

ANOTHER NATIONAL AND WOLF RIDGE FIRST



Wolf Ridge Environmental Learning Center was the first environmental learning center to be accredited as a school by the North Central Association. On November 8, 2017, Wolf Ridge added another of many firsts to its resume. For the first time in the nation students at an ELC live and learn in a building constructed to Living Building Challenge standards. Wolf Ridge reached a major milestone on the exciting *Making Waves* journey to advance environmental education in the United States.

This ambitious project consists of the renovation of our West Dorm into a building that by itself is a teaching tool. Shannon Walz, Wolf Ridge education director noted that, "The new Margaret A. Cargill (MAC) Lodge is a building that will not only inspire, but will help teach all who step inside its doors or sleep in its rooms about the importance of energy and water conservation."

The state-of-the-art sustainable construction includes monitoring meters in every room that track heat, electricity, and water usage. These meters will help visitors "see" how much energy and water they are using. With real-time feedback kids in their rooms and schools as a whole will be able to better understand how their lifestyle choices impact energy and water consumption. They can then make choices to change their behavior to become model energy savers.

It has taken a bit of doing to achieve this "first."

Our construction team has worked around the clock to get things finished. Imagine 50 construction workers all busily working on the renovation project; electricians wiring alarms, tanners working on heating ducts, drywallers taping and mudding sheetrock, painters priming walls, flooring specialists

MAC LODGE GRAND OPENING!

May 5, 2018

Join us for lunch and take a tour of the amazing Living Building Challenge (LBC) facility at Wolf Ridge. See the results of a building renovated to the highest international standards in sustainability. Watch your mailbox for details. ♦

laying carpets, plumbers installing toilets, and framers raising temporary walls. Sounds busy, right? It certainly was, but that wasn't all that was happening - now add 15 Wolf Ridge staff into the mix who were laboriously hauling, washing, and assembling all the bunk beds.

It looked like a Mario Brothers video game come-to-life. Fortunately nobody fell off scaffolding or suffered a whack to the head. Oh, there were some small mishaps - an elbow jabbed in fresh plaster and a railing accidentally installed on the wrong side of a top bunk. But that's it!

School groups moved into part of the MAC Lodge on November 8th because of approaching winter. Although our temporary housing - RV's from Bullyan

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VIEW FROM THE RIDGE

by *Pete Smerud, Executive Director*



Wow! These last few months at Wolf Ridge have been really exciting. We're on our way to a monumental achievement.

The Margaret A. Cargill (MAC) Lodge construction continues and students along with their parents and teachers now occupy it. No one said it would be easy, building to the highest level of sustainability to become Living Building Challenge (LBC) certified. After all, we are doing something that has never been done in MN, WI, ND, or SD. The project is one of only of about 45 in the world.

Most recently, we were challenged by the discovery that the closest certified manufacturer to Forest Stewardship Council (FSC) and therefore, LBC standards is in Maine or Oregon for both trusses and siding! We had to ask ourselves, do we get timber and product from Maine or Oregon or do we take the time and extend the renovation completion date to see if we can lift up local industry to the highest level of sustainability? What a dilemma! Saying no, we're not purchasing your local product but that of another company that meets our standards, can be great motivation for business to change. However, the act of developing and teaching new competencies for local industry is time consuming but a great investment in a more sustainable future. Guess what route we chose?

Trusses arrived a few weeks ago and siding manufacturing begins later this month. In both cases, the Wolf Ridge team is guiding industry to more advanced competencies. They are learning the skills of manufacturing and tracking wood fiber to Forest Stewardship Council standards, the highest sustainability standards in the industry. Harvested timber is being transported from Isabella to Two Harbors, MN and Su-

perior, WI where it will be turned into the products we need, while the manufacturers have stepped up with commitment to raise their practices to the highest levels. These are the types of stories heard almost weekly on this project. These stories illustrate how we are upholding our mission to develop a citizenry that has the knowledge, skills, motivation, and commitment to act together for a quality environment.

\$9.4M



We look forward to filling the Margaret A. Cargill Lodge with summer campers, school students, corporate groups, and others that want their children, colleagues, and partners to learn about what can be achieved in living more sustainably or at net zero. If we simply come together, commit, and work hard, this set of projects is proving it CAN be done.

In the past few months Wolf Ridge stepped over the \$7 million line in raising money for the Making Waves campaign! This was another milestone. Nearly 300 people, foundations, and corporations have come together to get us here. We're narrowing the gap to our ultimate goal of \$9.4 million. Please, please continue to tell our story. We need your help to find the additional \$2 million.

The new Lakeview House for staff, maintenance building, Margaret A. Cargill Lodge and Lake Superior campus are the results of the Making Waves campaign. In the coming months the MAC Lodge will be completed. These are absolutely tremendous achievements and we want to share it with you. Please put May 5, 2018 on your calendar. We want you here to celebrate along side us at a grand opening ceremony.♦

WOLF RIDGE FIRST continued from page 1

RV in Duluth - had heating and all the amenities, we couldn't keep them into the heart of winter.

Our pioneer schools that first stayed in MAC Lodge have been gracious about all the construction. The various trade workers have been extremely accommodating as we've wandered through the middle of their workplace with groups of curious adults, class-

es of students, and bunk bed parts. Through it all, we were surrounded by goodwill, benevolence, patience, and cooperation from everyone involved.

We are excitedly looking forward to the day when we get to celebrate the completion with our community! Join us in celebrating the first LBC project to pursue full certification in Minnesota with the grand opening of the

MAC Lodge on May 5th.

It all started when Jack Pichotta, a high school history teacher, first imagined students outdoors, experiencing authentic, hands-on learning to help them develop into stewards of our planet. Through embracing the Living Building Challenge, Wolf Ridge continues to imagine and make a quality environment for future generations.♦

These Wave Makers have raised \$7,117,400 as of January 22nd

\$1,000,000+

Margaret A. Cargill Foundation

\$500,000-\$999,999

Fred C & Katherine B Andersen Foundation
Donald Weesner Charitable Trust
State of MN

\$100,000-\$499,999

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Eugene & Tamara Champeau Foundation
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Nancy Quattlebaum Burke
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Gardner Builders
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\$5,000-\$24,999

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John Anderson
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Anonymous (2)
Athwin Foundation
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Al Schrader Family Foundation
Aaron & Jennifer Smith
Bill & Judy Walter

\$1,000-\$4,999

Student Naturalist's SY 03-04
In Memory of Darian Willette
- Joan & Nicholas Olson
- Will & Margaret Rousch
- Brittany Bennett
American Legion Post 550
Bloomington Lions Club
Beth Bockes
Tom & Christina Blum
Bill & Patricia Burns
Cannon Family Foundation
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Dennis Confer
Pat Coppo & Susan McCabe
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Donn & Donna Larson
Kris Larson
Charles & Hope Lea
Medtronic
James & Fran Mullin Fund
Tim Norman
Dan & Sallie O'Brien Fund
Robert O'Hara
Ronald & Lynn Olson
Jack & Genea Pichotta
Richard & Janet Putnam
Patricia Rogowski
Jim Rustad Charitable Fund
Lambert Smeets
Pete & Sue Smerud
Philip H & Barbara Strom
Charitable Fund

Terhuly Foundation
US Bank Foundation
Gregory & Donnette Wheelock
Wolohan Family Foundation

UP TO \$999

Student Naturalist's SY 93-94
- David Mackey
- Doug Sandok
- Michael Wehling
Student Naturalist's SY 14-15
- Grace Theisen
- Caitlin Cleary
- Marie Fargo
- Larissa Giebner
- Mark & Joan Laudeman
- Dylan Kelly
- Luciana Ranelli
- Shane Steele
Kristi Achor Pursell Family
Mark & Tess Ahlborn
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Gretchen Anderson Hanson
Jeff Hanson & Margit Bretzke
Gaylen & Julie Harms
Peter Harris & Carrie Anderson
Kyle & Eileen Heitkamp
Nancy Holmgren
Jan Horak
In Recognition of Aki Yada
- Elizabeth Hoover
Jan Horak
Lisa Huntley
Jennifer Edlund Johansen
Brad Johnson & Gail Buhl
Gregory D Johnson
Jeff Johnson & Beth Peter
In memory of Erika Jones Massie
- C Eugene & Judith Jones
Kenneth & Donna Jones
Nathan Jones
Kathryn Keller-Miller
Janis Kivela Hooey
Dan & Joann Knuth
Greg & Coralyn Koschinska
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David & Linda Wolf
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& John Eckfeldt
- Benjamin & Barry Kay Wolfe
Kirby & Cathy Wood
David & Diane Wright
Jeff Yost
Dan & Michelle Young



Thank you for the outstanding commitment!

*In-kind donors

MAKING IT REALITY

by Danielle Hefferan, Wolf Ridge Naturalist

I have had many ideas throughout my lifetime, some brilliant and some that make me cringe in hindsight. Having an idea is easy. I think bringing that idea to reality separates the dreamers from the doers. Whether it is getting a man to the moon or bringing the first ELC Living Building Challenge (LBC) project to fruition it takes all kinds of individuals - dreamers, fundraisers, organizers, detail people, big picture people, workers, etc. Wolf Ridge has gathered a team of such people. Gardner Builders is one group of several that is building our dream LBC project. Within Gardner's are many sub-groups of teams and individuals who are working to make the vision a reality. I had the opportunity to talk with a few of these folks.

When I reached out to Meghan Mahoney, of Gardner Builders, to see if she had any free time in her busy schedule to share some of the details of her job with me, I was met with pure enthusiasm. I started out by asking what her day to day looks like and Meghan immediately followed with, "Ah, let me jump back to June."

Meghan explained that once the project was underway, Gardner quickly realized they needed a person who was 100% dedicated to the LBC aspect of the project. Enter Meghan Mahoney, project engineer. Her first few months were all about figuring out how to ef-

fectively and efficiently carry out an LBC project. Some aspects of the project were struggling to move forward due to lack of documentation. Meghan began holding weekly meetings with a sustainability architect to learn as much as she could. She then set out to re-engage all the partners, offer opportunities for asking questions, and began to get on top of documentation.



Meghan, Pete Smerud, and Ryan discuss solar hot water panels for the MAC Lodge.

So, back to the day-to-day. Well, there really is no day-to-day. Meghan shared that every project is so different there is a lot of juggling and improv involved. (Sound familiar?) She helps to keep everyone on track by making schedules with the Carpenter Foreman, Ryan Endicott, and checking in with him regularly. She is the point of contact for anything LBC be it materials, trade partners, contractors, manufacturers,

and the project owner (Wolf Ridge), with the main goal of making sure Wolf Ridge receives the certification everyone is working so hard for.

I was getting the impression that Meghan must have to be constantly vigilant. She agreed. She has had moments where her heart has stopped at hearing a material that is not LBC compliant may have been used in a pinch to solve a problem. Luckily, there are some exceptions for temporary fixes like this. There are also some hard line no-no's to be aware of. She has to know what materials she needs more information on, for example sealants. Sealants are very common on construction sites and find themselves everywhere- floors, walls, doors and windows. Some sealants have formaldehyde in them, an LBC red list material stated to be a human carcinogen. Meghan has to have the specs from the manufacturers on what materials are used in each sealant. It is the trade partner's responsibility to communicate with the manufacturer so there is an added layer to communication. To make matters more tricky manufacturers sometimes have secret recipes they do not want released. In this case, they can claim propriety as long as they display all materials are LBC compliant. My head began to spin.

Meghan has learned a lot about talking to partners effectively and this project

Name: Meghan Mahoney

Hometown: Duluth, MN

Job title: Project Engineer

Job description: Learn, live and lead Living Building Challenge requirements, oversee, review and provide insight for LBC documentation from trade partners, review submittal documentation, develop procurement of materials, develop procurement of project schedule (based on information from Superintendent), oversee project budget, oversee all project administration.

Why is this project important to you? As an eco-friendly millennial who works in the construction industry, it is amazing to me to see where this industry is heading, as it relates to LIVING and green buildings! Being on the Wolf Ridge project- a place I went to when I was in 6th grade for 3 days and still remember my classes and how much fun it was - it's an honor to be an advocate for the first LBC certification attempt in the region and northernmost in the country.

What is your favorite meal? Hmmmm, that's a tough question. I would have to say fajitas.



has changed the way she views construction. She is looking forward to growing in her position and potentially furthering Gardner's LBC connection. I asked Meghan about a comment I heard a few weeks ago about her and the Gardner team staying through the night to clean the MAC lodge before

the soft opening. She laughed, brushed it off and let me know that Gardner believes in hospitality and providing the best they possibly can for their owners, even if it means late nights.

The Wolf Ridge community has expanded throughout this project to in-

clude Gardner Builders. We would love to introduce you to just a few of the Gardner staff who have become an educational arm of Wolf Ridge through the work they do. Meghan, Curtis, Ryan, Jonathan, and anyone else who has been a part of this project- thank you for making this dream become reality.♦



Name: Jonathan Ballmer

Hometown: I grew up outside of Bowling Green, OH, but now would consider my hometown to be Duluth.

Job title: I don't have a job title, but my role is to lead the Duluth team at Gardner Builders.

Job description: Make sure that each member of our team is empowered as well as has the tools and training to be successful every day!

Why is this project important to you? I feel fortunate to have the opportunity to work with such an incredible organization with amazing people that are doing really cool work! I don't know of anyone in Minnesota that hasn't personally or known of someone that has either had a life changing experience at Wolf Ridge or with a naturalist that studied at Wolf Ridge. It is like Six Degrees of Kevin Bacon, which is awesome! On top of that, to be part of a project that pushes the expectations for design and construction in the efforts of sustainability and will allow the building to become a learning tool that supports the mission is icing on the cake!

What is your favorite meal? It depends on the mood, but I would say I tend to gravitate towards pizza, nachos, and burritos.

Name: Ryan Endicott

Hometown: Clover Valley, MN

Job title: Superintendent

Job description: To create relationships with clients/trade partners in a way to make everyone efficient and productive.

Why is this project important to you? When I was a 6th grader at North Shore Elementary school we visited Wolf Ridge. I remember enjoying the trip and eventually using some of the skills we learned later in life. Since I have been up here, I have seen kids come from many different backgrounds. Some from right here in our backyard to some that have never been in the woods. Either way, it makes me happy to know that when the MAC Lodge is completed, we will have completed a new home for thousands of kids a year. This project is also important to me because of the degree of difficulty. Living Building Challenge is new to all of us. Day after day I get to take on new tasks with the best team in the world! When it's all said and done, Wolf Ridge with the help of Gardner Builders, HGA and great trade partners will have reached some hefty goals!

What's your favorite meal? Without a doubt, Thanksgiving dinner



Name: Curtis Martinson

Hometown: Andover, MN

Job Title: Superintendent

Job Description: Working directly with the owners and architects to ensure that the project vision is captured.

Why is this project important to you? The first time I came to WRELC for the job interview, I knew that I needed to do this project. The project and the environment up here is truly what I am passionate about. Getting to work in the woods and being able to do what I love couldn't get any better. My kids have been growing up going to family camps and we spend a lot of time outdoors hiking. If I can be a part of something that is benefiting that experience for other kids, sign me up! Also being part of the new LBC process sounded exciting. It brought me out of my comfort zone and provided a unique opportunity to work with our fellow trades on something that is changing the industry.

My favorite meal: I have 2. One is kitchen cooking and one is camping. Pot roast with potatoes and carrots is my inside meal. Chili and corn bread made over the fire for my camping meal.

WOLF RIDGE NEWS BRIEFS

In October, the entire Wolf Ridge team gathered in three groups to help formulate Wolf Ridge's strategic plan for the next three years. Dave Chase, a non-profit consultant and Wolf Ridge/Antioch University link, led us through the process. We found that no matter how you sliced the pie, the board, facilities, and program staff were all united in our vision for the future. The next few years see us focusing on fortifying our core operation as we head into our 50th year as an organization.

- The Wolf Ridge farm is all a buzz as one of 80 groups nationwide to win honeybees, a beehive, and beekeeping equipment from the Honeybee Conservancy's national Sponsor-A-Hive program. Micro-greens sprouted under grow lights in the farm processing building grace our salads. And as with any farm there were some struggles with nature. A section of our deer exclusion fence blew down with high winds and beavers preparing for winter adjacent to our fields caused some flooding!

- Elizabeth Williams, Wolf Ridge's recruitment associate attended the North American Boarding School conference in MA. She is now talking with some interested schools and different partnerships on the East coast.

- Registration for summer programs opened Nov. 10th. If you sign up for youth programs before March 31st you get an early bird discount. It is exciting seeing programs fill up with returning campers and friends we haven't met yet. Also new is our Grandparent/



Grandchild Grand Summer Adventure program. It is no longer offered through Road Scholar and is now open to grandkids ages 6-11. David Butcher attended the Camp America International Recruitment Fair in London, England. He visited with past staff and spoke with potential summer staff.

- Wolf Ridge is teaching businesses to be Forest Stewardship Council (FSC) certified. Trusses needed for the expansion on the MAC Lodge that meet LBC standards could only be found in Maine. Instead of transporting the trusses so far, we chose to meet the LBC by having a tradesman from HGA, (our architects) teach a Wisconsin company how to make these trusses. Now that is paying it forward for a more sustainable future!

- Over the past few months Wolf Ridge supporters hosted three house parties in Maple Grove, Duluth, and Grand Marais. The intent of these gatherings was to update folks with progress on the *Making Waves* fundraising campaign and LBC. It was great sharing stories of the construction and learning taking place through this Challenge in intimate settings with Wolf Ridge supporters. If you are interested in hosting a party contact Wolf Ridge or Pete Smerud.

- As part of their winter training and retreat, Wolf Ridge graduate naturalists spent a night at Voyageur Outward Bound School followed by a day of dogsledding in the BWCAW. Temperatures of -36°F, sunny skies, and dogs ready to run made for a perfect memory-making day in northern Minnesota. ♦



Chuck Campbell (84) recently retired from working for the City of Duluth, MN. He is loving it and curling is one of the activities that he is enjoying. **Lynnae Fischbach (07)** is now working at the Exploratorium in San Francisco. **Josh Hordorff (08)** is off on adventures in El Salvador. **Rhea Mehrkens (10)** had a baby boy, Max Joseph on December 24, 2017. **Meg (Dickoff) Blodgett (10)** had a baby boy, Sam on October 17, 2017. **Alyssa MacLeod (14)** is substitute teaching in New Hampshire. Students that know of her alternate life know not to mess with her. Alyssa is a top competitor in Spartan Races. Ask **Joe Walewski (89)** and **Luciana Ranelli (15)** about a foggy hike up Mt. LaFayette that she led them on. **Tracy Ironside (86)** is now the executive director at First Witness, a child advocacy agency in Duluth, MN. **Elizabeth Gerritt (15)** is the wilderness educator at Nature Bridge -

Yosemite. **Nils Anderson (15)** is balancing 2 jobs in the Twin Cities area. He is a seasonal naturalist with the Three Rivers Park District at the Baker Near-Wilderness Settlement and an intermittent naturalist at the MN Zoo. **Danielle Tikalsky (16)** is the latest Wolf Ridge alumnus to join the staff at the Great Lakes Aquarium as the special programs coordinator. ♦

PROFILE: DAVE CHASE



What is your connection to Wolf Ridge ELC? I first got involved with Wolf Ridge through its partnership with Antioch University New England (AUNE). Pete Smerud, Shannon Walz, and I met one another for the first time quite by chance at an ANCA Residential Environmental Learning Center Conference in the Poconos in January of 2015. While there, we began chatting informally about the idea of some kind of possible collaboration between Wolf Ridge and AUNE. While none of us knew it at the time, Joe Walewski was having conversations with Laura Andrews, then Antioch's Director of Admissions, about the very same idea. Clearly, it was meant to be! Since then, I've had the good fortune to stay connected with Wolf Ridge through my work at AUNE, as well my work as an organizational consultant, most recently helping with various aspects of Wolf Ridge's developing strategic plan.

What is your current occupation(s)? My full-time work is as a consultant to nonprofits around the country in the environmental, educational, human service, social justice, and sustainability fields on a variety of organizational development topics – strategic planning, board and staff training, process facilitation, capacity building, program evaluation, etc. When not doing that, I also serve as an adjunct faculty member in the Environmental Studies & Sustainability, Education, and Leadership, Management & Business departments at AUNE. I feel very lucky to have the opportunity to get to wear these two professional hats simultaneously!

Tell our readers about something that you have learned as the result of your time or association with Wolf Ridge ELC. Put a critical mass of bright, energetic, positive people with a shared passion for the outdoors and learning about it together, provide them with a 2000+ acre sandbox to play in, and give them plenty of opportunities to professionally express their interests and ingenuities in whatever way(s) they might like and then stand back and watch magic happen.

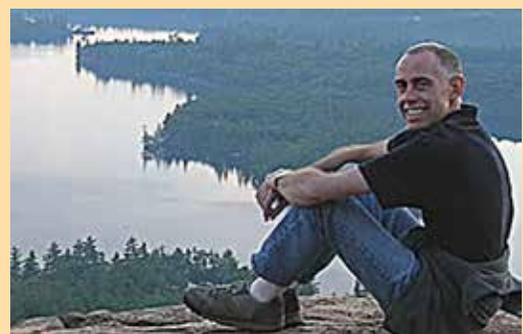
Please share a Wolf Ridge ELC memory. This past October, I was out at Wolf Ridge to facilitate several meetings associated with your developing strategic plan. The forecast suggested that it might cool off enough overnight for the drizzly fall weather to produce a few flakes of snow. When I awoke the next morning and peered out my window at Lakeview House, I was greeted by about a foot of the white stuff!

Tell us about yourself. My wife, Amy, and I live in the town of Walpole, NH – a little old rural New England town of farms and forests right on the Connecticut River. Amy (a former environmental educator and classroom teacher, now artisan) and I have been married for 20+ years. We “dog-share” a black Labrador retriever named Grendel with our 100 year-old neighbor who handles day shift duties while we hold down the nights and walking.

What book and/or movie would you recommend others read. A fellow New Englander named Noel Perrin penned a number of great essays about rural life that he compiled into a series of books entitled First Person Rural, Second Person Rural, etc. More than almost anyone I've ever read, Perrin captures rural New England life.

If you could visit with any conservationist/naturalist/environmentalist, living or dead, who would it be and what would you say. I'd love to spend a day with George Perkins Marsh! In many ways, he was our country's first environmentalist – and a man of boundless energy, endless enthusiasm, and immense intelligence. I wish he was both better known and more widely read than seems to be the case today.

If you were a tree, what kind of tree would you be? I've always been fascinated by elm trees. Where I grew up in northern Maine, the streets of our small town were lined with huge, old elms. In the summer, their overhanging branches and leaves would form these green canopies that made the streets feel like giant woodland tunnels. When Dutch elm disease struck that part of New England, most of the old elms were wiped out within a few years. But even today, you still can find a beautiful old elm gracing the rural landscape throughout the Northeast if you know where to look. ♦



LESSON PLAN UPDATE

by Shannon Walz, Education Director

You know that feeling you get when you have done something you are really proud of? Well, I have that feeling for our education team and the curriculum work that we have been doing. Over the last eighteen months Wolf Ridge has been doing an extensive review and update of our curriculum. All of our lessons have been rebranded, “SPIRALized” (remember Joe Walewski’s previous *Almanac* articles.) and we have incorporated ASSESSMENT more intentionally into our lessons.

ASSESSMENT is a word with a lot of baggage in today’s education world. Most commonly people think of tests, quizzes and worksheets; however, ASSESSMENT is really about learning what students know and using that to inform your teaching AND to help make the students’ thinking visible to them (metacognition). ASSESSMENT is a very important part of learning. Two common forms of assessment in education are: summative assessment - used at the end of a lesson or unit to gauge student understanding, and formative assessment - used throughout learning experiences to gauge student learning and to help students process learning experiences.

During the 2016-17 school year Luciana Ranelli led the ASSESSMENT integration charge. She worked closely with curriculum managers to integrate assessment routines into each class, review concepts and outcomes and apply the SPIRAL framework to the class. Luciana also facilitated professional development for all of the education staff throughout the year. We are working to weave ASSESSMENT and SPIRAL LEARNING into the fabric of our educational culture.

Much research went into identifying what assessment routines should be used in the lesson plans. Twenty-five routines were selected and adapted from sources such as: Page Keeley’s Science: Formative Assessment and the B.E.E.T.L.E.S. Project.

What makes a good ASSESSMENT routine for Wolf Ridge? Routines were selected that can easily be done outdoors; that don’t require a huge amount of resources to do; that are simple enough that naturalists can get clear instant feedback on students’ thought process; and are fun and engaging for students.

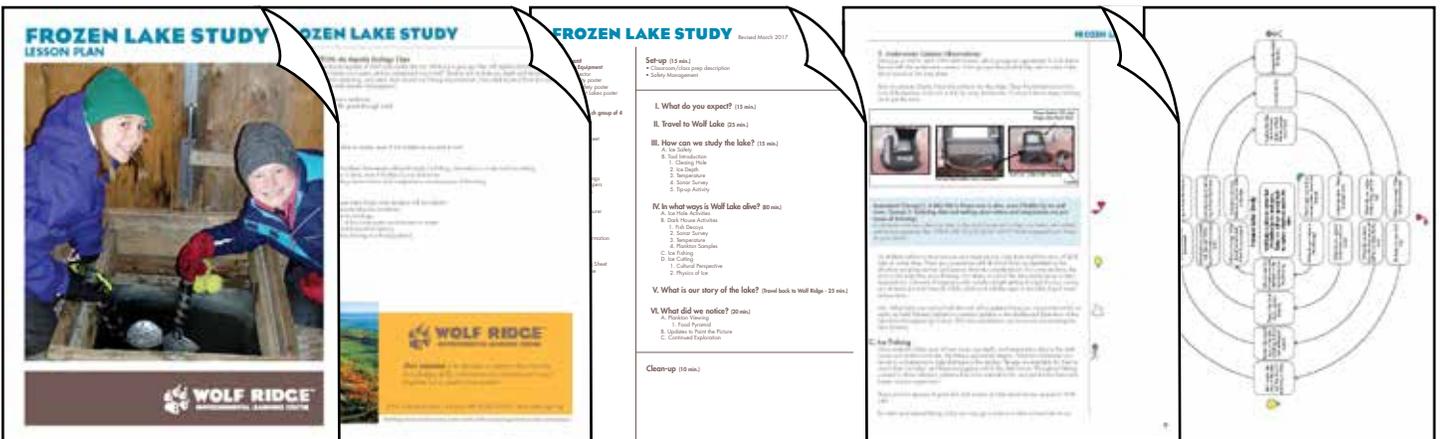
With this project, we strive to reach our goal of continually improving our curriculum. ♦

Example Assessment Technique: Fist to Five

Description: Fist to Five is a fast way to check for understanding of a concept or instructions, and to help learners be aware of their own thinking. After directions or a concept statement, ask students to signify their understanding by holding up a fist, 1, 2, 3, 4, or 5 fingers. A fist represents no understanding, one finger barely understand...and five fingers a complete understanding & can explain to someone else. As students show their response, next steps can include repeating certain steps of directions, a mental note to address the same concept another time in class, or making student groups of people who held up 2 or 3 fingers with those who held up 4 or 5 so they can help each other.

Resources needed: None

Variations: In winter, experiment with removing mittens or finding another way to show a scaled response (number of limbs pointed to center of circle, arms at the side to above the head like the sun’s path). Thumbs up/sideways/down can indicate “I get it, I do not know if I fully understand, I don’t get it.”



Front cover
Fresh new look with our updated branding.

Concept page
All of our concepts and outcomes for each lesson have been reviewed and updated.

Outline page
We have updated our class outlines - encouraging inquiry and curiosity with a question format.

Lesson plan body
Assessment routines are highlighted in new assessment boxes. Spiral Learning icons have been added.

Class Spiral:
Spiral view of the class flow.

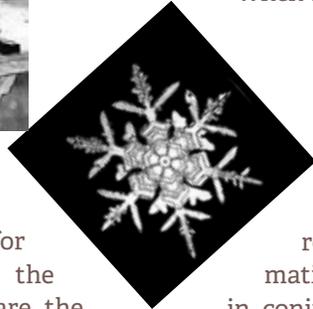
SNOWFLAKES

by Hannah Edstrom, Wolf Ridge Naturalist



"Under the microscope, I found that snowflakes were miracles of beauty; and it seemed a shame that this beauty should not be seen and appreciated by others. Every crystal was a masterpiece of design and no one design was ever repeated. When a snowflake melted, that design was forever lost. Just that much beauty was gone, without leaving any record behind."

~ Wilson "Snowflake" Bentley



Snowflakes have caught the attention of humans for eons. You've certainly heard the saying "No two snowflakes are the same". Wilson Bentley is responsible for that concept. When Bentley was 15, he asked his parents for a camera that could be attached to a microscope to capture images of snowflakes. It took him five years of trial and error. Eventually in 1885, he became the first person ever to photograph a snow crystal. Eventually he would capture nearly 5,000 snowflake images in his lifetime. After examining so many snowflakes he realized that each is unique.

Bentley kept careful weather records and wondered what conditions led to the various shapes and sizes of snowflakes. He concluded that temperature played a role, but it took another 30 years before researchers addressed the question of snowflake formation.

Today we know snowflakes begin their life as dust particles high in the atmosphere. A water droplet freezes to a dust particle creating an ice crystal. While the ice crystal falls to the ground, water vapor continues to freeze onto it forming a snowflake. Each snowflake follows a separate path to the ground resulting in their unique shapes. Because the snowflake falls as a unit, all sides of the snowflake are identical.

As Bentley surmised, temperature plays a role in snowflake formation and shape. It can be too warm to snow but never too cold. Ideal temperature points for snow are just below freezing and under 5°F.

Humidity plays a key role in snowflake formation. Humidity works in conjunction with temperature. Higher temperatures result in higher moisture content. Greater humidity helps to form longer arms on a snowflake; those arms spread out because more water vapor in the air is able to attach to the falling ice crystal. When there is less moisture in the air snowflakes are unable to grow much. Therefore, more intricate arms and snowflake designs are formed in warmer temperatures. These snowflakes produce very heavy snow due to high moisture content and ability to stick to one another.

While we mostly think about snowflakes in the classic six-armed form,

there are other shapes. Reduced moisture in the air results in snow crystals with a plate-like structure. Increase the moisture a bit and the plate will grow vertically forming a column. Snow crystals can also form as graupel (also called soft hail or snow pellets) or needles. Both of these forms develop at warmer temperatures with a moderate-low amount of moisture in the air. Some sources categorize snowflakes into as many as 121 types in eight categories!

The next time you brush snow off your car, shovel the sidewalk, or simply stand in the falling snow, check out the types of snowflakes around you. Look closely and correlate your observations to the temperature and humidity conditions. Explore your inner "Snowflake" Bentley. ❖



SNOWFLAKES Classifications & shapes

Classification	Count
Column Crystals	8
Plane Crystals	39
Combination of Column & Plane Crystals	8
Aggregation	121
Rimmed Snow Crystals	4
Other Solid Precipitation	4
Irregular Particles	4
Key	121

KEY

- 8 Column Crystals
- 39 Plane Crystals
- 8 Combination of Column & Plane Crystals
- 4 Rimmed Snow Crystals
- 4 Other Solid Precipitation
- 4 Irregular Particles
- 121 Aggregation

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PROGRAMS 2018

ADULTS

LNT Master Educator: May 16-20: \$450 register at NOLS at nols.edu

Advanced Bird Banding Class: June 17-21: \$1200

Beginning Bird Banding Class: June 23-30: \$2,195

Wilderness First Responder: April 2-9: Starting at \$725

Fabulous Fall Nature Geek-Out: Sept 28-30: \$325



ALL AGES

Open House: June 23, 2018 9:00-4:00 **Free**

Bird Banding Drop-in days:

June 6, 13, 20, July 6, 18, 25, & Aug 1 7:00-11:00am **Free**

Summer Family Camps: (all ages)

July 1-7, July 22-28, July 29-Aug 4: Starting at \$950/2 people

Guided Family & Group Wilderness Trips: Email david.butcher@wolf-ridge.org for ages, dates, & prices.

Grandparent/Grandchild Summer Grand Adventure: (ages 6-11 and adults) Aug 5-9: \$565

YOUTH

Summer Sampler: (2nd-5th gr) Aug 15-18: \$380

Discoverers: (4th-5thgr) June 24-30, July 8-14, July 15-21, July 22-28, July 29-Aug 4, Aug 5-11, Aug 12-18: \$597

Voyageurs: (6th-7thgr) June 24-30, July 8-14, July 15-21, July 22-28, July 29-Aug 4, Aug 5-11, Aug 12-18: \$597

Adventurers: (8th-9thgr) July 15-21, July 22-28, July 29-Aug 4, Aug 5-11: \$597

Day Camp: (1st-5thgr) June 25-29: \$190

Green Energy Camp: (4st-5thgr) Aug 12-18: \$597

Voyageurs 2-wk Ultimate Survival: (6th-7thgr) July 8-21: \$1300

Wildlife Camp: (6th-7thgr) July 22-28: \$597

Angling to Archery: (6th-7thgr) Aug 5-11: \$650

Girls Rock the Ridge Leadership: (6th-7th) Aug 12-18: \$597 **NEW**

Farm, Feast, & Fire Camp: (8th-9thgr) July 29-Aug 4: \$597

Camp Rock Climbing: (8th-9thgr) Aug 5-11: \$670

Counselor-in-Training: (10th-12thgr) July 22-August 4: \$990

Credit Camp - Freshwater Ecology: (10th-12thgr) July 15-28: \$1630

Credit Camp - Wilderness Ethics: (10th-12thgr) July 29-Aug 11: \$1630

Superior Service Learning Camp: (10th-12thgr) Aug 12-18: \$597

Superior Hiking Trail 5-day Backpack: (7th-8th) July 8-14: \$618 **NEW**

BWCAW Canoe 5-day: (7th-8thgr) Aug 12-18: \$618

Adventurers 2-wk BWCAW Canoe: (8th-9thgr) July 8-21: \$1390

Adventurers 2-wk Isle Royale Backpack: (8th-9thgr) July 15-21: \$1399

Adventurers Northwoods Kayak: (8th-9thgr) Aug 12-18: \$721

Isle Royale Kayak Expedition: (10th-12thgr) July 1-21: \$1529

Jr Naturalists 2-wk Quetico Canoe: (10th-12thgr) July 22-Aug 4: \$1462

Jr Naturalists 2-wk Apostle Islands Kayak: (10th-12thgr) July 29-Aug 11: \$1462

BWCAW Traverse Canoe Expedition: (10th-12thgr) July 1-22: \$2050



*Complimentary Issue
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Wolf Ridge is an accredited residential environmental school for persons of all ages. We offer immersion programs which involve direct observation and participation in outdoor experiences. Wolf Ridge programs focus on environmental sciences, human culture and history, personal growth, team building, and outdoor recreation.

Our mission is to develop a citizenry that has the knowledge, skills, motivation, and commitment to act together for a quality environment.

We meet our mission by:

- Fostering awareness, curiosity, and sensitivity to the natural world.
- Providing lifelong learning experiences in nature.
- Developing social understanding, respect, and cooperation.
- Modeling values, behaviors, and technologies which lead to a sustainable lifestyle.
- Promoting the concepts of conservation and stewardship.