



Overseeding Annual Crops

4



Meet Brian Hays

6

Flooding News
and Resources

9

NOBLE NEWS & VIEWS

RESEARCH

Why Natural History Collections and Surveys Matter Today

by Mike Proctor, senior research associate |
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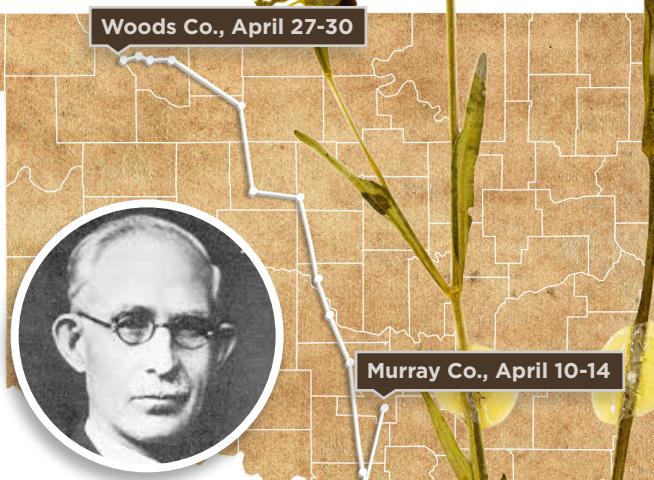


A little more than 100 years ago, G.W. Stevens traveled across Oklahoma collecting plant specimens as

the director of the Oklahoma State Botanical Survey. A portion of his first collecting trip brought him through Love and Carter counties, where several of the ranches operated by Noble Research Institute are located, ranches where I've spent much of the last nine years involved in various research projects.

Stevens' field survey was the first major undertaking to identify what plants occurred in Oklahoma. Up until that point and for the next 50 years or so, the study of natural history mostly revolved around two questions: what and where. In other words, finding out what species were present and where they occurred. The only way to answer those questions was to go out and collect specimens which then were dried, mounted and deposited in herbariums, usually at universities. While people could come along and make maps or study the anatomy of all the specimens of a particular species, nothing really exciting happened in those collections.

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G.W. Stevens, pictured above, directed the Oklahoma State Botanical Survey with three major explorations in 1913. During his exploration in April 1913, Stevens traveled through Murray, Carter and Love counties collecting botanical samples that were deposited at the University of Oklahoma.

Heimerl white four o'clock, right, is a specimen held in the University of Oklahoma's Robert Bebb Herbarium. Photo courtesy of Amy Buthod, collections manager.





As new technologies were developed and improved in the 1980s and '90s, the attention shifted to looking at how species and groups were related to one another based on DNA and pollen analysis. This was pretty attractive to folks because it all took place under air conditioning and didn't involve chiggers and ticks. Tissue samples for a study could easily be extracted from preserved herbarium specimens. Natural history studies dropped off dramatically and are continuing to decline.

There are a lot of questions out there today that didn't exist when G.W. Stevens and other early collectors were stumbling around through the prairies and woods of Oklahoma. Natural history collections and surveys can contribute a great deal to the answers.

VEGETATION REFLECTS ECOSYSTEM HEALTH

From historical collections and newer samples collected in particular habitats, we can begin to develop a concept of ecosystem health. How many native species are present versus non-natives? How closely do the species present today represent those documented for the site in the past? How have environmental changes affected native vegetation? How have land use practices influenced native vegetation? What can be inferred from the current vegetation about historical land use?

If we detect a difference — some species are absent that were present and new species have appeared — we can ask: What about this site has changed? How rapidly are changes taking place? Can we implement management practices to reverse the changes? Rarely do species invade an intact community. There is usually some disturbance that has taken place that sets the stage. Often the culprit is overgrazing, but it also may be something like a lack of fire. For example, eastern redcedar takes advantage of

both situations and causes havoc by invading grassland plant communities.

A great deal of information about the status of vertebrate and invertebrate species can be inferred by the status of the plant communities present. In most cases, the plant community is the habitat for those species. If it's gone, they're gone.

During field work in the heavily forested Big Thicket in southeast Texas, I occasionally came across single pitcher plants under closed-canopy pine forests. If they're only supposed to grow in pine savannas, why were they growing in the middle of the forest? Fires had been suppressed for so long that the pines had taken over the original savannas, which were the habitat for the pitcher plants. I was finding relict populations. Collections data can let us know where such habitats once occurred and where they might occur again, if properly managed.

COLLECTING PROVIDES INSIGHT INTO INVASIVE AND ENDANGERED SPECIES

When dealing with invasive species, other questions arise. Have those species always been around, or are they introduced? When did they first turn up? If they have always been around, why are they causing problems now? What has changed? How fast is the change occurring? Collections data can help answer those questions as well.

Natural history collections may also provide insight into endangered species that are particular about where they live. Data on specimen labels about geology and soils can be put into a GIS system and analyzed to locate other potential sites where those species might be found or could be reintroduced. It is also possible that what we thought was an endangered species based on museum collections isn't nearly as endangered once someone starts to focus on collecting them. Many organisms are easy to overlook and just are seldom collected.

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WHAT IS THIS PLANT, AND IS IT GOING TO CAUSE PROBLEMS?

We get quite a few requests at the Noble Research Institute to identify unknown plants that have turned up in someone's pasture. Most of the time, it's not necessary to collect anything or consult collections in the herbarium to identify it. However, learning how to identify plants is a skill best learned by collecting and using collections in one or more herbarium to verify those identities. A more challenging version of the same question might be, "Is this individual a really large specimen of a common species, or is it something else, for example, an invasive species that just showed up?" In that case, collecting the plant and sending it to a taxonomist at a herbarium might be a valid course of action. I can look at several pictures online, but they are no substitute for a cabinet full of specimens to compare with. Just being able to recognize that a plant is unusual is a skill that can't be replaced with technology.

COLLECTING HELPS ANSWER BIODIVERSITY QUESTIONS

How many species occur on a site? Do some appear only during or after really dry periods, or really wet ones? Several native forbs dramatically increase in abundance after fires. It's not that they are suddenly invading, but it's how that plant community is responding to fire. After every fire, those species behave in that fashion. Two years after the fire, the forbs will once more be minor components of that community. Some of the species occurring on a site don't show up every year, or even every decade. Seeds remain viable in the soil for extended periods of time and may germinate only when conditions are just right. This may occur only when the overhead canopy has been removed, such as in the case of a fire or after a severe drought.

Collecting in an area, even over an entire season, still doesn't capture all of the biodiversity that is likely to be present there. I'm specifically referring to plants here, but I think that trend holds true for whatever group of organisms one might study. Collecting is the only way to answer many biodiversity questions. We use some other technologies such as camera surveys or acoustic surveys to help measure biodiversity with animals, but they don't work with plants.

ECOSYSTEM STUDIES USE BOTH FIELD SURVEYS AND REMOTE SENSING DATA

Many of our ecosystems provide the food we eat and the water we drink. They also cycle nutrients and sequester carbon. Studying those ecosystems starts with knowing what organisms are present; in other words, collecting and depositing specimens. Mapping and defining these communities requires knowing which species assemblages — all the species in an area — occur in them.

Historically, traditional surveys and collections were the primary method of acquiring this data. Current efforts to classify and map vegetation still depend greatly upon data collected during early surveys as well as new data from ongoing surveys. Collecting field data tells us what is happening now in those communities. Previous collections provide information as to what those communities were originally. Combined with other data on land use patterns or climatology, we can then begin to predict what may happen within those communities in the future and how they may respond to disturbances. We can collect enormous amounts of remotely sensed data with satellites and UAVs, but without some knowledge of the plant communities on the ground, there's no way to make sense of all the interesting patterns present in that imagery.

KNOWING CLIMATE TRENDS TAKES DECADES OF DATA

What can natural history collections tell us about climate? Plants are usually collected while they have flowers present. The collection date and location are always recorded along with any observations about local habitat, soils or geology. If you have a number of specimens



of the same species collected in roughly the same location over a period of years, you can look at when those species flowered and compare past records to present. There can be a lot of variation from one year to the next, so decades of data may be necessary to say much about any trends. There are some maple trees in Red Rock Canyon near Hinton, Oklahoma, that suggest our climate may have been dramatically different in the distant past. Maples don't generally grow in the Great Plains, except in highly sheltered areas like deep canyons. When there was an ice sheet present in northeast Kansas, though, maples might have been much more widely distributed. Those maples represent a relict population that was established under a much different climate.

WHO KEEPS TRACK OF COLLECTIONS?

The Oklahoma Natural Heritage Inventory (ONHI) in Norman, Oklahoma, is the agency tasked with keeping track of the organisms that occur within the state. As the state's central repository, the agency maintains several datasets on state organisms, including the Oklahoma Vascular Plant Database. ONHI works with organizations such as the University of Oklahoma's Bebb Herbarium and

FOR MORE INFORMATION, VISIT:
Oklahoma Vascular Plants Database:
okahomaplantdatabase.org

Oklahoma Natural Heritage Inventory: oknaturalheritage.ou.edu

The Robert Bebb Herbarium:
biosurvey.ou.edu/bebb

Sam Noble Museum:
samnoblemuseum.ou.edu

the Sam Noble Museum, Oklahoma's Museum of Natural History, as they contribute to and catalog collections of the organisms of the state.

The Noble Research Institute has been working with ONHI to survey plants from our three research and demonstration ranches in Love County to provide us with information regarding the current level of plant biodiversity on our ranches as well as fill in some gaps in collections for the county. Even though plant survey efforts have not yet been completed, more than

500 species of vascular plants have been recorded just from those three ranches. Of those, we suspect 20-30 species have never been reported from Love County before. We collected one species that may well be the first report for the whole state of Oklahoma.

While many of the techniques involved in the study of natural history have changed very little in the last 400 hundred years, the application of new technologies to the old data and methods has dramatically increased the value of natural history collections and surveys and is likely to continue to do so for a long time.

This is the sort of thing that Aldo Leopold, the father of wildlife conservation, had in mind when he said, "To keep every cog and wheel is the first precaution of intelligent tinkering." 

PASTURES

The Why, What and How of Overseeding Annual Crops in Perennial Pastures



by James Locke, senior soils and crops consultant | jmlocke@noble.org



Overseeding annual crops into perennial pastures is a well-accepted and viable practice. However, there are several things to consider before you start. Your answers to the why, what and how questions below will guide you to the best fit for your operation.

WHY: WHAT IS THE GOAL OF THE OVERSEEDED CROP?

We overseed other crops into perennial pasture crops for many reasons.

The two most common goals are:

1. Extending the grazing season by adding an annual crop that grows in an alternative season to the perennial crop.
2. Overseeding legumes to add nitrogen to the soil for perennial forage growth. Overseeding also can be used for:
 - Improving overall forage quality by adding a higher quality annual, such as an annual clover, to a lower quality perennial, such as toxic endophyte-infected tall fescue.
 - Increasing soil organic matter to increase water-holding capacity.
 - Adding biological diversity to a monoculture system.

- Improving soil health by adding living roots to soil year-round.

All of these fit hand-in-glove with the sustainable, or regenerative, agricultural management systems being promoted today.

WHAT: INTO WHAT PERENNIAL FORAGE CROP WILL YOU BE OVERSEEDING?

Is the perennial forage warm-season, such as bermudagrass or Bahiagrass? Or a cool-season forage, such as tall fescue, orchardgrass or wheatgrass? While we want to reap the benefits of an overseeded crop, we don't want to damage the primary crop. For instance, a *Story continues on next page*



common practice is to overseed annual ryegrass in bermudagrass pastures. This can be a very beneficial, but if the ryegrass is not grazed or hayed off, it can severely compete with, or even smother out, the bermudagrass.

HOW: WHICH PLANTING METHOD WILL BEST ESTABLISH THE OVERSEEDED CROP?

The most important key to establishing any seeded crop is getting good seed-to-soil contact. A very close second is having the seed placed at a depth where it can germinate and emerge with enough energy to establish and thrive. If seed is planted too deep, it either may use all its energy reserves before emergence, die soon after emergence, or have its production significantly delayed or reduced.

Here are planting method options for overseeded crops, with their pros and cons:

The only way to ensure any consistency in planting depth or seed-to-soil contact is to use a properly calibrated planter, usually a no-till drill, for planting into a perennial sod. In order to get good seed-to-soil contact and the right depth, you need to be able to get the seed to the soil, which requires that the perennial forage

crop has been managed well. Managing the forage residual is often as much an art as a science.

1. Methods include grazing, haying or mowing to the desired stubble height, or chemical frosting the primary forage. Chemical frosting is using a low rate of herbicide, usually glyphosate, to mimic a light freeze on the primary perennial forage. This allows the overseeded crops to establish with less competition from the primary forage.
2. Another seeding option is broadcasting seed and allowing livestock to trample it in. While this option can be successful, it offers the least control over planting depth and soil contact. This option works best with species that are best adapted to very shallow plantings.
3. A final option is planting green, which means planting into the perennial forage without manipulating that forage. While green planting can be successful, expect that production from the overseeded forage will be significantly delayed and reduced.

IF THE RYEGRASS IS NOT GRAZED OR HAYED OFF, IT CAN SEVERELY COMPETE WITH, OR EVEN SMOOTHER OUT, THE BERMUDAGRASS.

These are just a few of the things to consider before overseeding into a perennial pasture. The more you consider the why, what and how for your operation, the higher your odds of success.



RANGE

Meet the New Pasture and Range Consultant at Noble

by Brian Hays, pasture and range consultant | kjhays@noble.org

Hello, my name is Brian Hays, and I am a new pasture and range consultant here at the Noble Research Institute. I received both my bachelor's and master's degrees in rangeland ecology and management from Texas A&M University. For the past 21 years, I worked as an extension specialist with the Texas A&M AgriLife Extension Service. For the past three years, I have lived in Ardmore, Oklahoma, with my wife Amy, our two sons and one daughter. During that time, my frequent visits to the Noble Research Institute have provided me the opportunity to collaborate with the consultants there on educational events and trainings.

I am passionate about native rangelands and natural resource management. I enjoy hunting and fishing, and spending time with family and friends.

I would like to highlight a few of the projects I've worked on with extension service to give you a better understanding of my work experience and background. Most recently, I led the private land stewardship efforts that included coordinating and delivering training and educational activities highlighting the public benefits derived from good land stewardship. The majority of the land in the Southern Great Plains is privately owned and managed. In my opinion, it is important that the general public understand the benefits producers and landowners provide to society through good land stewardship practices. Good stew-

I AM VERY EXCITED TO JOIN THIS TEAM AND TO CONTINUE WORKING WITH STEWARDS OF THE LAND TO HELP MEET THEIR MANAGEMENT GOALS.

ardship leads to diverse plant communities, which in turn provide forage for livestock, create wildlife habitat, protect the soil and promote rainfall infiltration to retain moisture and reduce run-off. With good, sound management practices — such as planned grazing management, proper stocking rate, prescribed burning, wildlife management, etc. — producers and landowners are able to maintain and improve their property to the benefit of their operations and society as a whole.

I've also had the opportunity to work on several projects that provide proactive management strategies for habitat management on private working lands for the benefit of the producers and landowners, and to promote such lands as partners in conservation strategies. These projects include developing conservation markets for endangered species in Central and West Texas. These voluntary programs provided producers and landowners with incentives to maintain and improve habitats on their properties, and included management plans to accomplish that goal. The plans included the management of grazing,

brush, grassland restoration, prescribed fire and wildlife sections that met the producer's and/or landowner's long-term goals for his or her property.

Several of my other extension service projects focused on working with producers and landowners on native grassland restoration to improve grassland bird habitat and rangeland watershed management. On both of these projects, I worked with land managers through result demonstrations to examine rangeland best management practices for reseeding native grasses, conserving water and improving water quality.

I enjoy working with producers and landowners, and I look forward to helping you make informed management decisions that will hopefully lead to profits and help you maintain and/or improve your land stewardship. Noble Research Institute consultants are highly respected among their peers, producers and landowners. I am very excited to join this team and to continue working with stewards of the land to help meet their management goals.



PONDS

Dead Pond Fish in Summer? Low Dissolved Oxygen Is Usually the Culprit



by Will Moseley, wildlife and fisheries consultant | wamoseley@noble.org

One of the most common calls we get during late summer regarding pond management is about a pond full of dead fish, and the owner wants to know what happened. People are worried the water has been poisoned and is unsafe. The vast majority of time, the fish kill is a result of low dissolved oxygen levels in the pond.

There are several reasons this phenomenon happens in summer, and in order to explain we need to discuss some chemistry.

1. First, warm water physically cannot hold as much dissolved oxygen as cold water can. So the maximum potential for dissolved oxygen is lower during the summer than other times of year.

Story continues on next page





2. Second, there are more aquatic plants growing during the summer than there are during the rest of the year, and a byproduct of their photosynthesis is oxygen.
3. When the sun is shining, plants put oxygen into the water. However, during nighttime, plants along with all the critters in the water use oxygen. This creates a high demand for oxygen during the night.
4. If the plants and animals use more oxygen during the night than is available, a fish kill occurs.
5. Dissolved oxygen levels are highest in the afternoon and the lowest right before dawn. A common sight in a pond with low levels of dissolved oxygen is fish piping (looks like gulping) at the surface of the water in the early morning. After photosynthesis starts back up, oxygen levels increase and the fish stop piping.

DEAD PLANTS CAN LEAD TO DEAD FISH

Another common reason for a fish kill due to low oxygen is when aquatic plants die, either naturally or due to human intervention. If we use herbicide to spray large volumes of nuisance vegetation, the dying and decomposing plants can lower oxygen levels enough to cause a fish kill. This is why we usually recommend spraying no more than

25%-30% of the total surface area of a pond or lake, and then waiting a few weeks to treat another section. This is one reason why it is important to treat early in the season before the vegetation becomes too abundant and water temperature becomes warm.

The decomposition process itself uses up dissolved oxygen. As plants and animals die and sink to the bottom of the pond, they start to decompose. Most of us who have gone swimming in a pond have experienced the cold layer of water about 5-6 feet below the surface. This is known as thermal stratification. The warm and cold layers don't mix very much, which means they don't transfer dissolved oxygen. As things decompose on the bottom of the pond, oxygen levels in the lower layer become very low. If we get a cold rain in late summer or early fall, the top layer can cool quickly enough where the two layers mix and the pond "turns over." This rapid turnover can cause a fish kill due to the low oxygen layer and decomposing biological material mixing with the upper layer of water.

Phytoplankton play a major role in fish kills as well. Phytoplankton are microscopic plants that give water a green hue. If they are too abundant, they can cause a fish kill due to high demand overnight, or during a phytoplankton die-off caused by too many cloudy days or runoff that causes turbid waters. Phytoplankton levels are highest in ponds that have high nutrient levels in the water, usually associated with runoff from the watershed.

HOW TO AVOID LOW DISSOLVED OXYGEN LEVELS

The best way to mitigate fish kills associated with dissolved oxygen levels is to reduce the causes of low dissolved oxygen.

Methods include:

1. Keeping a good grass cover in the watershed to reduce the amount of nutrients and soil that enter the water.
2. Not treating large volumes of aquatic vegetation with herbicides. Do treat early in the season, or use biological control methods such as grass carp.
3. Using diffusers Note: Fountains are popular among pond managers to increase dissolved oxygen, but most fountains are for looks only and do not put much oxygen in the water.
4. Taking emergency methods such as backing up a tractor to and running a shredder in the water, leaving a boat on a trailer and running the propeller, or using a large irrigation hose to blast water across the surface of the water to incorporate oxygen.

Most ponds will not experience a fish kill, so you may not need to use these techniques. However, if your pond is susceptible to fish kills, it might be worth adding management steps that increase oxygen and protect your fishing resource. 

FLOODING NEWS AND RESOURCES

Many areas of the Great Plains are experiencing significant flooding. We've compiled some links for farmers, ranchers and landowners who may be seeking information on recovering from the flooding events. You can also get other information from your local county extension and NRCS offices.

NEWS AND ARTICLES ABOUT RECENT FLOODING

JUNE 11

"State's Cattle Industry Hit Hard by Recent Floods—OCA's Michael Kelsey Says Relief Efforts Underway," Oklahoma Farm Report
bit.ly/mike-kelsey-flood

JUNE 12

"Cattle Producers Advised to Examine Their Livestock for Signs of Foot Rot as Wet Weather Persists," Oklahoma Farm Report
bit.ly/osu-superfootrot-warning

JUNE 13

"Cattle Producers Should Watch for Signs of Blackleg and Anthrax After Floodwaters Recede," Oklahoma State University
bit.ly/flood-disease



RESOURCES FOR THE RECOVERY

"Cattle Checklist After a Flood: Issues to Consider," National Cattlemen's Beef Association
bit.ly/cattle-checklist-flood

"Reclaiming Flood-Damaged Pastures and Forage Production," University of Nebraska
bit.ly/damaged-pastures

Various Resources for Before and After the Flood, North Dakota State University
bit.ly/livestock-flood-info

"Tips for Fixing Flooded-Out Soils," No-Till Farmer
bit.ly/fixing-flooded-soils

"Recovering Flooded Forages," University of Wisconsin
bit.ly/recovering-flooded-forages

NOBLE NEWS&VIEWS

IN THIS ISSUE

Natural History
Collections and
Surveys

1

Overseeding
Annual Crops

4

Meet Brian Hays

6

Low Dissolved
Oxygen

8

Flooding News
and Resources

9

SEPT. 10

Introduction to Integrity Beef



4-7:30 p.m.

Noble Research Institute
Pavilion
No Registration Fee

Connect with Noble Research Institute consultants and Integrity Beef Alliance members to learn more about the Integrity Beef Alliance terminal calf program and replacement heifer development program. You will learn about membership benefits and advantages of being associated with a regionally and nationally recognized marketing program.

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UPCOMING EVENTS

Preregistration is required. Registration closes five business days before the event.
For more information or to register, visit www.noble.org/events or call 580-223-5810.
For other agricultural questions, please call our Ag Helpline at 580-224-6500.



JULY | 30

Alternate bearing in pecans leads to problems associated with consistent production, quality and pricing. Join us to learn how to determine crop load on trees and how to properly thin the crop to improve the current season's quality and the following year's production.

9 a.m.-noon
McMillan Farm
14797 McMillan Road
Madill, OK 73446
No Registration Fee



AUGUST | 27

Understanding Irrigation Systems
and Technology for Pecans

9 a.m.-noon
Kruse Auditorium, Entry 5
No Registration Fee



SEPTEMBER | 3

So You Want To
Grow Pecans

6:30-8:30 p.m.
Kruse Auditorium, Entry 5
No Registration Fee



PART 1
SEPT.
5 | PART 2
SEPT.
12

Debunking
Deer Myths

4-7 p.m.
Bass Pro Shops
in Grapevine
2501 Bass Pro Drive
Grapevine, TX 76051
No Registration Fee