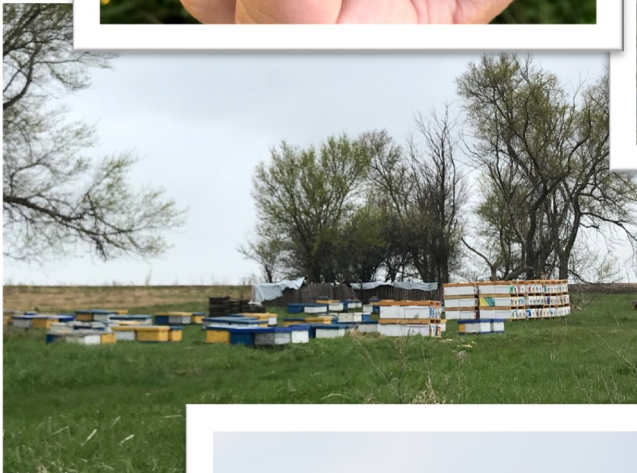

2020 Year in Review







2020 Year in Review



Using research, education, and demonstration to support regenerative agriculture



Ecdysis Foundation: Living the Mission

In my former life, I never understood the point of defining mission statements. It felt bureaucratic as we would put together a series of words that sounded wonderful, but those words seldom governed any actions. Indeed, many decisions would have been made much differently if my former self and colleagues had allowed those words to govern our actions. If we had followed those words, perhaps agriculture wouldn't be in the state that it is.

Recently, I reviewed the mission that I wrote one month after opening our doors. The mission outlined in 2016 is as true today as it was five years ago. With every decision that we make at Ecdysis Foundation, we think about how it positions us to attain this mission both in the short and long terms, and this has guided us through some challenging times.



Dr. Jonathan Lundgren

Director of Ecdysis Foundation

Agroecologist, Farmer, Rancher,
Beekeeper

Using research, education, and demonstration to support regenerative agriculture

- *Conduct science that solves planetary scale problems using our food production systems.*
- *Promote regenerative farming practices through curricula focused on farmers, the community, and the next generation of scientists.*
- *Demonstrate the feasibility of current and novel food production practices on an operating farm to showcase the viability of regenerative agriculture.*



Five years ago, we were a small team of three graduate students, a few summer helpers, and myself and family. We were trying to turn a milking parlor into a laboratory, and turn some small patches of lawn and perennial grass into a farm. I wasn't sure whether I would be able to cover salaries from one month to the next. At one point, our bank account was empty, and payroll


was due in a few days. I went to the mailbox, and a beekeeper had sent us a check for \$10,000 that floated us until the next check arrived. That is how we survived; we were overwhelmed with support (sometimes literally!) from people that believed in us. And the science we conducted in that first year was foundational.

In 2020, we had 20 on staff during the summer months in three states, putting good paying jobs into a rural community. Projects are underway from Saskatchewan to Kansas and from Alabama to California. Our budgets aren't overwhelming, but if needed we can comfortably walk away from any sources of funds and still attain our mission. The laboratory building at Blue Dasher Farm is being converted into a 5,000 ft² facility to accommodate our growing staff and project load. The bees, sheep, poultry, orchards, and crops are thriving and we are providing food to our local community. Our accomplishments have exceeded all expectations, and our identity as a national leader in the science underpinning the regenerative movement is clear.

Defining regenerative agriculture has risen to a fever pitch in society right now, with reviews of the scientific literature trying to determine how scientists and others

are defining regenerative food systems. This is essential to understanding the philosophical underpinnings of this movement, but we are still left wondering if a particular farm is regenerative or not. Ecdysis Foundation has been generating actual data that can be used to describe regenerative cropland and rangeland from around the US. The end result is a scoring system that we think will really help guide the dialogue on what regenerative farming systems are from a practical point of view. You can download this article here: <https://f1000research.com/articles/10-115>

One strategic change over the past year pertains to how Ecdysis Foundation will apply science to driving reform to our food system. Our long-term strategy is to have Ecdysis centers around the country (and even the world); this strategy is essential to reintegrating scientists back into food communities to inspire change. The problem is that this strategy is expensive and will take a while, and there is a sense of urgency (we only have 50 years of biodiversity and top soil left). This has left us in a conundrum: how do we quickly change our food system with minimal resources and personnel? We need to generate a massive quantity of high-quality data on a scale that has never been conducted before. For the past 2 years, we have been developing new technologies for automating the processing and identification of enormous farm inventories.

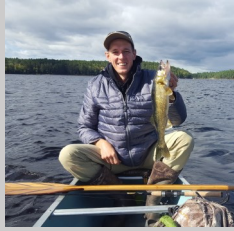
We are excited to introduce the 1,000 Farm Initiative. By 2023, we will generate full site inventories- soils, water, microbiology, plants, invertebrates, birds, and socioeconomics- on a continental scale. The focus is on major ecoregions, dominant cropping and livestock systems that can drive change regional food systems. The goals of this data-gathering effort is to 1) validate established regenerative systems relative to conventional counterparts, and 2) develop roadmaps for farmers that are transitioning to regenerative systems. Over the next 2 years, we will be expanding our infrastructure and staff to be able to accomplish this mission. The goal is to provide overwhelming scientific support to policy makers, consumers, supply chains, and the farming community to help expedite change to our food system. 



Dr. Mike Bredesen

Joined Ecdysis Team on Day 1

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



2020 has been a year of extremes here at Ecdysis. We've experienced everything from isolating at home, quietly toiling under our microscopes, to noisily caravanning across state and international borders to accomplish the regenerative ag research that is so direly needed. In this world of extremes one thing has remained unshakably steady: the upward climb of Ecdysis research and our positive impact on regenerative farming.

2020 brought with it the second year of a study being conducted on over fifty Canadian farms across Saskatchewan and Manitoba. For many of the farmers in this study, year two was only the second season of implementing regenerative practices. Despite only a short time under this new style of management it was crystal clear that soil and biodiversity had responded in a massive way. Standing in these fields made us feel as though healing was happening all around us. Vibrant, otherworldly violets of flax flowers waved in the breeze. The almost machine-like hum of countless pollinators in brilliant yellow fields of aromatic canola whizzed by our ears. The experience was in stark contrast to the monochromatic landscapes that we are used to on most farms in the Great Plains.

In Canada, we performed second-year monitoring of invertebrates in study fields but also added special observations to gain an understanding of how particular insect groups transform following regenerative ag adoption. For example, we know that the size of an insect community grows when we diversify farmland, but what is less clear is how the important services of weed consumption and

pest control by beneficial insects respond to regenerative agriculture. With our newly collected data we will finally be able to provide robust evidence.


The successful rollout of our Canadian research project spurred an expansion of similar work down in Kansas where we encountered an additional forty farms. At these southern sites we are collecting similar information to those in Canada. The opportunity to measure the characteristics of these transitional regenerative farms across a vast geographic area will provide a database the likes of which has never yet existed. We expect that our hard work on this project will prove to be instrumental in shaping policy and the status quo of farm management for centuries to come. It is truly that important!



Cropland



We're already witnessing an explosion of interest in the work that we're doing. In fact, this field season as we set traps and scoured vegetation for signs of insect life, we were often shadowed by documentary film crews capturing what they believe is a pivotal moment in food production. It is humbling for our team at Ecdysis to be part of a profound movement in regenerative agriculture, and frankly, fun to be involved with something so influential.

As so many others have, our crew of scientists and technicians faced all sorts of adversities in 2020. Amidst of all the negatives we could have focused on, Ecdysis staff chose to react by making this year memorable by conducting the most significant research we've ever been involved in. As a result, more collaborations are being formed and opportunities are being presented than at any time in Ecdysis history. We look forward to these and other opportunities as we peer ahead toward a shining future for this organization. 



This year held quite the unique challenge.

I am partnered with General Mills for my master's project working with 50 different farmers in North Dakota and Canada. With international border shutdowns due to COVID, we had to "sneak" into the Canadian border in June to be able to finish up my 2nd field season. (Really, we paid a lot of money to a lawyer in Toronto to draw up paperwork granting us entry and quarantine exemption). Unfortunately, this meant no physical contact with the Canadian farmers that I



Alex Michels

Joined Ecdysis Team in 2019

Alex is a master's student at South Dakota State University, researching regenerative agriculture, pollinators and birds in North Dakota and southern Manitoba, Canada.



at Blue Dasher Farm. We reared 16 monarch butterflies and kept them safe from predators and parasitoid wasps. Once they hatched from their chrysalis, they were released again on the farm.



We were able to do our small part to help this declining, charismatic species and had heaps of fun doing it!

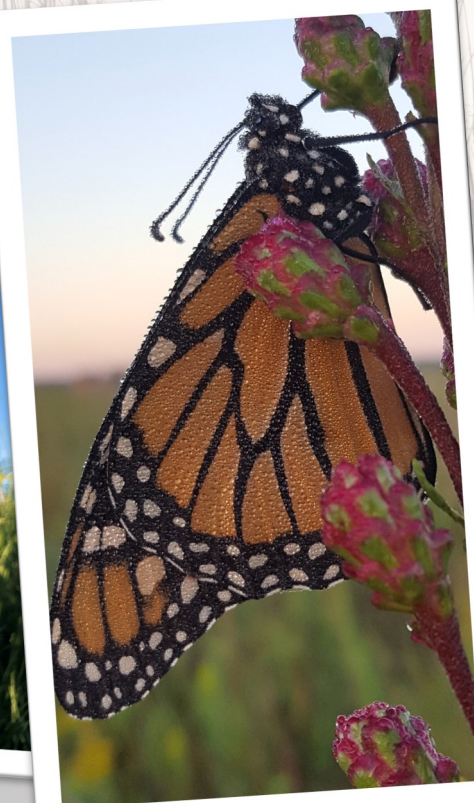
In December, it felt wonderful to finish up the last of my classes in my master's graduate career. I got a 4.0 overall GPA! In the coming months, I will be spending much of my time at the microscope identifying bees down to species level that were collected from North Dakota and Manitoba. If I am not at the scope, I can be found frazzled, frantically writing my thesis. 🍷



am working with. Had to be safe, eh? Not all was lost though—I still managed to get an order of poutine, to go.

For my research project, I am evaluating ecosystem services (e.g. pollination, litter degradation) that insects provide farmers in regenerative small-grain cropland. I am studying how regenerative farming practices (no-till, minimal chemicals, high plant diversity) affects insect and bird communities.

Throughout the summer, the technicians and I spent half an hour every Friday afternoon searching for monarch eggs and caterpillars on the prairie



Dr. Ryan Schmid

Re-joined Ecdysis Team in 2018

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



What a year it has been for the rangeland science team at Ecdysis.

While 2020 threw some curve balls our way, I am proud to say our team met all the challenges with a smile and enthusiastic attitude. I am thankful to work with such a talented



group of people. They make the long work days fun and never complain when I ask them to stick their hands into cowpies to help me find dung beetles. I am also grateful to the farmers/ranchers that let us study on their land, without whom we would not be able to accomplish our mission. And accomplish we did this year!

My field work focused on the Dakotas in 2020. The team and I sampled 20 pastures (10 pastures in South Dakota and 10 pastures in North Dakota). The data collected from these pastures will be combined with data collected in 2019 from 20 different pastures in the Dakotas. The purpose of sampling all these pastures is to examine the effect that regenerative rangeland management, i.e., high stock density, frequent rotation of herds, little to no insecticide applications to the herds, and long rest periods for the pastures, has on dung dwelling arthropods, gastrointestinal parasites, and plant community health. For this entire project we have extracted all arthropods dwelling



in 600 meadow muffins (a fun term for cowpies) and have identified the arthropods from half the muffins. We also identified the parasites from 400 of these cowpies, and I will use this information to inspect the perceived benefit of dewormers. Lastly, this project aims to understand the profitability of regenerative ranching relative to a more conventional herd management system, i.e., continuously grazed with frequent insecticide applications. To gather this information, we teamed up with Dr. Urs Kreuter and Jenna Likins of Texas A&M to survey ranch economics from the pastures I sampled. It is asking a lot from someone to answer financial questions about their operation, but after this study is finished, these ranchers will have some of the best-studied operations in the country, enabling them to use this information to make improvements tailored to their ranch.

In addition to all of our field labors, Ecdysis staff has been hard at work in the lab wrapping up another rangeland project examining correlations between re-



generative livestock management and arthropod communities from plant canopies, in the soil, and dwelling in cattle dung from pastures in the Southeastern United States. We identified 1,265 species from the 126,258 arthropods collected from these pastures. I continue to work on analyzing the data and preparing it for publication in open-access journals. One manuscript covering the relationship between fire ants and arthropod communities found in these pastures has already been submitted for publication, and an early draft is available to the public online at <https://www.biorxiv.org/content/10.1101/2020.12.04.398214v2>. Two other manuscripts from the same dataset are in preparation, and should be available to the public by spring 2021. This project was an enormous undertaking for Ecdysis when we were in the infancy of building the foundation. The publication of this work adds another chapter to one of the mantras of Ecdysis, big things can be accomplished by few when you have the right people.



Rangeland

Besides publishing in scientific journals, I enjoyed spreading the message of Ecdysis research by presenting to the good people of the Hamlin County Conservation District and Northern Plains Sustainable Agriculture. I appreciated discussing a variety of topics with both groups, including harmful side-effects of neonicotinoids (a common insecticide found in ground water) on deer health, the potential for problems with increasing use of 2, 4-D and Dicamba, and the future of regenerative agriculture. Perhaps most important to me were the discussions I had with folks after I finished presenting. These conversations are valuable information, letting me know what is on peoples' minds and how I can tweak my research plans to better serve the public.

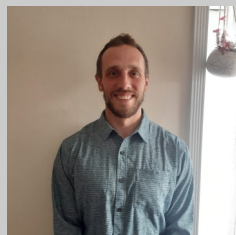
Lastly, I spent a significant portion of my time applying for competitive grants this past year. I targeted grant programs that are funded with no strings attached, e.g., Sustainable Agriculture Research and Education (SARE), Cedar Tree Foundation, Center for Excellence in Bison Studies, etc., so as not to compromise a study's integrity. If awarded these grants, I plan to use the money to examine nutrient cycling in regenerative rangelands all the way from the soil to the end product (meat), as well as the potential for regenerative ranches to conserve pollinators and be more profitable doing it. These are exciting ideas, many of which originated with conversations with ranchers. Of these, the most substantial idea started from a coffee club meeting with local farmers that grew into plans for building a roller-crimper. My fingers are crossed that all of these grants come through because I love pursuing these ideas to help out our local farmers and everyone that relies on the environment to sustain our way of life.

Until my next update, I want to thank everyone that has supported Ecdysis and my rangeland studies. I wish everyone a happy and prosperous 2021!

Take care,

Ryan Schmid





Tommy Fenster

Joined Ecdysis Team in 2018

Tommy is a master's student researching regenerative almond production systems while pursuing his degree at California State University East Bay.



Orchards

Regenerating California Almond

Tommy Fenster & Jonathan Lundgren

Five years ago, we followed the bees out to California, and found that if we don't change California agriculture, then everything that we do to help the bees in the Upper Midwest is for naught. Most of the nation's honey bees spend their summers in the Upper Midwest and Northern Great Plains. In the winter, these hives are trucked out to California to pollinate the almond and orchard crops.

If you ever go to the California Central Valley, you will see an intense agricultural economy that has nearly completely exploited its natural resources. Agricultural production here has peaked, and the cracks in the ice are becoming fissures. Dead soil, dust clouds, heavy tillage, and agrichemical use prevail. The farmers can see their profits diminishing year after year. It seems like the perfect place for an agricultural revolution.

In 2018, we communicated with some important players in the almond industry about doing a regenerative almond study, and were told that "soil health won't work here". The science needed to be done, but no one was ready to fund such a project on such slim prospects.

Tommy found some innovative, regenerative almond producers in the northern half of the Central Valley, and we decided to compare their systems to their conventional neighbors. The regenerative folks used no synthetic chemicals, maintained ground covers, integrated chickens, sheep, and cows into their orchards, and used composts and compost teas.


Then Tommy went to work. He sampled EVERYTHING he could get his hands on in these systems: soil geochemistry, water, soil microbial, plant, and invertebrate communities, nutrient density on the almonds, yields, and profits. There is nothing quite like sucking insects up from an orchard floor covered in chicken poop using a straw (or aspirator)...

The first half of 2020 was devoted to finishing the laboratory work for this project. In California, Ecdysis is partnered with the soil ecology laboratories of Dr. Patty Oikawa and Dr. Erica Wildy. In the beginning of the year, Tommy wrapped up the lab work to determine soil bulk density, as well as carbon and nitrogen. A big thank you to Chris, Ali, and Hilary, the three Cal State East Bay undergraduates who worked on the project!

In March, the lab at Cal State East Bay was shut down, forcing Tommy to bring the lab home and work on wrapping up invertebrate identifications in his spare bedroom. By summer, the lab work was completed, and the focus of the work shifted to statistical analyses. In October, the Ecdysis Foundation partnered with the Community Alliance of Family Farmers to host a virtual farmer field day with four farmers from the regenerative-conventional almond study.

The results definitively show the power of regenerative agriculture. Soil organic matter is increased by 30%, water infiltration rates increased six-fold, soil microbial community and soil health scores increased, and plant and insect communities thrived on regenerative farms. Yields and pest populations were unaffected by treatments, but profits were twice as high in the regenerative orchards.



These results set the stage for the future of Ecdysis's work in California, and helped secure funding to conduct a study comparing regenerative and conventional orchards in the Southern half of the Central Valley, as well as to conduct a study to document the changes that occur as almond orchards transition from conventional to regenerative management. 2021 should be an exciting and busy year! 

Tia Busenitz

Joined Ecdysis Team in 2019

Tia is a master's student in Entomology at the University of Nebraska, researching how pesticides and probiotics affect honey bee health and immune function.



Best moment

Bee work in summer gets incredibly hot and sticky, so after several hours of lifting boxes in the sun while wearing a well-padded suit any body of water becomes attractive, even a muddy pond full of scum. We planned it out the day before that we would all wear our swimsuits under the bee suits, and when we finished working with the hives we would jump into Buccholz' pond. We narrowly escaped the angry swarm of bees by walking approximately 10 feet away and slowly oozed into the small swampy pond. Only three of us had the poor decision-making skills necessary to jump in: Will, Marra and myself. We had a lovely slime fight and relaxed in the cool swamp for a bit. For about 3 days afterwards, anywhere I had an open wound prior

to swimming in the pond was a raised angry sore spot where the flesh-eating bacteria were undoubtedly attempting to take hold. Later in the summer, Jon, Ian, and I performed some aquatic sweeps of the Blue Dasher pond and I learned how prevalent leeches are. I probably will not be partaking in any more South Da-



kota ponds for a bit.

Accomplishments

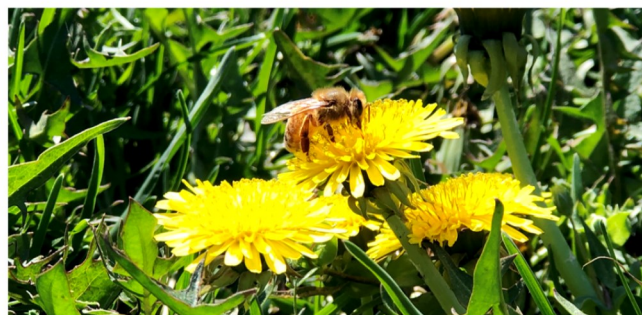
2020 has been a big year for bee work at Ecdysis and Blue Dasher Farm. To begin the season, in May of 2020 we ordered more nucs (nucleus colonies, or small honeybee colonies) than ever before, with a shipment of 160. This is double what we ordered last year!

The farm had exciting successes with overwintered colonies, six of which survived. All surviving overwin-

tered colonies were a part of the Vitamin C treatment group in 2019, hopefully indicating better survival.

In May, we greeted the arrival of new interns by putting them to work extracting over 75 lbs of honey. Braden picked up three blobs of wax and managed to juggle them. Roger regaled us with stories and poked fun at Jay.

After placing 166 honeybee colonies, we realized we needed to spread them out more, so we expanded to two bee yards for the first time. We loaded up the trailer with live bees and sat on them to prevent them from falling off. Despite the idea of pulling a trailer of live bees with Jon's arguably erratic driving, we successfully moved 60 colonies to a new location by a wildflower field.



During the field season of 2020, we executed the second year of ascorbic acid research on 60 colonies, and the first year of probiotic research on 90 colonies.

For the ascorbic acid study, hive weight, brood numbers, and Varroa incidence were collected.

Throughout the season, the bees were fed every two weeks, resulting in nine dinner dates with the bees. We also collected bee samples from each hive to look for vitamin C immune connections.

For the probiotic study, we looked at hive weight, brood numbers, and Varroa incidence. Bees were collected from each hive for microbial community sampling twice, and beeswax was collected from each hive for pesticide analysis. Over the course of the summer, the probiotic bees were fed eight times.



Monitors

During the spring and summer of 2020, a new honeybee monitoring project was deployed. The goal for the project was to create monitors to place into the beehives that would collect data for temperature, humidity, weight and sounds for 100 hives. And we were going to make them ourselves!

I called all of the computer and tech people I knew to ask their opinions on how to go about this, I received more than one “you’re crazy, just buy something.”

But with enough perseverance and possible lead poisoning from the 60:40 solder, we created 25 Raspberry pi monitors that run on power over ethernet. The data is then continuously uploaded and graphed to an online dashboard that can be accessed any time by cellphone or computer.

This huge project required the help of the whole team to solder 100 temperature and humidity probes,



100 scales, and 25 circuit boards; modify 100 postage scales; and modify and paint 25 honey supers for housing.

Austin Adey was our personal tech wizard. He spent many hours troubleshooting and designing the hardware, as well as programming the software for the project and climbing things to place antennae.

A special thanks to Ian for allowing us to steal his deadlifts for scale calibrations and Julia for her endless patience with tiny wires.

The monitors will be used to collect data on our beehives, including weight, temperature, humidity and sound monitoring. We will finally be able to locate the point in summer where the hives begin to decline, as well as collect more than enough information to distinguish treatment groups.



CHAD hive lifter

Before 2020, we were using a claw-like contraption to weigh beehives. This method was labor intensive and only allowed us to weigh 2-3 boxes at a time, requiring the splitting apart of the hives. Over the summer of 2020, my dad and I modified a hand truck to include a winch and mini forklift that can be used to lift and weigh the beehives.

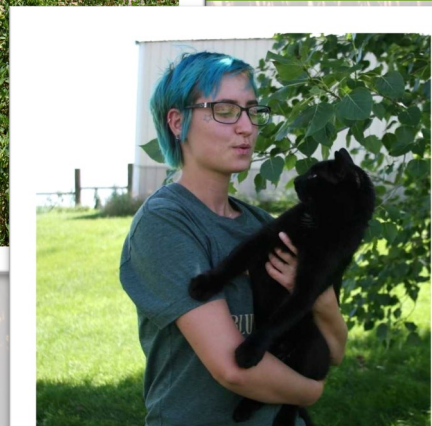
It was a very fun little welding project. We built the whole thing out of a piece of metal fence we found at the junk-yard, some drawer tracks and a boat winch.

ESA and School

In September of 2020, I presented the 2019 essential oils study to Entomological Society of America as a ten-minute student presentation.



Over the fall of 2020, my first semester of graduate school through UNL passed by. Notable events included surviving 9 credit hours of online courses during a pandemic and proposing the probiotic research thesis to the UNL Department of Entomology.

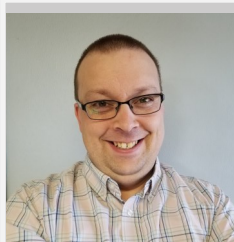


Honey bees

Biological Collections

Since I joined the Ecdysis staff in the summer of 2019, we have processed 358,966 individual arthropods that were collected across North America from 2018 onwards, with 771 unique species identified.

A further 1000 or more species have been added to the voucher collections without positive identifications (yet). This doesn't include the hundreds of species we already had in the collection from earlier work! And this process is still ongoing! This laboratory has become something of an arthropod-identification factory, continuously processing and identifying biodiversity in agricultural habitats across North America, including croplands and rangelands in



Dr. Kelton Welch

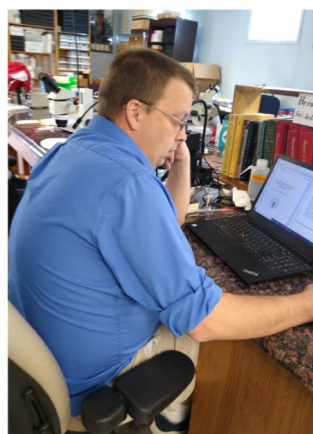
Re-joined Ecdysis Team in 2019
Kelton is in charge of the Mark F. Longfellow Biological Collection at Blue Dasher Farm.



portant, but at Ecdysis, we firmly

believe that agricultural environments are also valuable conservation resources that we can't afford to overlook, and we're working hard to document the biodiversity that our managed ecosystems can support. This data also helps us identify and promote the types

of agronomic practices that can transform farmlands into biodiversity reservoirs while still supporting productive agriculture. In short, it will show us how to live alongside our biodiversity, as part of the same ecosystem.



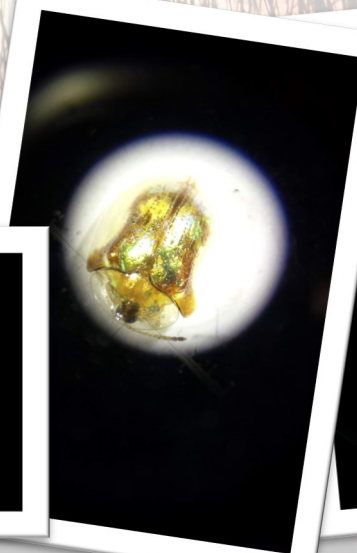
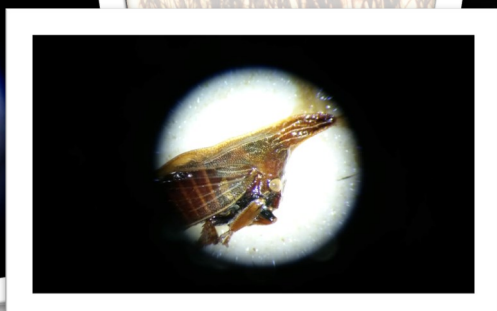
Our work is never finished. I am working to transform our field collections into an organized, fully curated collection of biodiversity

that will support our mission at Ecdysis and serve as a valuable resource for growers and researchers well into the future. This process requires thousands of hours of sorting, keying, cataloguing, cross-referencing, photographing and digitizing. As field studies continue pouring in at Ecdysis, the stream of incoming specimens is without end. I am currently in the process of databasing all collections, collating them into a single reference collection, and gathering the little tidbits of ecological and behavioral information that currently exists in the scientific literature for each species.



the Great Plains and central Canada, pastures in the southeastern states, and orchards in California. We are also developing and testing new ways to sample this biodiversity and process the data more efficiently.

This biodiversity we are documenting has been surprisingly under-represented in ecological collections, which have strongly prioritized the rapidly vanishing wilderness areas of our world. Of course, the wildernesses are very im-



Christina Lind

Joined Ecdysis Team in 2020

Christina first started helping guide Blue Dasher Farm in 2019, and has taken on important roles in communications at Ecdysis in 2020.



Blue Dasher

Becoming a part of the Mix

Christmas of 2019, Jon asked if I'd like to take part in ordering chicken breeds. I took that offer *seriously*, and I spent most of Christmas vacation researching poultry and creating an unnecessarily detailed spreadsheet of all the breeds. It was at the least, a great way of learning about the different breeds. We ended up ordering 2 geese, 9 ducks, 109 laying hens, and approximately 120 broiler chickens, and we couldn't wait for them all to come in. Needless to say, the farm was



crawling in free range poultry in the summer of 2020.

Crawling. The ducks and geese were my personal favorite, brimming with personality and sometimes sass in the case of the geese. We also had a couple locally purchased turkeys join the mix, and were pleasantly surprised by their friendly, dopey behavior all summer, deciding we will surely try those again. They made fast friends with many, following my 6-year old daughter, Leiana, and me around as we did chores and always standing by as close company with my father, Bill, as he helped with building projects.

While working with animals, we have our share of surprises that call for creative and skillful solutions. I was so grateful for the wealth of knowledge, interest and care of Jon's daughter, Gabby, towards chicken welfare. She even performed careful surgery on a chicken foot! That was not something I was ever expecting to be a part of in my lifetime, but I'm so glad that it's become a part of my life. Looking back at it now, it doesn't even seem strange that one could walk into the house to find chicken surgery occurring on the dining room table (meticulously cleaned of course).

Sheep:

On Valentine's Day of Blue Dasher's third lambing season, we had our first baby lamb, which was named Cupid. He was a spotted, spunky little guy, hopping around the paddock everywhere he went. I imagined the rest of those highly pregnant ewes' dismay as they laid to rest their tired legs of the weight, and he made a game of jumping from one of their backs to another. More lambs were soon to follow. Right during this February lambing, Leiana and I were responsible for watching the farm while Jon was away for work one weekend. It was grossly cold and we were absolutely inexperienced, but I was determined that we were up to the task. On the first day, I had spent the day working at McCrory Gardens and came back to the farm late, arriving to news from the lab staff of a struggling new lamb they had been caring for. Leiana and I spent much of the evening visiting the barn trying to care for the lamb and I continued as Leiana began to settle in for bed, but we unfortunately lost her early in the night. I felt utterly heartbroken; defeated and beaten by the loss. However, we were greeted Sunday morning by two sweet and healthy baby lambs, and seeing that new vibrant life with their attentive mother gave the weekend an uplifting new light that we really needed. We were quickly learning some of those big lessons of raising animals on a farm. Right on our first experience responsible for them we felt the lesson of defeat even when you are determined that if you care enough and try everything you can think of that it will turn out. However, on the other side of the coin, we were also able to experience the feeling of unexpected reward that a farm can provide from that beautiful new life. The lambing season ended with over 20 healthy lambs (9 females and 11 males), and was the most successful lambing season so far. The



lambs certainly had their personalities, especially Cupid and his "rat-pack" of buddies always getting into mischief and romping around the barn together.

In the early spring, as soon as green could be found on the farm, we started putting out the electric net fencing and rotating the sheep through. It was wonderful to see them frolic out on the open prairie, and satisfying to send them through the trees and watch them mow down the various weeds growing there while creating an entirely new community of plants behind them. The sheep always brought me peace to visit and watch in the fields, and I discovered that the simple sound of them chewing was soothing to me. I found it fascinating to watch the plant communities slowly rebound after their passage through, especially when they were moved along a straight line and you could see the evolution of before, immediately after, several days after, or even weeks after grazing in one field of view. The lambs again proved their mischief out on the fields, discovering a trick to sneak under and out of the movable electric net fencing and therefore leading the rest to eventually follow. They sure don't like being separated. We would often suddenly hear the sheep outside of the house, and I was grateful that they at least decided to come home when they got loose. We have a few things to try on fencing for the coming year that will hopefully help not only with that but also cut back a bit on the labor of frequent fence movement.

Crops:

For our field crops, we had an unexpected success with a gorgeous stand of Big Bluestem in 2 crop fields. The sheep were part of our management tool, rotating through the northern of the two fields twice early in the season, once again later in spring, and one last time after harvest. We harvested about 8 acres, and I had my first experience learning the combine. The header would get clogged now and again, needing adjustments to reach the right combination for the most seed and littlest biomass we could



achieve. It was truly an exciting feeling to harvest the seed of such a lovely stand of native grass.

Prairie:

I am a horticulturist and plant lover, so one of my favorite experiences of the farm this year was the prairie. Early in spring, the team executed a carefully planned prairie burn on a portion of the prairie that was easily 90% brome grass, in hopes to restore biodiversity and provide a competitive leg-up for the native plant life buried under the invasive grass. As the life began returning to the prairie, I was in awe nearly every day as I went to explore. The change and diversity of plants emerging was astounding, with no supplemental seeding or additional work done to increase that. I was left incredulous and fascinated with each visit as it evolved anew. As the beautiful native forbs and grasses and life sprang from the ground, so did the insects and critters that flocked to the prairie, now teaming with life. I've never seen anything like the complete transformation that I saw in that prairie, and I think I evolved right with it, truly inspired.



Bees & Wrap-up:

I didn't have a lot of experience with the bees yet, but as with much of the farm, the striking takeaway from 2020 was that I noted the generosity of farmer, rancher and beekeeper friends. Farmers and ranchers lent equipment, helped with mechanical problems, moved hay around the farm, and more. Fellow beekeepers offer their own strengths and resources to help us and each other solve challenges we face. Within all of those communities, the spirit of helping each other and working together has demonstrated more of a sense of community than I've experienced in a long time. I think that's what this style of farming leads to, and that feels very hopeful when I look to what the future for our children might look like in our region. It makes me feel honored to be a part of it all and now call Blue Dasher Farm, home. 🍯



Staff Achievements



In the Media

In 2020, we were featured in:

- -Investing in Regenerative Agriculture podcast
- -Bee Culture magazine
- -AgriView News
- -Mic Online magazine
- -Intercept magazine
- -Forbes magazine
- -Furrow magazine
- -Organic Farmer magazine



Peer-reviewed papers

- Bredeson, M. M., J. G. Lundgren. 2021. Interseeding cover crops into established corn fields affects invertebrate abundance and diversity and elevates the activity of generalist predators. *Biological Control*, in press.
- Bredeson, M. M., D. Beck, and J. G. Lundgren. 2020. Arthropod granivory of lime-coated cover crop seeds. *Environmental Entomology* 49(4): 848-853.
- Mogren, C. M., M.-S. Benitez, K. McCarter, F. Boyer, J. G. Lundgren. 2020. Diverging landscape impacts on macronutrient status despite overlapping diets in managed (*Apis mellifera*) and native (*Melissodes desponsa*) bees. *Conservation Physiology* 8(1): 1-14.
- Veres, A., K. A. G. Wyckhuys, J. Kiss, F. Toth, G. Burzio, X. Pons, C. Avilla, S. Vidal, J. Razinger, R. Bazok, E. Matyjaszczyk, I. Milosavljevic, X. V. Le, W. Zhou, Z.-R. Zhu, H. Tarno, B. Hadi, J. G. Lundgren, J.-M. Bonmatin, M. Bjileveld van Lexmond, A. Aebi, A. Rauf, L. Furlan. 2020. An update of the Worldwide Integrated Assessment (WIA) on systemic pesticides. Part 4: Alternatives in major cropping systems. *Environmental Science and Pollution Research* 27: 29867-29899.

Presentations

- Entomological Society of America (Michels; 130 views)
- Entomological Society of America (Busenitz; 70 views)
- Ridgewater College Soil Health Conference (Bredeson; 300 attendees)
- South Dakota Wildlife Society Meeting (Michels; 80 attendees)
- Northern Plains Sustainable Agriculture Conference (Schmid; 150 attendees)
- Ecofarm Conference (Fenster; 30 attendees)
- National No-till Conference (Bredeson; 1,080 attendees)
- Hamlin County Conservation District (Schmid; 25 attendees)
- Bioneers Conference, on-line only (Lundgren; 150 attendees)
- RE AMP seminar series (Lundgren; 25 attendees)
- Ecological Farmers Association of Ontario, on-line only (Lundgren; 200 attendees)
- Soil and Water Conservation Society, on-line only (Lundgren; 85 attendees)
- Entomological Society of America Annual Meeting, on-line only (Lundgren; 250 attendees)
- Colorado Pollinator Virtual Summit, on-line only (Lundgren; 400 attendees)
- Regenerative Agriculture Summit, Chico State University, on-line only (Lundgren; 100 attendees)
- SD Soil Health Coalition, Mitchell, SD (Lundgren; 30 attendees)
- MN Soil Health Coalition Field Day, Marshall, MN (Lundgren; 50 attendees)
- Pesticide Education Program, Montana State University, on-line only (Lundgren; 30 attendees)
- Land Stewardship Project Farm, Caledonia, Austin, Goodhue, MN (Lundgren; 210 attendees)
- California Small Farms Conference, Paso Robles, CA (Fenster and Lundgren; 300 attendees)
- Seminar Series, Cal Poly, San Luis Obispo, CA (Lundgren; 40 attendees)
- Montana Soil Health Symposium, Billings MT (Lundgren; 400 attendees)
- Keynote Lecture, EcoFarm Conference, Asilomar, CA (Lundgren; 1800 attendees)
- Keynote Lecture, American Beekeeping Federation Annual Meeting, Schaumburg, IL (Lundgren; 800 attendees)

2020 Awarded Grants



Corporate grants

General Mills

Competitive grants

The Wildlife Society (Michels; \$200)
South Dakota Farmers Union (Michels; \$2,500)
NC-SARE (Schmid et al.; \$100,000)
NRCS-CIG (Lundgren.; \$57,090)
MN DNR (Lundgren; \$20,000)
USGS/FWS (Lundgren; \$40,000)
W SARE (Fenster; \$15,000)

We share a heartfelt *Thank You* to everyone that makes the pursuit of mission possible:

2020 Staff List

Dr. Jonathan Lundgren
Dr. Michael Bredeson
Dr. Ryan Schmid
Dr. Kelton Welch
Tia Busenitz
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We are extremely grateful to have received ~\$32,000 in donations from individuals in 2020, and these contributions were essential in helping us work toward our mission of changing agriculture through grass-roots collaboration between farmers and scientists. Please consider making a tax-deductible donation to Ecdysis Foundation – we really cannot do this without your help.

