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2022

Annual Report



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Dr. Jonathan Lundgren

Founded Ecdysis Foundation in 2016

Jon is an entomologist, agroecologist, beekeeper, and rancher.

“They should have sent a poet.”

-CARL SAGAN



Jon overlooks the prairie on Blue Dasher Farm.

I cannot believe how small we are. Many times I have thought this over the past year. Ecdysis is headquartered in a pole shed in rural Deuel County, South Dakota. With a population of 4,200, it is one of the least populated places in the country. At ground zero of where change needs to happen, the largest agricultural research project ever attempted is being conducted: the 1000 Farms Initiative. The evidence generated by this project will reinforce a new trajectory for humankind.

Most of the 30-or-so staff doubted at least once as they deployed across the country in 2022. I inserted us into what seemed an impossible situation. We visited 389 farms this year, collected 20,000 soil cores, 79,000 insect sweeps, 41,000 plant biomass samples, and the list goes on. We all worked...so hard.

Amidst their doubt, what held them steadfast was a close-knit community that emerged. At the core of that community was a sense of belief.

Religion of my youth was used as a sledgehammer, and it didn't stand up to questions very well. Too often, the mythology and dogma that consumed this style of religion was used to control and give a black and white "easy way out" answer to problems that were a nearly infinite spectrum of grays.

In this case, spirituality and religion wasn't bad. The application of it was. It fed rebellion.

I turned to science; it stood up to questions really well. I became very good at posing logical questions and giving scrutiny. Science was a way to assess and interpret observations and ideas. I knew in my heart certain things. But if you ask the question in the wrong

context, science often cannot support what a heart says is true. Along this line, mis-formulated science is used to control and manipulate belief systems; even mine. In this sense, science wasn't all that different from the style of religion of my youth.

In these cases, the science isn't bad. The question is. It fed rebellion.

Our belief systems should stand up to scrutiny. The data should help us to refine the questions that uphold our beliefs. Through that refinement, our similarities outweigh our differences, and consilience of belief systems is realized.

How did we survive for millions of years until we let wrongly applied technology supplant our souls? Through connection and respect for the natural world, family, and community. Belief systems upheld these connections.

As we travelled at this pivotal time in human history, the staff met the farmers who were redefining what was possible with land management. Members of the staff cut themselves, had blisters, contracted Covid, blew out elbows, etc. At various times, they were wet and cold and hot and filthier than they had ever been. But they saw with their hearts and with their scientific instruments a different world end than the one we are saturated with by the screens of our lives.

Society seldom puts itself into scenarios that truly test its perceptions of the world as these women and men of Ecdysis Foundation did in 2022.

This year, the staff picked up the microphone to share the stories of 2022. For the first several years of Ecdysis Foundation, I was a public face for Ecdysis Foundation and regenerative agriculture. Regenerative agriculture needs strong leaders that people can trust right now. Leaders that aren't trying to sell something. The world also needs to know that it isn't just the strong leaders that are behind this movement.

I have tried to figure out why it was so powerful to have the staff (many of whom are recent college graduates) share their stories. They aren't professional speakers, but they spoke from the heart and they shared what moved them. I think that a big part of it is that the older generations have been bombarded with the increasing mess we have generated for most of our lives, and despite throwing technology against this monolith, it doesn't seem to be working. Amidst drowning in a losing battle, our eyes are squinting at the horizon to see hope. What they saw in the people of Ecdysis Foundation is that the cavalry is assembling.

Here we are, amidst of one of the greatest spiritual crossroads that humanity has ever faced. Ecdysis is a small band of people standing in front of a giant with a slingshot, trying to save our place on the planet using...science. Science and data are absolutely necessary, but it feels woefully inadequate by itself to solve the issues we are facing. It is why we practice relationship-intensive science, as we do.

One of the most challenging parts of my job is that I can walk onto a regenerative farm, and I feel that there is something different about it. With my senses and with my heart. The birds are singing, there is a cool health to the air, smell of the soil, and feel of the insects on your hands. Often, the farmer is nervous and excited and connected to something that s/he has built. Sometimes they are hoping that I can tell them that what they have produced is right. After all, I am a scientist. It is my job to turn that feeling into numbers that can be assessed empirically. If only these farmers understood: if they go to the farm every day, and see something that they have never seen before, then they are doing things right. That experience

is more accurate than any tool I can use to measure their farm.

In seeing a breathtaking celestial event, the data-driven, fictional scientist Ellie Arroway (written beautifully by Carl Sagan), in humble self-realization admits that they shouldn't have sent a scientist to explore the universe. They shouldn't have sent her. "They should have sent a poet."

This is one of the more challenging parts of my job. How on earth do you do turn the beauty of a regenerative farm into numbers without robbing its soul? I damn well better pose the question right. It is such a tremendous responsibility, gently holding in cupped hands a small fledgling of a belief system that could save our place on this planet. I am not sure I am cut out for such a responsibility. Yet, here we are.



Magic hour on the prairie.



Dr. Michael Bredeson

Joined Ecdysis Team in 2016

Mike is a research scientist in charge of cropland research around North America.



Mike speaking with community.

Road trips, new places, new friends, natural beauty. I must say, 2022 was a year to remember at the Ecdysis Foundation.

Though the job is a difficult one and the stakes are incredibly high, Ecdysis staff moves as one supportive unit to measurably change the world we exist on.

As a remote worker from my own farm site in Litchfield, MN I crave the summer field research season. During warmer months I finally have extended trips and interactions with my fellow researchers. Ecdysis does many things the right way, but the greatest thing is somehow finding the most thoughtful, interesting, and genuinely kind people to pack into minivans for projects all

over the nation. Ultimately, it is the people of Ecdysis which make the organization special.

2022 started with some icy cold days spent in the welding shop with my good friend and colleague Dr. Ryan



Mike and Ryan with the roller-crimper.

Schmid. We had high hopes to finish a partnership project with a few local farmers. Our mission was to build a roller crimper using the frame of an old field cultivator and other salvaged parts. I'm proud to say we accomplished our mission and local farmers were able to use our device to successfully roll cereal rye and other covers this spring.

Field research began with a February road trip to southern and central California to sample almond fields. Audiobooks, "jamming" out to music, and deep conversations were activities shared between copilots. The drive out was highlighted by a brief detour to Arches National Park in Utah which, although short-lived, was an awe-

inspiring experience - I will be making a return visit.

A few months later I was off to Washington state's Palouse region which is signified by drastic rolling hills of wheat. The Palouse, so uniform with agriculture was all at once beautiful and alien. I felt as a snow flea amongst tall drifts for as far as I could see in a featureless landscape.

The trip to Washington was downright wet. Somehow, the crew was able to maintain high spirits despite mother nature throwing us her worst, and fate throwing us some minivan difficulties. We overcame all and made the trip a grand success.

July brought with it a visit to the most wonderful farm I have ever set foot upon during my tenure at Ecdysis. Our trip to Kansas has taken place annually for quite a few years. Somehow, we had failed to connect with the folks of JAKO



Mike armed with soil probe.

Dairy farm in Yoder until 2022. This family operation rotationally manages a mixed-breed herd of cows which supplies the milk for the most wonderful dairy products you will ever have the pleasure of consuming. Their food is the stuff which makes you close your eyes, sigh, and appreciate life in a way you didn't know was possible - yes, it's THAT good.

Daniel and Robyn, operators of JAKO Dairy, opened their home to our crew to teach us and to feed us until we could hardly stand up. Every square inch of available cooler space was filled with JAKO products on our return to South Dakota.

My final field fete of 2022 took place across southern Wisconsin and Minnesota. Living nearly my entire life in central Minnesota I thought I knew my own state, but I had somehow not been introduced to the gorgeous driftless region of SE Minnesota and across the mighty Mississippi to our neighbors to the East. This trip offered us retrospection on the insane field season we had been having. Young, slightly tired researchers seemed pensive as they pondered all they had learned from this summer. Minds were busy in reflection, and conversations were deep in how to move forward with the mission of Ecdysis - To heal the land and heal damaged rural communities.



A selfie with a giant sequoia tree.



Tools of the sampling trade.

This annual lookback on happenings is always an important reminder of all that has been accomplished - All of the work done, lives changed, relationships created, places seen, and moments experienced.

Ecdysis, and more importantly, its people, are well. Though the job is a difficult one and the stakes are incredibly high, Ecdysis staff moves as one supportive unit to measurably change the world we exist on. 2022 was amazing, and I have a feeling that 2023 will be unbelievable.



Tia Busenitz

Joined Ecdysis Team in 2019

Tia is a graduate student in entomology (University of Nebraska) researching how pesticides and probiotics affect honeybee health and immune function.

I've been with Ecdysis for four summers now, and 2022 was the most amazing field season. We got such an incredible amount accomplished and made so many new friends and memories all over the country! When I think back to my first summer at Blue Dasher Farm, I can hardly believe how far we've come in such a short amount of time. Even the lab is unrecognizable.

What really struck me this year is the incredible amount of momentum the regenerative/sustainable agriculture movement has built up. We're barreling along at an extremely exciting rate: the folks I've met this year are so passionate and inspired to be a part of the solution to climate change and food

instability, among many other issues. And they're spreading the word. And their excitement is infectious.

After spending some time in this community, listening to the energy and devotion bubbling from people across all walks of life, it's made me hopeful for the future. The world feels impossibly huge, and impossibly terrible. But when you get right down to it, there are so many people who want to put their boots on and do the work to fix it. The unstoppable hope for a better future is more powerful and self-sustaining than any destructive force. This agriculture community is made up of bold farmers on the forefront, but there's also a supporting cast of authors, artists,



Some of our healthiest colonies in autumn before we pulled honey supers and extracted

activists and scientists who have realized agriculture is the pivotal hub of so many different social, cultural, and ecological issues.

Depending on how you look at it, this field is very new and exciting. Most people frame it as stepping into uncharted territory without much knowledge, which frankly tends to scare a lot of folks. "Will it work? Can we scale it up to feed the whole planet?" Many cultures have long been practicing this style of ecology driven land management. In a lot of ways, our progress is not at all an unstable



The minions of Ecdysis

venture into the unknown, but an act of relearning what we already know in our bones. Listening not only to the evidence, but to the people, land, and animals who have been trying to tell us what to do from the beginning.

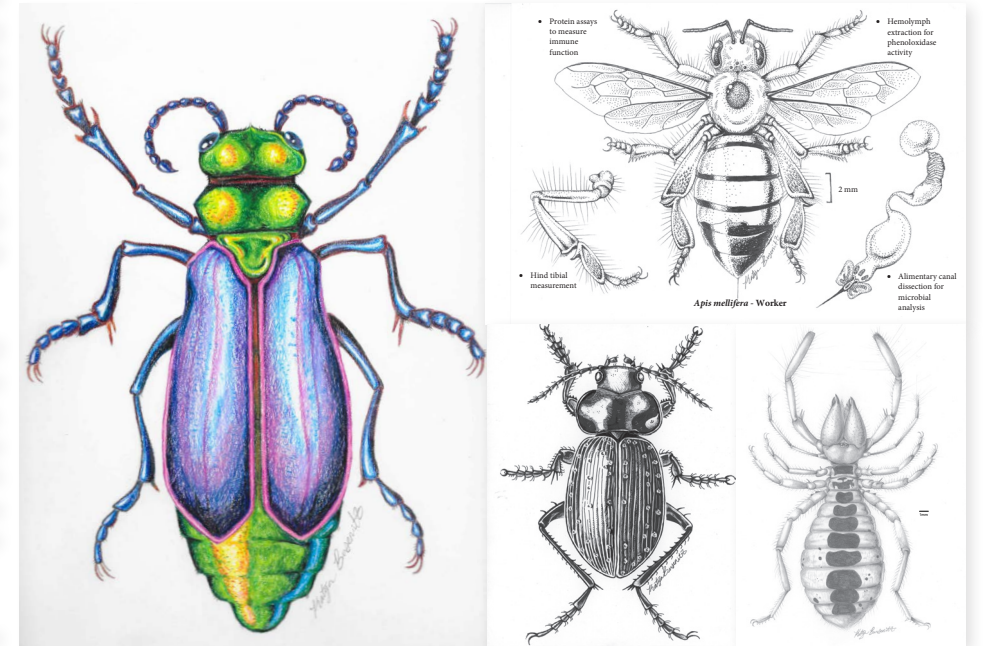
This fall we wrapped up the second year of fieldwork for the rangelands and pollinator study, which involved

delivering 80 beehives to ten different sites in South Dakota, measuring brood, varroa, and weight of the hives every month over the summer, as well as monthly pollinator surveys, floral counts, bird surveys, and plant biomass measurements. That's hard to imagine, so to put it into perspective we counted 86,460 individual flowers for our floral counts this summer alone!

After the season we collected and transported all equipment and honey laden colonies home for overwintering. Oof my back. A huge thanks to my teammates who helped me so much over the summer, carrying heavy hive boxes and counting flowers 'til their eyes crossed.

This year we also had honeybee colonies survive 2021 winter and build up strength over the summer, they're now wrapped up for winter. It might not sound like much, but this is the first year our bees have built until they were taller than me.

Fingers crossed that all our bees make it through the winter into 2023!



Illustrations by Tia Busenitz

The unstoppable hope for a better future is more powerful and self-sustaining than any destructive force.



One of our bees foraging on thistle at a SD rangeland



Brood counts at a SD rangeland.



Tommy Fenster

Joined Ecdysis Team in 2017

Tommy is a PhD student at UC Davis researching regenerative perennial cropping systems.

2022 marked my 5-year anniversary for working with Ecdysis. It was a productive year and I learned extensively from my colleagues at Ecdysis, my lab at Davis (The Gaudin Agroecology Lab), and from the farmers we are working with on our projects. In March of 2022 a team came out from Ecdysis (plus Greg Richardson from Paicines Ranch!) to kick off the first field season for my PhD dissertation. Over the course of 10 days the team conducted soil health, biodiversity, ecosystem functionality sampling across 15 vineyards in Sonoma, Lake, Mendocino, and San Benito Counties.



Joshua Estes taking petiole samples

The goal of study is to rigorously evaluate the environmental and economic outcomes of integrating sheep on commercial vineyards with different management legacies along the conventional-regenerative gradient to inform the development of best management practices, a cost-return calculation tool and identify new leverages for adoption. Research in other systems shows that the stacking of practices can have a synergistic effect, resulting in improved soil quality and biological community metrics. We hypothesize that the integration of grazers will have a positive additive effect on these metrics when combined with other agroecological practices such

“We hypothesize that the integration of grazers will have a positive additive effect on these metrics...”



The Ecdysis team during the March bud break sampling

as reduced tillage and pesticide use with benefits to sustainability. Additionally, this vineyard project is nested in the 1000 Farms Initiative, where the Ecdysis Foundation is conducting full systems assessments on 1000 farms, representing the major crops for each major agricultural region in the US. This experiment will fill critical data gaps in regenerative agriculture, specifically addressing the efficacy of regenerative farming across regions and cropping systems, while working with farmers to develop roadmaps to guide transitions to regenerative management.

Between March and resumption of fieldwork in the end of July, I worked with the Ecdysis foundation, researchers at Davis, extension specialists, vineyards, and a contract grazing company to submit a preliminary grant proposal to help fund our research as well as extensive outreach efforts to ensure the findings can be utilized by farmers. Our pre-proposal was deemed meritorious and in November the team submitted a full proposal.

Towards the end of July field work in the vineyards resumed and lasted until mid-September. To conduct this

fieldwork, I was joined by Joshua Estes, an undergraduate research technician in the Gaudin lab at UC Davis. Our first task was to carry out the 50% veraison sampling (when the grapes begin to sweeten and 50% of them have changed color). For this sampling we took leaf petiole samples to assess the vineyards' fertility management strategies, conducted insect sweeps, and did plant community biodiversity assessments. As soon as this sampling concluded, we began our harvest sampling in the vineyards. For this we assessed vine yield, cluster number, cluster weight, grape weight, as well as sub sampling berries to perform grape quality assessments.

The rest of the Fall was devoted to lab work and data analysis. In December of 2022 all the vineyards in the study received reports summarizing the results from their farm as well as the means for the vineyards with and without grazers in the study. This is something I am particularly proud of as it shows the Ecdysis's commitment to getting the data back to the farmers who are integral to the research we are conducting.

Dr. Matt Jones

Joined Ecdysis Team in 2021

Matt is a research scientist in charge of orchard crop programs in the Pacific Northwest.



2022 was a very busy year here in the Pacific Northwest. The Ecdysis Foundation began working with apple, cherry, and wheat growers as part of the 1000 Farms Initiative to better understand how regenerative farm management practices affect a wide suit of sustainability metrics.



The team in a Washington apple orchard.

The first part of the year was spent making connections and trying to recruit growers from the widest spectrum of farm management preferences as we could find. This meant we were looking for folks farming in a conventional/standard manner as well as folks trying some really innovative practices. 59 farms from Washington, Oregon, and Idaho agreed to work with us on this massive study. Starting with the first Oregon cherry blossoms in April until the last northern Washington apple harvest in late October, we worked with growers to time our extensive sampling efforts based on specific flowering periods and crop harvest dates.

We took thousands of soil health, plant biomass, water infiltration, insect diversity, and fruit/grain samples. We had three large sampling trips where teams of research technicians came out from our headquarters in South Dakota to help pull off the major sampling

efforts. There's no way we could have pulled it off without them.

Now, after months of field collections, it's time to process and enter the data, identify the insects, and get right back to planning for next year.

market demands, logistical challenges, knowledge gaps, and roadblocks to implementing the best available practices.

2. Growers are innovators. Planting daffodils amidst cherry trees to biologically deter gophers? For sure! Trialing wonky biological foliar sprays? Oh yeah. Augmenting pollinator and bird habitat? Of course. Testing 'out of the ordinary' levels of mulch and compost applications? Why not. Grazing cover crops and mixing up standard rotations? You bet. Planting ancient heritage varieties? Neat. Growers are thinking outside the box in so many ways. Seeing all this through the lens of my scientific training, it can be challenging to find ways to understand and quantify these effects, but it's exciting. Growers are the ones leading the way forward.

3. Assumptions should be challenged; It's the best way to learn. No single person knows all the best ways forward, and I feel confident that there is no one-size-fits-all definition for what "Regenerative Agriculture" even really is. BUT, if we remain open-minded, maintain high quality data collection standards, and mesh quality science with grower knowledge and experience, then we can move the needle in a positive direction.

For me, there are a few takeaways from this field season that I'll carry with me: **1. Every farm/farming operation is unique.** Seeing what's working for farmers on their specific piece of land is fascinating to me. I'm appreciative for the opportunity to meet with so many growers and to begin to understand the nuanced challenges growers in this region are facing as they navigate



Matt pauses while sampling wheat.

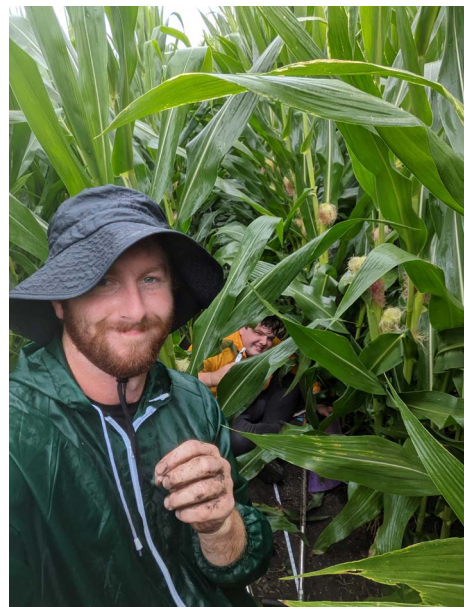


Daniel Pecenka

Joined Ecdysis Team in 2019

Daniel is a graduate student (SDSU) studying insects as bioindicators of regenerative agriculture with a focus on perennial wheat.

Hello all, my name is Daniel Pecenka. I have been a technician at Ecdysis for three years. Through working for Ecdysis, I have had the great opportunity to watch our scientists conduct amazing research. The thing I am most proud of is our contribution to changing our community's, even our country's food systems.



Being stalked in the corn

Because of our work, I wanted to become a part of those great scientists. So after many conversations, brainstorming, and heated debates, Jon and I decided to start a new project. This year, 2022, I started a research project looking at perennial wheat and wheatgrass. Specifically, this project considers the possible relationship between collected insects and the vitality of the wheat fields they were collected from. Perennial wheat is not a new product; it has taken a back seat to modern annual wheat varieties.

I will be looking at two breeds of perennial plants: Kernza, a wheatgrass from the Land Institute, and Salish Blue, a wheat variety from Bread Lab. Both these plants are hard to find and year one I was only able to make a few connections with growers and got a few fields.

However, things are looking up for 2023. Connections are continuing to be made, new people are being met, and the data we have already collected is in the process of being analyzed.

Ecdysis not only gave me the chance to start a research project, the group also gave me the opportunity to travel across the United States. The summer for 2022 took me from northern Montana to an hour north of Chicago Illinois.



Daniel and zebra pal

All of these growers were extremely friendly and inviting to the Ecdysis team showing great interest in the project. I was able to watch a beautiful sunset in the big sky Montana with the cooked to perfection organic New York strip steaks we got from a grower. This experiment has been enlightening for myself for a variety of reasons. This summer was the first time I lead a data collection trip, or adventure, as I like to call them. I normally experience trips through the eyes of a technician, which is just a day-to-day wonder. This time around, however, I got to experience the trips as a scientist. I took on more of a leadership role, helping plan the trip's agendas and itineraries.



Team "Bucket Hat"

A rewarding part of this new role as a scientist was being an active part in the memories of the team members. For example, at the end of a trip the team usually does one big cook-out at the place we were staying. During the cook-out, we would use the products we bought from the farmers and ranchers we had the opportunity to meet. During the dinner we, as a team would laugh and share memories from the trip, learning from each other's experience. This summer as a scientist I had an active role in making these memories because I was the one to choose the fields, contact the growers, and plan our adventures.

I cannot wait for the summer of 2023 to plan more trips and adventures for the next group of technicians. Here's to a New Year and a New Adventure!



In the SD Badlands

Dr. Stephen Robertson

Joined Ecdysis Team in 2021

Stephen is a research scientist with interests in regenerative fruit production and intercropping.



I would describe 2022 with the Ecdysis Foundation as being an intensely chaotic and glorious success. How else could starting our 1000 Farms initiative go? It is, after all, the most ambitious scientific investigation ever attempted, both in terms of the numbers of farms we will be visiting and the comprehensiveness of data we collect. This year alone, we visited over 300 farms and collected data on soil (microbiomes and nutrients), water, plants, arthropods, vertebrates, produce, and more. To put it lightly, we did an insane amount of work and have an insane dataset to match it.

This year, I was made painfully aware of the need for an effort like 1000 Farms. The need to find ways to repair damage done to our agricultural systems and the need to provide security to global food production. I worked closely with growers and was given the opportunity to talk one-on-one with producers from around the country. From California, where aquifers have nearly dried up from overuse, to Nebraska, where drought conditions in the central/western part of the state resulted in irrigation that visibly lowered the water level of Lake McConaughy (a manmade reservoir). From Washington, where late freezes threaten the United States' most valuable fruit producing areas, to North Dakota, where increased hailstorms can cause a complete loss of crop. While each region seems to be tackling different challenges, the common thread is that cultivating land in today's environments is harder than it ever has been.

Perhaps my most profound realization: farmer resilience is a thing of beauty. Even with the challenges they face, they persevere. Through the hardships they face in their personal lives that are directly related to their profession, they persevere. "Moving the needle" as one of the growers referred to it and has become a common phrase to describe motion forward around the halls of the Ecdysis Foundation. My year has reinforced a high respect for their

ability to withstand whatever is thrown at them, and not just trudge through but hold their heads high with pride for the work they do.

“Farmer resilience is a thing of beauty. Even with the challenges they face, they persevere.”

More to the point, the first part of my year was spent prepping for the upcoming field season. Mapping potential 1000 Farms participants, scheduling visits to clusters, and reviewing sampling protocols. This served me well as I made contacts with growers and led a team to North Dakota for a sampling trip in August. A substantial amount of time was spent on these collection trips, of which I attended six, getting the opportunity to visit seven states I had never been to previously. On one such trip, my hope of COVID immunity was dashed as I coughed my way back to South Dakota on a long car ride with two coworkers. I also spent a fair amount of time this year continuing efforts to bring online a revolutionary artificial intelligence program (aptly named "BugBox") designed to identify and catalogue our many thousands of insect samples in a way that automates data acquisition. I also wrapped up a publication from my dissertation. To end the year, I have been working to get the data we collected out to the scientific and producer communities, where people can use it, in the form of publications.

I consider myself lucky to have been a part of this year's efforts. Hard. Stressful. Sometimes overwhelming. But I came out of the experience with far more than I had going into it. I got to see the Californian wine country—to my surprise (as I find the reputation of many places to be overblown), it lived up to rumors of beauty and serenity. Most remarkable, I experienced the generous hospitality of our growers. Having been in academia for the last 10 years, my association with producers was often strained behind what is needed or

expected from each other. Nothing truly personal. Matching our objectives, we strive to make strong relationships with our growers here at Ecdysis. No kidding, it was not uncommon for



Stephen and snake in Napa Valley, CA.

folks to invite us to their homes, meet their families and friends, feed us, and integrate us into their lives. It was an absolute pleasure, and I look forward to building those relationships with more growers in the following years.

To those with whom we worked—thank you. Thank you for letting us work your land. Thank you for not turning us down and shutting us out. As I have said before, without you all, Ecdysis fails. Without your hard work and ingenuity, agriculture doesn't change and the world likely more threatened. You give us hope and provide the materials for study. We will be able to provide anyone willing to listen with the means to improve that state of our food production and culture—but only because you're working hard at it. Only because you're all doing what you do so well. Keep on keeping on.



Dr. Ryan Schmid

Re-joined Ecdysis Team in 2018

Ryan is a research scientist in charge of rangeland programs around North America.



Ryan Schmid and Ecdysis Team pose

WHAT A YEAR! It seems like that's my feeling each year I sit down to write my year-in-review. And I always think we can't possibly top it next year. But then, we always do. The team at Ecdysis is second to none, and together we worked on a lot of projects this year. These are just a few of the highlights.

WHAT WE DID

This year started off with a lot of time spent in the machine shop. Together, Dr. Mike Bredeson and I were busy building a roller crimper with partnering local farmers.

This piece of equipment is designed to terminate cover crops without the use of tillage or herbicides.

With the guidance and a lot of help from members of our local "Soil Builder's Club", especially Al and Seth Evenson, we were able turn an International 490 disc into a functioning roller crimper. In the first field tests last spring, the crimper did its job. Two local farmers borrowed our new machine to terminate their rye cover crops, and both were satisfied with the results.



The roller crimper

We even had another farmer borrow the crimper to see if it would kill a large patch of thistles. He was happy to report it chopped them up and killed the thistles without a drop of herbicide used in the process.

This build was publicly funded through SARE and because it was a publicly funded project, we are creating a how-to guide and video series for anyone that is interested in making their own crimper. We have also made the crimper available to farmers within 40 miles of Blue Dasher Farm.

During the summer months Tia Busenitz and I were busy with the second year of our pollinators in rangelands project. We're examining if regenerative rangeland management can conserve pollinators and improve



Ryan and Cooper at the barbeque.

the health of honey bee hives, all while being a good management system for cattle production. We are still sifting through the data to see if regenerative ranching improved pollinator diversity and honey bee health. But I can say it was easy to see the greater abundance and diversity of flowering plants that regenerative management supports.



Schmid (with sweepnet) and Team

A large portion of my time this year was spent leading trips across the Midwest to sample for our 1000 Farms project. This project took me to many places across the country from Washington, Montana, Nebraska, Iowa, and Michigan. Washington was a new state, and it was fun to see the Columbia River. The agriculture that has sprung up in the surrounding hillsides of the river was incredible. Besides Montana, all the other trips focused on row crops (mostly corn rotations), and it was amazing how much growing conditions changed from western Nebraska to Michigan. It is labor intensive work sampling corn fields in the middle of July when the corn is shedding pollen and taller than all of us. I am proud of our team to have accomplished this work, and for keeping a positive attitude while doing all of this tough work.



Checking the hives, Estelline, South Dakota

WHAT WE LEARNED

While traveling around the country to study agriculture, it struck me how fragile a food system we've created. When our food system is hitting on all cylinders, it is a thing to marvel. Feeding billions of people. But small mole hills turn into mountains of problems in a system that is so fine-tuned. Commodity agriculture has concentrated the production of many crops to small geographic pockets around the US, which leaves many of our foods vulnerable to regional weather events/disasters, supply chain issues, or disease outbreaks. Seems we are concentrating all our eggs into one fragile basket.

BEST MOMENT

Baseball was a recurring theme on many the sampling trips I led this summer. From reenacting scenes from the baseball movie "The Sandlot" in Michigan to visiting the Field of Dreams

in Iowa, baseball supplied the backdrop for some good moments. My favorite of these occurred while visiting the Field of Dreams. We were fresh from sampling a corn field for 1000 Farms and had all of our insect sampling gear in the van with us. So naturally, being the hard-working scientists we are, we couldn't pass up the opportunity to collect data from one more field (even if it was a baseball field). I got the sweep net out and swept the field, which produced some interesting stares from on-lookers.

But how many field entomologists can say they have data from the Field of Dreams!



A glorious rangelands sunset



Dr. Kelton Welch

Re-joined Ecdysis Team in 2019

Kelton is in charge of the Mark F. Longfellow Biological Collection at Blue Dasher Farm.

This has been the busiest year for me yet! In addition to the constant flow of specimens needing identifications, I have been learning how to manage a software-development project (BugBox) involving multiple different teams of contractors, and working with our technicians to innovate, optimize and digitize our sample-processing pipeline. I even got out of the lab for a while to participate on one of the field-sampling trips for the 1000 Farms Initiative.

Our insect collection, the Mark F. Longfellow Ecological Reference Collection, includes three major sub-collections, which I've called the Archival Reference Collection, the pollinator collection, and the Lundgren Legacy collection. Most of my job has focused on the Archival Reference Collection, which includes voucher specimens in isopropyl alcohol from most of our experiments. This year, the Archival Reference Collection has grown to include 10,736 fully curated arthropod specimens, representing 2,905 distinct morphospecies. Of these, 6,015 are identified to the genus level. These numbers do not include our collection of pinned specimens, of

our collection, representing very nearly two decades of entomological research in the Midwest and other parts of our continent.

Our digital collection is growing, as well. All 10,736 specimens from the Archival Reference Collection are entered into a digital database on BugBox. This database also includes 5,990 high-quality, focus-stacked photographs covering 2,661 of these specimens. These photographs have all been uploaded onto the BugBox platform,

“This is a big milestone for me; but of course, this was never a solo effort: everyone at Ecdysis Foundation is a part of it...”

and are currently being used to train an artificial intelligence algorithm to aid in identifying insects.

We've also updated our system for processing arthropod samples. Our old system had our team of technicians hand-sorting specimens into vials, which I then identified under a microscope. Our new process is what I call “photo-sampling”: our team uses digital microscopes to photograph field-

collected specimens and submit the photos to BugBox. We have already uploaded photographs of 12,000+ specimens onto the BugBox program, where I can review and confirm them.

For now, the burden of identifying specimens still rests squarely on my shoulders,

because BugBox isn't yet trained properly to do the work on its own. As we grow our database of photos and train our algorithm to work with them, we expect to see BugBox become more proficient at identifying insects on its own, allowing it to start sharing the load with me.

As of the time of writing (1 Dec 2022), 998,116 arthropod specimens have come across my desk for identification during my tenure with Ecdysis Foundation, and I expect that number to reach 1,000,000 before the end of the year. One million specimens identified in three and a half years! This is a big milestone for me; but of course, this was never a solo effort: everyone at Ecdysis Foundation is a part of it, and our army of technicians have been especially instrumental in processing and pre-sorting samples

and streamlining the process to make it possible for me to identify so many specimens.

UPDATE: On Dec 21, 2022, Kelton officially identified and logged the 1 millionth arthropod sample into Ecdysis's growing database



Araneae Linyphiidae, “the 1-millionth bug”

This has been a landmark year for us, and I'm looking forward to the new developments and milestones that are on the horizon.

Christina Lind

Joined Ecdysis Team in 2019

Christina is charge of Blue Dasher Farm operations and is the communications specialist.



The farm breathes. It has a heartbeat. It varies in strength and pace, sometimes quick and alerting to action, and sometimes slow and peaceful. This is my third report on this farm, and I think this farm gets more meaningful to me every year. It becomes more and more a part of me, and me a part of it. I know the curve of the land and where the hidden flowers bloom and when to look for them. I know which fruit trees bore fruit last year and which I expect to in the coming year. I know all of the animals, their quirks and personalities. The chicken that sounds like she's smoked a few too many years. The one that wants to hatch all of the eggs as her own. The ducks I've hatched in the house, and the peacock that still drags his shattered, irreparable wing. The pigs, goats, alpacas and sheep .. and all of their social dynamics. This year I even got to know the sounds of the bees, and have started to notice how to feel their energy. And of course, I'm always aware of all the things to do or could be done.

And with all of that familiarity, I still discover something new every day. I feel more a part of it all than ever. Give it time, and I think Blue Dasher does this to all of us here.

Sheep

The sheep flock has grown, and I further recognize just how hardy our flock is. This year, our demand was bigger than our supply, so we brought in several lambs from farms around the region. It seems every time we introduce new sheep, they immediately struggle while the main flock thrives. For the first month or two, the introduced flock worked their way through issues like eye infections, scours, weight loss, etc., while the main flock that was managed in the exact same way did wonderfully. This experience supported our gratefulness for our flock and we hope to keep it as closed as we can, only introducing new sheep to diversify our genetics as needed.



Clockwise from top: Mia with sheep; Kayli, Cassandra, and Liv; and poultry processing posing.



Poultry

We had both successes and challenges with our poultry. I hatched around 30 of our own chicks and ducklings, and was filled with joy as we heard the very first peeps from the incubator in the house. Although we end up with more roosters and drakes than desired, I enjoy hatching our own Blue Dasher Farm mix. We are looking into this coming year hatching a few specific breeds as well. We ordered some specific breeds from both local and national hatcheries, as well as our broiler chicks. This year, we were hit with coccidiosis early in the spring for the first time ever. I'm not sure where it came in from, but it also unfortunately hit while we were away on research and was a difficult first farming experience for those watching the farm for us. It was a tough way to start out the year with poultry, but as we got it under control the year became smoother and smoother. We didn't face the predator pressure of the previous year and had a fabulous harvest of our meat birds in the fall.

We are also trying a new way to process and sell our turkey, in 1 lb packages of breast meat. For us, it works wonderfully so we can take a pound or two to prepare at a time.

Bees

Our bees came out of the winter with several living hives, strong and vibrant and persisting - something that hasn't happened for us since the days the doors opened. It was invigorating to say the least. I had the opportunity to help Tia with her research and maintenance on our bees more this year, and I am completely captivated by these creatures. We had a large honey harvest of our “liquid gold” (as a customer's son calls it) in the spring, and one in the fall as well.

Alpacas

The alpacas have been a joy to add to the farm. Clean, fun, easy to fence, “sweet baby angels” as our staff member Kelly called them. One of my most enjoyable moments is when we took them to a neighboring farm with other alpaca owners to get them all shorn together. I love meeting other farmers and building that community. Then when I brought them home and unloaded them from the back of the van, the entire staff was sitting outside for lunch and exclaimed with shock, hurrying over to see their transformation from fluffy teddy bears to skinny giraffe-necks up close. I now have yarn and roving from them, and have been able to create soft, meaningful pieces right from our farm.

Pigs
 Fall of 2021, we added KuneKune pigs to the farm, and it has been one of my favorite additions and personalities that have become a part of Blue Dasher Farm. Our team instantly falls in love with them and their piggy antics, grunting and squishing into their tiny tub together to cool off in the summer, looking like the happiest creatures on earth. In addition to the two gilts from 2021, we acquired a boar and barrow this spring and are farrowing the pigs for next spring. I cannot wait for this to become a part of the farm.

Goats
Oh, the goats. This will be the biggest part of my tale this year, as they occupied arguably the most of our time while their contribution ... well, still awaits. The goats were my idea, and Jon may never let me live that one down. I have been very excited to raise dairy goats on a small scale, mostly for the learning, experience, and use as milk and home products for ourselves, family and staff. I had been trying to convince Jon while he'd warily respond "I've never seen a goat-proof fence", but, sure of myself that I could figure



it out, I persisted. Lots of people raise goats, after all.
 We found a pair of goats, Reo (short for Oreo) and Milkshake, named by Leiana. They were calm-mannered sweethearts and I felt quite satisfied with myself for the first couple of months. And then Milkshake began jumping the fence. And then she started jumping regularly. And every time we altered the fence or improved it, she'd push the limits and find a way out. But oh, she was a cuddly angel when I started to get mad about it. And she wouldn't run away when she got out. She seemed to do it for two reasons: she just wanted to prove she could do it, and stay with them just right outside the fence, or she wanted to be with us humans and happily follow us around. I even began avoiding walking by her so she wouldn't see me and jump over to join me.

We tried net fences, taller net fences, we tried multi-line electric with tall posts (she couldn't jump but she walked through it), and even resorted to put her in the hard paddock, which apparently, she was able to jump as well. Every successional time we reinforced the



Moments with Blue Dasher Farm critters.

fence tighter and taller and added more charge to her own little Fort Knox, there was Milkshake declaring confidently "Hold my beer".
 I was on my last thread with her, when we finally found a solution that held her in with the taller net fence and surrounding single line floating about a foot taller than it. We also built up the barn's stalls for the winter and thought we had her pretty corralled, until we brought her to a friend's farm for breeding ... and they reported "she jumped out of her pen, several times a day." Oh, Milkshake. I had simultaneous laughter and tears with her many times over the summer, while sweet Reo stayed right where we intended and did good goat things.
 We will have to see where this coming summer takes us with our goat adventure – it may have been short-lived, but we look forward to greeting some goat kids this spring.

Onward We Go
 What determines the success of a farm? Our farm supports and produces life. Food. It sustains itself with its income, and brings a richness to our lives that I would now feel lost without. It changes the lives of everyone that works here and becomes a part of it. We nurture its diversity, and it breathes life into us. We listen to its heartbeat, and we connect with ourselves and the environment that sustains us in a way I never could have imagined. Jon often says that he determines the success of a farm with seeing something new, every day. As the lungs of Blue Dasher Farm take in each deep inhale we learn something new, and as it exhales new life, we are thankful for everything it provides us.



It's been called
The Most Ambitious Agroecology Experiment
 ever conducted.

We agree.



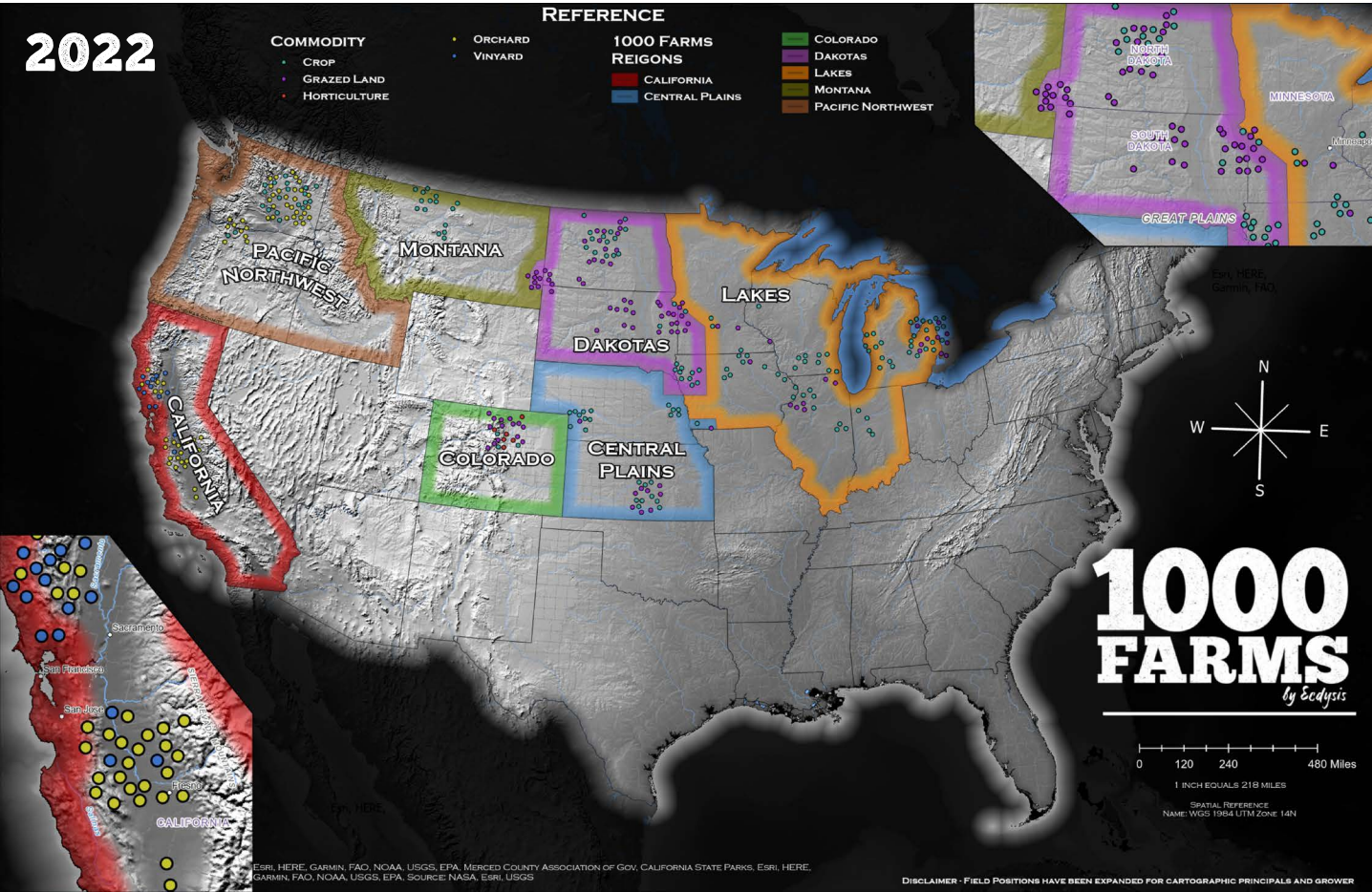
212 DAYS
389 FARMS
15 STATES



4,960
SOIL+WATER TESTS
19,840
SOIL CORES
31,000
PLANT BIOMASS SAMPLES



77,800
INSECT SWEEPS
FARMERS
ARE
CHANGING AGRICULTURE!
1000 FARMS
INITIATIVE
CONTINUES...
JOIN THE MOVEMENT!
www.ecdysis.bio



2022 map designed by Thomas Schmitt

Often called the most ambitious agroecology ever conducted, the 1000 Farms Initiative has already yielded a treasure trove of data - and it's just the beginning.

TO SAVE OUR PLACE ON THIS PLANET, we must change our food system. Regenerative practices are implemented at the level of individual farms, but the solutions and their delivery need to reach growers and be implemented on a continental level. The *1000 Farms Initiative* has already collected data from over 389 farms in 2022 alone, and is poised for even more in 2023. The information gathered at this scale is unprecedented and desperately needed. That is why we have embarked on the *1000 Farms Initiative*.

The **1000 Farms Initiative** generates **full site inventories** in various stages of regenerative adoption. We are analyzing key factors to show producers the health of their land, how their land compares with others, and how to incorporate regenerative methods into

their agricultural production in order to disseminate these farm-level results back to the farmers and agricultural communities to inspire change.

Our research balances tried-and-true approaches with new techniques that advance and scale the science on ecosystem monitoring. Measurements quantify the following:

- Soil Chemical and Physical Properties**
- Soil Microbiology**
- Water Dynamics**
- Plant Communities**
- Diversity and Biomass**
- Invertebrate Diversity+Distribution**
- Bird Abundance**
- Diversity and Habitat Use**
- Pests (Plant Pathogens + Insect Pests)**
- Yields and Nutrient Analyses**
- Economics and Net Profitability**

Ecdysis Foundation is uniquely able to successfully complete this initiative. We have been developing new technologies, procedures and partnerships that are strategized to generate, analyze, interpret and share an overwhelming amount of farm- and landscape-level data. We practice relationship-intensive science. We want to meet the farmers, shake their hand, and learn about what makes their farm special. We need farmers, and we need both financial and community support to complete this powerful mission.

Visit our website (www.ecdysis.bio) to sign up your farm, support the project, or find out how to be a part of this exciting research.



Our team had the opportunity to see much of the nation's food system. We were able to meet farmers in many production systems and experience nearly 400 sites across the country with all of our senses.

It was humbling, fascinating, and eye-opening for all of us. We have created a food system of great efficiency, but incredible fragility.

See some of the views of our food system through the eye of our lens.

Above: The differences in California almond orchards are clearly visible between conventional (left) and regenerative (right) operations.



Montana rangelands, Alex Michels



PNW Apple Orchard, Amy Heibuilt



Honeybee on sunflower in ND, Daniel Pekenka



Washington wheat, Anqi Zhang

We also experience the restorative power of regenerative farming here on our own farm in eastern South Dakota. When all around us span vast monocultures,

We see the great abundance of life and diversity churning out of a system that works as one.

On quiet evenings, we absorb the artistry of an unbroken prairie with all senses. Even our long winters hold new and exciting beauty for us to find every day.



Foraging for elderflowers at sunset, Christina Lind



Rudbeckia at sunset on Blue Dasher prairie, Christina Lind



Sundogs on a cold winter sunrise on Blue Dasher Farm, Christina Lind

Ecdysis Staff Accomplishments

Presentations

“Regenerative Food Systems”, University of Life Sciences, Lublin, Poland, Online, January 17, 2022
 “Applying Science to Regenerative Food Systems”, NRCS: Conversations in Soil Health #18, Online, January 20, 2022
 “Regenerative Agriculture and Conservation”, Ducks Unlimited SD Chapter Meeting, Watertown, SD, January 29, 2022
 New Mexico Beekeepers Conference, Online, Feb 5, 2022
 Montana Soil Health Symposium, Billings, MT, Feb 9, 2022
 “Regenerative agriculture as the solution for bees”, Best Practices for Pollinators, Online, March 2, 2022
 “Regenerative Agriculture” NOFA Rhode Island Winter Conference, Online, March 6, 2022
 National Organic Summit for Rhode Island, Discussion Groups, Online, March 6, 2022
 “Does Regenerative Ag Work Here?”, Ivanhoe, MN, March 10, 2022
 Oklahoma Grazing Land Coalition, Multiple Presentations, Clinton, OK, March 25, 2022
 Sustainability Lecture, Rhodes College, Memphis, TN, March 29, 2022
 “How do insects and other critters affect a soil’s health?”, Ridgewater College Soil Health Workshop, Ridgewater College, Willmar, MN, April 4, 2022
 Conference on World Affairs, Colorado University Boulder, Multiple Presentations, April 6, 2022
 Funders for Regenerative Agriculture Science Webinar, August 31, 2022
 Agriwebb, Webinar, October 31, 2022
 Dakota Rural Food Conference, “No Money, No Problem: Building a Roller Crimper on a Budget”, Sturgis, SD November 19, 2022
 Eastern Montana Regenerative Association, “Arthropod Community in Cattle Dung”, Nov 22, 2022
 Purdue University, Seminar Presenter, West Lafayette, Indiana, Dec 1, 2022
 Almond Board of California Annual Conference, “Regenerative Almond Production Systems” (Poster) Sacramento, CA, Dec 7, 2022
 Acres Eco-Ag Meeting, Greeley, Colorado, December 7, 2022

In the Media: Print & Web

Foodtank, “1000 Farms Initiative”, January 31, 2022
 Revitalization, “1000 Farms”, Issue 164, February 1, 2022
 Ag Week, “Interseeding Cover Crops”, February 7, 2022
 Civil Eats, “Soil Proof: The Plan to Quantify”, March 7, 2022
 FoodPrint, “Making Sense of Regenerative Labels” July 6, 2022
 Successful Farming, “How Regenerative Research Practices Spur Market”, July 13, 2022
 Farm and Ranch Guide, “Dung Beetles: Openers of the Cow Pie”, Oct 26, 2022
 Rockefeller.org, Feature, November 9, 2022

In the Media: Radio & Podcasts

Minnesota Public Radio, “Nationwide Study”, January 19, 2022
 Sourcing Matters, “Regenerative Study”, Ep 103, January 20, 2022
 American Public Media, Field Work Radio Program, February 4, 2022
 Superpowers for Good, “He Quit His Job As a Scientist to Be a Farmer”, March 8, 2022
 Mindful Business, “1000 Farms Initiative”, Ep 98, March 15, 2022
 Farm to Table Talk, “Better Farming”, April 5, 2022
 Blue Nest Beef Podcast, April 6, 2022
 AgEmerge, “Pollinators, Poop, and Pastures”, April 12, 2022
 BeeKeeping Today, “Earthday Update”, S4 Ep44, April 18, 2022
 Climate Change Realty Podcast “Changing the Climate”, May 29, 2022
 Investing in Regenerative Agriculture Podcast, June 14, 2022
 Los Angeles National Public Radio Interview September 2, 2022
 Soil Health Podcast IN NRCS, September 22, 2022
 The Poor Prole’s Almanac, “Holistically Grazing for Insects with Ecdysis Foundation”, Sept 26, 2022

Hosted Events

Regenerative Almond Field Day, Burroughs Family Farm, Turlock, CA, February 17, 2022
 OLLI Tour of Blue Dasher Farm & Ecdysis Foundation, May 25, 2022
 Boulder County Regenerative Agriculture Field Day, August 4, 2022
 Blue Dasher Field Day, Estelline, SD, August 11, 2022
 Insect Festival at McCrory Gardens, Brookings, SD, September 10 2022

Ecdysis People

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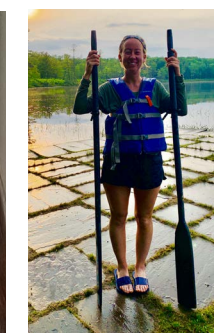
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Noah Bell



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KC Jensen



Anne Knofcynski



Cassandra Koel



Christina Lind



Alex Michels



Cooper Millar

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Lynnette
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Thomas
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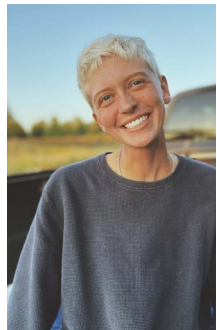
Allison
Shorter



Jay
Skaar



Adam
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Kayli
Tolk



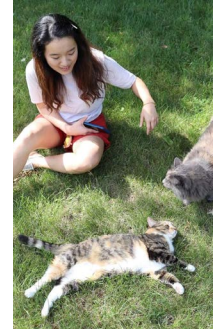
Olivia
Torbert



Mia
Werger



Bobbie
Wilson



Anqi
Zhang

Fun Favs & Words of Wisdom

Favorite Lab/Farm Memory

"The sheep are out" (also favorite overused quote)

"Dressing up the alpacas and pigs in Halloween costumes."

"The alpacas running over to give kisses+nibbles"

"Helping to herd the sheep when they got out. Great break from the microscope!"

Favorite Field-Sampling Music

"Kelton singing REO Speedwagon on repeat in the South Dakota Badlands"

What/Who most inspired you?

"I was most inspired by the team of researchers at Ecdysis and how they can work the long hours and in unbelievable environmental conditions - rain, sleet, 104 degrees, etc."

"All the farmers I meet on the trips who are willing to go against the grain and try new practices"

Favorite Overused Quotes

"He on X-Games Mode!", "Lock 'n Load!", Turn n' Burn!"

What are skills you only learn while working on a farm?

"Learning that everything will break down sooner than you think; and trouble-shooting: Farmers can fix anything with whatever they have at their disposal. It's truly impressive"

When Ecdysis is successful, what will the world look like?

"The world's pace will be slower. Families will be priorities. We will be connected to our food and the natural world."

"I would finally rest knowing my future family is inheriting a better world."

"Every piece of food on a plate has a story."

Thank you to our Supporters

#NoRegrets

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Adee Honey Farms

Amy Divine/Joy Fund

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Bird and the Bees Honey

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South Dakota State University

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Sustainable Farming Association

(MN)

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and Steven S. Todd

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Understanding Ag

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Valley Land Alliance

Walton Family Foundation

Yosemite Farm Credit

Check out our ongoing *1000 Farms Initiative*
and other projects on our website and social media!



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