www.esri.com/arcgis-blog/products/story-maps/mapping/choosing-the-right-story-map/>.

This article is an overview with hyperlinks on the different types of story maps and how to choose the one that is right for your story.

"What Is ArcGIS Online." What Is ArcGIS Online-ArcGIS Online Help | Documentation. Accessed December 11, 2020. <https://doc.arcgis.com/en/arcgis-online/get-started/what-is-ago.html#:~:text=ArcGIS Online is a cloud, being mobile in the field>.

Provides information about the ArcGIS app.

Wright, Dawn. "Mapping the World's Ecosystems." *ESRI Blog* (blog), January 10, 2019. Accessed November 27, 2020. <https://www.esri.com/about/newsroom/blog/mapping-the-worlds-ecosystems/>.

"A Conversation with Roger Sayre, Senior Scientist for Ecosystems at the U.S. Geological Survey" about the giant project that he led to create a map of the entire world's ecosystems. There are over 3,000 entries in the resulting data layer as each ecosystem was broken down into several areas to include climate and precipitation, soil composition, and types of vegetation.

Resources for Students

ESRI Canada Education. "A Children's Map of Canada." Map. A Children's Map of Canada. Accessed September 2020.

<https://edu.maps.arcgis.com/apps/webappviewer/index.html?id=50e049fe3fb94a9eadc1602a7954af2c>.

An interactive map that young children can use to practice locating items using the map key (legend). This map can be zoomed and panned to see the whole world or a very local place. It can be used to begin to have a discussion about story maps and what information we can get from maps.

Esri's StoryMaps Team. "Celebrating Great Trees." Map. In *ArcGIS StoryMaps*. ESRI, 2019. This is a beautiful story map about famous trees found all over the world.

"Forest and Woodland Habitats." TheSchoolRun. Accessed October 2020.

<https://www.theschoolrun.com/homework-help/forest-and-woodland-habitats>.

This is an article on forest and woodland habitats that can be used with students to research these habitats. Great for providing background information prior to working with maps.

George, Jean Craighead. *One Day in the Woods*. Livonia, MI: Seedlings Braille Books for Children, 2010.

Ignotofsky, Rachel. *The Wondrous Workings of Planet Earth: Understanding Our World and Its Ecosystems*. New York: Ten Speed Press, an Imprint of the Crown Publishing Group, a Division of Penguin Random House LLC, 2018.

A non-fiction source for student research.

"Learning About Forests Pathway: Eco-Schools USA." National Wildlife Federation. Accessed December 11, 2020. <https://www.nwf.org/Eco-Schools-USA/Pathways/LEAF>.

Another great resource for you to help your students learn about the forests of the world.

Pfeffer, Wendy, and Robin Brickman. *A Logs Life*. New York: Aladdin Paperbacks, 2007.

A simple story that helps younger students realize the importance of trees (even once they have died).

Shaw, Barbara, and Chad Wallace. *Pass the Energy Please*. Nevada City, CA: Dawn Publications, 2000.

A resource for students to learn how plants and animals provide food for each other.

Simmon, Robert. "Global Land Cover Classification." In *NASA Visible Earth: A Catalog of NASA Images and Animations of Our Home Planet*. NASA, 2011.

A world map of land cover with data collected by MODIS Land Cover Group with images from the MODIS instrument about Terra (a satellite). This can be one map that your students can look at closely to decide what the map is showing them.

Society, National Geographic. "Terrestrial Ecosystem." National Geographic Society. Accessed December 11, 2020. https://www.nationalgeographic.org/topics/resource-library-terrestrial-ecosystem/?q=&page=1&per_page=25.

This website's encyclopedic information on terrestrial ecosystems has all the information you need for your students to begin exploring forests.

Zegna, Janet. "World Forest Ecosystems Data Layer on Oceans Basemap." Map. October 2020. [https://dcge-](https://dcge-mapsmart.maps.arcgis.com/home/webmap/viewer.html?webmap=f0a48ee926804c64995873f5709f217d)

[mapsmart.maps.arcgis.com/home/webmap/viewer.html?webmap=f0a48ee926804c64995873f5709f217d](https://dcge-mapsmart.maps.arcgis.com/home/webmap/viewer.html?webmap=f0a48ee926804c64995873f5709f217d).

I made this map with the data layer that has four classifications of forest. The Mixed Forest and Woody Wetlands are only shown for the United States. Anyone using this map should be aware that the information is not complete.

Zegna, Janet. "Four Types of World Forests with Bioclimate Basemap." Map. October 2020.

[https://dcge-](https://dcge-mapsmart.maps.arcgis.com/home/webmap/viewer.html?webmap=519ecf99a97e4d7590d2e3561de4bdaa)

[mapsmart.maps.arcgis.com/home/webmap/viewer.html?webmap=519ecf99a97e4d7590d2e3561de4bdaa](https://dcge-mapsmart.maps.arcgis.com/home/webmap/viewer.html?webmap=519ecf99a97e4d7590d2e3561de4bdaa).

This is a map of four forest types overlaid on a basemap that shows the world's climates. This map can be used to talk about what types of trees can be found in what areas of the world (generalized). You could also see that trees do not grow in certain areas. Why might that be?

Appendix A

The following is a table of the ELA, Science, and Social Studies Standards that are expected to be met by students working on this unit.

Common Core State Standards for ELA		
<u>Standard & Grade Level</u>	<u>Number</u>	<u>Explanation</u>
College and Career Readiness Anchor Standards for Writing	CCRA.W.2	Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
	CCRA.W.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
	CCRA.W.6	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
	CCRA.W.7	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
	CCRA.W.8	Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism
	CCRA.W.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
	CCRA.W.10	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
ELA Reading: Informational Text: Grade 1	RI.1.5	Know and use various text features (e.g., headings, tables of contents, glossaries, electronic menus, icons) to locate key facts or information in a text.
	RI.1.6	Distinguish between information provided by pictures or other illustrations and information provided by the words in a text.
	RI.1.10	With prompting and support, read informational texts appropriately complex for grade 1.

ELA Writing: Grade 1	W.1.2	Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.
	W.1.5	With guidance and support from adults, focus on a topic, respond to questions and suggestions from peers, and add details to strengthen writing as needed.
	W.1.6	With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.
	W.1.7	Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions).
ELA: Language: Grade 1	L.1.1a-j	Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
	L.1.2a-e	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
Delaware Social Studies Standards		
Geography K-3	1.K-3a	Students will develop a personal geographic framework, or "mental map," and understand the uses of maps and other geo-graphics. Students will understand the nature and uses of maps, globes, and other geo-graphics.
	2.K-3a	Students will develop a knowledge of the ways humans modify and respond to the natural environment. Students will distinguish different types of climate and landforms and explain why they occur.
	4.K-3a	Students will develop an understanding of the character and use of regions and the connections between and among them. Students will use the concepts of place and region to explain simple patterns of connections between and among places across the country and the world.
Next Generation Science Standards – Life Science Strand		
Science and Engineering Practices: Grade K	K-LS1-1	Scientists look for patterns and order when making observations about the world.

	K-ESS3-1	Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.
Grade 2	2-LS4-1	Make observations of plants and animals to compare the diversity of life in different habitats.
Disciplinary Core Ideas: Grade 2	2-LS4-D	There are many different kinds of living things in any area, and they exist in different places on land and in water.
Cross-Cutting Concepts: Grade K	K-LS1-1	Patterns in the natural and human designed world can be observed and used as evidence.
	K-ESS3-1	Systems in the natural and designed world have parts that work together
Grade 1	1-LS1-2	Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.

Notes