Phenology Calendar

2023

Artwork and writing by OWL class of 2027

Foreword

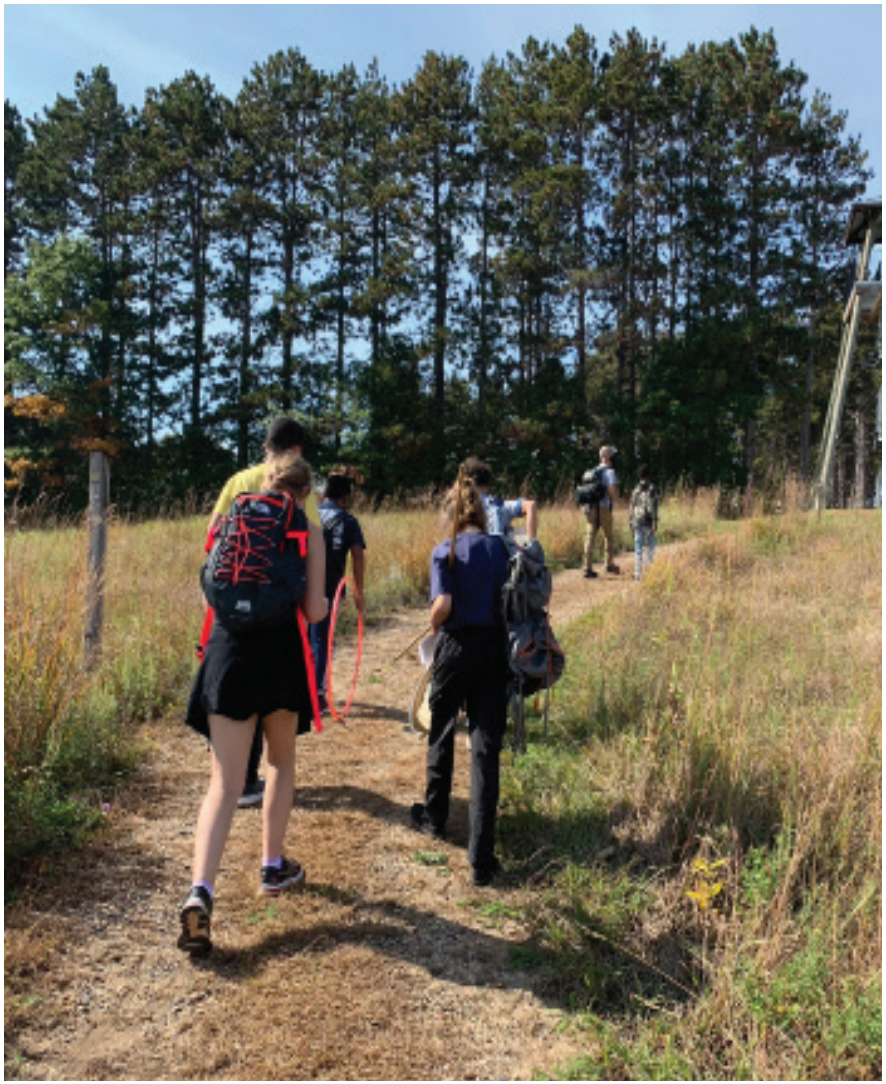
As the seventh graders at Open World Learning Community (OWL) began to explore the question, "What makes a community thrive or suffer?" their studies extended beyond the sphere of human community. During fall field work, students tromped through the Minnesota prairies, deciduous forests, and coniferous forests of Belwin Conservancy. Thermometers and photometers in hand, the students sought to discover what makes ecological communities thrive or suffer. In the field, we analyzed the living and non-living components of each of Minnesota's ecosystems. Students had opportunities to get to know Minnesota's wild species in person, and by the time snow flew, everyone had selected their own Minnesota species to research.

In late winter, Art teacher Kristin Moeller led OWL seventh graders in creating artwork featuring their Minnesota species. Minnesota species artwork opened another way of knowing, keeping the learning process personal and immediate. When Kristin shared the final art pieces with me, I was very impressed, and I think you will be, too.

When spring rolled around, students conducted research on the seasonal activities, or phenology, of their species while simultaneously investigating how Minnesota's climate – and seasons – are changing. With the help of English Language Arts teacher Preston West, students synthesized their learning by writing about the impact of climate change on their species' phenology.

This calendar showcases how each seventh grader at OWL experienced climate change as a phenomenon within their local sphere —as an influencer of a Minnesota species they came to know through outdoor experiences, artistic interpretation, and scientific research and writing. I have learned so much about Minnesota species and how climate change is affecting them; I hope you enjoy this calendar as much as we have enjoyed making it.

Dr. Megan Olivia Hall, Ph.D., NBCT
OWL Science & Agriculture Teacher



Megan Hall

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David Gundale, Principal

Special thanks to

Leo Bickelhaupt, Megan Hall, Kristin Moeller, and Preston West

Layout Team

Claire Ales, Lizzie Dreher, Constance Van Genderen, and Remy Short, Class of 2027

Cover Art

Great Blue Heron (*Ardea herodias*)
Ingrid Thune
Merlin Bird (*Falco columbarius*)
WahWah Say

The Artwork and paragraphs showcased in this years phenology calandar were made by the 2021-2022 7th graders life science students of OWL. Each student researced and illistrauted one MN species, paying attention to how their species was impacted by climate change. In the process the class of 2027 discovered the phenology or seasonal events, of their chosen species.

Fall Field Work

In the fall, the 7th grade students returned to fieldwork. The class learned about what makes communities thrive and suffer. The students went on multiple expeditions such as going to Youth Farm where they learned about plants, and nature. They also went to Belwin nature center to track and observe phenology. Later, the students rode the green line transit around the city. While downtown, the students stopped at many places, such as the capital, union deopt, and gathered footage for their adversiements, that they would later make in ELA & American Studies.

Megan Hall

January

Barn Owl (*Tyto alba*)
Annabelle Wilson

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Chinook Salmon *(Oncorhynchus tshawytscha) Chloe Best*

Chinook salmon (Oncorhynchus tshawytscha) or king salmon are a species of anadromous fish native to the North Pacific Ocean and connecting river systems. They were introduced to Lake Superior's feeding rivers in the 1960s to diversify sport-fishing, but climate change is making it harder for the lake to support a Chinook population. The water is warming rapidly and, in the hotter seasons, oxygen has trouble reaching deeper areas of the lake because of temperature layers created by thermal stratification. Climate change is causing the Chinook salmon and other cold-water fish to suffer. They're trapped in a "temperature-oxygen squeeze", between warming temperatures on the surface and low oxygen on the bottom.

February

Black Bear (*Ursus Americanus*)
Neve Dawson

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American Mink *(Neovison vison) Lizzie Dreher*

The American mink or the *Neovison vison* is a species of mink that lives in nearly every state in America, besides Arizona. The mink live near rivers and streams, and their diets rely heavily on fish from their area. Unfortunately due to climate change, the increased temperatures on our planet have begun to lower the water amounts in rivers the fish live in, and the fish that mink heavily rely on as a main food source are beginning to die off. Studies show there has been a 46% decrease in mink population from 2002 and 2006, and fish population also dropped in that time. There are other factors like hunting, and some predators that could be contributing to the decrease of mink population that has arisen, but there were predators and hunters before the fish population began dropping, bringing down the minks with them. To conclude, climate change has increased temperatures and lowered water levels killing fish species that American mink depend on for survival, and affecting the mink population greatly.

Bobcat (*Lynx rufus*)
By Dylan Bickelhall

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Flying Squirrel (*Glaucomys sabrinus)*
Kaden McNamara

The flying squirrel (*Glaucomys sabrinus*) is a flying mammal adapted to the cold that lives in coniferous forests and eats truffles and other fruits. Flying squirrels are naturally adjusted to cold temperatures but are okay with somewhat warm temperatures and rely heavily on coniferous trees to live in. Climate change is raising temperatures to extremes such as ninety degrees way more often than normal, temperatures that the flying squirrel is unused to and cannot deal with. Climate change is also causing droughts that will make the trees unable to gain water or nutrients thereby killing off all the trees that the flying squirrels need to live. Those droughts are also killing off all the fruit that the flying squirrel needs for food, starving the flying squirrel. In conclusion, climate change will raise temperatures to a point where flying squirrels can't handle it and will kill off all of the trees that the flying squirrel needs for protection and all of the fruits that the flying squirrel eats.

April

Meadow Jumping Mouse (*Zapus hudsonius*)
Aria Kulseth

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Painted Turtle *(Chrysemys picta) Claire Ales*

The Painted Turtles (*Chrysemys picta*) are negatively affected by climate change. The painted turtle population lays their eggs in late spring. Unlike other species, the gender of the turtle depends on the temperature of the nest. When the nest is warmer the hatchling will be female, and when the nest is cooler the hatchling will be male. With temperatures rising, the nest temperatures will also rise. This will cause more female hatchlings than males. As temperatures rise, more female turtles will be born and that will negatively impact reproduction and the population of painted turtles.

May

White Aster (*Symphytrichum ericoides*)
Anya Robertson

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Zebra Mussels *(Dreissena polymorpha)*
Anneli Lofgren

Zebra mussels are small, striped mussels that originated in Eurasia. They hitchhiked to North America by sticking to ships of travelers and were introduced to the U.S in 1988. They're recognized as one of North America's most destructive invasive species. Native species of mussels and other animals have to compete with zebra mussels for space and food. They filter out algae that native species need for sustenance, and they attach to mussels, incapacitating them. Without a natural predator, zebra mussels will will cotninue to damage ecosystems. Zebra mussels hurt the environment in a variety of ways. Attached organisms increase drag and reduce speed on boats, increasing fuel consumption, which contributes to the higher rate of the burning of fossil fuels. Keeping Zebra mussels under control is a difficult task, because their eggs can be microscopic, traveling from infested waters by swimsuit, boat, etc, to a clean freshwater area. I believe zebra mussels are a huge problem, and need to be eradicated.

June

Common Milkweed(*Asclepias syriaca*)
Constance Van Genderen

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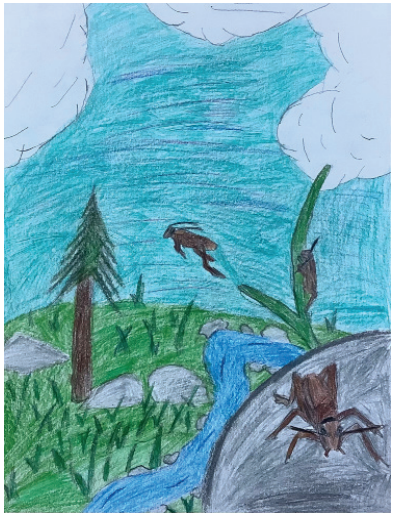
Field Cricket *(Gryllinae) Oscar Mons*

The field cricket (*Gryllinae*) is an insect that can be found in most areas in the Midwest and East Coast. Prairie fires, caused by raised temperatures due to climate change and global warming devastate grassland, the cricket's primary habitat. This also causes competition as more crickets are concentrated on a single prairie. Habitat loss also contributes to the overall decrease in the cricket population due to agricultural encroachment. Climate change directly impacts field cricket populations and destroys habitat and food sources that field crickets are dependent on. In conclusion more direct action needs to be taken to set aside protected areas for the species to recuperate without fear of habitat loss.



July

Crow (*Corvus*)
Gwyneth Huett

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Blue Jay *(Cyanocitta cristata) Rylan Merwin*

The blue jay (*Cyanocitta cristata*) is a bird that's mostly portrayed as aggressive and mean. However, it is still worth saving. The blue jay population has dwindled down by about 30% since 1970. The main cause of this decline is habitat loss. While some of this habitat loss is caused by climate change, most problems for the blue jays are caused by humans themselves. Blue jays tend to live in more mixed forests, and they feed on berries and other things that fall from trees. But humans are cutting down these trees, and spraying pesticide on the seeds of these berries. This is problematic for other birds as well. This means that if we don't make at least a little effort to stop our own destructive actions, the blue jay and other bird's populations may go down even more. In conclusion, humans need to stop causing problems and start fixing them, before they become out of our control.

August

Western Moose (*Alces alces andersoni*)
Joessph T. Schwartz

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Oriole *(Icterus) Ariel Olson*

The oriole (Icterus) are omnivores that mainly eat insects, berries and nectar. Due to climate change there will be negative impacts on the orioles, wildfires will burn down their habitats, freezing temperatures will make insects and plants that the orioles eat will die in floods and constant rain will stop plants from growing. Insects will also stop from being in sight of the orioles. In conclusion, climate change will harm the orioles source of food, but its habitat will be mostly safe from harm.

September

Northern Leopard Frog
(*Lithobates Pipiens*)
Sara Missaghi

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Brown Marmorated Stink Bug *(Halyomorpha halys) Luke Hobday*

The brown marmorated stink bug (BMSB), *Halyomorpha halys*, is an invasive pest native to East Asia. It devours crops and garden vegetables. It has disrupted 43 states already. With rising temperatures due to climate change, BMSB will have a better climate to reproduce and survive, and give them more inhabitable ground to cover, allowing them to move further north into Canada. With more of these pests eating the vegetation that the local species depend on, the population of the animals will plummet, and the BMSB will invade homes with increasing numbers. In conclusion, climate change will definitely affect the BMSB positively but will be devastating for you, your garden, and many other species.

October

Oil Beetle (*Meloe*)
Collin Larson

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Northern Pocket Gopher
(Thomomys talpoides)
Remy Short

The northern pocket gopher (*Thomomys talpoides*) is a gopher that lives in tunnels underground in soil. Global warming and climate change are disrupting their tunnels. The tunnels get too warmed and then the gophers leave their dwellings. When the weather gets cold or dangerous, such as rain, the gophers get cold and can't return to their burrows because they have been destroyed by the heat. In conclusion, climate change is negatively affecting the northern pocket gopher by warming their homes too much and disrupting their habitat.

November

Eastern Spotted Skunk
(*Spilogale Putorius*)
Kai Walker

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Norway Pine *(Pinus resinosa)*
Sam Koering

The Norway pine or red pine, also known as the *Pinus resinosa,* can be found all over Minnesota, Northeast USA and Canada. The Norway pine will be affected by climate change negatively. A direct result of climate change is more severe weather including droughts. Droughts will damage the Norway pine and other trees because of the little amount of water in the ground. Warmer temperatures cause more parasites that damage the Norway pine. Bark beetles are thriving off of the bark, and harming the tree. They burrow into the tree, sucking the water out of it, causing the tree to die of dehydration. In conclusion climate change is negatively impacting the species and is causing the Norway pine to dry up and run out of water, and in many hot spots dying of parasites.

December

Coyote (*Canis latrans*)
Harper Kopka

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Red Pine *(Pinus resinosa) Alex Shuster*

Studies on the Red pine (*Pinus resinosa*) show that climate change shall affect the tree negatively. The red pine grows in northeastern and northern Minnesota in mixed forests. In Minnesota over the past years the temperatures have gotten hotter and the winters have gotten warmer. Predictions for Minnesota include even hotter average temperatures and it also includes changes in rainfall it is said to become more intense and more random. This will all affect how the red pine grows, and it will affect the red pine's climate. According to a study modeling climate change the red pines height growth will decrease 30% in the next 20 years particularly in southern locations. Also with total precipitation shrinking during the growing season and temperatures rising during the growing season it could affect the growth of trees. With temperatures getting warmer it makes the trees more vulnerable to bark beetles. Climate change will make the growing season less effective for the red pine. It will also make it more vulnerable to pests and parasites such as the bark beetle. With climate change becoming more prominent it will hurt the red pine population and how it grows and lives.


Lucy Sutton

Northern Leopard Frog (Rana pipiens) Sara Missaghi

Northern leopard frogs (*Rana pipiens*) live in permanent ponds and wetlands with dense vegetation. Due to climate change these permanent bodies of water and ponds are likely to experience more rapid evaporation and, as a consequence, become rare. The dense vegetation used for foraging and deep hibernation in these waters have also started declining. Northern leopard frogs lay one clutch of eggs per year and depend on the weather to reach a certain temperature so they know when to start laying eggs. As temperatures rise, the frogs are more likely to produce eggs at the wrong time and are at risk of more unsuccessful reproduction due to climate-related timing mismatches and clutch failures. Northern leopard frogs are negatively affected by climate change because their wetlands and ponds are drying up and they are laying eggs at the wrong time.

American Black Bear (Ursus americanus) Neve Dawson

Ursus americanus, better known as the American Black Bear, is the most common bear in the Ursidae family. These large, heavy, and protective omnivores have an expansive diet, including roots, berries, fish, meat, and insects. They are also welcome to the idea of human leftovers, as campers would well know. Climate change has an impact on bears. Their habitat is slowly dwindling, due to human activity and forest fires. Food sources, though they have many, will decrease. Fish species will dwindle and die from warming waters. Forest fires will become more frequent, killing larvae and the immobile berries and plants. Their prey will most likely change as their food sources will too, perhaps making them harder to hunt. The rise of global temperatures has the potential to make life more difficult for this powerful species.

North American Porcupine (Erethizon dorsatum) Roman Rufi

The North American porcupines (*Erethizon dorsatum*) are negatively affected by climate change. The long summers cause droughts and droughts can cause wet winters and less foliage. Because of this, the porcupines lose around 40% of their body fat, and have less places to hide from predators. In conclusion, the North American porcupine population will continue to suffer until they are extinct.

Spring Peeper (Pseudacris crucifer) Liam Nowatzki

The Spring Peeper (*Pseudacris crucifer*) is a species of frog that lives in east United States and south-east Canada. Spring peepers surprisingly aren't affected by climate change, at least not greatly. The only difference to spring peepers due to climate change is that they start to peep earlier. This is because their body's know when spring is coming, due to the weather. Because of climate change the weather gets warmer sooner in the winter, causing them to start peeping earlier. In conclusion, spring peepers aren't greatly affected by climate change.

More writing about climate change

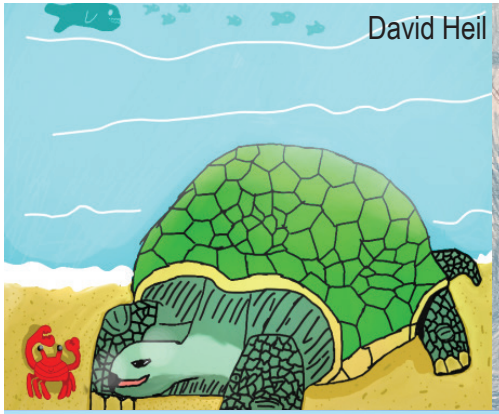
Meadow Jumping Mouse (Zapus hudsonius) Aria Kulseth

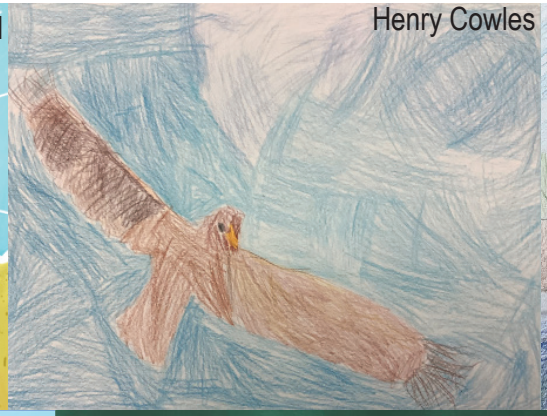
The Meadow jumping mouse (*Zapus hudsonius*) is a rodent that can be found throughout the northern part of North America and Minnesota. They prefer moist grasslands and vegetated areas near water sources, because they are best for their population size. They are easily recognizable by their big hind feet, and very long tails. The meadow jumping mouse is not currently impacted by climate change, but some of their subspecies are being impacted by habitat destruction and cow grazing, which causes a decrease in biodiversity. Although the meadow jumping mouse isn't currently greatly impacted, as we've seen with its subspecies, it could eventually face habitat destruction. If the meadow jumping mouse becomes endangered, the food web would become unstable, because they are a source of food for many animals, including foxes, hawks, and more. This is why we need to preserve the meadow jumping mice' habitats because their endangerment could be disastrous.

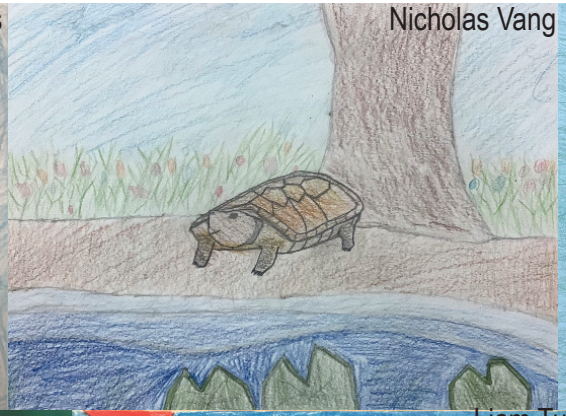
Grey Wolves (Canis lupus) Alva Healy

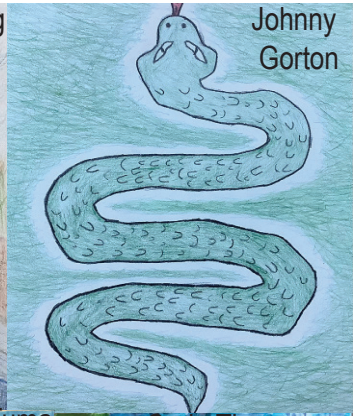
Gray wolves (*Canis lupus*) were already endangered species before people started to study the effect climate change had on them. Before and during the 1900s, gray wolves were nearly hunted to extinction, leaving few packs left. This is what causes the influx of deer in the US. Though they were eventually put on the endangered species list, there were still a very small number of them in the US and Europe. Afterwards, people started to investigate how climate change affected them and prey. People associate the rise of greenhouse gasses with the world getting warmer, which also happens, but it also can lead to colder and harsher winters in the US and Europe, where gray wolves and their prey can be found. The gray wolf depends on prey—such as deer or caribou—which depend on vegetation in late winter to sustain them. When there's more snowfall later in the season, they cannot find it. Many of the gray wolves' prey migrate to find food, which leaves the wolves in need of food. This lack of food also affects pack dynamics. Because they don't have enough food, many wolf pups don't survive past a young age. Without sustainable future generation, the pack will die off. Some of the packs move with their prey, but that means that they won't come back unless something draws them there. With the wolves dying or migrating with prey, when winter is finally over, an increase in the deer and caribou population will happen. With no predators to keep the population in check, the deer population will dominate the forest, which, in turn, is negatively affecting other species that share the environment. Wolves are keystone species, which means that they are a species on which other species in an ecosystem largely depend, such that if it were removed the ecosystem would change drastically. With the wolves gone or dying, the environment they lived in will suffer, causing moremgratare its environment.

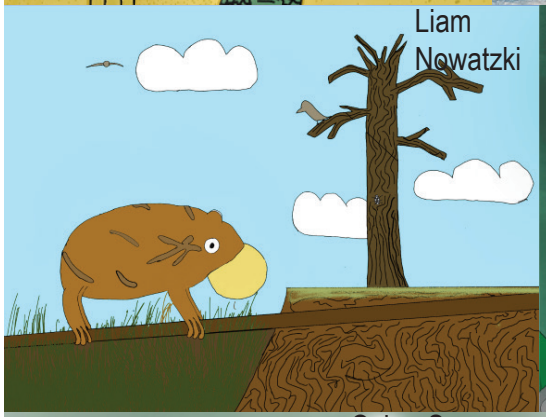
More Artwork

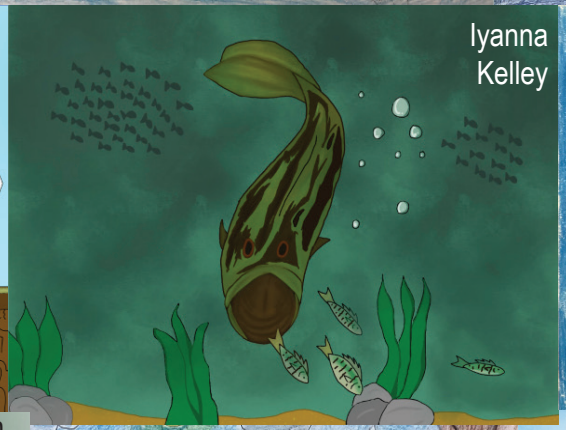

David Heil


Henry Cowles


Nicholas Vang


Johnny Gorton


Liam Nowatzki


Iyanna Kelley


Liam Tuma


Craig Thompson Wenzel


Oskar Swanson

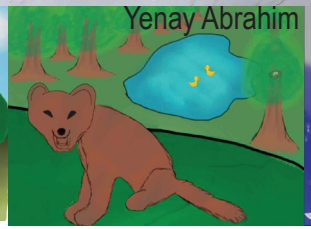

Joaquin Paez


Margot Collette


Owen Mikesh


Juniper Krings


Ke'Mya Lewis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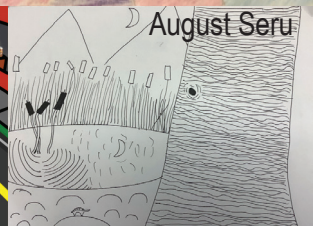
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