

DIXON WATER FOUNDATION

2019 – ANNUAL REPORT



HEALTHY LAND. HEALTHY WATER. HEALTHY LIVING FOR ALL.

The Dixon Water Foundation's mission is to promote healthy watersheds and sequestration of carbon through regenerative land management, to ensure that present and future generations have the water resources they need.

Through our ranches, grants, education programs, and research partnerships, we hope to help people protect the great environmental resources of our country.

This report summarizes the efforts taken by Dixon Water Foundation to achieve the goals of their mission in the year 2019.

2019 Staff and Board of Directors

Staff:

- Robert Potts – President and CEO
- Casey Wade – Vice President of Ranching Operations
- Melissa Bookhout – North Texas Education Coordinator/Secretary/Treasurer
- Philip Boyd – Director of Science and Communications

Ranch Managers:

- Robby Tuggle – North Texas Ranch Manager
- TBD – West Texas Ranch Manager

Board of Directors:

- Clinton W. Josey, Jr.
- Kathy Smyth
- Jerry Addison
- Hugh Aljoe
- Walt Davis
- Leslie C. Rauscher
- Laura Whiting
- Robert Potts

Science Advisory Board:

- Dr. Bonnie Warnock
- Dr. Richard Teague

2019 changes in Board of Directors and Staff:

The Foundation saw the need to create a staff position that would be dedicated to developing and directing research and communications plans. Philip Boyd was hired in the summer of 2019 to fill this position. Philip lives in Marfa, Texas, and is a graduate of Sul Ross University's Natural Resource Management master's program. Philip will also be overseeing educational and outreach programming on the Foundation's West Texas ranches.

Jonathan Baize had been managing the Mimms Unit in Marfa, Texas, but left that position in October 2019 to pursue other endeavors. That position is currently not filled as of Spring 2020.

Jerry Baggs retired from his position as ranch manager at the Leo Unit in September 2019.

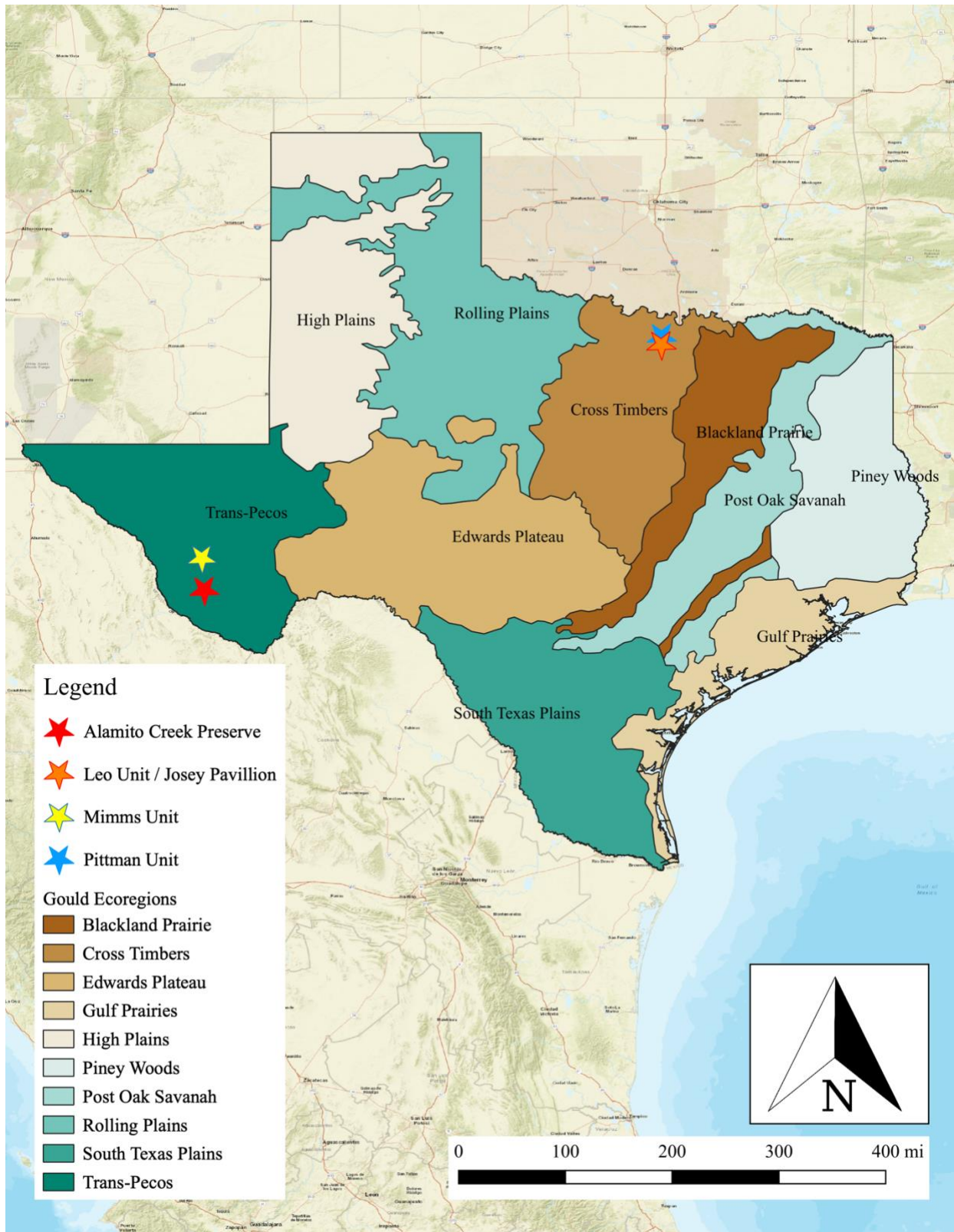


Figure 1. Dixon Water Foundation Ranch locations and Texas Ecoregions created from map in Gould, F. W. 1975, updated by Texas Parks and Wildlife Department (TPWD) GIS Lab 1/09/2004 and downloaded from the TPWD GIS Website

2019 Ranching Operations

North Texas

Dixon Water Foundation owns and manages roughly 4,500 acres in Wise and Cooke Counties. The ranches are in the Cross Timbers and Prairies Ecoregion (*Figure 1*) in North-Central Texas, 22 miles north east of Decatur, Texas, and 32 miles north west of Denton, Texas. The Foundation ranches sheep and cattle in North Texas.



Figure 2. Photo from the Block property, now part of the Leo Unit, Decatur, Texas. (photo credit – Melissa Bookhout, May 2019)

Property updates

The Foundation began the sale of the Bear Creek property west of Fort Worth, Texas. The sale of the Bear Creek allowed the Foundation's North Texas ranching operations to be focused in one location, reducing travel and staffing overhead. The sale also allowed the Foundation to acquire several native prairie properties adjacent to the Leo Unit outside of Decatur, Texas (*Figure 3*), in order to grow that operation in an efficient and integrated manner.

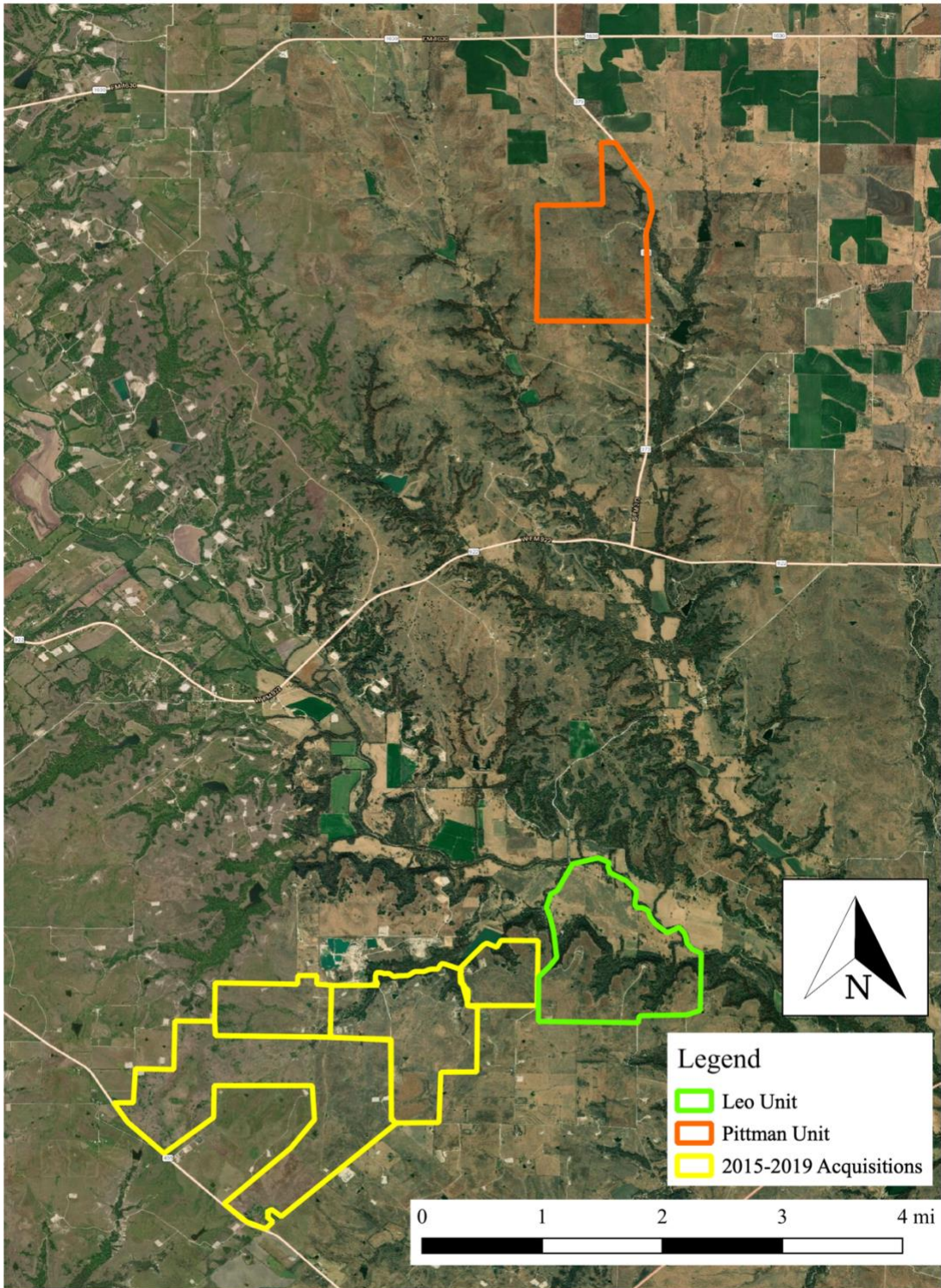


Figure 3. Map of Dixon Water Foundation North Texas Ranches

North Texas 2019 Grazing Conditions

Precipitation – The Leo and Pittman Units received 40 in. of precipitation in 2019.

Livestock update

Red angus cows and Pharaoh bulls have been used exclusively on the North Texas ranches for past 3 years. The operation is working towards ultimately being a cooperator with Pharaoh Cow Company as a way to market the Foundation’s livestock. The Foundation also plans to work towards being Audubon Certified at the North Texas ranches in the near future. In early 2019, the board decided to purchase some corriente cows to increase the herd number with low input animals.

The Foundation runs a mix of Dorper, St. Croix, and Katahdin sheep that are marketed in Hamilton, Texas.

The North Texas ranches are currently in a growth period, increasing stock numbers to meet the abilities of our new land acquisitions. The year 2019 was a good, productive year that moved the Foundation closer to achieving their goals.

Biological Monitoring update

Foundation staff conducted annual biological monitoring at the North Texas ranches in November 2019. The biological monitoring process employs a method developed by Holistic Management International. The process involves traveling to fixed monitoring points each year where staff throw 100 darts into the air around each point. As the darts hit the ground, staff document what type of ground cover the dart landed on: bare ground, litter, or basal plant cover. The staff member also documents the type of plant closest to the dart, based on 10 categories: Prairie complex, Johnson Grass, High Seral Forb, Mid Seral Grass, Mid Seral Forb, Introduced Grass, Sedges, Bermuda Grass, Low Seral Grass, and Low Seral Forbs.

Leo Unit- On the Leo Unit, this type of monitoring has been conducted since 1989. A primary goal of the grazing plan the Foundation has in place is to reduce the amount of bare ground on the landscape. Through annual monitoring, the Foundation is able to track any changes in conditions. On the Leo Unit, there are 5 fixed monitoring points. When the percentages are averaged for all 5 monitoring points, the 2019 biological monitoring efforts reported an average of 15.80% basal plant cover, 84.00% litter, and 0.20% bare ground across surveyed points on the Leo Unit (*Table 1*). This is a reduction of 4.80% in bare ground from the 2018 monitoring effort, and a reduction of 22.00% in bare ground since 1989 (*Figure 4*).

Table 1. Leo Unit - Ground Cover Averages			
	Basal Plant	Litter	Bare Ground
1989	36.60%	41.20%	22.20%
2018	25.20%	69.80%	5.00%
2019	15.80%	84.00%	0.20%

Table 1. Percent cover for each cover type on the Leo Unit between 2018-2019 and 1989-2019.

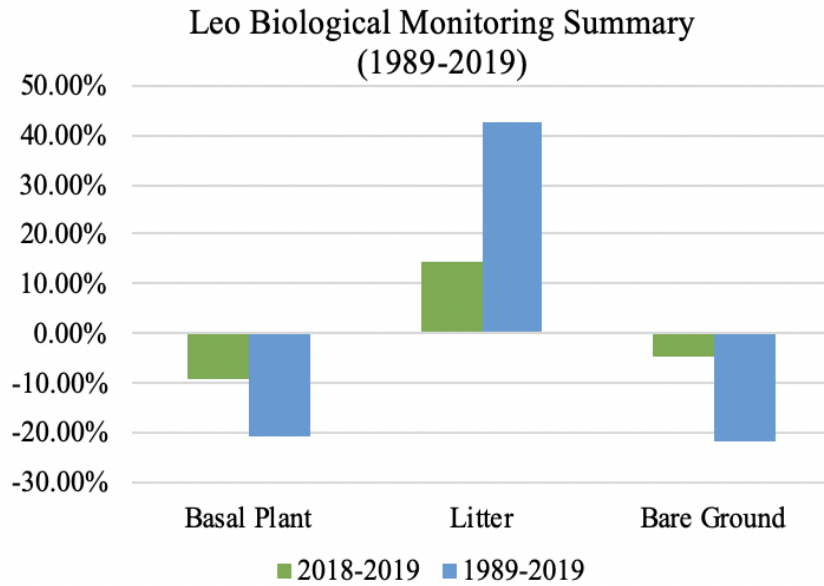


Figure 4. Percent change in ground cover types on the Leo Unit between 2018-2019 (green) and 1989-2019 (blue).

Each individual year and monitoring point may show some variation. When all monitoring point results are averaged and plotted on a chart for each year that has been surveyed, an overall trend in ground cover change can be seen (Figure 5). Through consistent monitoring efforts, staff has recorded a decreasing bare ground trend at the Foundation’s Leo Unit.

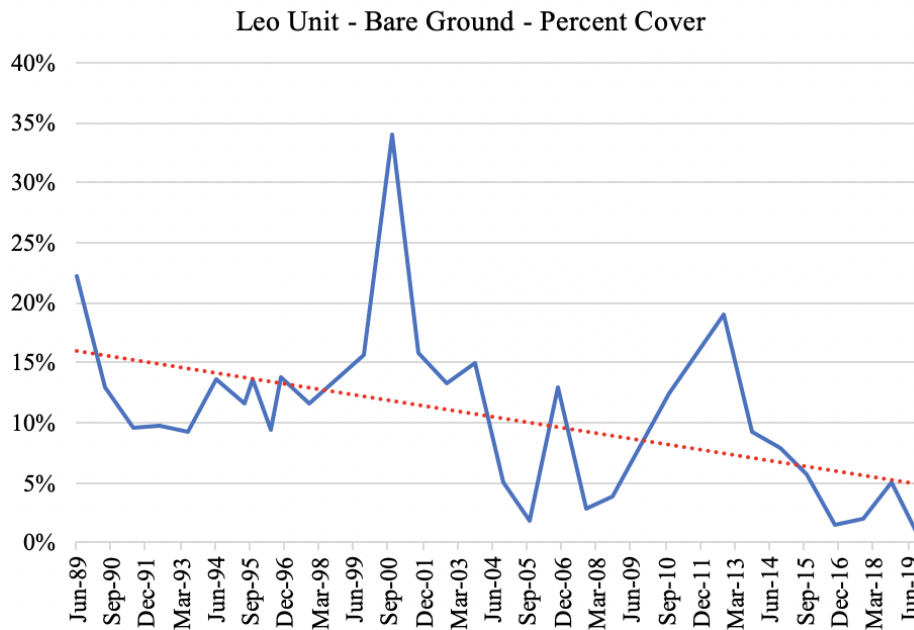


Figure 5. Leo Unit- Percent bare ground recorded 1989-2019 (blue line) and trend of change in bare ground 1989-2019 (red line)

Heard Unit- The Heard Unit is a property connected to the Leo Unit. The Heard Unit has been surveyed utilizing the same biological monitoring method as the Leo Unit since 2015, when the Foundation bought the land. There are 3 fixed monitoring points on the Heard Unit. One of these points was not surveyed in 2018. With a smaller sample size than the Leo Unit, and a portion of missing data, an increasing trend in bare ground was documented from 2015-2019. (Figure 6).

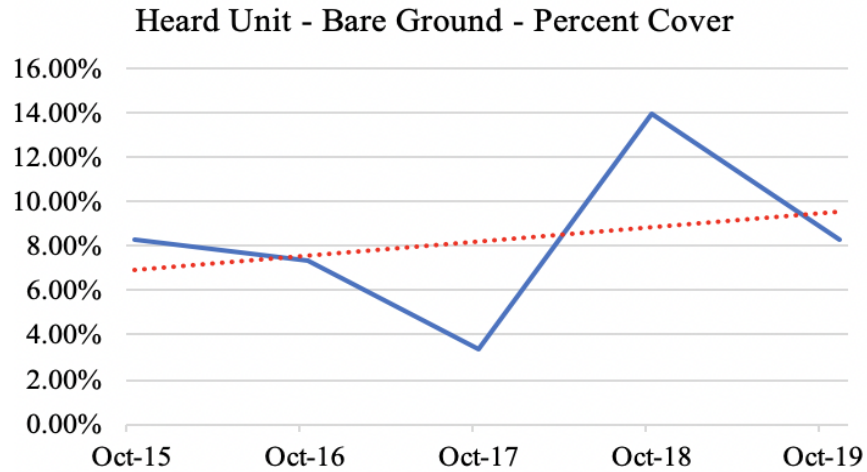


Figure 6. Heard Unit - Percent bare ground recorded 2015-2019 (blue line) and trend of change in bare ground 2015-2019 (red line)

Forman Unit- The Forman Unit is a property connected to the Leo Unit. The Forman Unit has been surveyed utilizing the same biological monitoring method used on the Leo and Heard Units since 2016. There are 3 monitoring points on the Forman and 2019 marked the 4th year of monitoring. The average amount of bare ground surveyed is minimal (0.60%) with a slight increasing trend throughout the monitoring data (Figure 7).

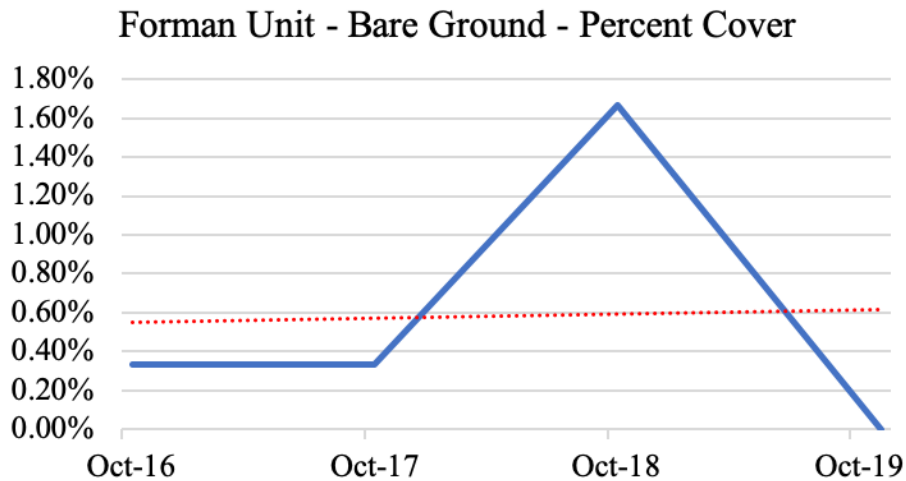


Figure 7. Forman Unit - Percent bare ground recorded 2016-2019 (blue line) and trend of change in bare ground 2016-2019 (red line)

The Heard and Forman properties are both in a transitional stage out of their historic management regimes. Historic grazing was uneven and not managed under the stock density that the Foundation is implementing. There are infrastructure changes and changes in successional vegetation composition that may initially reflect negatively in the monitoring data.

Pittman Unit- The Pittman Unit is a property roughly 7 miles north of the Leo Unit. The Pittman Unit has been surveyed utilizing the same biological monitoring method used on the Leo Unit since 1999. There are 5 monitoring points on the Pittman Unit. The unit was not monitored in 2018 due to wet conditions. The average amount of bare ground surveyed in 2019 was (0.40%) with a decreasing trend throughout the monitoring dataset (*Figure 8*).

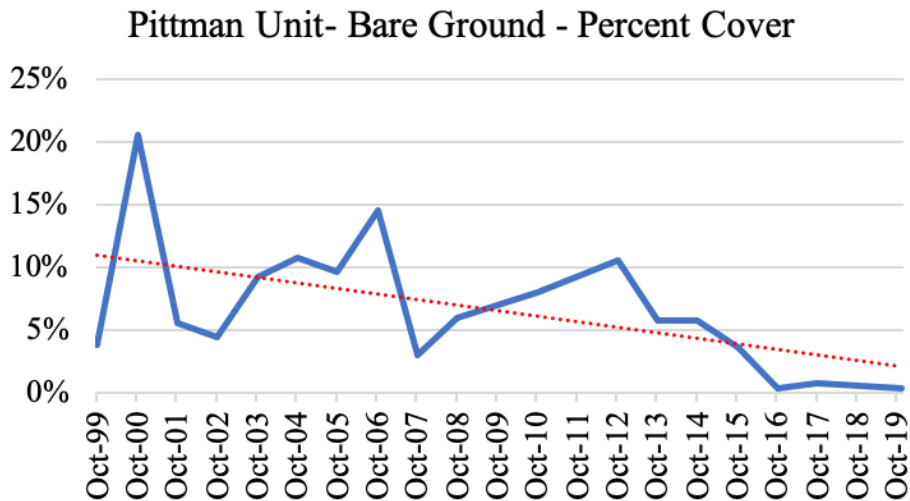


Figure 8. Pittman Unit - Percent bare ground recorded 1999-2019 (blue line) and trend of change in bare ground 1999-2019 (red line)

West Texas

Dixon Water Foundation owns and manages roughly 30,500 acres in Presidio County. The ranches are in the Trans-Pecos Ecoregion (*Figure 1*). The Foundation's ranches are located near the town of Marfa, Texas, and along Alamito Creek, roughly 30 miles south of Marfa, Texas. The Foundation grazes cattle on the Mimms Unit ranch and grazes on Alamito Creek Preserve on a seasonal basis.

Property updates

In 2019, the Foundation acquired approximately 5,000 additional grasslands acres (*Figure 9, Figure 10*) to add onto the existing Mimms Unit through the purchase of the property to the north west of the Mimms Unit. This property was historically part of the Mimms Unit and has been under low pressure grazing for the previous few decades. The property was purchased from the George Estate and is under a conservation easement with the Texas Agricultural Land Trust. In 2019, the Foundation sold 640 acres of the Alamito Creek Preserve ranch, maintaining ownership of the creek corridor and immediate uplands (*Figure 11*).



Figure 9. Photo from the George property, now part of the Mimms Unit, Marfa, Texas. (photo credit – Philip Boyd, March 2020)

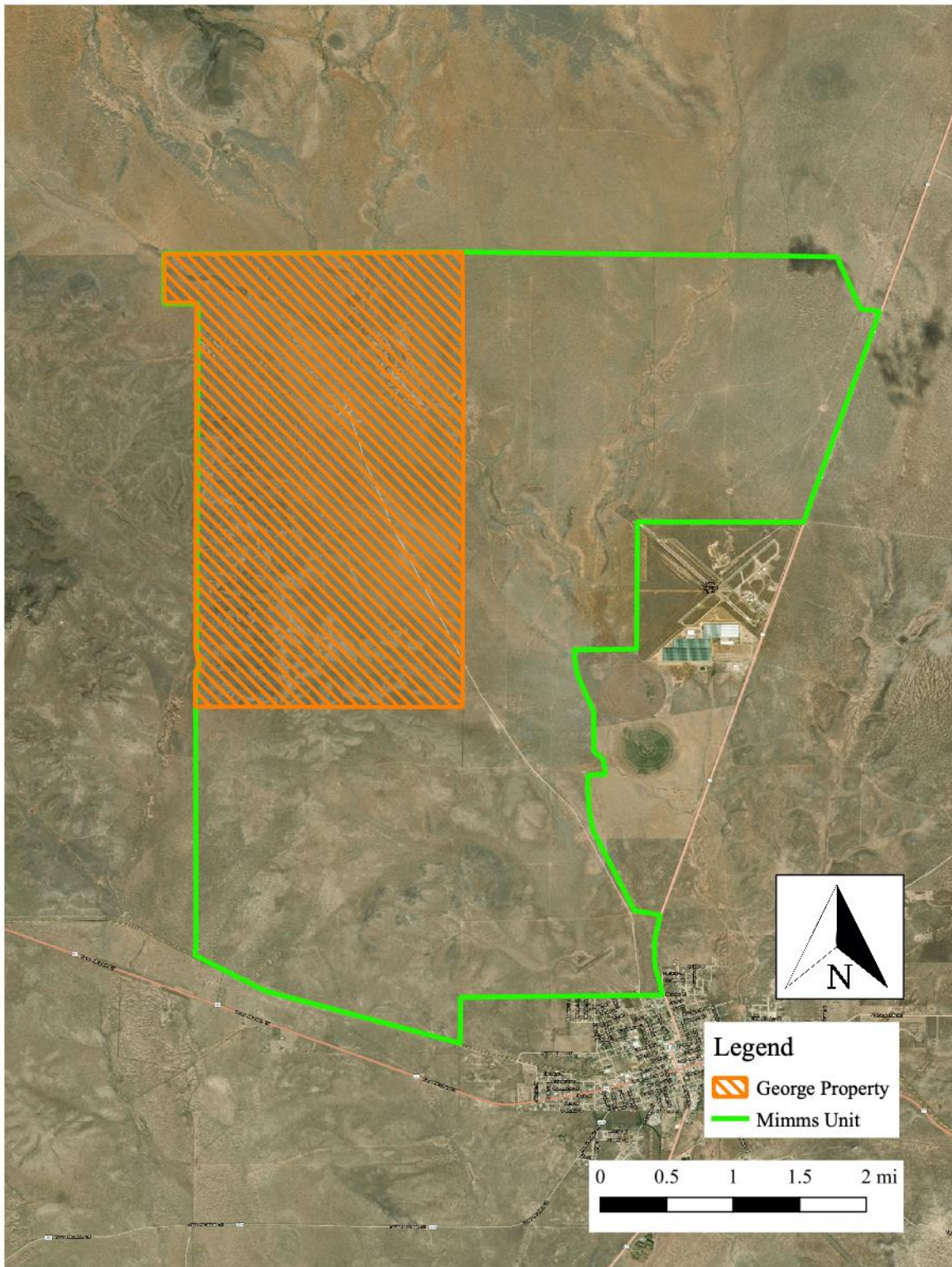


Figure 10. Mimms Unit boundary (green) and the George Property addition (orange), acquired in June 2019.

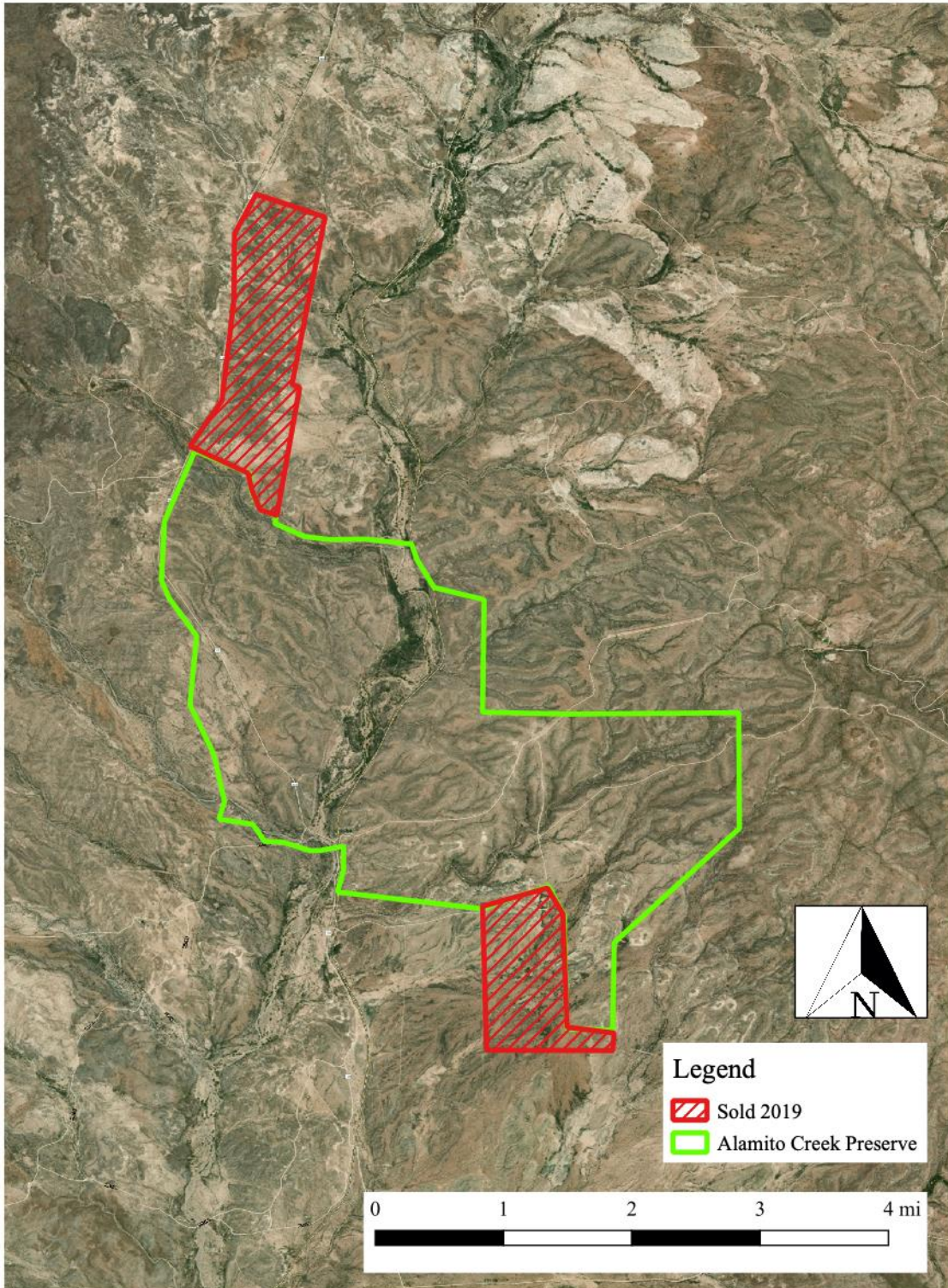


Figure 11. Alamito Creek Preserve boundary (green) and areas of the property that were sold in 2019 (red).

West Texas 2019 Grazing Conditions

Precipitation

Precipitation on the Mimms Unit is measured by 3 methods:

1. A weather station at the nearby Marfa Municipal Airport, which borders the north eastern portion of ranch 3 miles north on Highway 17 from the town of Marfa, Texas.
2. Analog rain gauges at ranch headquarters at the northern edge of the town of Marfa, Texas.
3. Data collected at 6 weather stations installed in January 2018 by the University of Texas Bureau of Economic Geology (UT BEG) across the northern portion of the ranch.

Weather station data from the Marfa Municipal airport was obtained through the National Oceanic & Atmospheric Administration (NOAA), reported 11.01 in of precipitation in 2019.

Analog rain gauge levels were recorded by ranch managers and entered on paper charts used to track grazing details at the Mimms headquarters at the south end of the ranch. These rain gauge data reported an annual precipitation level of 15 in. for 2019. There was 5.10 in of precipitation during the growing season (July – September). The first frost occurred October 24th, 2019.

The UT BEG weather stations were serviced in September 2019 by a UT BEG technician. Some of the stations had clogged rain gauges or other parts that were not functioning. The stations had been incorrectly calibrated, but this was corrected during the September 2019 visit. Once the data was collected and adjusted for any incorrect calibrations, the UT BEG station data reported an average of 9.05 in of precipitation across all 6 weather stations for the year 2019. The months with the highest levels of recorded precipitation were June, September, and October (*Figure 12*).

In a typical year, the north side of the ranch receives more rainfall than the south side. The precipitation data for 2019 shows the inverse of this trend.

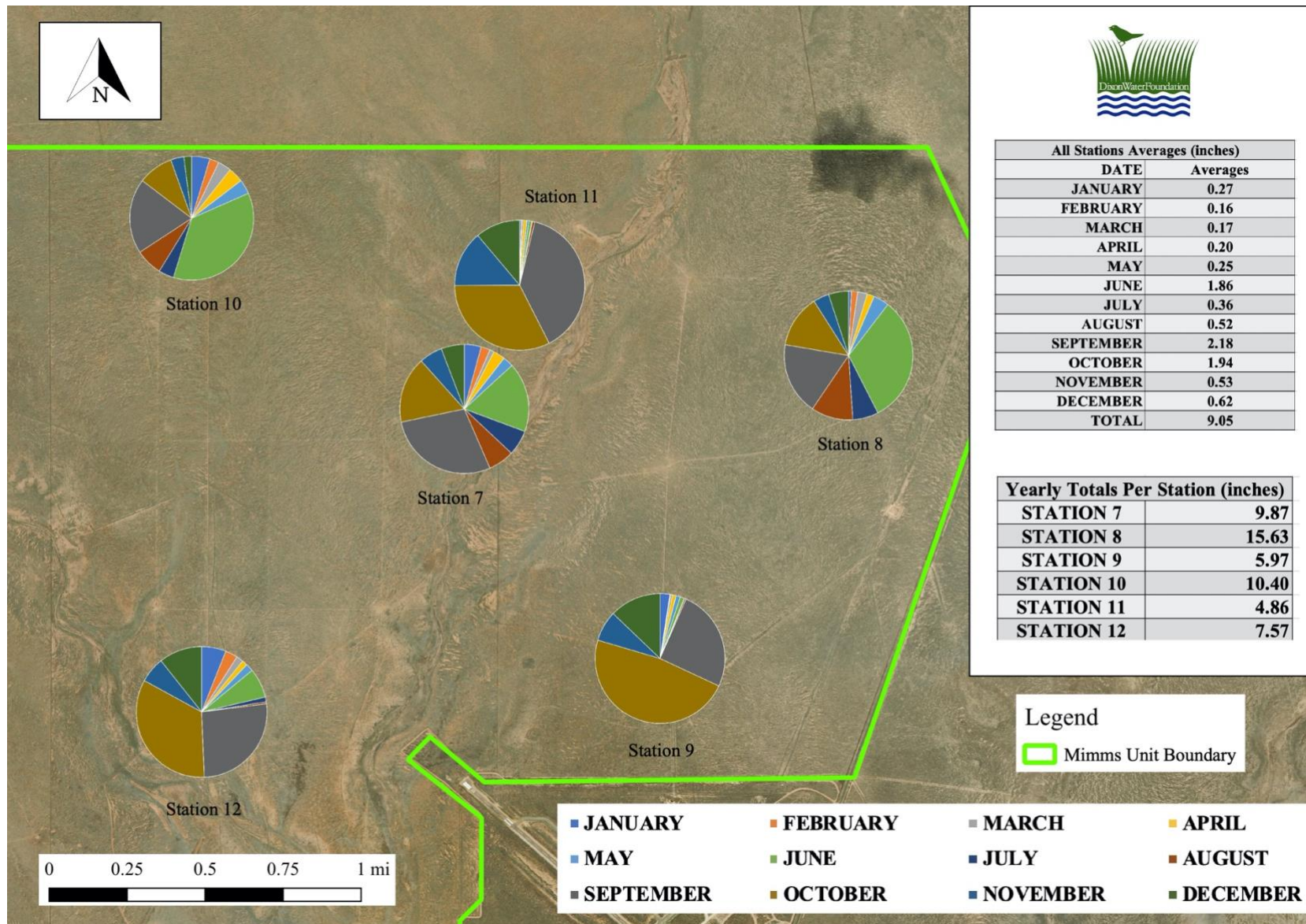


Figure 12. Monthly precipitation measurements (inches) collected by 5 University of Texas Bureau of Economic Geology weather stations on the Mimms Unit ranch and averaged per month for the year 2019.

Livestock update

The Mimms Unit operates both as a Hereford cow-calf operation and as a grass-finished operation utilizing Trask Hereford bulls. The ranch joined the National Audubon Society's Conservation Ranching program and in 2019 was certified under Audubon's new incentive program to identify cattle that produced beef grazed on "Bird-Friendly Land" (Figure 13).



Figure 13. Audubon's Certified Grazed on Bird Friendly Land label. (Courtesy of [Audubon.org/conservation/ranching](https://www.audubon.org/conservation/ranching))

Casey Wade, Vice President of Ranching Operations, rated the 2019 growing season as "medium to good". Steers were sold in 2018 due to dry conditions in that year, which led to the ranch not having a steer crop to sell in the 2019 season. In the previous 3 years, steers were sold through the Grass-fed Alliance, which is a supplier for Whole Foods Market.

Biological Monitoring update

Foundation staff conducted annual biological monitoring at the West Texas ranches in October 2019. Staff monitored the Mimms Unit, the new George Property acquisition, and the Hip-O East, which shares the Mimms Unit's western boundary and is leased by the Dixon Water Foundation and under the Foundation's grazing management. The biological monitoring process employs a method developed by Holistic Management International and is the same as the methodology used at the Foundation's North Texas ranches. The process involves traveling to fixed monitoring points each year where staff throw 100 darts into the air around each point. As the darts hit the ground, staff document what type of ground cover the dart landed on: bare ground, litter, or basal plant cover. The staff member also documents the type of plant closest to the dart, based on 10 categories specific to the West Texas ecoregion: Prairie complex, High Seral Grass, High Seral Forb, Blue & Black Grama, Mid Seral Grass, Mid Seral Forb, Introduced Grass, Sedges, Low Seral Grass, and Low Seral Forbs.

Mimms Unit- Dixon Water Foundation purchased the Mimms Unit in 2008 and began grazing it in 2009. The Mimms Unit has been monitored since 2010. The ranch succumbed to a large fire (“The Rockhouse Fire”) in April 2011, and most of the ranch burned. A shared goal across all Dixon Ranches is to utilize the grazing plan to reduce the amount of bare ground on the landscape. Another goal of the Mimms Unit is to be able to compare pastures grazed in a low stock density/continuous setting to pastures grazed in a high stock density rest/rotational setting. The Foundation has 4 monitoring points across the larger portion of the ranch which employs the rotational grazing practices, and 2 monitoring points in the continuously grazed pasture. Across the entirety of the ranch, bare ground has decreased while basal cover and litter have increased (Figure 13). Data averaged for all stations in each grazing regime shows a declining trend in bare ground for each management technique (Figure 14, Figure 15). The rotationally grazed pasture shows an average of 17% less bare ground than the continuously grazed pasture. When all pastures are averaged, the Mimms Unit, as a whole, is showing a reduction in bare ground (Figure 16).

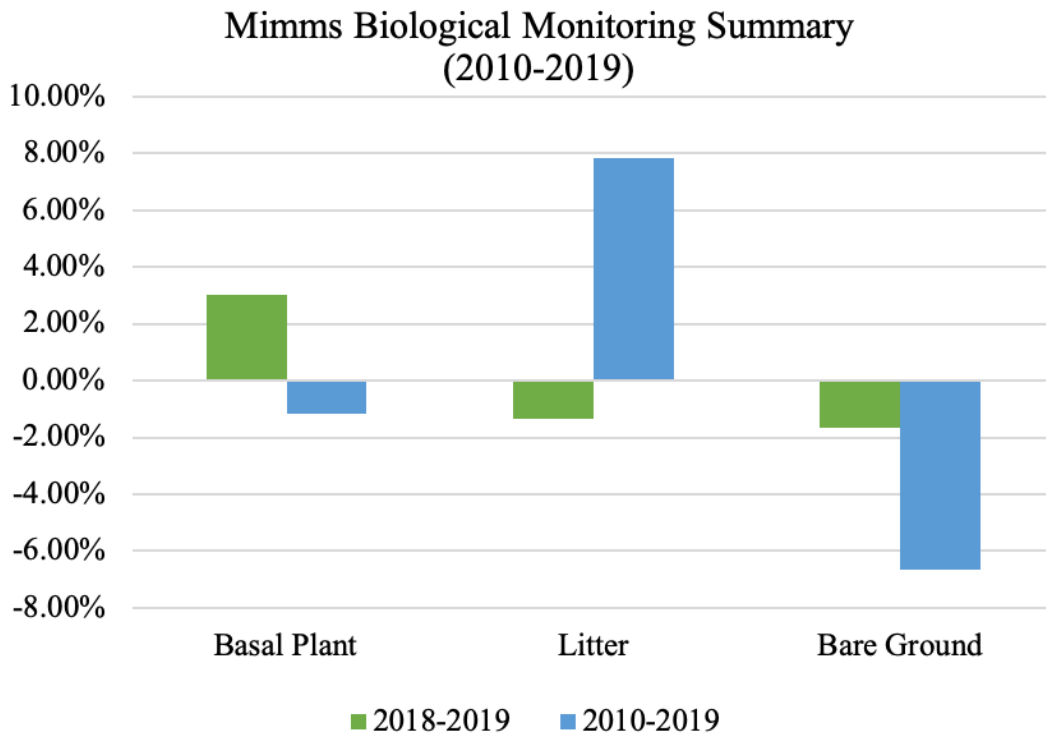


Figure 13. Percent change in ground cover types between 2018-2019 (green) and 2010-2019 (blue).

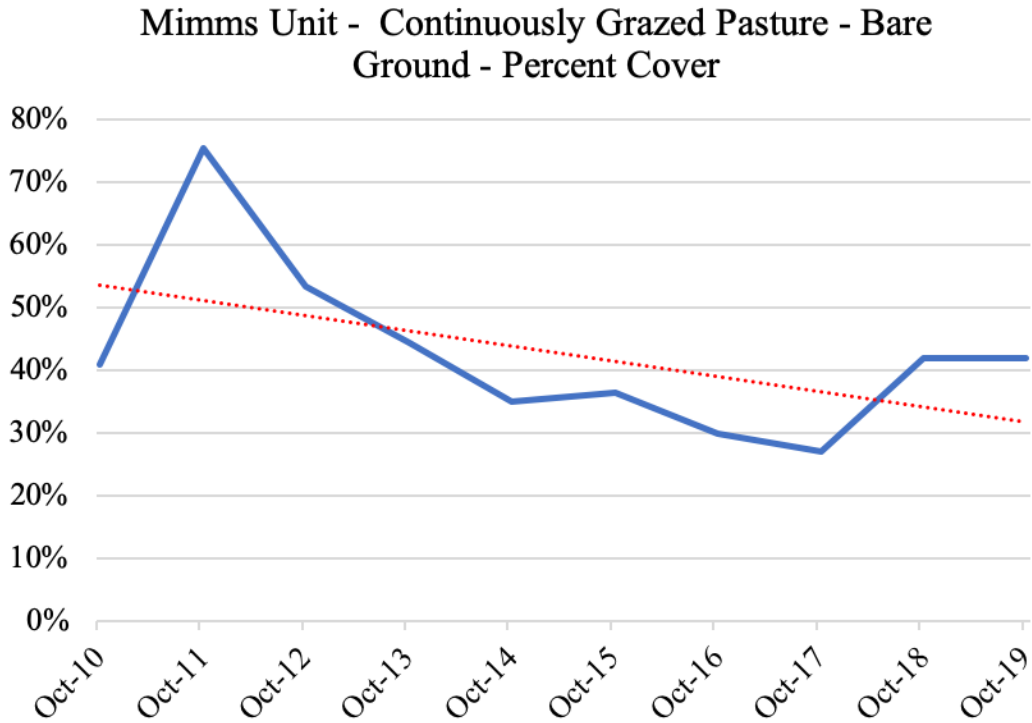


Figure 14. Mimms Unit (Low Stock Density/Continuously Grazed Pasture) - Percent bare ground 2010-2019 (blue line) and trend of change in bare ground 2010-2019 (red line)

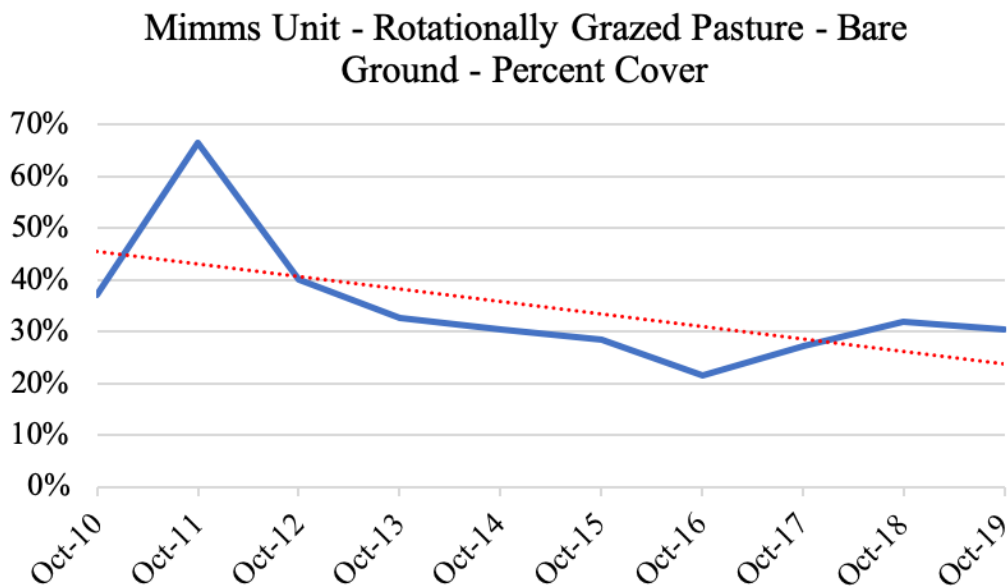


Figure 15. Mimms Unit (Rotationally Grazed Pasture) - Percent bare ground 2010-2019 (blue line) and trend of change in bare ground 2010-2019 (red line)

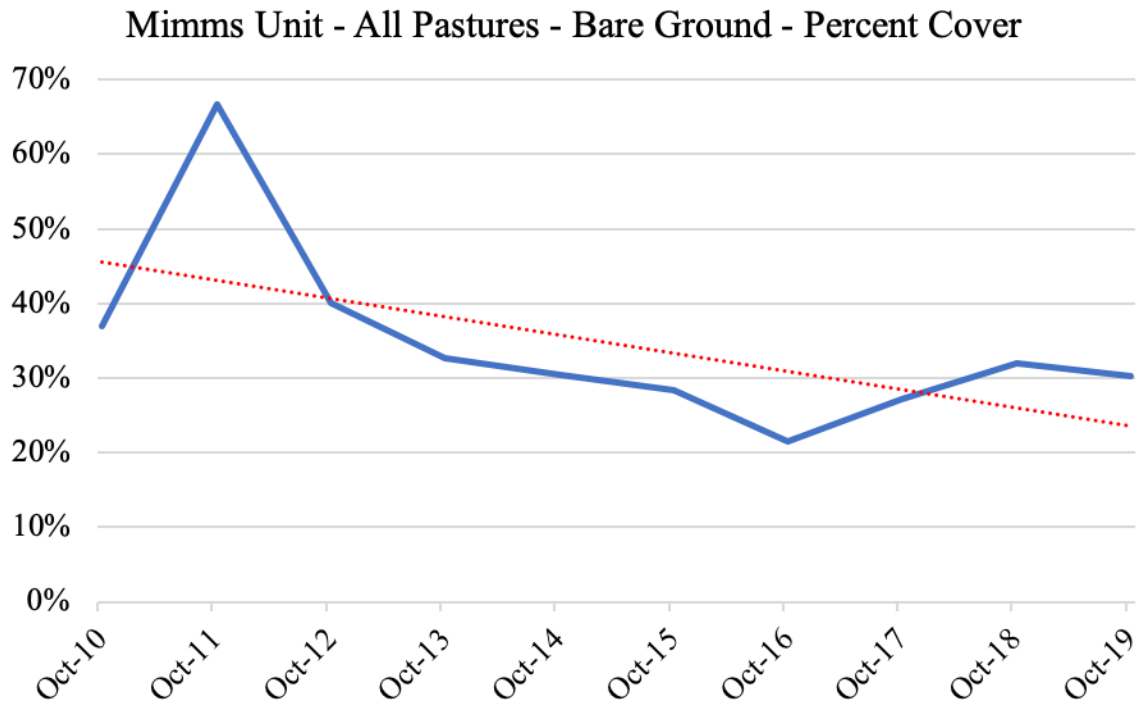


Figure 16. Mimms Unit (Average across all pastures) - Percent bare ground 2010-2019 (blue line) and trend of change in bare ground 2010-2019 (red line)

George Property – Two monitoring points were evaluated on the George property within the Mimms Unit. This was the first year of biological monitoring on the newly acquired property. Recorded percentages of ground cover types (*Table 2*) will serve as benchmarks to compared to future monitoring efforts. The Foundation plans to add a third point to the George Property in the second year of biological monitoring.

Table 2. George Property - Initial Monotiring - Ground Cover Percentages			
	Point 1	Point 2	Average
Litter	23%	38%	30.50%
Basal Plant	38%	47%	42.50%
Bare Ground	39%	15%	27.00%

Hip-O East- The Hip-O East is directly west of the Mimms Unit. The ranch is 8,000 acres and is leased by the Dixon Water Foundation. It is primarily grazed during the summer months and serves as grounds for calving season for the Foundation’s West Texas herd. Calving season begins August 1 in an attempt to allow calves to be born after the typical Trans-Pecos monsoon (July- September) season has begun, allowing for the summer precipitation to increase the nutritional production of the grasslands.

Staff conduct biological monitoring at 2 fixed points on the Hip-O East property. The methodology is the same as that which is conducted on the Mimms Unit. Biological Monitoring of the Hip-O East began in 2015. On average, there has been a slight increasing trend in bare ground across the 2 monitoring points over the 5-year period (*Figure 17*).

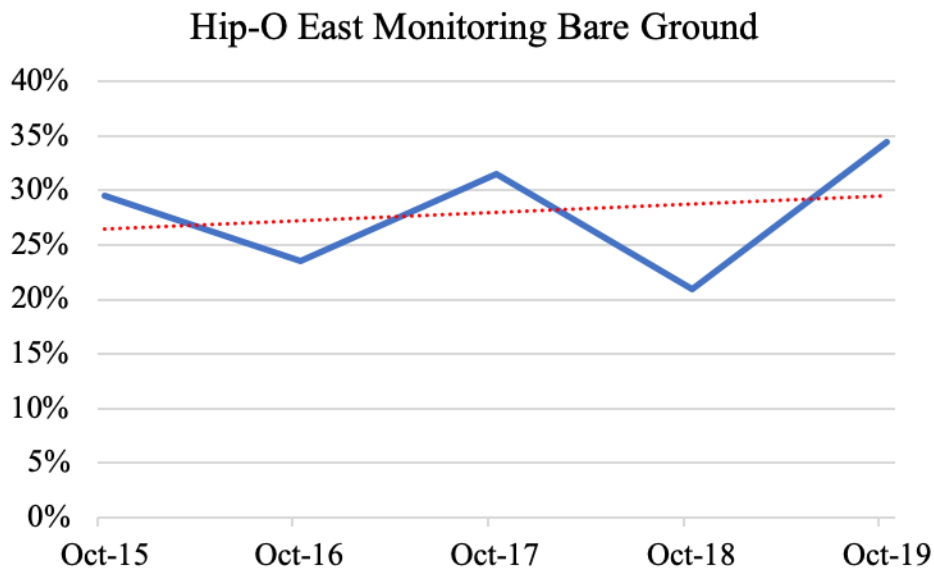


Figure 17. Hip-O East - Percent bare ground 2015-2019 (blue line) and trend of change in bare ground 2015-2019 (red line)

The Hip-O East unit is not owned by the Foundation and does not contain the infrastructure required to graze in the same fashion as the Mimms Unit. The Hip-O East is grazed seasonally, immediately before the monitoring period and this may reflect negatively in the data that is collected. Anecdotally, the Hip-O East is transitioning successionaly under the grazing pressure towards a more grass-dominated community and away from dense tumbleweed cover seen in the earlier stages of monitoring.

Bale Feeding on Bare Ground: Hay bales left on patches of bare ground on the Mimms Unit to feed cattle during the dormant season and attempt to stimulate recovery of the soil and vegetative cover. The cattle break down the bales, leaving litter, manure, and urine in places where they have fed. Bale feeding in 2019 produced mixed results, with some areas showing improvement (*Figure 18*) and some showing minimal change (*Figure 19*).



*Figure 18. Bare ground recovery after bale feeding on the Mimms Unit March – July 2019
(Photo credit - Jonathan Baize)*



Figure 19. Bare ground comparison before and after bale feeding on the Mimms Unit February – July 2019 (Photo credit - Jonathan Baize)

2019 Research Efforts

North Texas

Soil Sampling

Nobel Institute

Leo and Pittman Units- The Noble Institute visited the Dixon Water Foundation's North Texas ranches in March 2019 to collect soil samples from ranches involved in their Land Stewardship Program. As of March 2020, the 2019 samples are still being processed and the data analyzed.

Plant Inventory

Botanist Bill Carr

Leo and Pittman Units- Bill Carr visited the Leo and Pittman units in June 2019 in a continued effort to inventory plants on the properties. He spent time on the properties connected to the Leo that were purchased in 2019.

Surface Water Quality and Biodiversity

University of North Texas

Leo Unit – The University of North Texas (UNT) was given a grant to begin looking into how land management impacts vegetation, hydrology, and soil properties and how those may affect water quality and biodiversity in surface water. The 2019 grant funded the first phase of this research, involving surface water surveys, on-site water quality monitoring, and habitat and biodiversity surveys focused on the Leo Unit in order to establish baseline conditions and inventory. Preliminary results were presented as a poster at Texas Chapter American Fisheries Society (Texas AFS) annual meeting in Waco, Texas in January 2020.

The researchers provided preliminary reports on their 2019 efforts. Some highlights from the report (Dr. David Hoeinghaus, Dr. Aaron Roberts, Principal Investigators, 2020) are pasted in the excerpts below.

- **Participation** - A total of 16 student participants assisted with the Dixon Water Foundation project. Master's student Emily Hartdegen served as the graduate student project lead. Of these participants, 50% were undergraduate students, 12.5% were master's students, and 37.5% were Ph.D. students. In addition, 68.75% of the participants identified as an underrepresented group in science. Underrepresented groups in science are defined by the National Science Foundation (NSF) as women, persons with

disabilities, and those of black, Hispanic, American Indian, or Alaska Native descent. One volunteer is a U.S. armed services veteran. More than half (56.25%) of the participants assisted with the project in both the field (i.e. at the property) and in the laboratory. The majority (62.5%) of participants have been assisting with the Dixon Water Foundation project since its beginning in May 2019.

- **Water Imaging**- Since May 2019, over 3,500 drone images have been taken to survey surface water on Leo complex ranches. Drone imagery will be provided with associated metadata upon completion of the project.
- **Water level** loggers are deployed in Whiskey Creek, Clear Creek, and Dixon Creek. Loggers were programmed to measure and record water levels and temperature at 15-minute intervals during deployment. Units were removed from streams in late August for maintenance, and their deployment locations were reevaluated. Four loggers were redeployed in early October. Data from these four have been processed through February 2020.
 - Whiskey Creek water levels decreased dramatically through June. The channel was confirmed dry during field sampling on July 29. From October through January, the creek had slight increases in water level associated with rain events, but those events were short duration and the creek bed was often dry. On January 10, the area received a precipitation event large enough to increase water depth from 0 to 0.68 meters. The creek has retained water as of February 2020.
 - Clear Creek water levels, measured upstream of the Dixon creek input, gradually decreased from June to September. Levels remained relatively low through October. November and December are characterized by fluctuations in water level associated with precipitation events during this time. Data is unavailable for this logger after December 21 as the logger was buried under sediment by high flows and we are waiting for flows to decrease to safely retrieve it and re-deploy.
 - From June to July, water depth in Dixon Creek remained below 0.5 meters. In October, the creek was largely dry, but a small pool that contained the data logger retained water and changes in depth were minimal. Water became more variable and upstream riffle areas often had flows in November. On January 10th, a large precipitation event increase depth to 4.63 meters but then quickly fell to 1 meter within 24 hours.
 - Fluctuations in downstream Clear Creek mimic those seen upstream and, to some extent, Dixon Creek. Clear Creek experienced a 4 meter increase in water depth on January 10th in response to precipitation that day. Water levels were unusually low in late January and early February, but have gradually fluctuated throughout that time.
 - Sampling occurred every ten to fourteen days from June to August, when surface water presence and abundance was most variable. By late August, changes in surface water were minimal and sampling frequency was increased to eight-week

intervals through February.

- **Water Quality**- Sampling occurred every ten to fourteen days from June to August, when surface water presence and abundance was most variable. By late August, changes in surface water were minimal and sampling frequency was increased to eight-week intervals through February.
 - Water quality results indicate aquatic habitat availability and water quality declined during summer months but recovered during fall. Water quality during summer was generally represented by low pH, high temperature, low dissolved oxygen, and elevated levels of Nitrogen and Phosphorus. Compared with summer, water quality during Fall and Winter exhibited decreases in temperature, conductivity, and nutrient concentrations and increased pH.
- **Biodiversity** –
 - **Fish species** - A total of 5,150 individuals representing 24 species was collected across all sites from June 2019 to February 2020. Preliminary multivariate analyses integrating species relative abundance and environmental data suggest that differences in stream fish assemblage structure across sites and time is associated with stream flow and dissolved oxygen. Variation in pond fish assemblages was reduced during summer months. These results are presented simply as an example of the types of analyses that will be conducted with the full dataset, when complete. Note that spatial factors and dynamics of individual sites through time as a function of seasonal dynamics in water availability will also be assessed and UNT will provide detailed descriptions of all analytical methods and interpretations.
 - **Macroinvertebrates** - A total of 19,173 macroinvertebrates representing 34 species was collected across all sites from June 2019 to February 2020. Preliminary analyses was conducted for fish assemblage data and presented at the Texas Chapter AFS meeting in January 2020 based on samples through August 8 (due to time required to sort samples in the lab), and thus are not included. The preliminary data for invertebrates through August provides an incomplete understanding of seasonal dynamics and relationship with water availability and quality. As with all other data, complete analyses will be conducted as datasets are finalized.



Figure 20. UNT researchers assess macro-invertebrates in Clear Creek, August 2019 (Photo by Philip Boyd)



Figure 21. UNT researchers surveying water quality and biodiversity in Clear Creek, August 2019 (Photo by Philip Boyd)

West Texas

Grassland Bird Research

Bird Conservancy of the Rockies Surveys (2014-2018)

Mimms Unit- In Early 2019, the Bird Conservancy of the Rockies shared the results of a 5-year study (2014-2018) on the Mimms and Hip-O East units. The focus of this study was to inventory bird species utilizing the ranches in an attempt to understand how the Foundation's grassland management may be impacting bird populations and bird habitat. Some highlights from this report are posted in the excerpts that follow. For full details, please refer to the original report linked from the Dixon Water Foundation website dixonwater.org.

- **Diversity-** Forty species of birds were recorded on surveys at Mimms and E. Hip-O ranches, including 22 species of conservation concern, according to Texas Parks and Wildlife, the U.S. Fish and Wildlife Service, and/or Partners in Flight: Montezuma Quail, Scaled Quail, Northern Harrier, Golden Eagle, Burrowing Owl, Short-eared Owl, Peregrine Falcon, Prairie Falcon, American Kestrel, Loggerhead Shrike, Cactus Wren, Sprague's Pipit, Horned Lark, Chestnut-collared Longspur, McCown's Longspur, Cassin's Sparrow, Lark Bunting, Black-throated Sparrow, Grasshopper Sparrow, Baird's Sparrow, and Eastern Meadowlark.
- **Density-** Several species showed an apparent increase in density over the 5 years, and especially over the first 4 years, including of conservation concern such as Baird's Sparrow and Sprague's Pipit, suggesting that the grazing management across both properties and grazing regimes are compatible with the habitat needs of these species. In general, densities of all grassland bird species on Mimms and E. Hip-O ranches are considerably higher than estimates of average density across the Marfa region from 2009 to 2011, as detailed by the Commission for Environmental Cooperation in 2013, especially for species of continental and regional conservation concern.
- **Grazing treatments** - Only one species, Vesper Sparrow, showed a significant difference in response to grazing treatment (continuous vs. rotational) on Mimms Ranch, with higher densities in the rotational pastures. However, seven species had slightly (but not significantly) higher densities in rotational vs. continuous grazed pastures in most or all years: American Kestrel, Brewer's Sparrow, Grasshopper Sparrow, Lark Bunting, Savannah Sparrow, Northern Harrier and Sprague's Pipit. Conversely, four species had slightly (but not significantly) higher densities in the continuously grazed pastures in most or all years: Baird's Sparrow, Chestnut-collared Longspur, Eastern Meadowlark and Horned Lark.

- **Vegetation –**
 - **Grass cover** has increased on Mimms ranch under both grazing regimes, although since 2016 grass cover has been consistently higher in the continuously grazed pasture. Grass cover was initially similar under both grazing regimes in 2014 and 2015, but dropped considerably in the rotational pastures in 2016 (and to a lesser degree in the continuous pasture) and on E. Hip-O. Since then grass cover has increased across all areas, although it has remained slightly lower in the rotational pastures than in the continuous pasture on Mimms. Grass cover on E. Hip-O was roughly the same in 2018 as in 2015, although it decreased in 2016 and 2017. Grass height was higher in the continuously grazed pasture than the rotationally grazed pastures from 2014 to 2016, but since 2017 has been similar under both treatments. Grass height decreased sharply in 2016 across all strata, corresponding with the general decrease in grass cover across the properties in 2016.
 - **Forb cover** (not including tumbleweed) was minimal in most years and showed no particular trends over time, although it increased in all strata in 2016 and 2017. Forb height also increased in 2016, but since then has gradually decreased. Bare ground decreased on Mimms from 2014 to 2018, especially in the continuous pasture. Bare ground on E. Hip-O was similar in 2018 as in 2015. Tumbleweed cover has generally been low on both properties, but slightly higher in the Mimms rotational pastures than in the continuous pasture, which in general have been similar to E. Hip-O ranch. Tumbleweed cover spiked in 2016 and 2017 on both properties and under both grazing regimes, but the spike was more pronounced in the rotational pastures on Mimms. ‘Other’ cover, which was made up primarily of loose/dead vegetation, cow pies, rocks, low woody ground cover, and other minor cover types, has remained more or less the same from 2014 to 2018, although it spiked in 2016 and 2017 across all strata, similar to forbs, mainly from increases in loose/dead vegetation.
- On a continental level, the DWF properties support a small but significant portion of the total populations of several priority species, including up to 0.1% of the estimated Baird’s Sparrow population, 0.2% of Sprague’s Pipit, and .5% of Chestnut-collared Longspur, demonstrating the important role these well-managed ranches can play for grassland bird conservation in North America.

Bird Conservancy of the Rockies Surveys (2019)

Mimms Unit/Hip-O East – Bird Conservancy of the Rockies technicians returned to the Marfa Grasslands in the winter of 2019 to walk transects on the Mimms Unit and Hip-O East to continue their population survey research. Technicians occasionally stayed at the Mimms Unit house during this period.

Sul Ross State University - Borderlands Research Institute

Mimms Unit- Three graduate students who conducted grassland bird field research on the Mimms Unit successfully defended their thesis and graduated in 2019. These students were Fabiola Baeza-Tarin, Denis Perez-Ordonez, and Kaitlyn Williams. Their thesis titles are as follows:

- Baeza-Tarin, 2019, *Overwinter Habitat Requirements of Baird's Sparrow and Grasshopper Sparrow in the Marfa Grasslands, Texas*
- Perez- Ordonez, 2019, *Overwinter Survival and Habitat Selection of Baird's and Grasshopper Sparrows in the Marfa Grasslands, Texas*
- Williams, 2019, *Effects of Livestock Grazing on Scaled Quail and Grassland Birds in the Marfa Grasslands, Texas.*

Alejandro (Alex) Chavez Treviño is currently pursuing his master's degree and was the primary field research coordinator for 2019, the fourth year in ongoing over-wintering grassland bird research with the Borderlands Research Institute. Alex's work is focusing on Grassland bird abundance and diet response to habitat management. His primary advisor is Dr. Mieke Titulaer. Alex conducted his 2019 field season from December 2019 – March 2020. His technician stayed at the Mimms Unit house during this time. Occasionally, students from the Universidad Autónoma de Chihuahua stayed at the Mimms house as well to assist with field work. These students accompanied Dr. Titulaer on the trip as she works part time in Chihuahua and part time at Sul Ross State University in Alpine, Texas. During each visit, Foundation staff were given an opportunity to talk to the group to explain grazing practices on the Mimms Unit and to answer questions (*Figure 22*).



Figure 22. (Left) Researchers hold a grasshopper Sparrow on the Mimms Unit (Photo by Alex Chavez), (Right) Dixon Water Foundation staff explain grazing practices on the Mimms Unit to grassland bird researchers and volunteers, winter 2019 (Photo by Philip Boyd)

Texas Parks and Wildlife Department, Borderlands Research Institute

Mimms Unit – In the winter of 2019, Texas Parks and Wildlife Department provided a report entitled:

“Final Performance Report 4/1/16— 8/31/19 As Required By
The Wildlife Restoration – Section 4 Grant Program Texas TX W-179-R-1/F16AF00341,
479999, Habitat relationships of grassland birds in the Chihuahuan Desert”.

This report summarized the grassland bird research that had taken place on the Mimms Unit from 2016-2019. The report outlined 4 research objectives:

1. Map Chihuahuan Desert grasslands,
2. Monitor wintering grassland bird assemblages associated with the desert grasslands,
3. Assess habitat conditions of desert grasslands, and
4. Evaluate bird-habitat relationships relative to habitat conditions in the study area of west Texas and northern Mexico.

Highlights copied directly from that report are posted in the excerpts that follow. For full details, please refer to the original report linked from the Dixon Water Foundation website dixonwater.org.

- **Summary of survey efforts-** In total, researchers tagged a total of 217 sparrows in three winters, for which they collected 6,486 bird locations. Researchers also collected vegetation data for 3,116 of these bird locations. In each year researchers collected vegetation data in a grid of points spaced evenly throughout the study site, summing up to 1,548 vegetation surveys in total.
- **Survival-** Estimated winter survival was lower in 2017-18 compared to 2016-17 and 2018-19, and generally lower for Grasshopper compared to Baird’s Sparrow. For Baird’s Sparrow, estimated winter survival was 100%, 77%, and 80% for 2016-17, 2017-18, and 2018-19, respectively, with an overall average of 85.5% in three year. Estimated winter survival of Grasshopper sparrow in 2016-17, 2017-18, and 2018-19 was 79%, 47%, and 75%, respectively, with a three-year average of 65.9%. In 2017-18, survival of Baird’s Sparrow was lower in Marfa compared to Janos and Coahuila, Mexico, where 100% of the Baird’s Sparrows survived. Grasshopper Sparrow survival was similar at those sites, but higher in Durango, Mexico. The data across all 4 sites (1 in Marfa, 3 in Mexico) had not been analyzed at the time of this report, but within sites, and for both study species, temperature seems to be the most influential for survival rates.
- **Habitat microclimates-** Minimum daily temperature was significantly lower in short grass and litter compared to tall grass and bare ground. The minimum temperature in shrub was significantly higher compared to the other vegetation types. The difference in maximum temperature between shrub and tall grass likely explains why the maximum temperature was higher in bird points; Baird’s and Grasshopper sparrows tend to avoid shrub cover and select for taller grasses. Although the difference between short and tall

grass was small it was statistically significant, and considering the fact that minimum temperature was the most influential variable for winter survival, short grass may not provide sufficient protection against low temperatures on cold days. More research is needed to test this hypothesis and evaluate the relation between vegetation, microclimate, and winter survival.

- **Home range-** Researchers calculated the size of home range and core area for birds with more than 30 locations. In 2016-17 this gave researchers home ranges for 24 Baird's and 14 Grasshopper Sparrows, in 2017-18 for 24 Baird's and 17 Grasshopper Sparrows, and in 2018-19 for 19 Baird's and 21 Grasshopper Sparrows. Combining the three years, Baird's Sparrows had an average home range size of 6.87 (\pm 9.42) ha and Grasshopper Sparrows of 4.92 (\pm 5.65) ha. Researchers used additive linear regression models to determine which environmental variables could affect the variation observed in home range size. For Baird's Sparrow they found two top models including the variables grass height, grass cover, and year. For Grasshopper Sparrow they found four top models including the variables year, shrub cover, grass cover, and grass height. Researchers suspect that different space-use strategies that could explain the large variation in home range size across individuals.
- **Habitat selection-** Results from this research show that Baird's Sparrows select for more grass cover, taller grass, and other cover, and avoid tall shrubs, forb cover, and Salsola. Grasshopper Sparrows select for less bare ground and tall grass.
- **Soil seed bank-** Seed biomass was higher in points where birds were located compared to random points, but only in the rotational grazing system. This could mean that overall seed biomass is lower in the continuous grazing regime and birds select for seed resources when possible. Alternatively, birds could be selecting for some other habitat feature in the continuous grazing system. However, researchers determined the most dominant genera in the soil samples and found that seed resources are more variable in the rotational grazing system. Panicum was the most dominant seed in the diets of wintering Baird's and Grasshopper sparrows in northern Mexico (Titulaer et al. 2017). Therefore, this seems to suggest that Baird's and Grasshopper sparrows are selecting for Panicum seeds in the rotational grazing system, whereas they do not have this option in the continuous grazing system. This does not mean that the grazing regime is promoting or impeding the growth of Panicum. The continuously grazed site differs from the rotationally grazed site in a number of ways, including soil type, rainfall, aspect, and slope. All these differences are probably the reason for the variation in plant species across the two sites. Further research is needed to determine if this variability can be attributed to grazing practices and how that influences the soil seed bank and food availability for overwintering grassland birds.

Borderlands Research Institute

Alamito Creek Preserve- In September 2019, Dr. Titulaer accompanied Philip Boyd to the Alamito Creek Preserve to discuss research and outreach opportunities. The conversation is ongoing.

Grassland Mammal Research

Texas Tech University

Mimms Unit- Researchers from Texas Tech University in Lubbock, Texas, were in the Trans-Pecos attempting to capture and study the Tawny-bellied cotton rat. This small mammal had been found at Point of Rocks, in Jeff Davis County, nearby to the Mimms Unit, in the mid-1990s but had not been found since. Researchers were attempting to locate this species to learn more about its distribution and to determine if the Point of Rocks population was an isolated population, or part of a larger, unstudied population in the region. Researchers set Sherman traps in the north eastern pastures on the Mimms in the fall of 2019 for one weekend. They did not capture their target species.

Sul Ross State University – Borderlands Research Institute

Mimms Unit- Jacob Locke is currently pursuing a master’s degree at Sul Ross State University. The research for his thesis focuses on pronghorn habitat carrying capacity. He has been conducting vegetation surveys, some of which occur on the Mimms, throughout several seasons. He is sampling for nutritional value in available forbs, which are the primary component in pronghorn diet.

Soil Research

U.S. Department of Agriculture – Natural Resource Conservation Service – Soil Survey

Mimms Unit- Employees at the Soil Survey office in Marfa, Texas, have made on-going visits to the Mimms Unit to study soil types across the ranch in an effort to accurately map soils in the region.

Archaeology

Sul Ross State University – Center for Big Bend Studies

Mimms Unit and Alamito Creek Preserve- In late 2019 and early 2020, archaeologists accompanied Foundation staff to inventory archaeological sites on both properties. Multiple sites were located, identified by rock structures, stone tools and fragments (*Figure 23*), and evidence of earth ovens (*Figure 24*). The archaeologist’s stated the following in field reports from those visits:

“Currently, we do not have a definitive site associated with the emergence of humans into the region. Alamito Creek seems a natural location to find a Clovis- or Folsom-aged site (the oldest accepted cultures in North-America). These sites will be buried and may require a focused effort to locate. The most visible sites on the properties date to the Holocene (ca. last 10,000 years). The large scatters of burned rock and stone tools/waste

materials on both properties are evidence of the ingenuity of humans to adapt to a changing desert environment. Research into these sites coupled with a radiocarbon/description of the sediments in the Alamito cutbanks will help us understand how this environment changed over time and how people responded to that change. We have already documented evidence that Central Plains bison hunters were occasionally in the region, and it is reasonable to assume they followed bison herds, but we need to find the corroborating data. The Mimms Ranch and Alamito Creek Preserve both have tremendous archaeological research potential. We feel we can partner on a research project that helps achieve both of our organizations goals while helping conserve your archaeological resources for future generations to enjoy.



Figure 23. Prehistoric rock tools, structures, and grinding holes on Mimms Unit and Alamito Creek Preserve (Photo by Center for Big Bend Studies December 2019-February 2020)



Figure 24. *Photo of earth oven heating element (pile of fire-cracked rock) along Alamito Creek on the Mimms Unit. The oven is photographed next to backpack for scale. (Photo by Center for Big Bend Studies, February 2020)*

Plant Inventory

Botanist Bill Carr

Mimms Unit – Bill Carr visited the Mimms Unit to complete a 7-year inventory of plant species on the ranch. He also left samples in an herbarium at the Mimms headquarters. The plant ID list is posted on the Foundation website. Bill had this to say about the ranch's plant life:

"Thanks to the Dixon Water Foundation, I've been able to make several visits to its Mimms Ranch during the last seven years in order to catalogue the botanical details representative of what some in the conservation community refer to as the Marfa Grasslands. Small portions of the Mimms Ranch are visible on the west side of the highway to Fort Davis just north of town, and to many eyes they may seem to support a monoculture of grass. But that monoculture actually includes 300 plant species, of which 51—by September's count-- are grasses. Fifty-one species of grasses! I've been doing botanical inventories for more than half of my 64 years—to put it another way, this was not my first rodeo—and I can't recall ever seeing such diversity. Lately we've heard a lot about the disappearance of quality grasslands in Texas and elsewhere in North America, but Marfa can boast large, functional examples of the region's grama-dominated grasslands. We just have to take a minute to notice and enjoy them."

Stream Mechanics

Mimms Unit and Alamito Creek Preserve - In October 2019, the Foundation sponsored a Stream Mechanics workshop in Marfa that was organized by the Rio Grande Joint Venture. This workshop focused on learning a methodology to measure stream channels in order to calculate effectiveness of restoration effort. The group visited Alamito Creek Preserve to take some measurements of the creek channel. In December 2019, Dr. Kevin Urbanczyk (Sul Ross State University and the Rio Grande Research Center) and Jeff Bennett (Rio Grande Joint Venture) visited the Mimms Unit to take measurements of stream channels on the northern portion of the George property. These measurements will help inform the design of a regional curve that can be applied to measuring stream restoration efforts in the Trans-Pecos. Dr. Urbanczyk and Jeff Bennett also installed a permanent benchmark on a t-post on the northern portion of the George property. This benchmark will serve as a fixed point to mount a Real-Time Kinematic (RTK) survey device to take repeated measurements from in the future.

2019 Outreach Efforts

North Texas

Leo and Pittman Units, Josey Pavilion- Our North Texas ranches hosted over 400 people from 34 event field visits, meetings, and workshops including Holistic Management International's Taking Your Grazing to the Next Level workshop, October 2019.

West Texas

Mimms Unit - Our Mimms Unit ranches hosted over 120 visitors through 18 events, field visits, workshops and meetings. Additionally, in December 2019, the Mimms hosted the annual Overland Racing La Pradera half-marathon race in Marfa, Texas with 35 participants. The Mimms Unit also hosted interns Katherine Haile and Zach Vaughn as part of Sul Ross State University's Sustainable Ranch Management Program from January 2019 – May 2019.

Alamito Creek Preserve – The Foundation's Alamito Creek Preserve hosted over 50 visitors through 6 field trips for birding, bird research, and archaeology.

All Dixon Ranches

In the summer of 2019, the Foundation launched its first Instagram account. From July 2019 – December 2019 there were 20 posts made to the account, covering various topics that included: grazing operations, research on Foundation ranches, workshops, and wildlife. The account has 200 followers and most posts are shared to the Foundation's Facebook account as well.

2019 Grants

In 2019, Dixon Water Foundation awarded \$652,000 in grants to 16 organizations. Recipients of 2019 Dixon Water Foundation grants were:

American Bird Conservancy - Rio Grande Joint Venture
Audubon Texas – Conservation Ranching
Hill Country Alliance – Headwaters Challenge
Holistic Management International
Kids on the Land
National Center for Appropriate Technology - Soil for Water
North Central Texas College – Josey Institute
Ogallala Commons, Inc.
People and Carnivores
Pioneers USA – Pastoralist Initiatives
Sul Ross State University – Clint Josey Endowed Chair, Sustainable Ranching
Texas Conservation Alliance – North Texas Water Education
Texas Land Conservancy
Texas Wildlife Association Foundation
University of North Texas – Water Quality and Biodiversity Research
YMCA - Roberts Ranch

2019 Sponsorships

In 2019, Dixon Water Foundation awarded \$26,296 in event sponsorships to 14 organizations. Recipients of 2019 Dixon Water Foundation event sponsorships were:

Big Bend Ranch Rodeo
Coastal Prairie Partnerships - Annual Meeting
Cooke County Beef County Cattle Improvement Association
Holistic Management International
Marfa Independent School District - Robotics Team
National Center for Appropriate Technology
Respect Big Bend - Stakeholder Meeting
Sand County Foundation
Sul Ross State University - Range and Wildlife Plant ID Team
Sustainable Markets Foundation - Holistic Management International Conference Scholarships
Texas Land Trust Council Conference
Texas Parks and Wildlife Department - Lone Star Land Steward Award Ceremony
Texas Wildlife Association - L.A.N.D.S. Event
Texas Wildlife Association - Private Lands Summit