Swamplands

Let the Games Continue…Tribal Survival:

We've made it halfway through the swamp, but will we get bogged down in the middle? Have students continue to work together as tribes. Throughout the units, tribes will compete in fun, non-competitive activities that will challenge their intellectual, cooperative, and athletic skills. Remind them that everything they do matters to the tribe and helps us survive (or not…)

Surviving the Swamps Unit **Two**

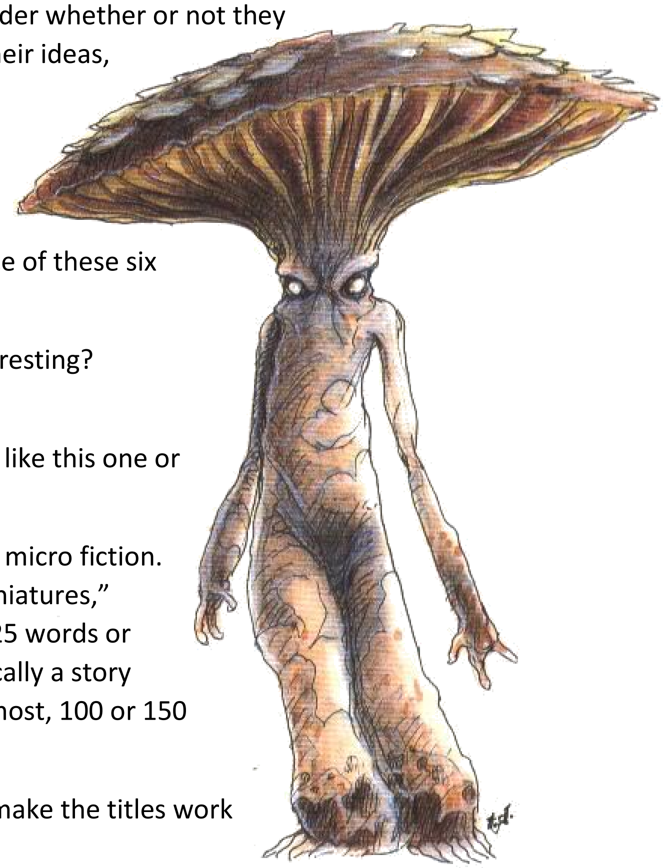
Day One: Figments

What are the essential elements of a story? How can writing flash fiction help us become better writers? In this lesson, students will consider the nature of stories and learn to write more concisely by reading and writing flash fiction.

Warm-Up | Before students enter, project or write the following famous short short story, attributed to Ernest Hemingway:

For sale: baby shoes, never worn.

When students enter, ask them to copy the story and consider whether or not they think it *is* a story. Once students have had time to record their ideas, come together as a class to discuss the following:



- What does a story need in order to be a story?
- What questions does this story leave you with?
- What do you think is happening beneath the surface of these six words?
- Is the amount of what's left unsaid unsettling? Interesting? Annoying?
- Do you think it's harder to write a short short story like this one or a longer work, like a novel? Why?

There are novels. There are short stories. And then, there's micro fiction. Micro fiction, also called "flash fiction", "short shorts," "miniatures," "sudden fiction" and "postcard fiction," and "hint fiction' [25 words or less] among many others is a genre of fiction which is basically a story ranging anywhere from a few sentences to, usually at the most, 100 or 150 words, but up to 1000.

Another example (notice how in these stories the authors make the titles work for them, they are crucial.)

"Houston, We Have a Problem," by J. Matthew Zoss.

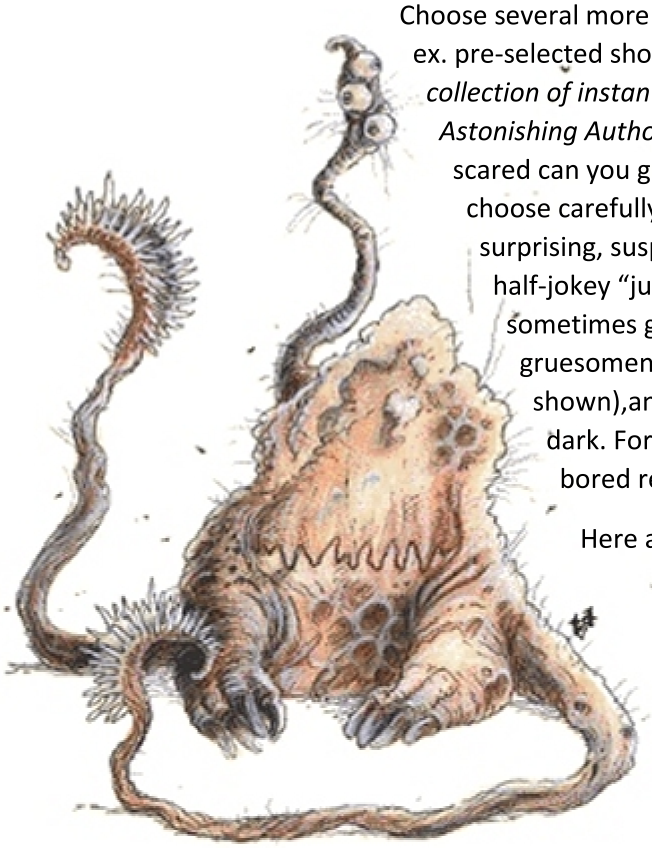
I’m sorry, but there’s not enough air in here for everyone. I’ll tell them you were a hero.

This genre of fiction is particularly fun, yet challenging to write. It defies many “rules” which appear to go along with writing a short story. For example, I’m sure that we’re all familiar with the typical storyline of a story: an introduction, rising action, climax, falling action, and conclusion, and, of course, character development throughout the plot. Well, with micro fiction, you can forget all of those rules! Here is a classic example of micro fiction:

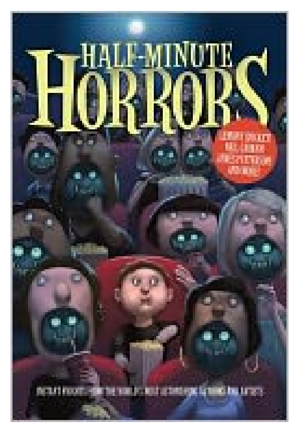
As the sun bore down on my face, I squinted across the void. The wire seemed to stretch on forever. With an exasperated sigh, I slipped one foot on the tightrope, and began to walk.

While you never know the narrator’s name or where he or she is, you’re still able to get a clear picture of what is happening. Within these three sentences, you were probably able to glean that there is a bit of personal conflict, because the person “sighs exasperatedly”. Additionally, if you were an extra-observant reader, you probably could tell that this person is a tightrope walker. Lastly, this person appears to be a pretty expert tightrope walker, because it seems as though he or she has done this many times. However, this still leaves you with a lot of questions. What is this person trying to accomplish by walking across this wire? What’s going to happen next in the story? A good micro fiction piece should provide you with a lot of information, but should also leave you wondering, and asking a lot of questions. Flash fiction adheres (stays closer to) more than any other narrative form to Hemingway’s famous iceberg dictum: only show the top 10 percent of your story, and leave the other 90 percent below water to be conjured. This is the true challenge behind writing micro fiction. It’s important to give the reader information to keep him/her from getting confused, but also withhold information to leave him or her wondering.

Go Short!



Choose several more works of flash fiction to read and discuss, ex. pre-selected short short stories from *Half-minute Horror: A collection of instant frights from the World’s Most Astonishing Authors and Artists* edited by Susan Rich How scared can you get in just thirty seconds? Make sure to choose carefully for your audience, while often fun, surprising, suspenseful, or even humorous, these aren’t half-jokey “jump” tales- they are truly creepy, sometimes gruesome (although in general the gruesomeness is more suggested than actually shown),and, when there’s humor, it’s usually very dark. For lovers of the short and scary tale, though, and for the bored reluctant reader, this is a fantastic choice.



Here are some additional sources for flash-fiction inspiration:

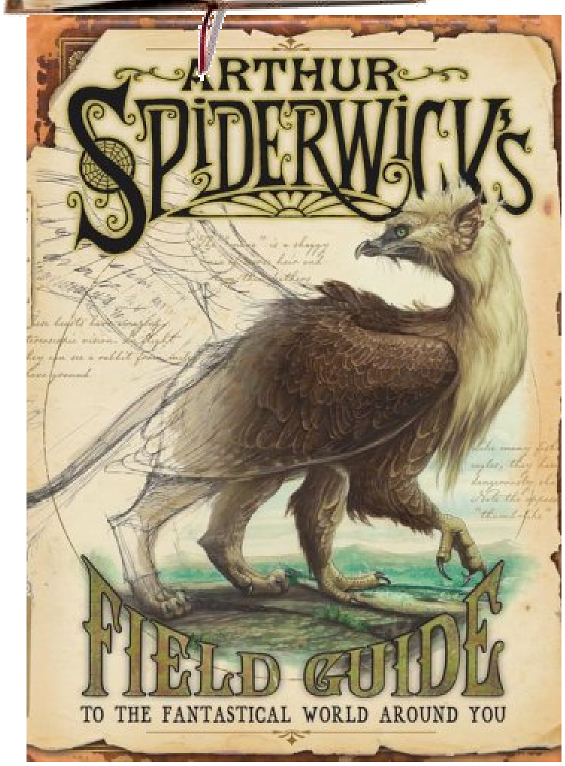
- [Previous Scholastic award-winners in Flash Fiction]

- [100 Word Story,](#) which also has written and photo prompts for writing
- [NPR's Three Minute Fiction contests](#)
- [Flash Fiction Online](#)
- [The Guardian | Flash Fiction By Kids, For Kids](#)

Invite students to read one story at a time on their own, or read several as a group, annotating as they go. (Or, recording their thoughts via a [double-entry graphic organizer](#).)

Then, have students meet in pairs or small groups to further the discussion. Some of the questions they might discuss:

- What do they know about the plot, characters, setting and theme of the story?
- What questions does the text raise?
- What is unwritten?
- What literary devices do they notice?
- What individual words or phrases jump out? What denotations or connotations are important to note about individual words?
- How "complete" a story is this? Why?



When students are finished, ask groups to share observations about the stories and follow up with these questions for the whole class:

- In general, do you think these stories work?
- How do you read them differently from the way you read a longer work?
- What do they give you that a longer work doesn't?

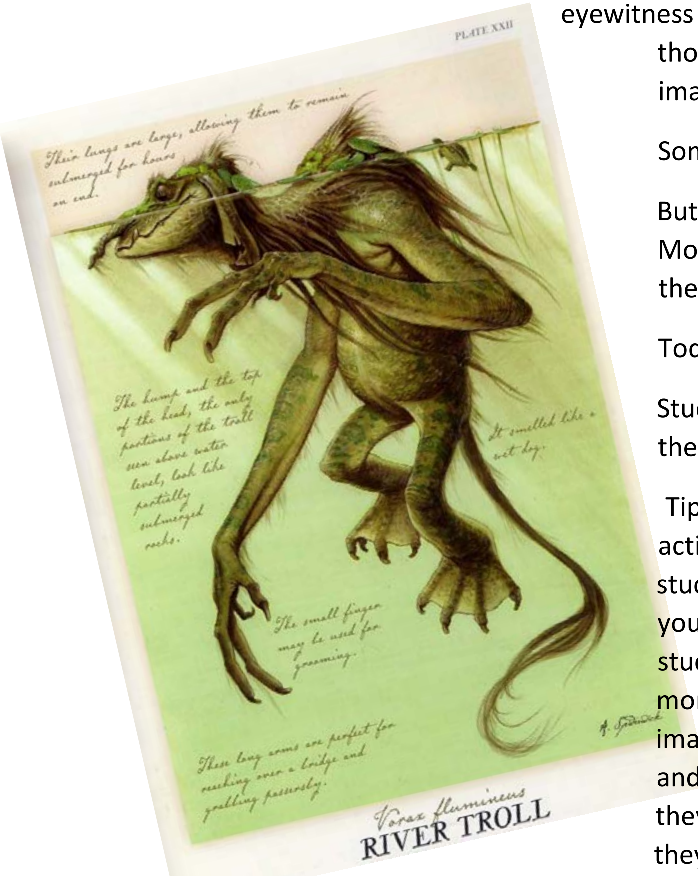
There really is no excuse for not reading flash fiction: it doesn't take long! Flash Fiction can be very fun not only to read, but to write as well!

What Lurks Beneath?

Brainstorm as a group what might happen to you if you were to get stuck in the swamp. What or who might you encounter?

Mysterious creatures lurk beneath the waters of this week's concept art writing prompt.

It all began with a strange, mysterious correspondence…an unfinished tome filled with eyewitness accounts and images of mysterious creatures otherwise thought to be the stuff of legend. Have students gaze upon the images (and/or on their own sculptures from the day before).



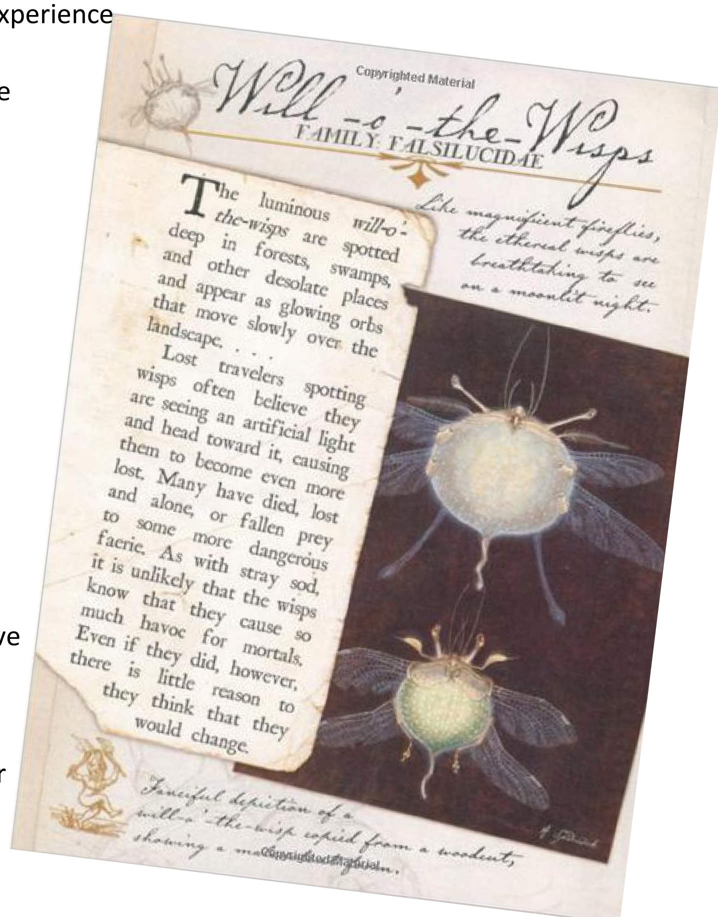
Some of them are pretty bizarre; some of them less so.

But there’s a lot of story in these images. Ex. "Go Fish" by Monica Langlois. Is this girl about to get eaten? Or is she doing the eating?

Today’s challenge is simple:

Students are to choose an image and use it as inspiration for their story.

Tip: Have students use knowledge gained through the unit activities to think of difficulties that might come up from being stuck in the swamp (as a monster or as a human). How would you get back out? What would you need to survive if you were stuck in the swamp for a day? How about a week? Are they the monster? Students will write about their imagined experience and what they believe they would need and what they would need to do to be able to survive.

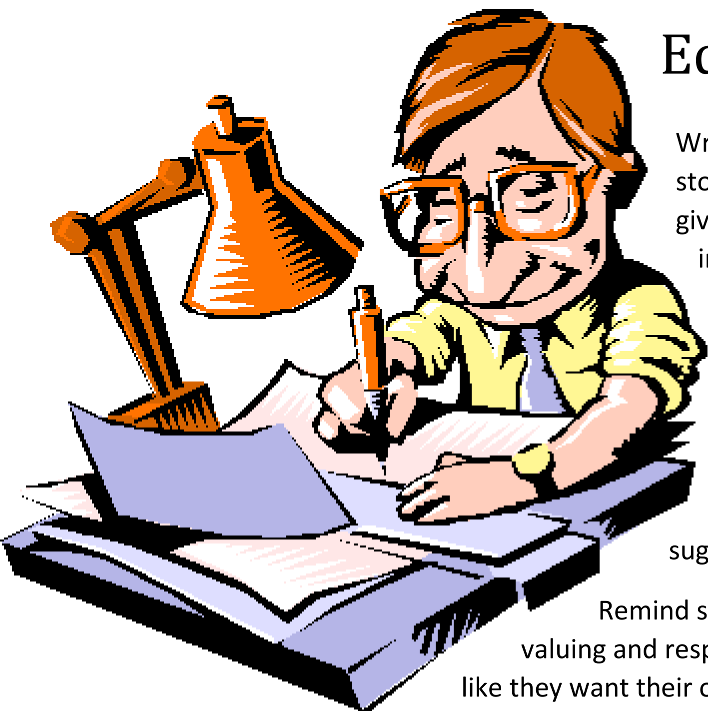


Have students work to keep their swamp monster stories to fewer than 150 words and follow the rules/lack of rules of flash fiction.

Allow time for students to peruse the following images, in the book(s) read earlier, their own sculptures, or additional resources, ex. *Arthur Spiderwick's Field Guide to the Fantastical World Around You* by Tony Diterlizzi, or the *Monstrous Manual* by the same author, and decide on which image they’d like to write about. After students have decided on an image to write about, they should begin brainstorming ideas for their story

Once students are done with their first draft of their story, they may begin self-editing and peer-editing.

Note: Much younger children who are not yet experienced writers may still participate in the creative writing process. Instead of asking them to write stories based on ideas the class comes up with, you may want to have very young children tell the stories out loud. You can take dictation or have students sit in a circle and creating a story out loud about one of the pictures, with each child adding a detail to the one before. Teachers can record the stories that younger children invent about these pictures and read them out loud later.



Editor's Corner

Writers and story tellers have editors who make sure that a story is the best it can be, drawing out the best in the story, giving suggestions on where a story could go, where it could be improved, and what else they would like to know about the characters, plot, setting, etc of a story.

Give each group colored pens. Groups get points for effectively editing each other's papers and lose points for marking things up only to make the page red. Each group gets to read aloud (to the small editing group) and edit another groups story (or multiple stories) and give suggestions and ask questions.

Remind student editors they are treat each manuscript with dignity, valuing and respecting the hard work the authors have invested into it, just like they want their own work to be respected, and that they are looking for interesting language and details, they should get a clear picture of what is happening, and the story should provide the reader with a lot of information, but should also leave you wondering, and asking a lot of questions. And if possible, the story should be under 150 words. Editors should make a word count.

Final Touches & Telling Tales

After their stories have been edited by themselves and the peer group, students may begin writing their final draft.

Finally, display the images from the lesson, monster sculptures, and/or books in front of the class (if you have poster-size images, they work even better), or display one or more copies of the book. Organize a class read-aloud where each student is given the opportunity to read his/her story aloud to the rest of the class. Allow the other students in the class time to discuss/comment on each story and decide which image/monster it belongs to.

Option: A fun way to bring older and younger students together might be for a class of older students to collaborate on creating an images book of their own, and then to present it to a lower-grade class and ask for help inventing stories to go with the scenarios. And vice versa, they could also ask younger students to illustrate the short stories that they've written.

image: http://cyrilbarreaux.deviantart.com/art/the-Mahwot-311647340

Something great and glowing emerges from a dilapidated complex in the swamp. What is the tiny figure at the opening to do? Play Indiana Jones? Serve as lion tamer of the swamp monster? Or just get out of the being's way?

Standards Alignment for Day One K-8

K

RL.K.7. With prompting and support, describe the relationship between illustrations and the story in which they appear (or the story they inspire) (e.g., what moment in a story an illustration depicts).

W.K.3. Use a combination of drawing, dictating, and writing to narrate a single event or several loosely linked events.

These standards will be met while students complete the writing/story assignment, edit and peer edit their stories, create final drafts, present them to the class and explain what image inspired the tale and how they were inspired.

1

SL.1.4. Describe people, places, things, and events with relevant details, expressing ideas and feelings clearly.

RL.1.7. Use details in a story to describe its [an illustration's] characters, setting, or events.

These standards will be met when given as part of the instructions on what should be included in the story and while students complete the writing/story assignment, edit and peer edit their stories, create final drafts, present them to the class and explain what image inspired the tale and how they were inspired.

2

RI.2.7. Explain how specific images (e.g., an illustration) contribute to and clarify a text.

SL.2.4. Tell a story with appropriate relevant, descriptive details.

W.2.3. Write narratives in which they recount a well-elaborated event or short sequence of events, a) include details to describe actions, thoughts, and feelings.

These standards will be met when given as part of the instructions on what should be included in the story and while students complete the writing/story assignment, edit and peer edit their stories, create final drafts, present them to the class and explain what image inspired the tale and how/why they were inspired.

3

RL.3.7. Explain how specific aspects of an illustration contribute to what is conveyed by the words in a story (e.g., create mood, emphasize aspects of a character or setting) and vice versa.

W.3.3. Write narratives to develop real or imagined experiences or events using effective technique and descriptive details.

These standards will be met when given as part of the instructions and example on how to write a story, what should be included in the story, and while students complete the writing/story assignment, edit and peer edit their stories, create final drafts, present them to the class and explain what image inspired the tale and how/why they were inspired.

4

RI.4.7. Interpret information presented visually and/or orally, (e.g., an illustration and a story inspired by, or written about it) and explain how the information in the image contributes to an understanding of the text [and vice versa.]

W.4.3. Write narratives to develop real or imagined experiences or events using concrete words and phrases and sensory details to convey experiences and events precisely.

These standards will be met when given as part of the instructions and example on how to write a story, what should be included in the story, and while students complete the writing/story assignment, edit and peer edit their stories, create final drafts, present them to the class and explain what image inspired the tale and how/why they were inspired. Peers will have to explain whether or not both seeing the inspiration and hearing the story increase their understanding rather than just seeing one/hearing one.

5

RI.5.6. Analyze multiple accounts of the same event or topic (ex. an illustration or story prompt), noting important similarities and differences in the point of view they represent.

W.5.3. Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and d) Use concrete words and phrases and sensory details to convey experiences and events precisely.

These standards will be met when given as part of the instructions and example on how to write a story, what should be included in the story, and while students complete the writing/story assignment, edit and peer edit their stories, create final drafts, present them to the class and explain what image inspired the tale and how/why they were inspired.

Students will compare and contrast different stories that were inspired by the same image/prompt and see whether they mostly were the same, had similar elements or were wildly different from each other.

6

W.6.3. Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and d) Use precise words and phrases, relevant descriptive details, and sensory language to convey experiences and events.

R.L.6.4 b) analyze the impact of a specific word choice on meaning and tone.

These standards will be met when given as part of the instructions and example on how to write a story, what should be included in the story, and while students complete the writing/story assignment, edit and peer edit their stories, create final drafts, present them to the class and explain what image inspired the tale and how/why they were inspired.

While peer editing, and self editing, they will look closely at word choice, especially as the word count is so limited, and see how using those words or substituting a different one might change or impact the story.

7

W.7.3. Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and d) Use precise words and phrases, relevant descriptive details, and sensory language to capture the action and convey experiences and events.

RL.7.5.. Analyze how a story's form or structure (e.g., flash fiction format) contributes to its meaning.

These standards will be met when given as part of the instructions and example on how to write a story, what should be included in the story, and while students complete the writing/story assignment, edit and peer edit their stories, create final drafts, present them to the class and explain what image inspired the tale and how/why they were inspired.

We will discuss, after the examples in the unit and also after reading our group stories, whether or not and how the flash fiction format impacts the way a story is told or its meaning.

8

RL.8.3. Analyze the impact of the author's choices regarding how to develop and relate elements of a story or drama (e.g., where a story is set, how the action is ordered, how the characters are introduced and developed).

W.8.3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and d) Use precise words and phrases, telling details, and sensory language to convey a vivid picture of the experiences, events, setting, and/or characters.

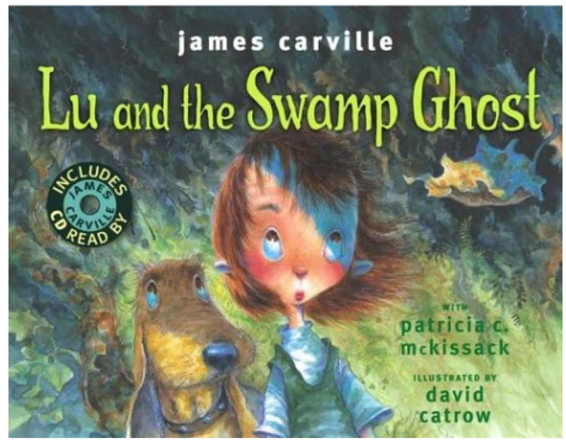
These standards will be met when given as part of the instructions and example on how to write a story, what should be included in the story, and while students complete the writing/story assignment, edit and peer edit their stories, create final drafts, present them to the class and explain what image inspired the tale and how/why they were inspired.

While peer editing and self editing students will look at how the elements of the story impact the meaning or what we get from the stories and whether or not those choices work or need adjustment to make the story even more impactful.

Day Two: Swamp Masters

In our journey through the swamp we want to learn from the best, from those that have gone before us and made their ways through the treacherous swampland safely. In order to learn we must read their tales, book(s) about other adventurers in the Swamplands such as *Petite Rouge: A Cajun Red Riding Hood* by Mike Artell, *Lu and the Swamp Ghost* by James Carville, *Little Pierre: A Cajun Story from Louisiana* by Charles Perrault, and/or *Liza Lou And The Yeller Belly Swamp* by Mercer Mayer. Read, discuss, and help students find the similarities to other great adventurer's we've/they've read about such as Tom Thumb, Hansel and Gretel, Red Riding-hood, Three Billy-Goats Gruff and the Uncle Remus stories as well as others they might be familiar with. We'll compare and contrast as we discuss how these adventurers survived the swamps, what challenges they faced and how they overcame them.

Petite Rouge threatens Ol' Claude with a whack.



Now let's revisit some of the questions that we discussed during the previous activity. If we lived in the swamp how would we survive? What types of food might we eat? Where would we live? What types of pets might we have? What types of transportation might we use? Discuss with your group and come up with the answers to these questions. Write sentences to answer your questions. Draw pictures to support your answers. Be as creative as you can and use the information you have seen today to answer each question.

Can We Survive Quicksand?

*Possible book to use when discussing quicksand is *The Quicksand Book* by Tomie DePaola

We will start by watching a video of quicksand, ex. the Teenage Mutant Ninja Turtles trying to escape quicksand (https://www.youtube.com/watch?v=boAoDQHJUo8). Then ask students what they would do if they got stuck in it, and/or/then the Princess Bride 59 second clip (https://www.youtube.com/watch?v=d8Fsyld7YD0). A brief class discussion will follow to determine their prior knowledge of the sticky, tricky substance.

Afterward, explain that quicksand is actually a colloid made by over-saturation of the soil or sand by water in the place where it forms and we will watch an amazing video of Bear Grylls actually escaping from quicksand and explaining how to do it! (There are several, including http://adventure.howstuffworks.com/28993-man-vs-wild-moab-desert-quicksand-video.htm)

After visiting this website discuss how Hollywood has used quicksand in movies to create action scenes in movies [see how many here: http://www.quicksandmovies.net/clips.html] . After having watched Bear Grylls, the Teenage Mutant Ninja Turtles and the clip from the Princess Bride (https://www.youtube.com/watch?v=d8Fsyld7YD0), ask the students to answer is quicksand really as dangerous as we might have once thought (and is it portrayed accurately in the movies)? Ask the question why would a swamp be a probable place to find quicksand? If we lived in the swamp and we fell into some quicksand would it be possible for us to get out of it?

Digging Out of the Pit

Now we are going to make our own quicksand using the recipe for clay-based quicksand at http://www.radiolab.org/story/recipe-quicksand/ (because that is the type of soil found in the Atchafalaya Basin).

What gives quicksand its wriggle-worthy properties? Its non-Newtonian nature, of course (you didn't see that coming). The properties associated with being one of those wacky fluids is their ability to change viscosity based on the rate and force of applied stress. Quicksand is the best example but ketchup, gak, and bogs are all non-Newtonian. Thankfully, you don't have to be Newton to build your own pit.

Fred is the managing director of a studio where films featuring quicksand are made (he prefers we don't use his last name). As part of his job, Fred is the guy who re-creates different types of quicksand pits. He told us that depending upon the size, shape, and distribution of particles you use, there are two types "quicksand" you can create, based on the two ways non-Newtonian fluids behave.

Traditional sand-based quicksand is thixotropic. So when undisturbed, it is solid-like, but when suddenly shaken or agitated, it becomes less viscous and more fluid. In laymen's terms, if you come across one of these pits when you're furiously running down a jungle trail (away from Sasquatch, obvi), the moment you hit the pit's surface you disrupt the sand's placid state, making it more liquid-y, less solid-y, and thus able to suck you in.

"Traditional quicksand is sand in a constricted area, with water percolating up through it," says Fred. "What happens is the sand particles are lifted by the pressure underneath, making a cap on top that looks like walkable ground."

When someone steps on the surface, their body weight displaces the deeper water, causing it to rise to the surface.

Another funky behavior of non-Newtonian fluids can be seen in game shows, where contestants run across pools of cornstarch and water. No, they aren't walking on water, rather, they are banking on the other way non-Newtonian fluids can behave. Known as *dilatancy*, this property is defined by a fluid's ability to *harden* under stress. Sadly, or perhaps fortunately, dilatancy pits are only found on game shows, not out in nature (but if you do find yourself on a game show, and you want to get in, then you need to inch in slowly).

Natural quicksand pits come in many different flavors, from sand to clay or peat. Keep in mind, says Fred, "Sand is the most dangerous."

"You may only be knee-deep, but once the sand locks up, you become trapped and exposed to the elements," he explains.

Want to make your own pits? Here are some recipes to sink by.

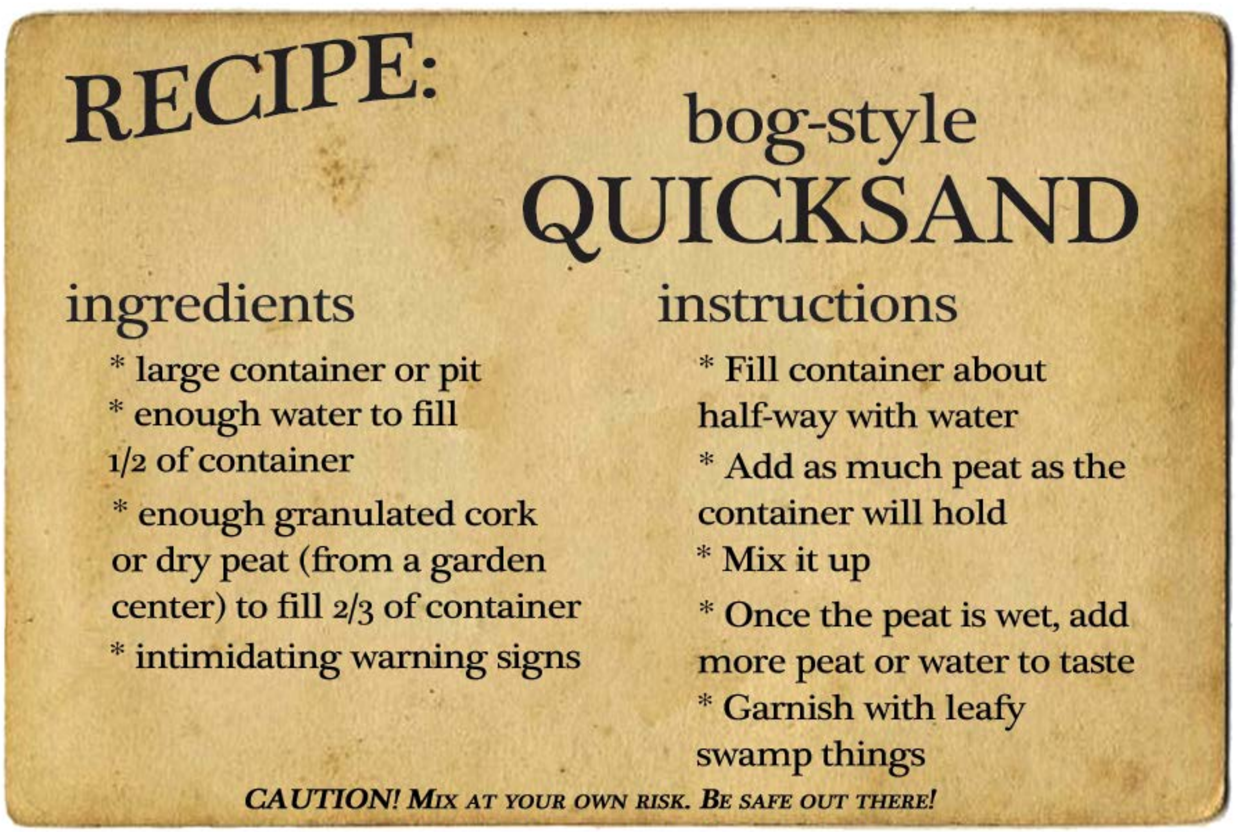
Swamp Walk: Walk like a Monster

Walking through marsh, bog, and swamp areas can be challenging, and it's important to be able to read the terrain and understand the techniques for effective movement. The best thing is Know your swamp, marsh, or bog. Not all swamps, marshes, or bogs are the same and some of them are more dangerous than others to be attempting to travel through. Things to bear in mind include depth, animals that lurk in the swamp, plant life (roots can entangle you or trip you), and other such potential problems, such as quicksand. [Find further tips and advice to help us survive here: http://www.wikihow.com/Walk-in-a-Swamp]

Now it's time to experiment: Students and staff will construct our very own quicksand pits in large plastic storage bins. As the students make their quicksand pits for the contest, discuss how quicksand does not start out that way but is formed over time due to erosion and the amount of soil that ends up mixed into the water, or vice versa until it is over its saturation point. Discuss how this erosion occurs as well.

After the students make quicksand, have them examine it with their team members and list all the properties they can come up with. Before we have the contest, the class will discuss which properties of the colloid substance are chemical and which are physical.

Students will be divided into teams and a contest will ensue. The team that escapes the quicksand first wins a sticker or small prize. We continue until all teams have had a turn.



RECIPE:

sandy QUICKSAND

ingredients

* large container or pit
* enough sand to fill 2/3 of container
* water to fill remaining 1/3 of container
*a hose
* a white flag of surrender

instructions

* There actually aren't any hard and fast instructions
* Working with sand is pretty complicated, so...
* Experiment until stuck
* Call a friend, or trained horse, to pull you to safety

CAUTION! Mix at your own risk. Be safe out there!

RECIPE:

clay-pit QUICKSAND

ingredients

* large container or pit
* powdered clay
* water
* jungle decorations
* iron-willed endurance

instructions

* Add a few inches of water to your pit – say 6 inches
* Add clay in a layer of no more than 2" deep (dry)
* Mix by hand
* Add water as needed, but go easy with the clay (add it gradually or it'll pack together and be very tough to mix)

CAUTION! Mix at your own risk. Be safe out there!

Some safety notes:

*If you get sucked into sandy quicksand, once you stop moving, the sand will return to a more solid state, and trap you. So it turns out, the *more* you wriggle and squirm, the looser the sand will become, allowing space for your body and allowing you to get out. In quicksand prone areas, like Alaska, fire fighters sometimes use a wand (for our purposes, any hose will work) to shoot water or air underneath the trapped body, loosening the sand particles and voila! Freedom!

*Clay is quite slippery when wet, so be sure to have a dry rope nearby to pull your body out.

*To sanitize any of your pits (expect the peat one to grow its own ecosystem of bugs and bees, says Fred), you can occasionally shock them with chlorine.

*Remember folks, don't make the pit any deeper than you are tall; Fred keeps his around five feet.

*** OBLIGATORY WARNING!*

Hey kids, if you do successfully build a quicksand pit, don't be evil and lure unsuspecting people and animals into it. And don't get yourself stuck with no hope of rescue.

Standards Alignment for Day Two K-8

K

7.9.2 Observe, discuss, and compare characteristics of various [mixtures of] solids and liquids.

7.9.1 Describe an object or material by its observable properties.

These standards will be met while students conduct the quicksand experiments, during observation (and use) of the various mixtures' elements and parts, and also during discussion.

1

7.7.1 Realize that water, rocks, soil, living organisms, and man-made objects make up the earth's surface.

7.7.2 Classify earth materials according to their physical properties.

These standards will be met while students conduct the quicksand experiments, during observation (and use) of the various mixtures' elements and parts, and also during discussion.

2

7.7.1a Compare and record the components of a variety of soil types.

7.7.1b. Analyze and compare a variety of soil types.

These standards will be met while students conduct the quicksand experiments, during observation (and use) of the various mixtures' elements and parts, and also during discussion.

3

7.7.2b Analyze the physical characteristics of different kinds of rocks and/or soil.

7.7.2c Describe how rocks and soil types can be classified according to their physical characteristics.

These standards will be met while students conduct the quicksand experiments, during observation (and use) of the various mixtures' elements and parts, and also during discussion.

4

7.11.2b Design an investigation to identify factors that affect the speed and distance traveled by an object (or person) in motion.

7.11.2c Identify factors that influence the motion of an object or material.

These standards will be met while students conduct the quicksand experiments and compare and contrast and analyze and record how the different mixtures affected their ability to move quickly through the quicksand, whether each mixture felt or reacted differently than the others.

They will identify the different elements that changed and form opinions on their effects on the abilities of humans to move through them and which one they think might be the most difficult to escape from and why.

5

7.12.2 Identify the force that causes objects to fall to the earth.

7.12.1 Recognize that the earth attracts objects without directly touching them.

Students will determine the role that gravity has to play when objects and animals fall into quicksand and why objects have a tendency to go down.

6

6.3.03 a. Describe how physical processes shape the characteristics of a place, [environment, or ecosystem.]

7.2.3 Draw conclusions from data about interactions between the biotic and abiotic elements of a particular environment.

Students will learn how and why quicksand is more likely to form in a swamp area and what processes (erosion, water movement, particle movement etc) cause it to be form. We'll describe how Hollywood portrays quicksand vs how it is in real life and our understanding *after our experiments of the the effects that quicksand (non-living) has/might have on the animals (including humans) and objects that encounter it.*

7

7.7.1 Use physical properties to classify minerals, soils, and/or earth materials.

7.7.4 Recognize that the earth's materials (ex. soils) have different thickness, states of matter, densities, and makeup.

Students will compare the feel, texture, ability to move in, and other aspects of the different quicksand mixtures and come up with a classification system as a class. They'll be able to see while conducting the experiments that while we may think of all soil as 'dirt' it actually is made up of a wide variety of different components.

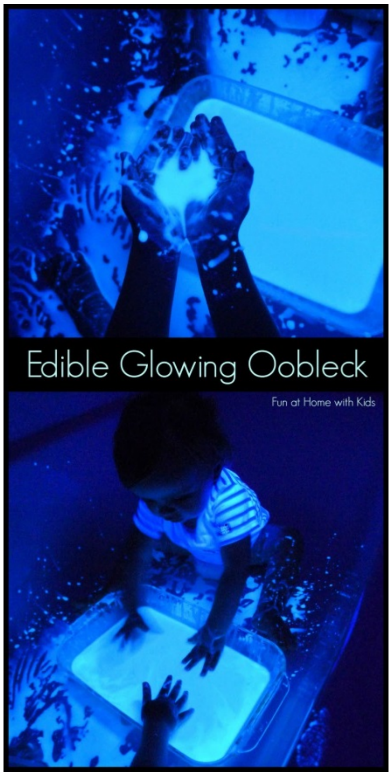
8

7.9.7 Describe how the characteristics of a compound or mixture are different than the characteristics of their component parts.

7.9.2 Illustrate the particle arrangement and type of motion associated with different states [and mixtures] of matter.

These standards will be met while students conduct the quicksand experiments, during observation (and use) of the various mixtures' elements and parts, and also during discussion as learn how quicksand is formed. We will compare sand by itself, water by itself, peat by itself, and clay by itself and their characteristics to the characteristics they have as individual components vs. when they are mixed into quicksand. We'll illustrate the motion of sand particles and clay particles in quicksand through our experiments.

Day Three: Glowing Goo!



In honor of blue glows, wily wisps, and swamp mud, have students make glowing "swamp mud," [Oobleck, or cornstarch quicksand], using cornstarch (or starch extracted from potatoes) and tonic water to create a fluorescing 'magic mud' and shine it under a black light.

Materials per batch:

- 1 16oz box of cornstarch
- 2 cups Tonic Water with Quinine
- Blacklight

Mix the cornstarch with tonic water until it's smooth. If there isn't enough "give" to the cornstarch and it is not dripping from your fingers like it is in these photos, add a tablespoon more tonic water at a time. If it is too runny and does not make dramatic ribbons or hold together when you squeeze it with your hand, add more cornstarch a tablespoon at a time

Note: If you can't find Tonic Water with Quinine you can make safe 'glow water' using 2 tablets of Nature's Way Vitamin B-50 Complex (or other B vitamin high in Thiamine if you want a really great glow with a blacklight) and water. Using a kitchen mallet and Ziploc bag, pound the vitamin into powder and add it to a glass of warm water and stir. Replace the tonic water with 'glow water.'

Just what grows in the mud between our toes?

Everything on our planet is connected together, linked by a giant recycling system called the biogeochemical cycle. It is an amazing process. We can actually investigate how our planet recycles and reuses everything needed to support life by making a small model of the biosphere.

For this experiment, we will be building a Winogradsky column which is a simple device for culturing a large variety of microorganisms and is a visual experiment for demonstrating life cycles and needs of soil bacteria. It was invented by Sergei Winogradsky and contains pond/river/swamp mud and water mixed with a carbon source such as newspaper, blackened marshmallows or egg-shells. We will also use and test a sulfur source such as egg-yolk. Incubating the column in indirect sunlight for days, weeks, and months results in a colorful gradient of different microorganisms due to oxygen levels, nutrient types and sulfur levels.

Did you know that nature reuses and recycles? To live and grow, organisms need specific nutrients nearby for them to eat—just like we do. How do the nutrients end up there? Most of these nutrients are continuously being moved through a biogeochemical cycle, which transports nutrients and other chemicals through the living and nonliving parts of Earth—for example, iron that was once in a rock might later enter the soil where it can be absorbed by a plant and then eaten by an animal.

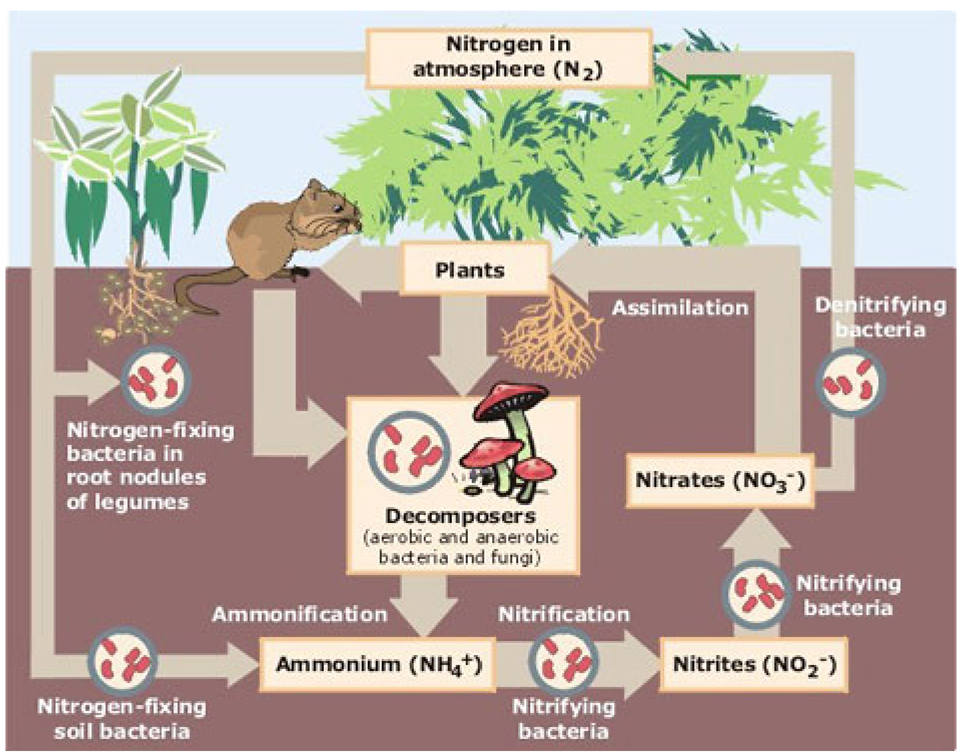
The biogeochemical cycle is a closed system, which means that the nutrients aren't lost or created; they're continuously reused and recycled.

A given ecosystem might have several biogeochemical cycles going on within it. Some important nutrients that are recycled through an ecosystem are oxygen, carbon and sulfur.

Most of the nutrients that organisms need in the living part of the earth, or biosphere, get there by being moved along through a biogeochemical cycle. A biogeochemical cycle is a pathway that moves nutrients and other chemicals through the living and nonliving parts of the Earth (which are called the biotic and abiotic parts, respectively). The biogeochemical cycle is also what is known as a closed system, which means that these nutrients are not lost or created, but are constantly being reused and recycled. Basically, all organisms depend on nutrients from other living creatures and from nonliving components of the planet, and these nutrients are constantly being moved around. Knowing this, you can probably see how biogeochemical cycles are important for both ecology and earth science.

A given ecosystem (which is a system with living and nonliving parts that interact together), such as a swamp, may have several biogeochemical cycles going on within it. Nutrients (and other chemicals) move through the living parts of an ecosystem by being part of organisms. Nutrients also move through nonliving parts of ecosystems, like water, land, and the air. (These parts make up the hydrosphere, lithosphere, and atmosphere, respectively.) Some important nutrients that are recycled through an ecosystem are phosphorus, nitrogen, oxygen, carbon, and sulfur.

Some examples of biogeochemical cycles are the water cycle, the carbon cycle, and the nitrogen cycle. Figure 1, below, shows the nitrogen cycle. You can see how nitrogen is recycled through the production of different nitrogen-based compounds, such as ammonium (NH4+) and nitrates (NO3-). These different compounds are used by different organisms, such as different types of bacteria.



Everything on our planet is connected together, linked by a giant recycling system called the biogeochemical cycle. It is an amazing process. We can actually investigate how our planet recycles and reuses everything needed to support life by making a small model of the biosphere. What will be important to include in our miniature system so that it can support different types of life?

One of the pioneers of the "Cycle of Life" concept was a Ukrainian-Russian microbiologist named Sergei Winogradsky. In the 1880s, by studying the unique microbes that live in different soil conditions, he discovered how nitrogen was recycled in a process called *nitrification*. He discovered that water and mud poured into a tall bottle and placed in the sun turned many different colors. He found that by adding a few simple things, such as cheese, eggs, or paper, he could control which colors appeared. He went on to study different soil microbes that each recycle different nutrients in the biosphere, like nitrogen, phosphorus, sulfur, carbon, and oxygen. Sound familiar? These are all important nutrients in the Earth's biosphere, recycled by biogeochemical cycles. Now you know why those soil-dwelling microbes are all so important!

One of the tools that Sergei invented to study these processes was a long, sealed column of muddy soil, now called a **Winogradsky column**, after his important discoveries.

Within a Winogradsky column, different **gradients** are formed. For example, over time, there is more oxygen at the top of the column, next to the air, than at the bottom. Similarly, if sunlight is shining more on the top of the column than the bottom, then there can also be a sunlight gradient from the top to the bottom.

The gradients of oxygen and sunlight in a Winogradsky column affect where different microbes can live in it. For example, it might sound strange to us, but a lot of bacteria actually cannot live in the presence of free oxygen. They are called **anaerobic bacteria**. There are several different types of anaerobic bacteria, and they usually live further down in the column. Bacteria that need oxygen, or make oxygen, such as **cyanobacteria**, usually live near the top of the column. Bacteria that need free oxygen are called **aerobic bacteria**. Similarly, several different types of bacteria need sunlight so they can get energy (through **photosynthesis** or a similar process). Those bacteria will want to be where they can get sunlight in the column.

An interesting interaction that can happen in a Winogradsky column involves a gradient of *hydrogen sulfide*. It has to do with a common type of anaerobic bacteria called **sulfate reducing bacteria**. This bacteria actually eats *sulfur* and turns it into *hydrogen sulfide*. Hydrogen sulfide is a poisonous gas that is responsible for the characteristic smell of rotten eggs. The sulfate reducing bacteria sometimes live at the bottom of Winogradsky columns, making a hydrogen sulfide gradient in the column with high amounts at the bottom and low amounts near the top. The hydrogen sulfide, while toxic to humans (but not in the quantities in your Winogradsky column), is actually eaten by other types of anaerobic bacteria, such as **green sulfur bacteria** and **purple sulfur bacteria**. To thrive, these bacteria need energy from sunlight in addition to the hydrogen sulfide.

Here's a recipe for making our own Winogradsky column. With just mud, paper and an egg, we can grow colonies of multi-hued microbes!

In this science project, students will work in groups and make their own Winogradsky columns to study soil samples and investigate how including different nutrients affects the bacteria that grow in it. Each column will model the biosphere. By adding a source of sulfur or carbon to each column, they will test how each nutrient affects bacterial life in their miniature biosphere.

Including carbon may affect a group of anaerobic bacteria called purple non-sulfur bacteria, which are bacteria that need sunlight and a carbon source. To help students identify the bacteria there is a poster illustration as well as Table 1, below, which shows the main groups of bacteria that they may find in a Winogradsky column, along with the general order in

Column Position	Bacteria	Color
Top	Cyanobacteria	Green
	Purple non-sulfur bacteria	Red, purple, orange, or brown
	Purple sulfur bacteria	Red/purple
	Green sulfur bacteria	Green
Bottom	Sulfate reducing bacteria	Black

Table 1. To help you identify them, this table lists the main groups of bacteria that you may see in a Winogradsky column along with their general position within a column and their usual coloring.

which they appear (from the top to the bottom of the column) and what color they usually are. Note that some types of bacteria, such as the purple non-sulfur bacteria, can come in many different colors (there are many different species).

How will adding sulfur or carbon cause the populations of soil-dwelling microbes to change? Will some of the bacteria be unable to grow? Will some grow even better? Get ready to load some bottles with mud to make your own Winogradsky columns and find out!

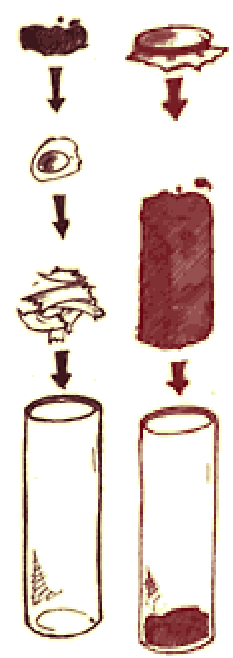
Questions & Predictions

- After a Winogradsky column has been sitting for a few days/weeks, where do students think the most oxygen will be?

- How do they think the oxygen gradient in a Winogradsky column will affect where different microbes are living in it?
- If there is a lot of sulfur in a Winogradsky column, what types of bacteria do they expect to see more of? Do they expect to see less of any other types of bacteria?
- How are sulfate reducing bacteria different from green sulfur bacteria and purple sulfur bacteria? How are all of these bacteria types similar?

Materials:

- 4 (+) tennis-ball containers or plastic soda bottles with the top cut off
- container top or plastic wrap and a rubber band
- mud from the edge of a shallow pond or swamp (the smellier the better)
- swamp/pond/river water
- spoons
- lamp with a Scissors
- Knife (optional)
- Permanent marker
- Ruler
- Gloves
- Shovel or trowel
- Two buckets
- Newspaper or plain paper (shredded)
- eggs
- Two bowls
- Two large mixing bowls
- Measuring cups
- Wide stick, for packing mud into the bottles
- Measuring teaspoon
- Adjustable desk lamp with 40-watt incandescent bulb or 13-watt compact fluorescent bulb (optional)
- An empty surface, such as on a desk or table, that is at warm room temperature (about 72 to 78 degrees Fahrenheit). It should not receive any direct sunlight but if you're not using a desk lamp, the area should be near a very sunny window.
- Plastic wrap
- Plastic trash bags or grocery bags
- Four rubber bands
- Cardboard box or brown paper bag
- Flashlight



Preparation

• Remove any wrappers from the bottles as best you can.
• If using water bottles carefully cut the tops off your bottles. You may need to use scissors and a knife to do this, and an adult might need to help. Cut the top off right where the bottle starts curving inward near the top. Save the cut-off tops to use as funnels later.

• Using a permanent marker, make a small mark where your bottle would be about 85 percent full. For example, if your bottle is six inches tall, you would make a mark at about five inches up from the bottom. You will fill the bottles to this level with mud.
• Label each bottle with what will be added to its mud. One will have newspaper added, one will have egg yolk added, one will have newspaper & egg added, and two will only hold plain mud (with nothing added). One of the plain bottles will be kept in the dark, the other four bottles will be exposed to light.
• Go collect some mud from a muddy stream, pond, lake or marsh. Use caution around the water and always have adult supervision. (You may want to first put on some rubber boots and old clothes that can get muddy.) Put on gloves and fill one bucket with about one-half to one gallon of mud, scooping it mostly from just below the water's surface.
• In the other bucket, collect some water (one-half gallon at most) from the same location.
• Bring your buckets home and go wash up if needed! (Until you use them, keep your buckets shaded so they don't get too hot.)

Procedure

In a bowl cut about a quarter sheet of newspaper or plain paper into thin strips, and then cut the strips into tiny rectangles. These will be a source of carbon for the microbes in the mud. *How do students think adding carbon will affect the microbes that grow in the Winogradsky column?*

In a second bowl add an egg yolk (raw or hard-boiled). If it is hard-boiled, crush the yolk into a mash. If it is raw, be sure to wash your hands after handling it, as raw eggs may contain salmonella bacteria. The yolk will be a source of sulfur for the microbes in the mud. *How do students think adding sulfur will affect the microbes that grow in a Winogradsky column?*

Put on some gloves and get your bucket with your mud. While stirring, slowly add the water you collected to the soil until your mixture becomes like a milk shake. Also while stirring, be sure to pick out all sticks, leaves and rocks from the mud.

In a large mixing bowl blend a little more than two cups of the mud and the egg yolk. Using a cut-off bottle top as a funnel, pour about one inch of the mud mixed with egg yolk into the bottle labeled as only having egg yolk added. Tap the bottle on a hard surface to pack the mud down and use a wide stick to pack the mud more. Continue adding about one inch of mud at a time and packing it down until you are at the 85 percent full mark you made. Set the bottle aside.

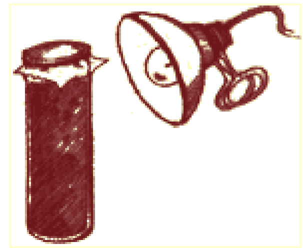
In another large mixing bowl blend a little more than two cups of the mud from the bucket (remix if water has settled out) and the ¼ sheet of the shredded newspaper or paper. Using a cut-off bottle top as a funnel, pour and pack about one inch of the mud at a time into the correctly labeled bottle until you are at the 85 percent mark. Set the bottle aside.

In a third bowl blend in a little more than 2 cups of the mud, ¼ of a newspaper sheet of shredded paper and an egg yolk , add an inch of mud, and mix well. Then, fill the container with mud up to the 85 percent full mark and cover it. Wash your hands after you complete the setup.

Take the two remaining bottles, which you should have labeled as having plain mud. Into the two bottles funnel and pack in mud directly from the bucket of mud (remix if water has settled out) until they're 85 percent full.

After sitting about 30 minutes the water should be about 0.2 to 0.8 inch deep on top of the mud in each bottle. Carefully add more water or remove some, as needed. Leave at least 0.2 inch of empty space at the top.

Let it Grow! Let it Grow!



Find an empty flat surface, such as a desk- or tabletop, that is at warm room temperature (about 72 to 78 degrees F). It should not receive any direct sunlight. If you're not using a desk lamp, the area should be near a very sunny window. Cover the surface with plastic trash or grocery bags to protect it.

• Carefully move your bottles to the surface, being careful not to spill them! Cover each bottle with plastic wrap, secured with rubber bands. Your Winogradsky columns are now ready for testing!

• If you're not using a desk lamp, arrange the three Winogradsky columns (that will receive light) so that they'll receive a lot of light, but they should not be exposed to direct light. If you're using a lamp, arrange the three columns so that they're 20 inches away from the lightbulb. For those bottles that are being lit by lamp, write a small "L" on the sides of the bottles that are facing the lamp. *What do students think will happen on the sides facing the light?*

• Set the Winogradsky column with plain mud that won't receive light on a surface at room temperature. Then either place a cardboard box upside down over the column, or put it in a brown paper bag, so that no light reaches the bottle. *What do students think will happen in the column that doesn't receive light?*

For the next six to eight weeks leave the Winogradsky columns where you set them. If you're using one, keep the desk lamp on 24 hours a day. Put the container about a foot from the 40-watt bulb that you can leave on all the time. Every few days, briefly remove the container's top to vent off the gases (if too much gas is allowed to build up, it can blow the top off). If the mud at the top is drying out, add a little water. In a few weeks, or sometimes just in a few days, they'll see auras of brilliantly colored bacteria. Keep watching, and you'll see the colors develop and change during the next several months.

(If a plastic wrap lid comes loose, just reattach it with a rubber band.) Observe the columns once a week, looking for color changes in them. Each area of coloring should be a group of the same type of microbes. When observing the columns, have students try turning off the lights and shining a bright flashlight at the columns—this can help you see the colors better. *What colors do students see appear in the columns? Where in the columns do they appear? How do the columns look different from one another? Do they see any worms, shrimp, snails or other larger organisms in the columns? How do the columns change over time? What do students think their results have to do with what was added (or not added) to the columns?*

• Tip: You should see some green coloring appear on some columns after one to two weeks. You may need to look closely for it. If you do not see any green coloring, the columns may not be receiving enough light. You could try moving them closer to the light source.

• **Extra:** Do this activity again, but this time test multiple bottles for each condition. For example, test three Winogradsky columns with egg yolk. *How reproducible are your results? Is there a lot of variation between the different columns that were set up the same way?*

• **Extra:** Students could try testing several different sources of mud or soil to see if the microbial growth will be different from location to location. They could even try some beach sand. *What do you think your results tell you about the soil quality and microbes that live at each site you test?*

• **Extra:** Test some different kinds of additives to look for microbes that live in unique and challenging environments. For example, you could test increasing amounts of salt in a series of Winogradsky columns to test for salt lovers (called halophiles) or place columns at different temperatures to find microbes that like heat (near a heat vent) or cold (in the refrigerator). *Can you select for microbes that live in more extreme conditions?*

Observations and results

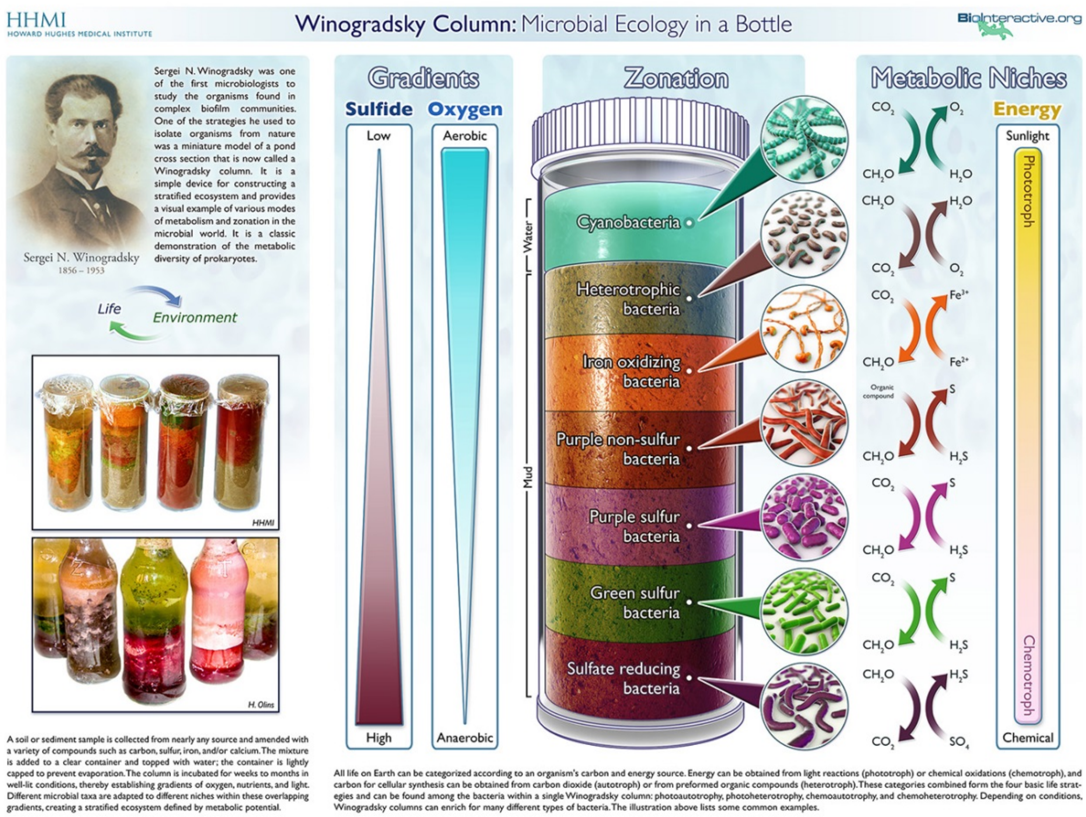
Did the columns that were in the light make areas of green coloring on the sides facing the light whereas the column in the dark remained dark brown? Did the three columns that were in the light create color patterns that were somewhat different from one another?

Over time gradients of different nutrients should have formed in the Winogradsky columns. These gradients affect where different microbes grow within the columns. For example, over time there's more oxygen at the top of a column that at the bottom, and this means that microbes that can tolerate or make oxygen will be at the top. Microbes that cannot tolerate free oxygen (called anaerobic bacteria) will be further down. Similarly, microbes that need light to make energy (via photosynthesis or a similar process) will need to live where they can get light in the column.

Many kinds of bacteria live in mud. Some are decomposers that get nutrients by breaking down organic materials things like the egg and paper. During the process of decomposition, all the oxygen near the bottom of the container is used up.

Other bacteria are photosynthetic. Blue-green bacteria near the top of the mud column use light, carbon from carbon dioxide, and hydrogen from water to make carbohydrates and give off oxygen just like plants. The carbon dioxide they need is released when the decomposers break down the paper and egg.

After about one to two weeks, or faster, depending on how much light the columns receive, some green coloring should appear in the columns receiving light on the illuminated sides. This is mostly due to cyanobacteria and algae, which need light. The column in the dark should remain dark brown. In the column that had egg yolk you may have seen areas of darker green, purple, and/or black coloring develop over time near the bottom—these colorings could be groups of certain anaerobic bacteria: green sulfur bacteria, purple sulfur bacteria and sulfate-reducing bacteria, respectively. Sulfate-reducing bacteria actually eat sulfur and make hydrogen sulfide gas, which is eaten by the green and purple sulfur bacteria. Red, orange and green bacteria that grow near the bottom of the column are less tolerant ¬ or completely intolerant ¬ of oxygen. They're photosynthetic, but they get their hydrogen from hydrogen sulfide, the gas that smells like rotten eggs. In your container, hydrogen sulfide is released when the decomposers break down the protein in the egg.



In the column that had newspaper you may have seen some areas of brown, orange, red or purple near the middle—these colorings could be groups of purple nonsulfur bacteria, which need a carbon source to thrive. You may have seen worms, snails, shrimp or other small organisms in the water, but probably not many (if any) in the bottle with the egg yolk, because hydrogen sulfide is toxic to most organisms!

Your mud contained some of each of these kinds of bacteria when you collected it. You provided the bacteria with conditions that are just right for them, and their populations exploded. The colorful patches are colonies of billions of bacteria.

So what?

Scientists believe that for the first billion years that life existed on the planet, the atmosphere contained little oxygen. Bacteria like those at the bottom of your mud column thrived. It wasn't until about two billion years ago that the blue-green bacteria filled the atmosphere with its photosynthetic waste product oxygen. This effectively banished other kinds of bacteria to places where there is no oxygen to mud and sediments and (more recently) to the insides of plants and animals.

But these oxygen-phobic bacteria still have crucial roles to play. Some take part in the global sulfur cycle. Others convert nitrogen into forms needed by plants. And neither cows nor termites would enjoy their cellulose-based diets without the helpful bacteria in their guts that digest the cellulose for them.

So as we trudge through the swamp we're squishing some amazing life between our toes!

Cleanup
Be sure to wash your hands and anything else that came into contact with the raw egg, because they can carry salmonella. Also wash your hands after handling the mud. When you are done with your Winogradsky columns, with permission you can dump the mud outside (such as in a composter or back in a muddy area).

More to explore
Building a Winogradsky Column Video Demonstration, from NASA Quest
The Winogradsky Column, from *Microbial Life*
Winogradsky Columns, from The Pennsylvania State University
Growing a Soil Menagerie, from Science Buddies

Standards Alignment for Day Three K-8

K

7.4.1 Observe how plants and animals change as they grow.

7.3.2 Record information about the care, feeding, and maintenance of a living thing.

While constructing Winogradsky columns we will discuss how to live and grow, organisms need specific nutrients nearby for them to eat—just like we do.

Students will record their observations of the changes of the various columns in science journals as the experiment and variables are tested.

1

7.3.2 Describe what organisms, ex. plants and animals need in order to grow and remain healthy.

7.3.1 Conduct investigations and record data about the growth of different plants and organisms under varying conditions.

While constructing Winogradsky columns we will discuss how to live and grow, organisms need specific environments to live in and nutrients nearby for them to eat—just like we do.

Students will record their observations of the changes of the various columns in science journals as the experiment and variables are tested.

2

7.3.2 Design a model of a habitat for an organism in which all of its needs would be met.

7.5.1 Investigate the relationship between an animal's characteristics and the features of the environment where it lives.

While constructing Winogradsky columns that contain all the nutrients etc that soil microorganisms need, we will discuss how to live and grow, organisms need specific nutrients nearby for them to eat—just like we do.

We will talk about how different microorganisms seek out specific nutrients and their preferred environments (oxygen rich, lacking in oxygen, light rich, lesser light, etc) in order to survive. We will relate their characteristics to the environments they dwell in and determine how they relate.

3

7.5.2 Investigate the connection between an organism's characteristics and its ability to survive in a specific environment.

7.7.2b Analyze the physical characteristics of different kinds of soil.

While constructing Winogradsky columns that contain all the nutrients etc that soil microorganisms need, we will discuss how to live and grow, organisms need specific nutrients nearby for them to eat—just like we do.

We will talk about how different microorganisms seek out specific nutrients and their preferred environments (oxygen rich, lacking in oxygen, light rich, lesser light, etc) in order to survive. We will relate their characteristics to the environments they dwell in and determine how they relate.

We will compare soils from different locations as one of our variables (keeping all else the same in the two containers and their environments) in order to see if the same microorganisms are/are not present in different locations around the area.

4

7.3.3 Identify how a variety of organisms meet their energy needs.

7.3.1 Demonstrate whether or not plants and organisms require light energy to grow and survive.

While constructing Winogradsky columns we will discuss how to live and grow, organisms need specific nutrients nearby for them to eat—just like we do.

Students will observe the growth of the various microorganisms within the columns (including those with greater and lesser access to light) and draw conclusions on whether they think organisms need light to grow and survive.

5

7.3.2 Compare how organisms different obtain energy.

7.3.1 Demonstrate whether or not all living things rely on the process of photosynthesis to obtain energy.

While constructing Winogradsky columns we will discuss how to live and grow, organisms need specific nutrients nearby for them to eat—just like we do. We will discuss and observe how the different microbes use different sources to break down and use for chemical energy. We will discuss how certain microbes use photosynthesis and others decompose matter and how these different organisms work together to get what they need to survive. We will determine whether the need of some organisms for photsynthesis and other organisms depend on those organisms means all organisms depend (eventually) on the process of photosynthesis.

6

7.2.3 Draw conclusions from data about interactions between the biotic and abiotic elements of a particular environment.

7.2.1 Compare and contrast the different methods used by organisms to obtain nutrition in a biological community.

7.2.2 Create a graphic organizer or model that illustrates how biotic and abiotic elements of an environment interact.

While constructing Winogradsky columns we will discuss how to live and grow, organisms need specific nutrients nearby for them to eat—just like we do. Most of these nutrients are continuously being moved through a physical process called a biogeochemical cycle, which transports nutrients and other chemicals through the living (biotic) and nonliving (abiotic) parts of Earth. The biogeochemical cycle is a closed system, which means that the nutrients aren't lost or created; they're continuously reused and recycled.

A given ecosystem, such as our swamp, might have several biogeochemical cycles going on within it. Some important nutrients that are recycled through an ecosystem are oxygen, carbon and sulfur. Different soil microbes play key roles in recycling these and other nutrients.

Different soil microbes play key roles in recycling these and other nutrients and a Winogradsky column allows us to observe these processes up close.

Students will record their observations and diagrams of the different columns in science journals as the experiment and variables are tested.

7

7.3.3 Identify the materials used by organisms as/to make food.

7.3.06 Understand how physical processes shape the Earth's natural landscapes and affect environments and ecosystems.

7.3.6 Describe the movement of oxygen and carbon dioxide between living things and the environment.

How will you use these standard**s** in your instruction? Explain here.

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Different soil microbes play key roles in recycling these and other nutrients and a Winogradsky column allows us to observe these processes up close.

Students will record their observations in science journals as the experiment and variables are tested.

8

0.2.2 Construct and maintain a model of an ecosystem.

6.3.1a. Describe the role of biotic and abiotic factors in the cycling of matter in the ecosystem.

6.3.1 b. Describe how water, carbon, oxygen, sulfur, and/or nitrogen cycle between the biotic and abiotic elements of the environment.

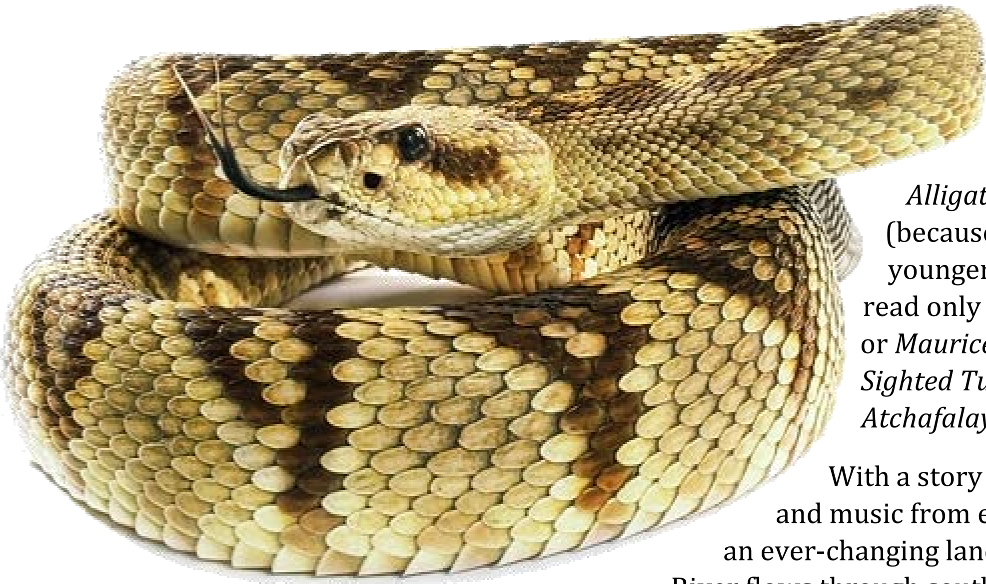
How will you use these standards in your instruction? Explain here.

While constructing Winogradsky columns we will discuss how to live and grow, organisms need specific nutrients nearby for them to eat—just like we do. Most of these nutrients are continuously being moved through a biogeochemical cycle, which transports nutrients and other chemicals through the living (biotic) and nonliving (abiotic) parts of Earth. The biogeochemical cycle is a closed system, which means that the nutrients aren't lost or created; they're continuously reused and recycled.

Different soil microbes play key roles in recycling these and other nutrients and a Winogradsky column allows us to observe these processes up close.

Students will record their observations in science journals as the experiment and variables are tested.

Day Four: Investigating Swamp Snakes:



Option: Introduce this section with a story related to swamps such as the fun *Alligator Sue* by Sharon Arms Doucet (because the book is a bit long for younger children, it may be best to read only one or two chapters at a time), or *Maurice the Snake and Gaston the Near Sighted Turtle: Tim Edler's Tales from the Atchafalaya*, if you can find one.

With a story around every bend in the river and music from every corner, the Atchafalaya is an ever-changing landscape. As the Atchafalaya River flows through southeast Louisiana, its muddy waters shape and sustain a landscape of remarkable beauty. The Atchafalaya Basin, one of America's last great river swamps, stretches across 1.2 million acres, from Simmesport to the Gulf of Mexico. A rich diversity of plant and animal life thrives in the basin's bottomland hardwood forests and marshes, which support highly productive fisheries and hunting grounds and nearly 300 species of native and migratory birds.

Discuss with students the 24 different types of snakes found in the Atchafalaya Basin and the surprising fact that only 7 are poisonous [http://1079ishot.com/venomous-snakes-louisiana/]. Show pictures from the Louisiana Wildlife and Fisheries website and Army Corps of Engineers, along with information for recognizing and avoiding poisonous reptiles such as the Canebrake Rattlesnake, Cottonmouth and Copperhead.

Then, have students work in groups to create their own scaled picture graphs and bar graphs to represent various species of snakes (like pit viper, rattlesnake, coral, etc). They will research the attributes of the snakes. They will use the data they learn to graph out the various characteristics of the snakes as they compare their differences and similarities. They will then do word problems to determine the number of percentage of snakes that have similar characteristics. They can also determine which are most prevalent and then compare their characteristics to the snakes of TN. http://www.tennsnakes.org/

Teachers can then help their students create and write word problems on the board based on their relevant research and the students math level and abilities.

Characteristics to Research

Habitat

Preferred Food

Number of Offspring

Where they reside

Physical Characteristics- color, length, head shape

Is it is Poisonous?

Are they aggressive or not?

Investigating Swamp Snakes

Name:	Habitat
Preferred Food:	Number of Offspring:
Where they reside:	Physical Characteristics Color Length Head shape
Venomous or not?	Aggressive or not?
Other:	Other:

Name:	Habitat
Preferred Food:	Number of Offspring:
Where they reside:	Physical Characteristics Color Length Head shape
Venomous or not?	Aggressive or not?
Other:	Other:

Name:	Habitat:
Preferred Food:	Number of Offspring:
Where they reside:	Physical Characteristics Color Length Head shape
Venomous or not?	Aggressive or not?
Other:	Other:

Survivor Challenge: Quicksand!

You Never Know if You'll Float…or Sink

Before the Activity
Prepare two sets of cards in advance of the game:

- Prepare a set of 25 "scoring cards." On each of those cards, write a different instruction, for example:

* Earn 100 points
* Lose a turn
* Take 50 points from the other team
* Earn 70 points
* Double your total points
* Take an extra turn
* Earn 500 bonus points

- On the other set of cards, write 25 questions related to the topic or skill(s) you want to review and reinforce, ex. information from student snake research and from the units part 1 & 2. (Note: Questions might be created in list form rather than on cards.)

Introduce the stack of scoring cards to students. Shuffle the cards. Put the stack face down on a desk.

Alternative idea.
You might post the 25 scoring cards in random order on a bulletin board or chalkboard. Post the cards *with the blank side facing students and the scoring instructions hidden from view.*

Arrange students into two or more teams. Decide which team goes first, and then pose the first question to a member of that team. If the student answers correctly, he or she draws a scoring card from the stack (or removes one from the bulletin board or chalkboard). The score on the card determines the score the student earns for his or her team.

- If the team has 0 (zero) points and the card selected reads "Earn 50 points," the team has a total of 50 points.
- If the card reads, "Double your present score," the team doubles its score of 0, for a total of 0 points.
- If the card reads, "Deduct 50 points from your score," the team subtracts 50 from 0, for a score of -50.

If the student answer incorrectly, the first student on another team to raise his or her hand earns the right to "steal" the question. A correct answer earns that student the opportunity to choose a scoring card...

Of course, the scoring card could carry a negative message, so answering a question correctly is no guarantee that a team will earn points; as a matter of fact, the team could lose points! A team could conceivably answer all the questions correctly and lose the game. That's why the game is called "Quicksand! See, you never know when you'll start to sink!

A Couple More Twists

- You might have each student track the score for each team. Students track the team scores on their own. At the end of the game, each student who correctly calculated each team's final score might earn 50 bonus points for his or her team.
- You might introduce another rule. Since no team member knows whether the scoring card he or she selects will earn or lose points, you might allow students the option of *not* selecting a card when they answer correctly. If the student thinks the next card in the stack might carry a negative scoring instruction, he or she is free to pass and earn (or lose) no points for the team. Students only learn whether that was a good move or not if the next student to choose a card reveals the scoring instruction on the card.

Standards Alignment for Day Four K-8

K

W.K.7. Participate in shared research and writing projects (e.g., explore a number of snakes and express opinions about them).

W.K.8. With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.

These standards will be met while students participate in and conduct the research project over the snakes of the Atchafalaya and answer the questions on the sheet and during discussion and review game rounds.

1

W.1.7. Participate in shared research and writing projects (e.g., explore a number of "how-to" books or sites on a given topic, ex. snakes and use them to write a sequence of instructions, ex. surviving a snake encounter or swamp adventure).

W.1.8. With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.

These standards will be met while students participate in and conduct the research project over the snakes of the Atchafalaya and answer the questions on the sheet and during discussion and review game rounds.

2

W.2.7. Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).

W.2.8. Recall information from experiences or gather information from provided sources to answer a question.

These standards will be met while students participate in and conduct the research project over the snakes of the Atchafalaya and answer the questions on the sheet and during discussion and review game rounds.

3

W.3.7 Conduct short [as well as more sustained] research projects based on focused questions, build knowledge about a topic, demonstrating understanding of the subject under investigation.

W.3.8. Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

These standards will be met while students participate in and conduct the research project over the snakes of the Atchafalaya and answer the questions on the sheet and during discussion.

4

W.4.7. Conduct short research projects that build knowledge through investigation of different aspects of a topic.

W.4.8. Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

5

W.5.7. Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

W.5.8. b) gather relevant information from print and digital sources;

c) summarize or paraphrase information in notes and finished work,

These standards will be met while students participate in and conduct the research project over the snakes of the Atchafalaya and answer the questions on the sheet and during discussion and review game rounds.

6

W.6.7. Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.

W.6.8. a) Gather relevant information from multiple print and digital sources;

These standards will be met while students participate in and conduct the research project over the snakes of the Atchafalaya and answer the questions on the sheet and during discussion and review game rounds.

7

W.7.7. Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.

W.7.8. Gather relevant information from multiple print and digital sources, a) using search terms effectively;

These standards will be met while students participate in and conduct the research project over the snakes of the Atchafalaya and answer the questions on the sheet and during discussion and review game rounds.

8

W.8.7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

W.8.8. Gather relevant information from multiple print and digital sources, a) using search terms effectively;

These standards will be met while students participate in and conduct the research project over the snakes of the Atchafalaya and answer the questions on the sheet and during discussion and review game rounds.

Academic Vocabulary Guide for Part Two:

K

- Basic needs (food, clothing, shelter)
- Parts
- Wants
- Cooperation
- Story
- Water

1

- Continent
- Texture
- Location
- Living
- Non-living
- Environment
- Plant
- Insect
- Shelter
- Mixed
- Precipitation

2

- Natural resources
- Similarities
- Differences
- Renewable
- Non-renewable
- Habitat
- Investigate
- Infer
- Compare
- Consumer
- Producer
- Contrast
- Dissolve
- Organism
- Energy

3

- Threatened
- Water cycle
- Endangered
- Conservation
- Landforms
- Natural resources
- Population
- Mixture
- Decomposer
- Predator
- Prey

4

- Camouflage
- Carnivore
- Ecosystem
- Herbivore
- Physical Adaptation
- Producer
- Expansion
- Diversity
- Consumer
- Omnivore
- Mimicry

- Erosion
- Behavioral adaptation

5

- Parasitism
- Parasite
- Integration
- Human rights
- Significant
- Solution
- Surface
- Area
- Model
- Dissipate
- View
- Personification
- Point of view
- Visual image

6

- Imagery
- Hyperbole
- Relevant
- Criteria
- Abiotic
- Biotic
- Cause
- Effect
- Climate change
- Scavengers
- Protocol
- Sample
- Tides
- Biosphere

7

- Organ system
- Tissue
- Speed
- Impact
- Urbanization
- Topography
- Physical process
- Spatial
- Function
- Property
- Interaction with texts
- Characteristic
- Trait

8

- Element
- Order
- Relative
- Vernacular
- Species
- Variation
- Biodiversity
- Sensory
- Details
- Infer

Sample Supply List

Chosen Books

Glowing Quicksand

Materials per batch:

- 1 16oz box of cornstarch
- 2 cups Tonic Water with Quinine
- Blacklight

Quicksand Variations

- Dried Clay
- Sand
- Dried Peat
- Containers

Winogradsky Columns
Materials:

- 4 (+) tennis-ball containers or plastic soda bottles with the top cut off
- container top or plastic wrap and a rubber band
- mud from the edge of a shallow pond or swamp (the smellier the better)
- swamp/pond/river water
- spoons
- lamp with a Scissors
- Knife (optional)
- Permanent marker
- Ruler
- Gloves
- Shovel or trowel
- Two buckets
- Newspaper or plain paper (shredded)
- eggs
- Two bowls
- Two large mixing bowls
- Measuring cups
- Wide stick, for packing mud into the bottles
- Measuring teaspoon
- Adjustable desk lamp with 40-watt incandescent bulb or 13-watt compact fluorescent bulb (optional)
- An empty surface, such as on a desk or table, that is at warm room temperature (about 72 to 78 degrees Fahrenheit). It should not receive any direct sunlight but if you're not using a desk lamp, the area should be near a very sunny window.
- Plastic wrap
- Plastic trash bags or grocery bags

- Four rubber bands
- Cardboard box or brown paper bag
- Flashlight

Swamp Snakes

- Access to internet/books
- Pencils
- Sheets printed out