Evaluation of Sprague's Pipit's Conservation Status on their Wintering Grounds in Texas

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INTRODUCTION

Loss, fragmentation, and degradation of native grasslands since European settlement is well documented in North America (Samson and Knopf 1994, Samson and Knopf 1996, Herkert and Knopf 1998). Land cover estimates based on thematic imagery indicate that <30% of grassland remains in the Great Plains, with losses most pronounced in tallgrass prairie (Samson et al. 2004). Conversion of grassland to cropland has exerted the greatest influence on the spatial extent and distribution of grassland in the region. However, urbanization, mineral exploitation, water extraction, plantings of exotics, overgrazing, and shrub encroachment following alteration of natural disturbance regimes have also contributed to continent-wide reduction in native prairies (Samson and Knopf 1996, Vickery et al. 1999, Samson et al. 2004).

While conversion of grassland to other land cover types has slowed since industrialized agricultural expansion during the 20th century, continued pressures on native grasslands have prompted binational, national, state, non-profit, and private programs to improve sustainability in agricultural practices and support efforts to protect, restore, and manage remaining Great Plains grasslands. Improved practices and programs aimed to conserve remnant prairies have stemmed, in part, from observations and data identifying precipitous declines in wildlife associated with grassland vegetation (e.g., American bison [*Bison bison*], Freese et al. 2007; black-footed ferret [*Mustela nigripes*], USFWS 2008). Interagency interventions to preserve and restore grasslands have prevented imminent extinction of a large number of grassland fauna. However, the list of trans-national grassland species in decline continues to grow (e.g., monarch butterfly [*Danaus plexippus*], USFWS 2014), warranting continued cooperative research and management at federal, state, and local levels and at broad- and fine spatial scales to assess the conservation status of prioritized species and provide resources for at-risk species.

Widespread declines of grassland birds, specifically migratory birds that breed in the northern Great Plains and winter in the southern Great Plains, have prompted such actions (Peterjohn and Sauer 1999, Butcher and Niven 2007). Three general hypotheses may explain migratory bird declines: 1) reduced fecundity or fitness on the breeding grounds due to human-induced habitat change, 2) increased mortality during migration between the breeding and wintering grounds, and 3) increased mortality on the wintering grounds due to human-induced habitat change (Donovan et al. 1995, Rappole and McDonald 1994). Given the importance of nest survival to population viability, research has focused on elucidating avian-habitat relationships on the breeding grounds. Studies conducted during the reproductive portion of a bird's life cycle may provide USFWS officials with data to evaluate resiliency, redundancy, and representation of populations and may help inform subsequent risk assessments. Unfortunately, we have limited data to evaluate species-specific responses to migratory and winter habitat characteristics, which would be necessary to conduct a comprehensive risk assessment and better predict avian responses to future habitat alteration scenarios. As such, we must use the best available information and technology to gain perspective on the current conservation status of species, to help inform time-sensitive policy decisions, and to provide a framework for future efforts.

The Sprague's pipit (*Anthus spragueii*; pipit hereafter) is a small migratory passerine that breeds exclusively in mixed-grass prairie of the northern United States and Canada and winters in a variety of grassland types across the southwestern United States and Mexico (Robbins and Dale 1999; Fig. 1). Over the past 50 years, pipit populations concurrently declined with habitat loss, fragmentation, and degradation across the Great Plains (Peterjohn and Sauer 1999, Butcher and Niven 2007). This downward pipit population trend coupled with limited information prompted USFWS officials to consider listing the species as federally threatened or endangered (USFWS 2010). However, the listing has since been precluded by higher conservation priorities (UFSWS 2010, 2011, 2012, 2013).

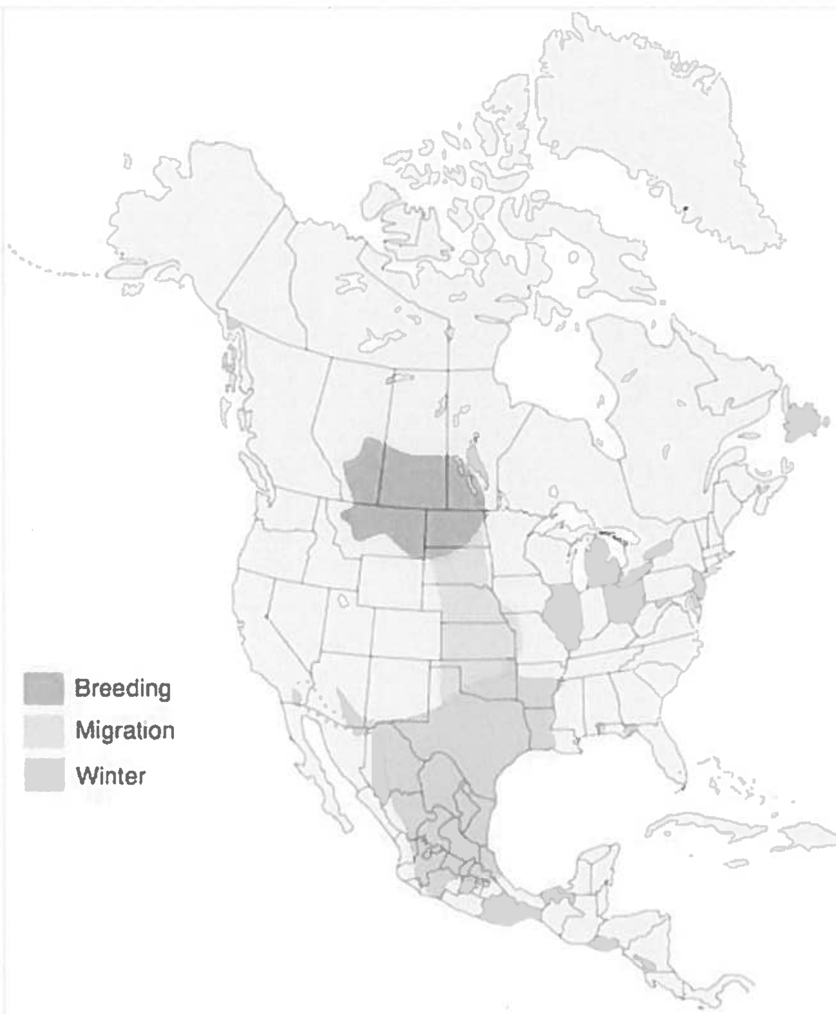


Figure 1. Distribution of Sprague's pipit habitat in North America (Davis et al. 2014).

In 2014, the USFWS updated the pipit's listing priority number (LPN) from eight to 11 and suggested that threats to pipit population persistence were moderate to low in magnitude (USFWS 2014). The recent LPN decision was aided by information gathered and analyses conducted during a 2014 expert elicitation (EE) meeting held to assist USFWS in assessing the biological status of the species. As described in the EE meeting documentation and subsequent Species Status Assessment (SSA), experts from the U.S. and Canada discussed the pipit's habitat requirements during breeding, wintering, and migration, reviewed current conditions on the breeding grounds, and projected future habitat conditions and likely consequences in term of probability of persistence (Aron 2015). A major portion of the meeting was dedicated to examining plausible future scenarios for the probability of pipit persistence (defined as 300,000 individuals) on the breeding grounds at 10-, 20-, and 40-years into the future. Experts determined that pipit population persistence was likely unless the region experienced accelerated conversion, identified as ~14.7 million additional U.S. acres of grassland converted to another land cover type, for the next 40 years (Aron 2015). Experts were also asked to rank the five largest threats to pipits on the breeding range, which they identified as habitat conversion, habitat degradation, climate change, energy development, and pesticides, and suggested that the best conservation strategy for the pipit on their breeding grounds is to preserve remaining large, intact grasslands (Aron 2015).

Far less information is available to determine pipit winter habitat requirements and to identify potential threats on their wintering grounds, which extends from the southwest corner of Arizona, southern New Mexico, central and southern Texas, eastern Louisiana, southern Arkansas, and southern Oklahoma in the U.S. and throughout northern Mexico (Jones 2010, Davis et al. 2014). Site-specific studies and observations indicate that pipits need large grasslands on their wintering grounds, but pipits may use a broader-range of habitat conditions on their wintering grounds than found on the breeding grounds, including turf grass farms, golf courses, heavily grazed Bermuda grass, roadways, and areas of burned pasture (Robbins and Dale 1999, Freeman 1999). Detections recorded at prioritized conservation areas in Texas and research conducted in north-central Mexico suggests that pipit density is positively correlated with patch-size and negatively correlated with shrub cover (Desmond et al. 2005, Jones 2010, Panjabi et al. 2010, Pool et al. 2012). However, no broad-scale surveys have been conducted to identify pipit-habitat relationships or minimum patch size requirements across the geographic extent of their winter range. During the 2014 EE meeting and as documented in the SSA, experts suggested that threats to pipits on their wintering grounds are similar to threats identified on the breeding range and include habitat conversion, habitat degradation, climate change, energy development, and pesticide application (Aron 2015). However, quantitative relationships between pipits and most these factors are unknown for the species' wintering range.

The USFWS is expected to consider information gathered and analyses conducted during the formal 2014 EE meeting along with the SSA and published literature to inform an Endangered Species Act (ESA) proposed decision in fall 2015 on whether the species warrants ESA protections. Research conducted on the breeding grounds suggests pipit populations have stabilized between 1.1 and 3 million birds and that population persistence is highly likely given current and predicted conditions. However, there is uncertainty regarding the amount and distribution of pipit habitat across their winter range and the potential impacts of winter habitat conversion on the species (USFWS 2014, Aron 2015). To address current data gaps on the wintering grounds and to assist USFWS in assessing the biological status of the species, we addressed the following questions for the state of Texas, where winter range maps indicate the largest proportion of pipit winter habitat occurs in the U.S.:

1. Where is potential Sprague's pipit wintering habitat located in Texas?

2. To what degree, and where, is Sprague's pipit winter habitat at risk from habitat conversion in Texas?

3. What is the spatial and financial extent of grassland and grassland bird conservation efforts in Texas? How do conservation efforts align with potential pipit wintering habitat and areas at risk of conversion?

We provide an inclusive, data-driven delineation of potential pipit wintering habitat in Texas that identifies areas with the highest potential to support pipits during the wintering season in Texas. We also categorize the potential for grassland conversion per county using an analysis of Texas Land Trends and Ag Census data collected from 1997–2012 and estimate the percentage of remaining potential pipit habitat at 20-, 35-, and 50-years into the future under best- and worst-case conversion scenarios. Finally, we provide a baseline for statewide conservation efforts that may help support pipits and other species associated with grassland vegetation during some portion of their life cycle.

Similar to SSA analyses conducted for pipits on the breeding grounds, there are unknowns and assumptions we had to make for our identification of potential pipit wintering habitat, grassland conversion estimates, the potential impact of conversion on pipit habitat, and estimates of grassland conservation efforts on the wintering grounds in Texas. We explicitly define these limitations throughout and provide recommendations for future data collection that would enhance our ability to assess the conservation status of pipits in this portion of their wintering range.

Objective 1: Identify the distribution of potential pipit wintering habitat in Texas

Habitat, or the fundamental niche, is a multi-dimensional domain defined by the ecological preferences of a particular species (Grinnell 1917, Hutchinson 1959). Quantifying habitat availability for any species requires characterization of the fundamental niche dimensions based upon data collected at locations of known use (i.e., realized niche). Data of this type can be used to estimate or model resource utilization, and to differentiate "breeding" from "migratory" and "wintering" habitat for neotropical migratory bird species like Sprague's pipit. However, such analyses require additional data defining the physiological and behavioral context of resource use within each habitat type (termed the "Fourth Corner Problem"; Legendre et al. 1997).

For the Sprague's pipit, we have no range-wide field data to differentiate species-specific responses to migratory versus winter habitat characteristics in Texas. And while there are ongoing studies being conducted on grassland conservation areas along the Gulf Coast, these data are spatially and temporally limited, and may not adequately represent all available habitat types across the state. The Breeding Bird Survey data uses a standardized sampling methodology, but is conducted during June and sampled along roadways. As such, BBS data provides no inference to winter habitat use of pipits in Texas (https://www.pwrc.usgs.gov). Alternately, the Christmas Bird Count occurs during December of each year, but aggregates detections from multiple observers over a 15-kilometer radius area, therefore lacking locational specificity (https://www.audubon.org). Given this lack of range-wide data collected in a statistically appropriate manner, and the timeframe allotted to this project (which precluded field sampling), we used pipit and co-occurring species observation points recorded by citizens using eBird, a real-time, online checklist program dedicated to birding (www.ebird.org), to identify potential pipit wintering habitat in Texas. The eBird data has no research design or standardized sampling methodology, but does provides the largest available data set to drive statewide pipit habitat mapping using remotely sensed data.

We developed our potential pipit habitat map by overlaying three independent models created using eBird survey locations, Landsat imagery, and the normalized difference vegetation index (NDVI) data. More specifically, we created the following: (1) a spectral classification of habitat based upon known winter Sprague's Pipit sighting locations using Landsat 8 imagery, (2) a spectral classification based upon known sightings of multiple, co-occurring avian species with similar autecological characteristics using Landsat 8 imagery, and (3) an identification of homogenous grassland, grass savannah, and rangeland cover types using spatial analysis of NDVI classifications. Co-occurring species included grasshopper sparrow (*Ammodramus savannarum*), McCown's longspur (*Calcarius mccownii*), chestnut-collared longspur (*C. ornatus*), lark bunting (*Calamospiza melanocorys*), and American pipit (*A. rubescens*). We used eBird detections recorded from 2006–2008 and 2011–2013 to coincide with Land Trends and Ag Census data used for Objective# 2. We limited our eBird detections to points recorded from November–March to maximize the number training points in our remote sensing analyses while minimizing the inclusion of potential outliers in terms of migratory versus wintering temporal period. This resulted in 1721 pipit points and 14,714 co-occurring species points. We developed all models in ArcMap 10.3, using bands 1–7 of Landsat 8 with 30-meter imagery acquired from October 14, 2014 to February 10, 2015. We used scenes with minimal cloud cover when available. We processed scenes from October 2014 separately due to differences in vegetation characteristics associated with that time period.

We screened locations of pipit and co-occurring species detections by location and we deleted redundant congruent sightings from each map (i.e., only one sighting was used per location, resulting in 103 unique pipit locations and 548 unique co-occurring species locations; Figs. 2 and 3). We generated training samples for each bird model by buffering pipit or guild species detection location by 500 meters. Buffers containing more than 20% "non-habitat" land cover according to the 2012 National Land Cover Dataset (e.g., water, developed, forest, and barren land cover classes) were eliminated from further analysis. Pixels within the buffered areas of the remaining locations were categorized into "potential habitat" and "not potential habitat" using NDVI thresholds representative of grassland and rangeland cover types (i.e., spectral values representative of grass cover; NDVI < 0.15 and > 0.6 is not grassland), then used as training regions to identify potential habitat from imagery in a statewide maximum likelihood supervised classification. The output was a binary raster model of potential habitat for pipits and guild species. We further constrained each bird model by eliminating areas of low confidence during the supervised classification analysis, and applied a smoothing filter to remove single, misclassified cells. The third model was created by first calculating NDVI from imagery (NDVI= [band 5 – band 4] / [band 5 + band 4]), then calculating variability of positive NDVI values using a 100-ha pixel-based moving window analysis. The three resulting binary models were aggregated to 990-meter pixels (0.9801 square kilometer), and summed to produce a final composite model of Sprague's pipit potential wintering habitat in Texas with values ranging from 0 to 3 (Figs. 4–7). The final model was ranked by combinations as Low (co-occurring species x NDVI or pipit alone), Medium (pipit x NDVI), and High (pipit x NDVI x co-occurring species), because strength of evidence was weighted toward combinations containing Sprague's pipit locational information (Fig. 7).

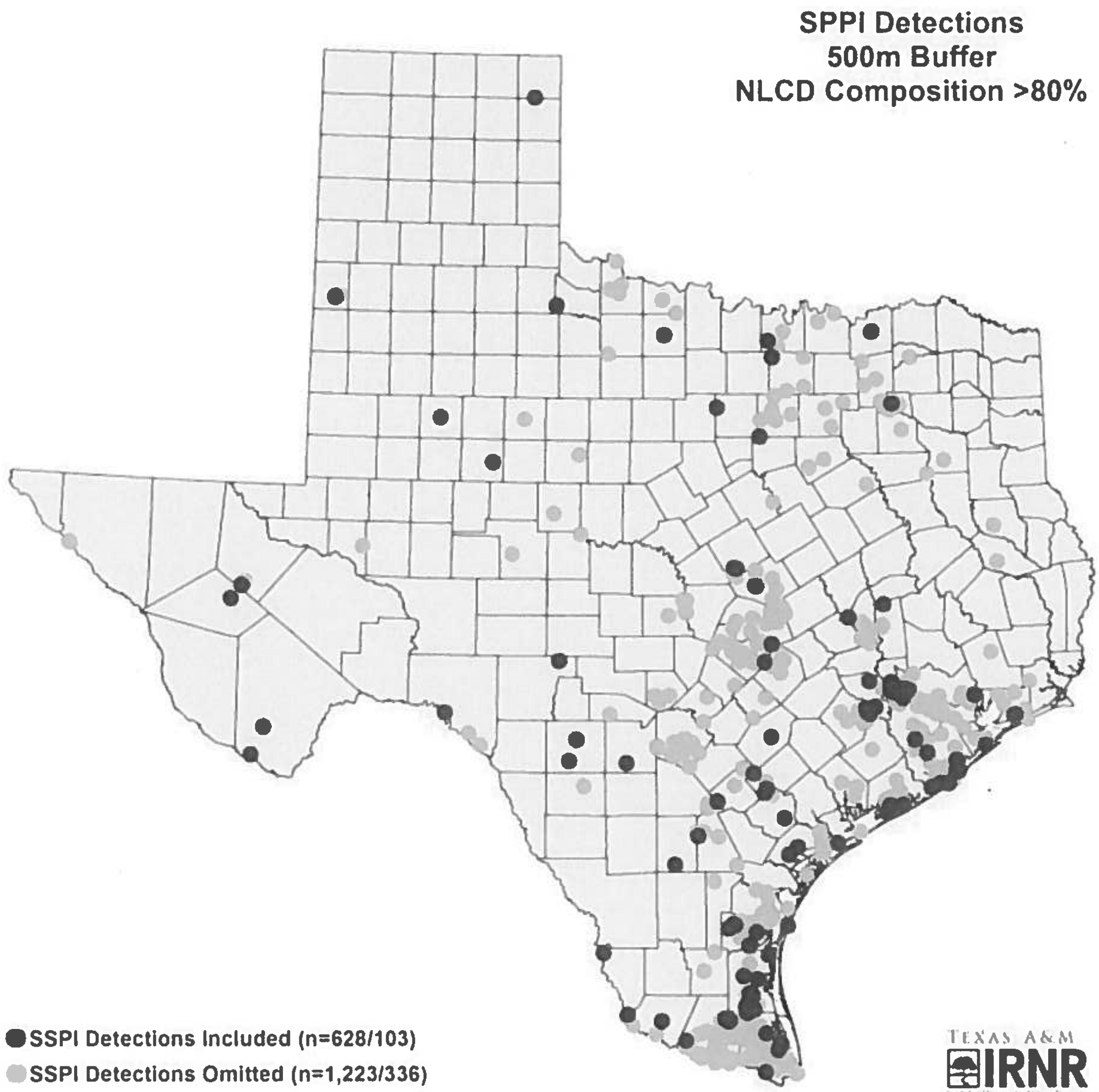


Figure 2. Locations of Sprague's pipit eBird detection used to model potential wintering habitat in Texas.

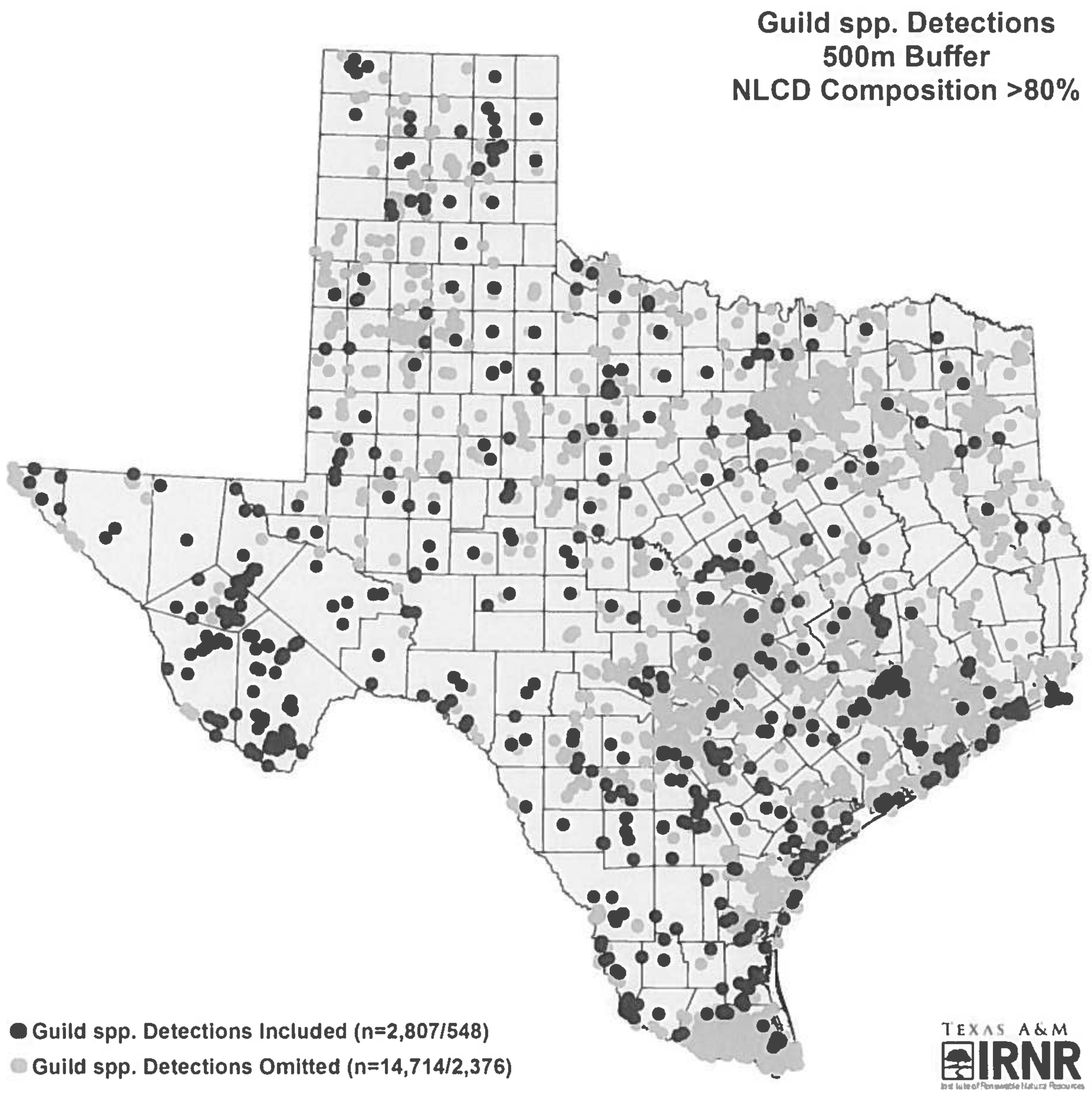


Figure 3. Locations of co-occurring species eBird detection used to model potential Sprague's pipit wintering habitat in Texas.

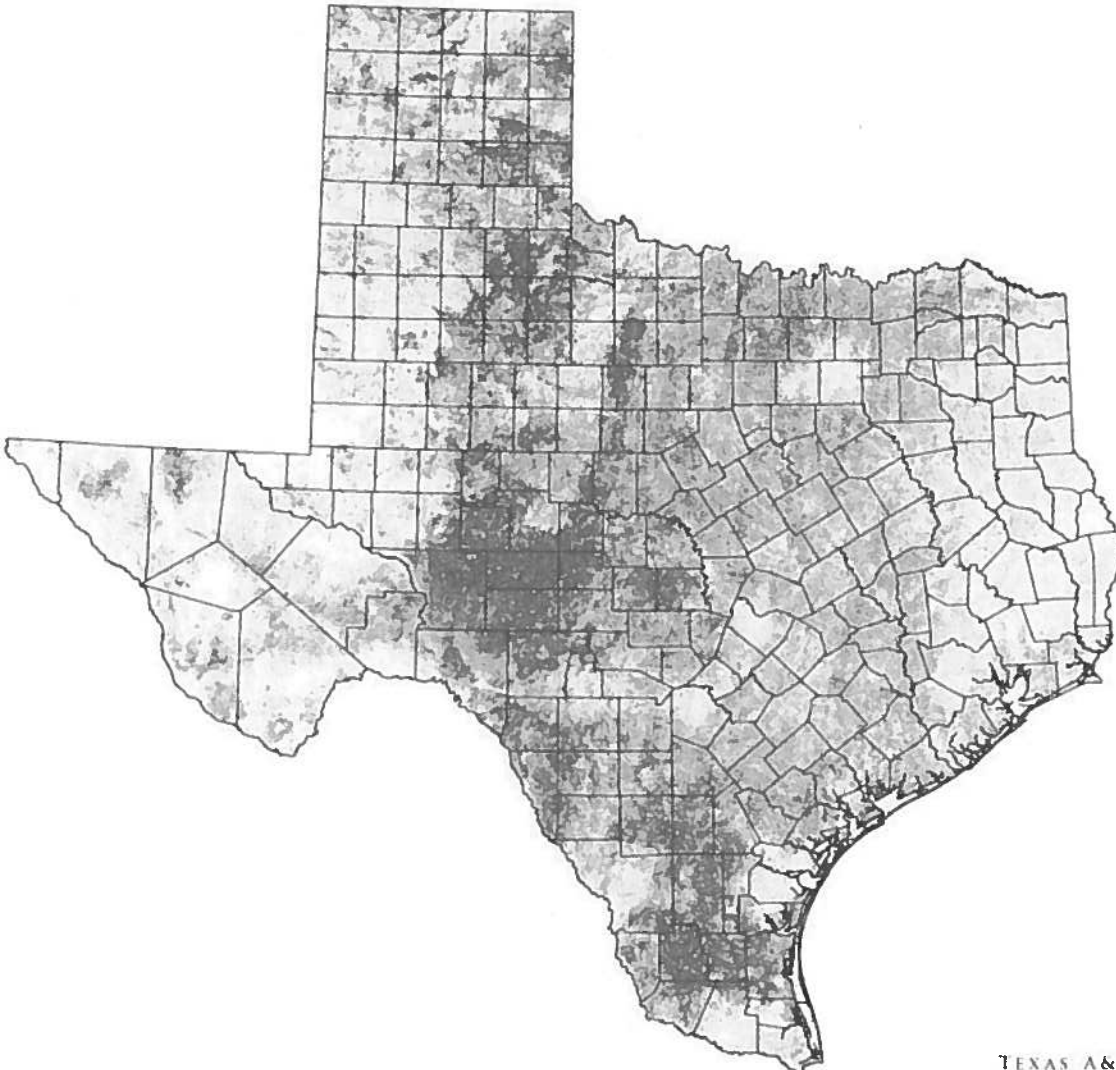


Figure 4. Potential Sprague's pipit winter habitat in Texas delineated using eBird pipit detections and Landsat 8 imagery.

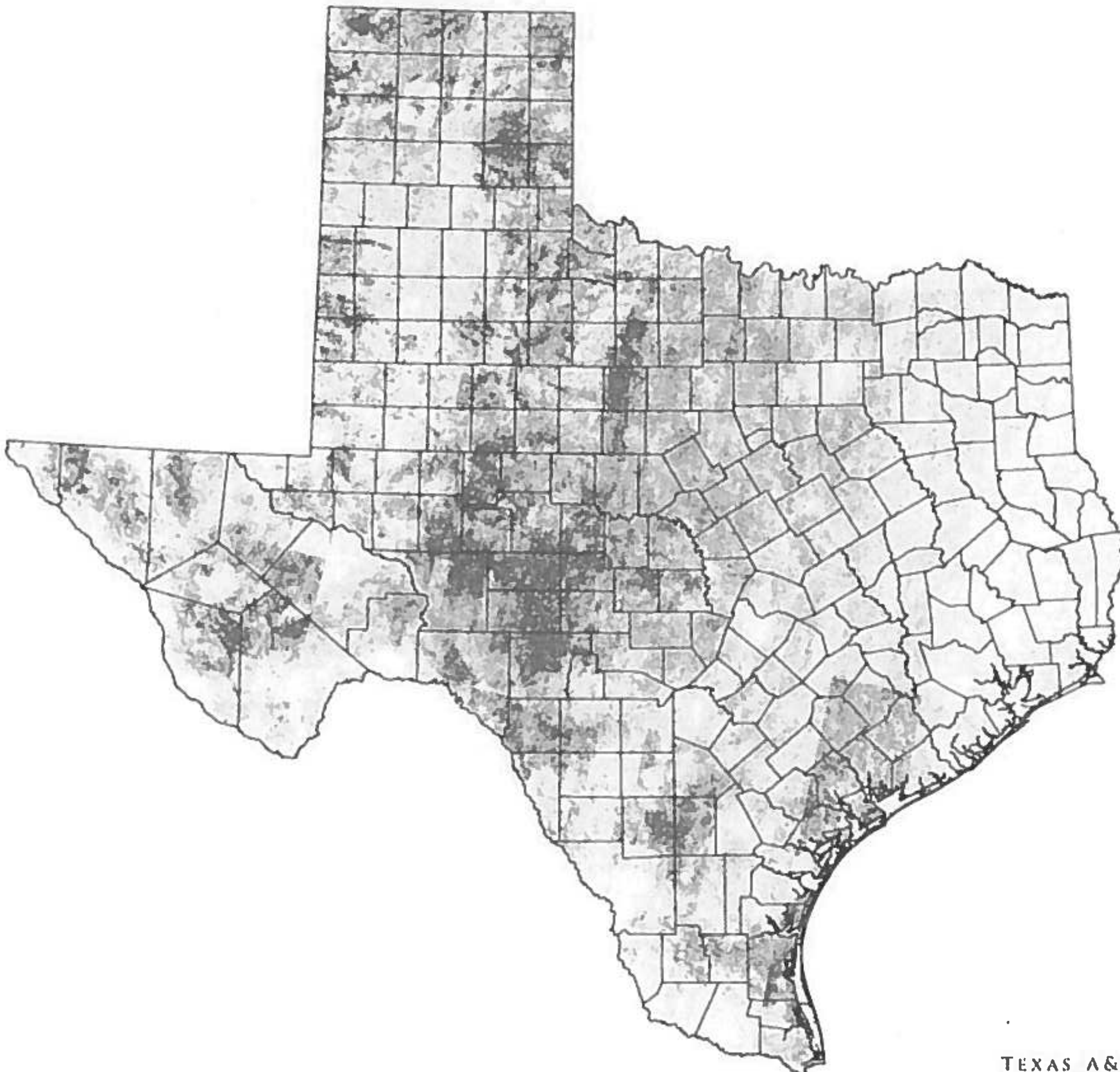


Figure 5. Potential Sprague's pipit winter habitat in Texas delineated using eBird detections for co-occurring species and Landsat 8 imagery.

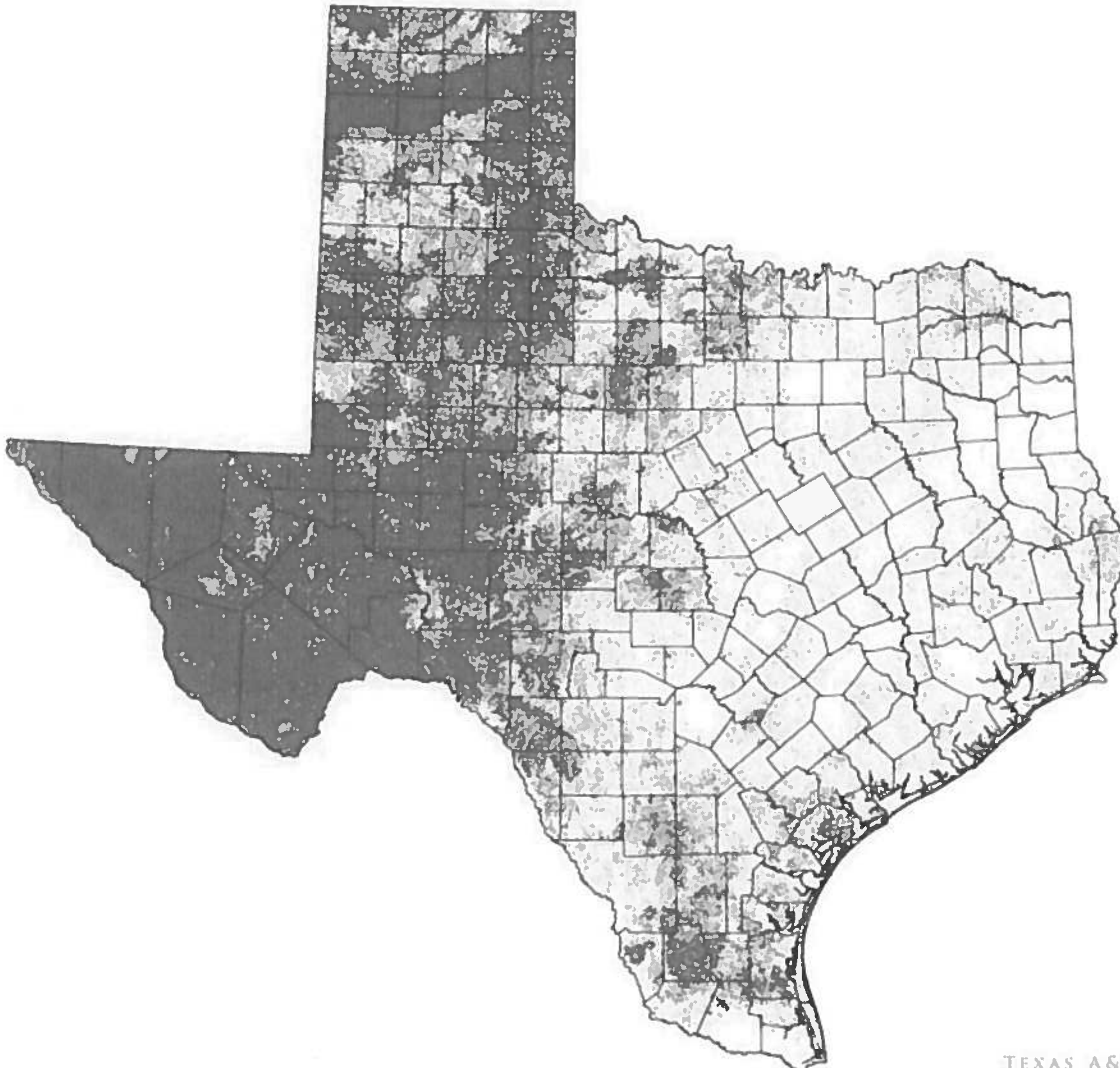


Figure 6. Potential Sprague's pipit winter habitat in Texas delineated using variation in NDVI values.

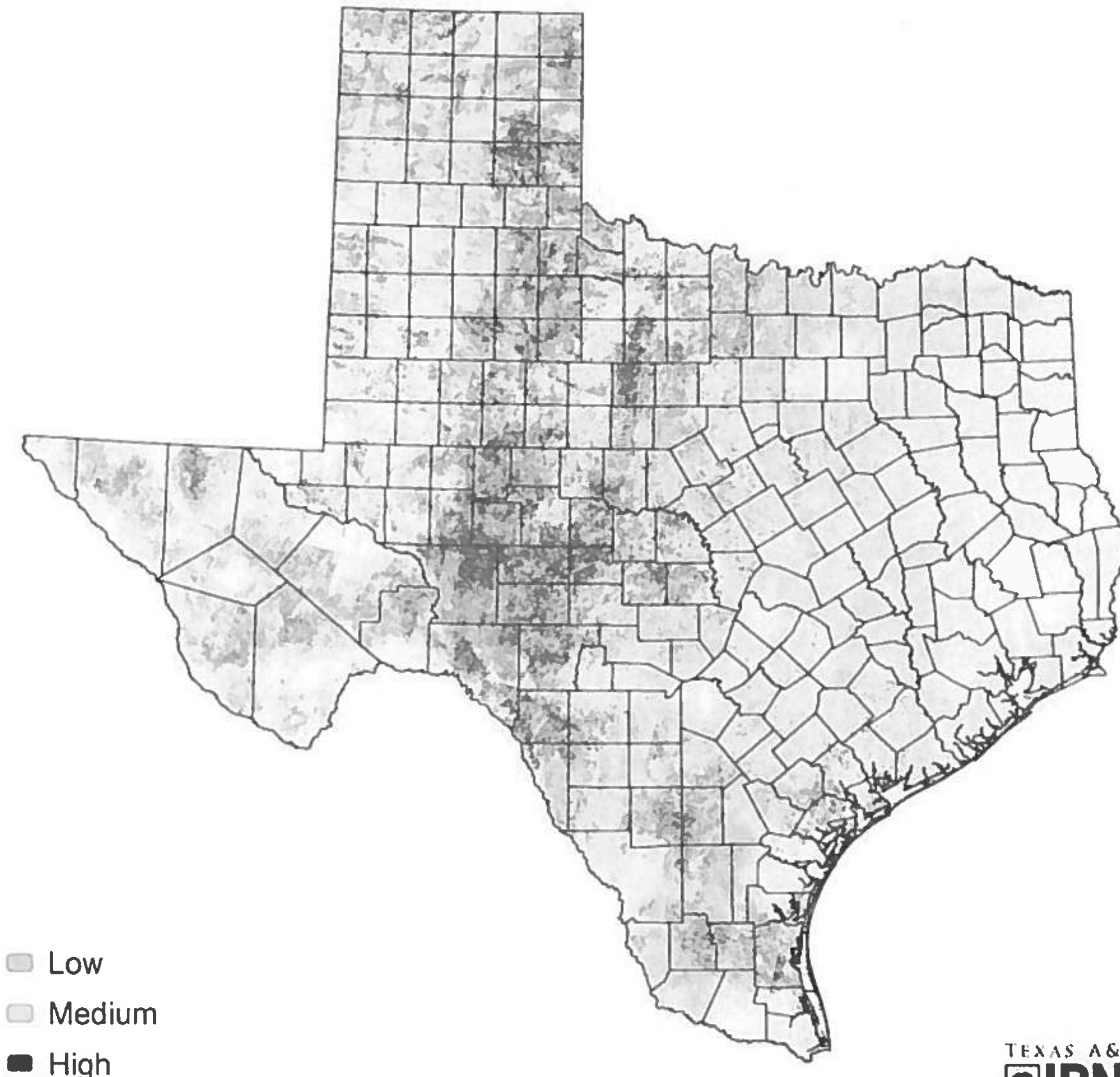


Figure 7. Final composite of Sprague' pipit potential wintering habitat in Texas. Low, medium, and high categories represent the degree of overlap among three independent estimates of potential pipit habitat.

Because each spatial model provided an independent estimate of potential habitat for the Sprague's pipit, congruence among models (areas of overlap) provides increased evidence of habitat likely to support migratory or wintering Sprague's pipits. As such, this algorithm attempts to achieve sensitivity (conservative state-wide estimate of available habitat) while providing for relatively high specificity (identification of habitat based solely upon spectral similarity of known sightings during the winter period). Because these analyses are focused on habitat, they are independent and complimentary to estimates of density and trends in historic relative abundance statewide. However, the final habitat map may contain area outside the realized niche for wintering Sprague's Pipits due to lack of specific autecological factors such as site-specific vegetation structure and composition, temperature, precipitation, soil moisture content or other factors yet to be identified which might constrain the extent of habitat utilized during the wintering period.

While our model represents a data-driven delineation of potential pipit habitat across the state given the available geographically distributed observations, we caution that identifying the realized niche for wintering Sprague's pipit can only be obtained through field studies that account for detection probability (e.g., mark-resight, distance sampling, double-sampling or other methods resulting in a probability density function for detectability) under a probabilistic sampling design. Further, an improved understanding of habitat-resource utilization will require field monitoring or telemetry studies to identify pipit-habitat relationships, minimum patch size requirements, patch occupancy estimates, as well as patch-density estimates by habitat type.

Objective 2: Categorize the potential for grassland conversion per county using an analysis of Texas Land Trends and Ag Census data. Estimate the remaining potential pipit habitat at 20-, 35-, and 50-year increments into the future under best- and worst-case conversion scenarios.

Over the past 150–200 years, grassland bird populations have experienced precipitous declines due to habitat loss and fragmentation (Knopf 1994, Peterjohn and Sauer 1999). Recently, habitat conversion has been identified as the primary threat to pipit population persistence (USFWS 2014, Aron 2015). To help inform broad-scale conservation efforts for the species on their breeding grounds, Lipsey et al. (2015) examined the threat of cropland conversion on pipits in the northern Great Plains. Using a range-wide bird survey data set, information regarding known pipit-habitat relationships on the breeding grounds (Davis et al. 1999, Davis et al. 2006, Fisher and Davis 2010, Sliwinski and Koper 2012), a previously developed cropland suitability model (Smith et al. as cited by Lipsey et al. 2015), and compiled ownership data (Doherty et al. 2013), Lipsey et al. (2015) estimated the regional distribution of pipit populations, assessed vulnerability to future habitat loss under future scenarios of cropland expansion, and explored the relationship between land tenure and pipit population distribution. Results from the breeding grounds indicated that pipits were disproportionately distributed across the landscape (i.e., 75% of the birds occurred within 30% of the study area), that 70% of the breeding pipit population is located on private lands, and that cropland conversion at its current rates is unlikely to result in pipit endangerment within the foreseeable future (Lipsey et al. 2015). This study provides information necessary to implement strategic broad-scale conservation planning and highlights the importance of integrating ecological and land trends data under a risk assessment framework.

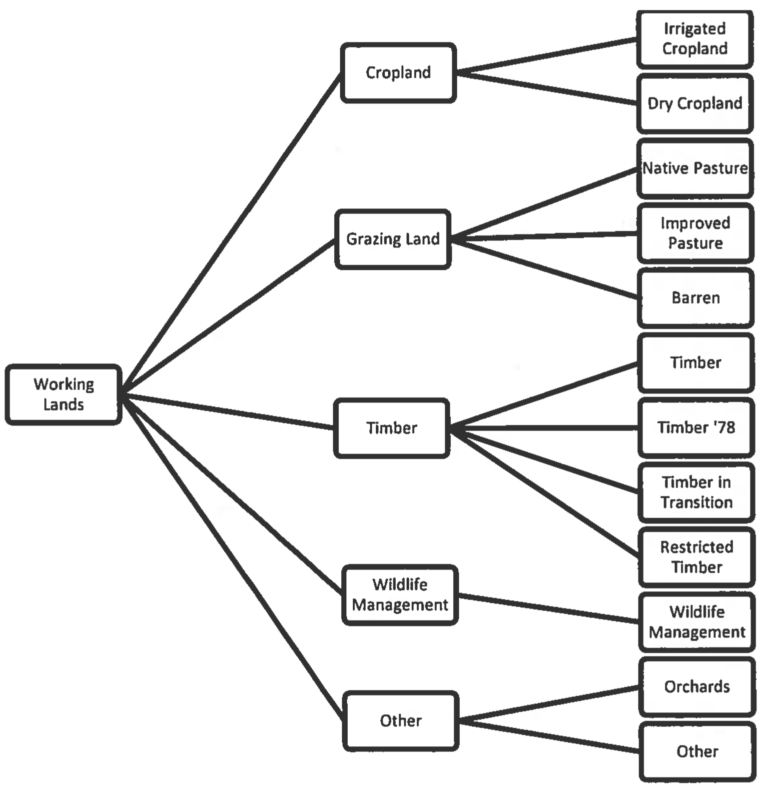
Similar to the breeding grounds, experts identified habitat conversion as the biggest threat to pipits on their wintering grounds (Aron 2015). Research conducted by Pool et al. (2014) on Grassland Conservation Priority Areas suggests that grassland conversion in the central Chihuahuan Desert is occurring at a rate >6% per year. Within Texas, there was a net loss of approximately 1.1 million acres of working lands (1-d-1 agricultural lands by appraisal status) from 1997 to 2012 (Fig. X; Texas Land Trends 2014). Because there is limited published information regarding the distribution and abundance of pipits across their wintering range (but see Pool et al. 2012 for estimates derived from 12 study sites in Mexico and 4 study sites in the U.S.), the potential risk of grassland conversion via agricultural expansion, shrub encroachment, or energy development on pipits is generally unknown. As such, it is difficult to assess the potential risk of habitat conversion to pipits on their wintering grounds in the same detailed manner as Lipsey et al. (2014). To the degree possible, our goals for Objective #2 were to (1) spatially delineate conversion risk for potential pipit wintering habitat using available land trends data at the county level, and (2) estimate remaining potential pipit habitat at 20-, 35-, and 50-year time increments under the best- and worst-case habitat conversion scenarios. We chose this timeframe to coincide with available land trends data and the general timeframe for risk assessments used to inform the USFWS's SSA process (i.e., at least 40 years into the future).

We examined county-scale habitat conversion risk using Texas Land Trends and Ag Census data collected from 1997–2012 (Texas Land Trends 2014). The Texas Land Trends project is conducted every five years following the availability of the USDA NASS Census of Agriculture data, and serves to describe the status and recent changes in land use, ownership size, and land values of privately owned Texas farms, ranches, and forests. These working lands data are compiled through the Texas Comptroller of Public Accounts (Texas Property Tax Assistance Division), which produces an annual compilation of land use and land value data for all independent school districts (ISDs). This ISD-scale data set represents all private lands designated with a 1-d and 1-d-1 appraisal status. 1-d agricultural use status refers to lands devoted to full time agricultural operations where the owner's primary occupation and source of income is derived from agricultural enterprises. 1-d-1 open space status designates lands based solely on the primary use of the land with no consideration for the landowner's income/occupation. The original land use categories and metrics obtained from the Comptroller include:

- D1 (qualified) irrigated cropland (# of acres)
- D1 (qualified) dry cropland (# of acres)
- D1 (qualified) barren / wasteland (# of acres)
- D1 (qualified) orchards (# of acres)
- D1 (qualified) improved pasture (# of acres)

- D1 (qualified) native pasture (# of acres)
- D1 (qualified) timber @ productivity (# of acres)
- D1 (qualified) other ag land (# of acres)
- D1 (qualified) wildlife management (# of acres)
- D1 (qualified) restricted-use timber (# of acres)
- D1 (qualified) timber-in-transition (# of acres)
- D1 (qualified) timber @ 78 market (# of acres)

For Texas Land Trends reporting purposes, this data is statistically adjusted to remove outliers and aggregated to form five major land use classes: cropland, grazing land, timber, wildlife management, and other. The aggregated major land use classes in relation to the original Comptroller categories are as follows:



Values for ISDs that no longer exist due to school district consolidations were retroactively assigned to the new ISD. County-level land use data represents all ISDs whose centroid fell within the county boundary. As such, the total land use area in a given county may exceed the actual area of the county itself.

Fragmentation and conversion of Texas working lands is measured through the loss and percent change in total acres reported by the Texas Comptroller. Working lands undergo conversion when they move from a D1 Qualified Open Space status to any other type of property tax classification. Because these data are reported at the ISD level, we can only say that the land has been converted to non-working land classifications, but cannot track exactly which classification the land is converted to. General property classes and property appraisal classifications are as follows:

- A: Real Property: Single-family residential
- B: Real Property: Multifamily residential
- C1: Real Property: Vacant Lots and Tracts
- C2: Real Property: Colonia Lots and Tracts
- D1: Real Property: Qualified Open-space Land
- D2: Real Property: Farm and Ranch Improvements on Qualified Open-Space Land
- E: Real Property: Rural Land, not Qualified for Open-Space Appraisal, and Residential Improvements
- F1: Real Property: Commercial
- F2: Real Property: Industrial
- G: Real Property: Oil and Gas, Minerals and Other Subsurface Interests
- H1: Tangible Personal Property: Personal Vehicles, Not Used for Business Purposes
- H2: Tangible Personal Property: Goods in Transit
- J: Real and Personal Property: Utilities
- L1: Personal Property: Commercial
- L2: Personal Property: Industrial and Manufacturing
- M: Mobile Homes and Other Tangible Personal Property
- N: Intangible Personal Property
- O: Real Property: Residential Inventory
- S: Special Inventory
- X: Exempt Property

As reported in Texas Land Trends (2014), we examined statewide loss of working lands at 5-year increments from 1997–2012 and total percent change in working lands by county from 1997–2012. Using the total acres of working land for each year analyzed (1997, 2002, 2007, and 2012), we created a two linear regression models to predict working land acreage at 20-, 35-, and 50 years into the future. We developed one regression model as the best-case working lands loss scenario (slope of working land loss from 2007–2012) and one regression model as the worst-case working lands loss scenario (slope of working land loss from 1997–2007) (Figs. 8 and 9). We applied the resulting equations to total working land acres in 1997 to create best- and worst-case scenario prediction maps for 2032, 2047, and 2062 (Figs. 10–13). Because percent change in working lands was <4.8% under each best- and worst-case conservation scenarios at each time-step into the future, and thus difficult to discern in a spatially-explicit context, we present predicted loss as the number of remaining working land acres per county (Figs. 10–13).

Our next step was to examine how risk of working land conversion aligned with potential pipit habitat at the county scale. Using the remotely-sensed map created for Objective #1 (Fig. 7), we identified counties with >50% of their total area designated as having potential pipit habitat. One hundred and ten counties (hereafter "pipit counties") fit this criterion. To be clear, these counties do not represent the full extent of potential pipit habitat identified during our mapping process in Objective #1. Nor should our county-scale delineation be interpreted to represent the relative importance of specific counties to long-term pipit persistence (e.g., there many sites along the Texas coast with long-term records of pipit detections that were not identified in our county-scale analyses). Rather, our pipit counties represent the areas within the state with the largest contiguous grasslands that may support pipits during the wintering season in Texas.

The rate of working lands loss was higher between 1997 and 2007 when compared to the rate of working lands loss between 2007 and 2012 (Fig. 8; Texas Land Trends 2014). The net loss in Texas working lands from 1997–2012 was ~1.1 million acres. The majority of land conversion occurred within urban areas (Fig. 9), which coincides with USDA NRI land trends data (USDA 2013). This trend in conversion of working lands around urban areas continued at each time-step into the future under the best-case and worst-case conversion scenarios. However, the number of counties at highest risk of conversion remained similar across years (Figs. 10–13). Of the 110 pipit counties, 15 were identified as having the highest risk of grassland conversion (Figs. 10 and 12). Most pipit counties at highest risk of conversion occurred in the western portion of the Panhandle or in urban areas of northern Texas (Figs. 10 and 12). Southern counties at highest risk of habitat conversion also occurred near urban areas (Figs. 10 and 12).

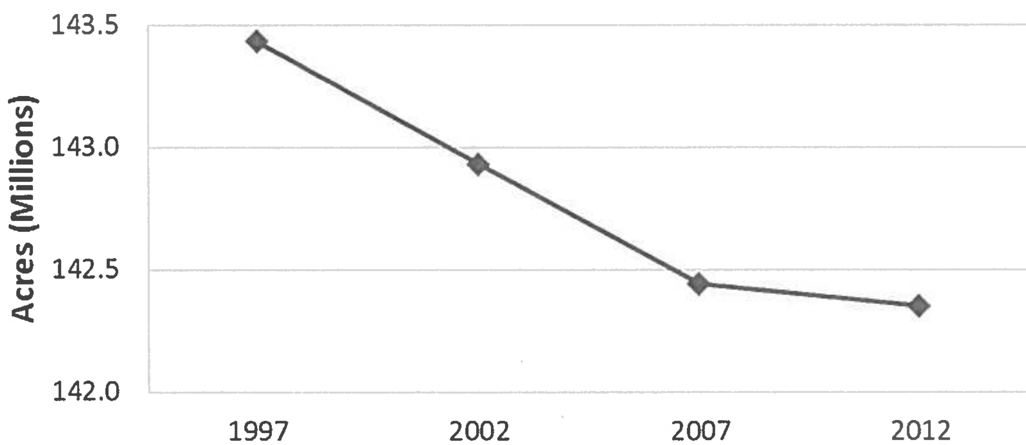


Figure 8. Total working lands in Texas from 1997–2012.

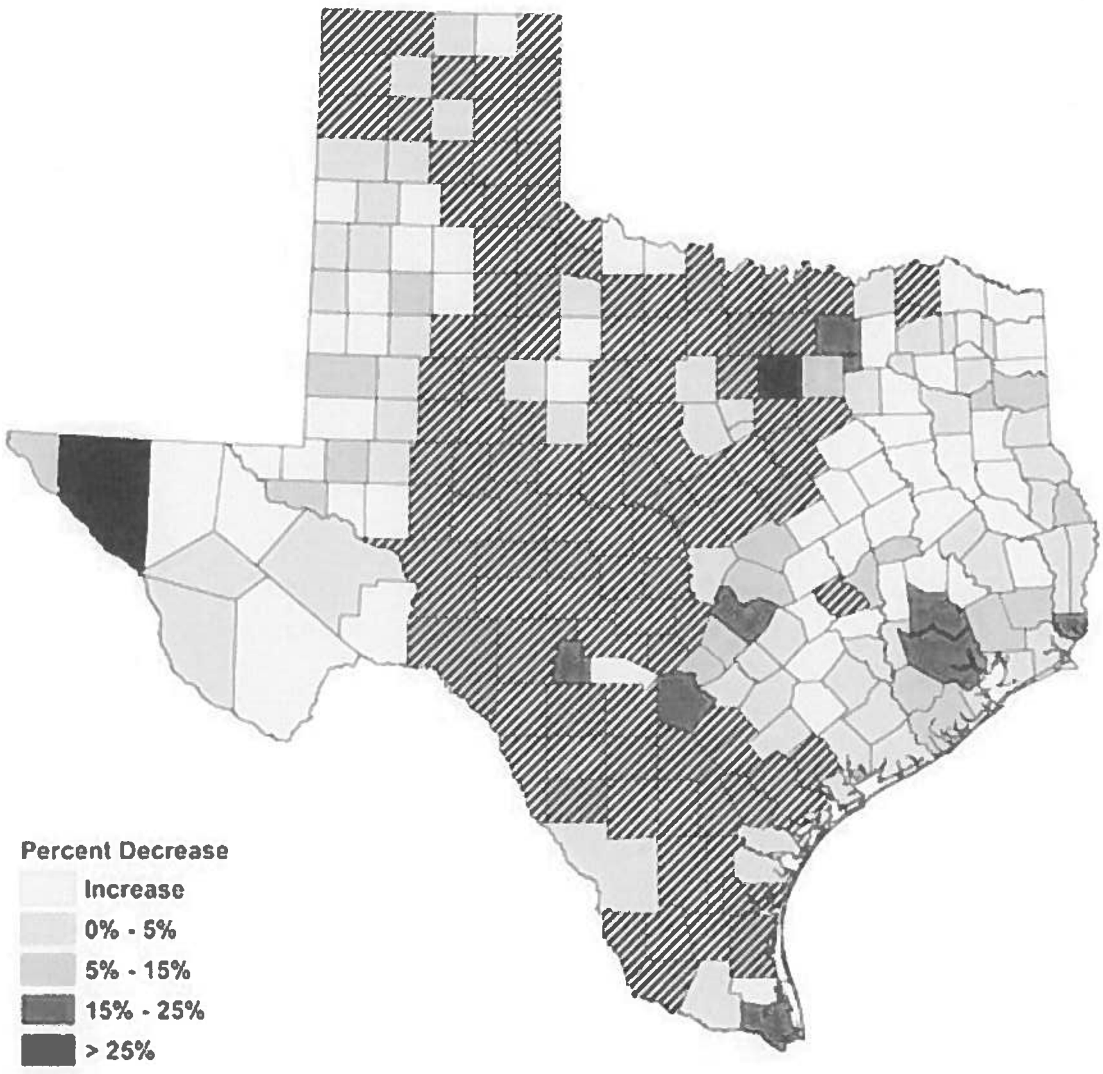


Figure 9. Loss of working lands in Texas from 1997–2012. Counties with >50% of their total area identified as potential Sprague's pipit habitat are represented by black hatching.

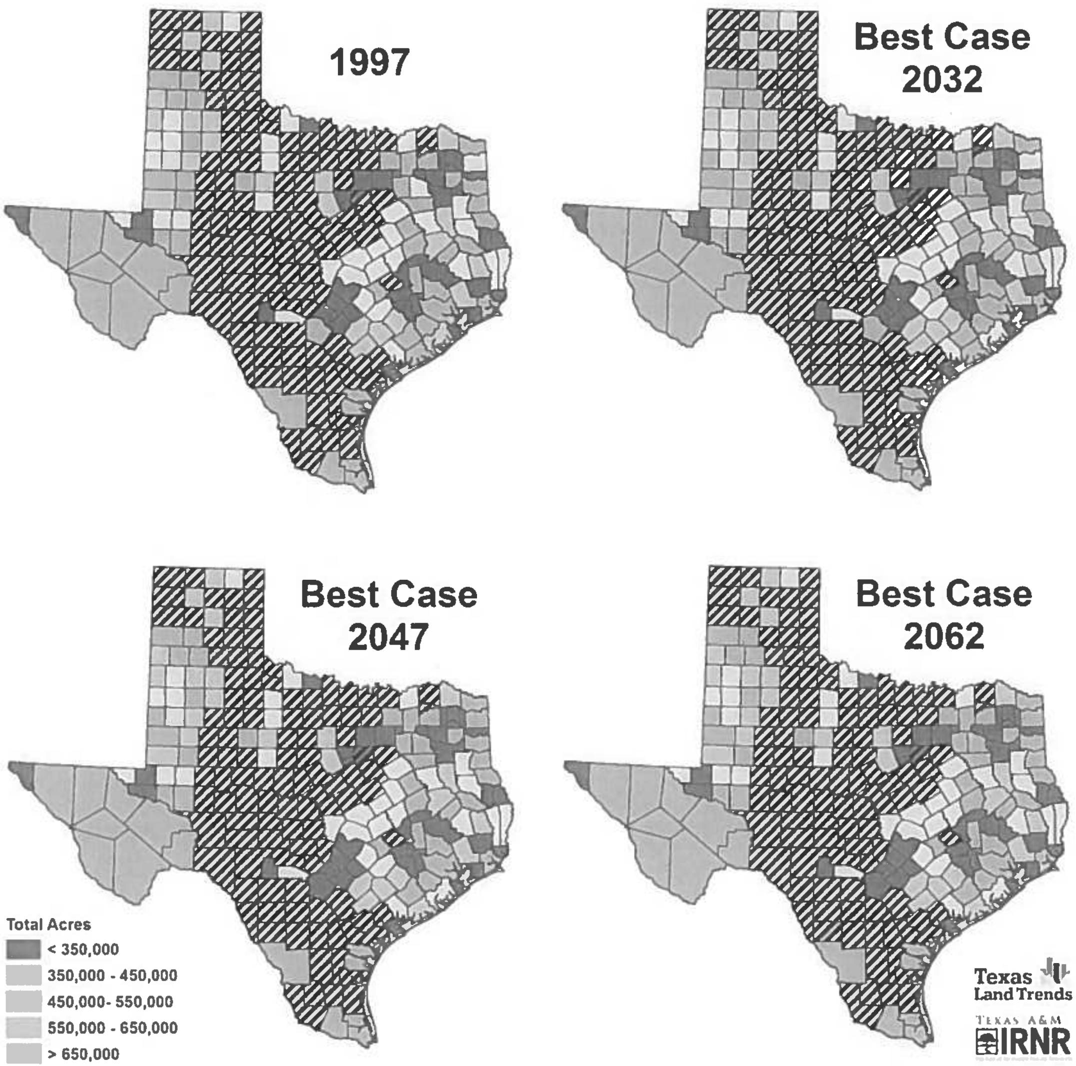


Figure 10. Remaining acres of working land per county in Texas at 20-, 35-, and 50-years into the future under the predicted best-case conversion scenario estimated from the slope of working land loss from 2007 – 2012 (Fig. 8). Counties with >50% of their total area identified as potential Sprague's pipit habitat are represented by black hatching.

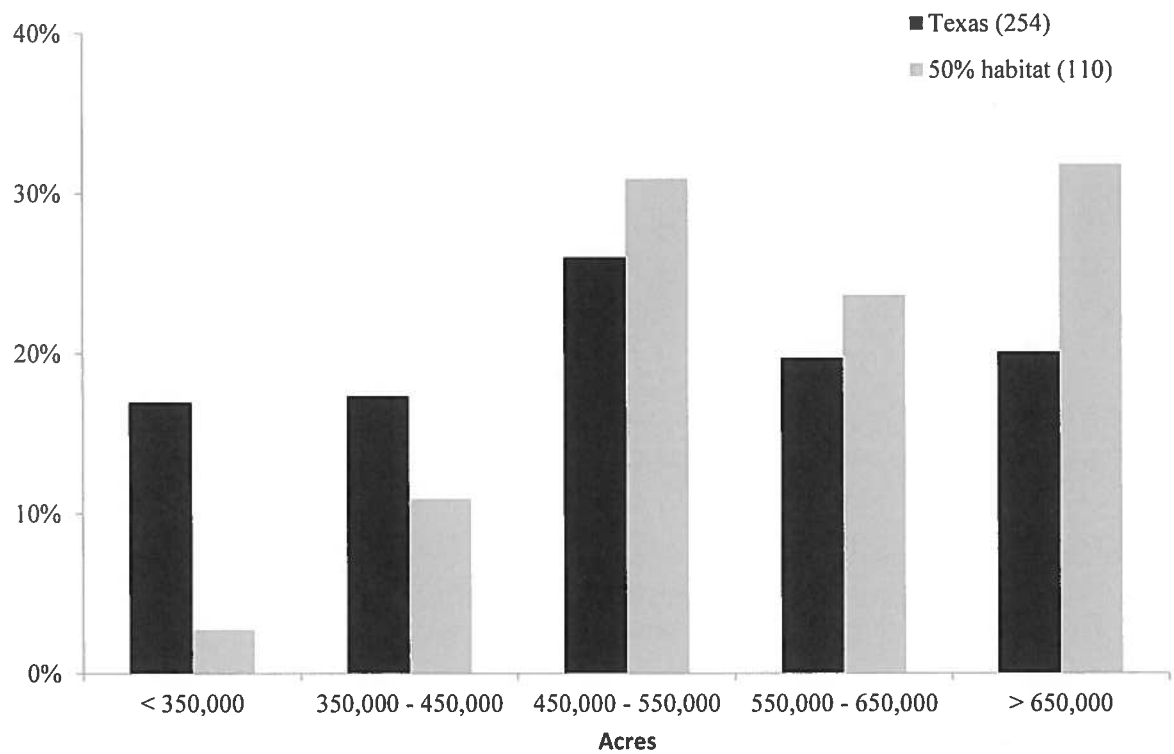


Figure 11. Percentage of Texas counties and percentage of Texas counties with >50% of their area identified as potential Sprague's pipit habitat in relation to the remaining acres of working land per county following 50-years under the best case conversion scenario. Data corresponds to spatial representation in Figure 10.

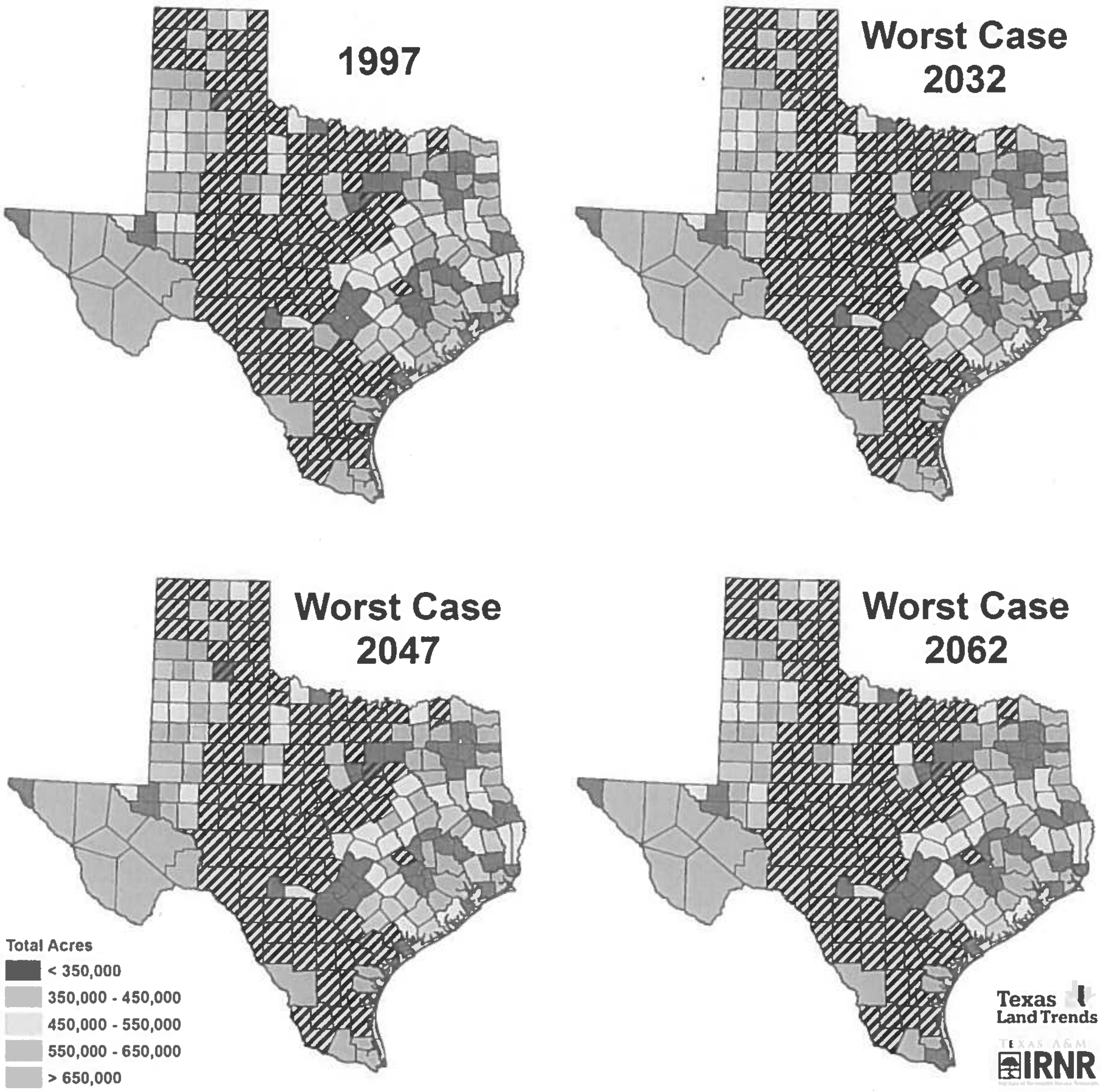


Figure 12. Remaining acres of working land in Texas at 20-, 35-, and 50-years into the future under the worst-case conversion scenario estimated from the slope of working land loss from 1997–2007 (Fig. 8). Counties with >50% of their total area identified as potential Sprague's pipit habitat are represented by black hatching.

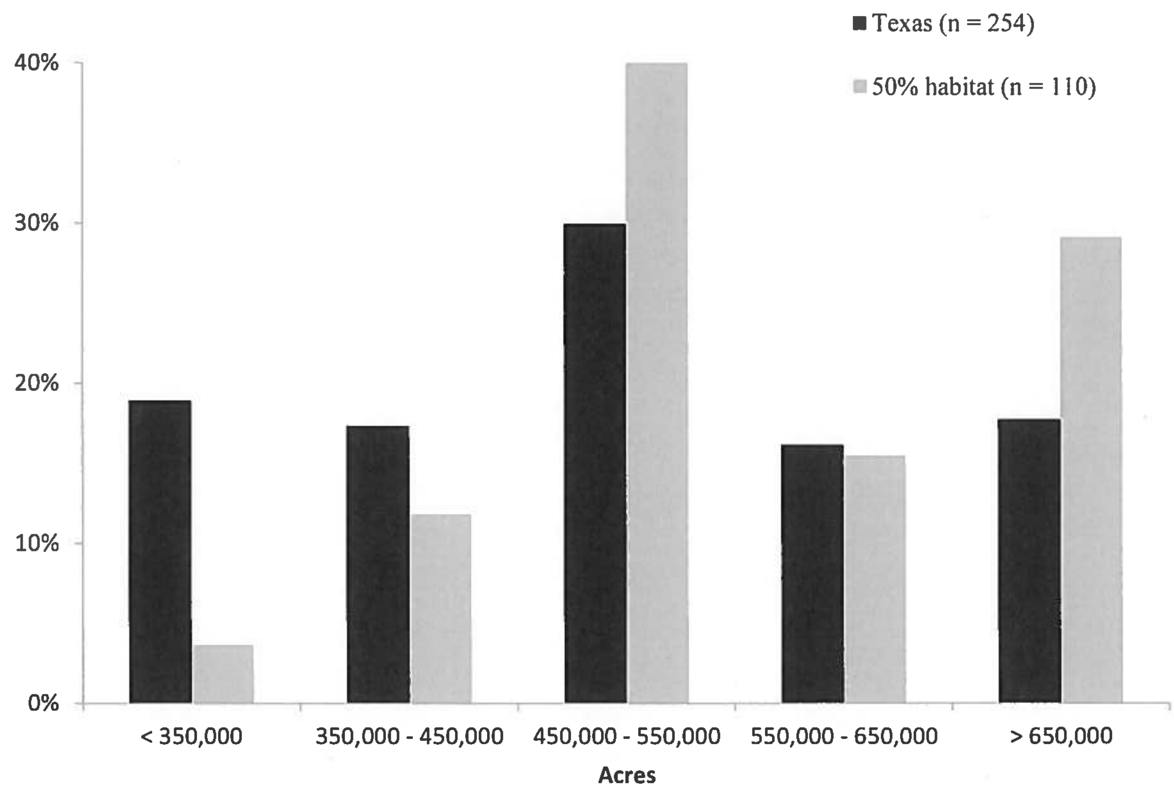


Figure 13. Percentage of Texas counties and percentage of Texas counties with >50% of their area identified as potential Sprague's pipit habitat in relation to the remaining acres of working land per county following 50-years under the wost-case conversion scenario. Data corresponds to spatial representation in Figure 12.

Our working land conversion scenarios suggest that most counties with remaining large tracts of potential pipit habit are at low risk of habitat conversion in the next 50 years. However, as with all data sets, there are caveats and limitations associated with county-scale analyses. First, our identification of potential pipit habitat and subsequent pipit counties is based on remotely sensed imagery and non-randomly collected pipit data as described for Objective #1. This provided an inclusive, conservative estimate of potential wintering pipit habitat across the state based on the best available statewide data. However, other factors (e.g., temperature, precipitation, grassland condition, grass height, patch size, management regime) likely influence the distribution of wintering pipit habitat in Texas. Ground-based data collected across the state would be necessary for development of a predictive occupancy or abundance model for pipits, which would allow for a more accurate representation of how areas at risk of conversion align with pipit wintering habitat. Such data would also help predict region-specific pipit responses to habitat conversion, as conversion in some areas may be more detrimental to pipits than in others.

Our Land Trends data analysis assumed a linear conversion rate for habitat loss across all counties and years. It is likely that habitat conversion rates have an asymptotic maximum associated with population density and the habitat/urban area ratio within each county, and will therefore exhibit anisotrophic variability in both the spatial and temporal dimensions. Because the conversion rates cover a limited temporal period, they may not be representative of future conversion rates due to changes in U.S. demographics as a result of economic fluctuations, climate change, or other factors influencing immigration/emigration. Further, we note that our estimates of risk assume a binary pipit response to land use conversion, and therefore do not take into account differential responses to habitat change. Because so little is known about pipit resource utilization on the wintering grounds, we have no way to predict if alternative land uses may alter pipit preference, and therefore reverse risk trends. Similarly, our risk estimates do not account for ancillary biotic and abiotic threats to pipit wintering habitat including climate change, energy development, and pesticide application, and the responses of pipits to those threats has not been estimated. It is therefore likely that the multivariate interaction of even a few of these unknown factors could alter future habitat trend estimates in an unpredictable manner. As such, additional data on habitat utilization by pipits on the wintering range will be required to improve risk estimates in a meaningful way.

Stabilizing population trend data from the breeding grounds and our working lands conversion scenarios suggest that habitat conversion on the wintering grounds may not be having an immediate or widespread negative effect on pipits. However, seven of the 15 fastest growing cities in the nation are located in Texas (U.S. Census Bureau 2014) and annual population growth in the state increased 36% annually from 1997–2012. Concurrent with increasing loss of working lands near urban areas, land market values increased in rural areas and land ownership size in rural areas decreased (Texas Land Trends 2014). This pattern suggests that land fragmentation in rural areas could influence pipits and other grassland associated species with large minimum patch size requirements. As such, the loss of habitat in rural areas may represent a greater risk to pipit and other grassland birds than similar losses in or near urban areas. Because rates of urban flight may contribute to habitat conversion as the "baby boom" and "generation X" cohorts reach retirement age, habitat conservation efforts is rural areas will likely increase in cost as rural lands are consumed. Federal lands support many species of conservation concern. However, any comprehensive habitat conservation system will require efforts on rural private lands.

Objective 3: Determine the spatial and financial extent of grassland conservation efforts in Texas. Identify how our conservation efforts align with potential pipit habitat and areas at risk of habitat conversion.

Conservation of declining species requires protection and restoration of their habitat (Wilcove et al. 1998). In the United States, numerous laws and regulations (e.g., Endangered Species Act, National Wildlife Refuge Improvement Act) mandate these activities on public and private land, and more than 4,000 public and private organizations dedicate time and financial effort toward conservation of wildlife and their habitat (NWF 2002). Unfortunately, few states have summarized expenditures and acreage for conservation efforts by federal, state, private, and non-profit agencies as a way to evaluate the efficacy of established programs and, to our knowledge, no states have coordinated data collection and analyses across agencies to aid identification of future conservation priorities. In addition, there is no organized way to track additive public and private land conservation efforts by habitat type, which would help inform federal and state listing decisions and resource allocation. Our goals for Objective #3 were to (1) describe public and private land conservation expenditures in Texas, (2) spatially map county-scale acreage and expenditures as an index of grassland conservation efforts across the state, and (3) determine how grassland conservation efforts in Texas align with potential pipit habitat and areas at risk of habitat conversion. Results from this portion of our research will identify the spatial distribution of conservation efforts across grasslands potentially inhabited by pipits in Texas and can serve as a foundation for future grassland conservation projects.

We derived acreage and financial estimates using publically available data and information obtained through consultations with federal, state, private, and non-profit agencies (programs and data summarized in Appendix A). Our acreage and financial estimates include support for acquisition, protection, restoration, and maintenance of grasslands and programs that focus on conservation and management of species that inhabit grasslands during some portion of their life cycle. Statewide acreage estimates represent the spatial extent of formally protected lands, defined as lands protected through simple fee acquisitions (i.e., lands purchased outright), rentals (i.e., short-term agreements that do not ensure long-term protection), and conservation easements (i.e., voluntary agreements with private landowners). County-scale acreage estimates represent the number of formally protected and actively managed acres that contribute to grassland conservation efforts. Acreage from a single property that received treatments under more than one program during the reporting period are included for every program that provided services to support grassland conservation efforts on the property (e.g., 100 acres enrolled in a federally supported grassland conservation program from 2010–2012 and actively managed by a non-profit organization from 2014–2015 is represented as 200 acres toward grassland conservation efforts). To the degree possible, we excluded duplicate acreage estimates for the same property reported by multiple agencies for the same activities (e.g., if federal and state agencies cooperated on management activities for the same property and both agencies reported these actions independently, we included the acreage estimates once in our calculations). We took a similar approach when estimating expenditures toward grassland conservation efforts at the state and county scales. We generated most data for efforts that occurred between 2010 and 2015. However, due to reporting constraints, our federal estimates include a minimum estimate of acreage and funding for the Conservation Reserve Program (administered by the Farm Service Agency) for efforts that occurred between 1996 and 2015. County-scale acreage and funding estimates should be interpreted as a minimum index of effort, not exact calculations, due to the data caveats and limitations outlined below.

Grassland conservation efforts in Texas are supported by 13 federal programs, 10 state programs, 33 non-profit and private organizations, and 5 multiagency programs (Appendix A). Information obtained from federal, state, private, and non-profit agencies and programs indicate that there are ~6.7 million acres of formally protected land in the state of Texas (Fig. 14). Eighty-five percent (~5.7 million acres) of the formally protected land is located on public property and 15% (~990,000 acres) of formally protected land is located on private property. We estimate that ~1.7 million acres (25%) of formally protected land overlaps with potential pipit habitat (1.3 million acres [76%] on public land and 395,000 acres [24%] on private property). Federal, state, private, and non-profit agencies and programs have invested ~$146 million in grassland conservation efforts on ~6 million acres of public and private land (Table 1).

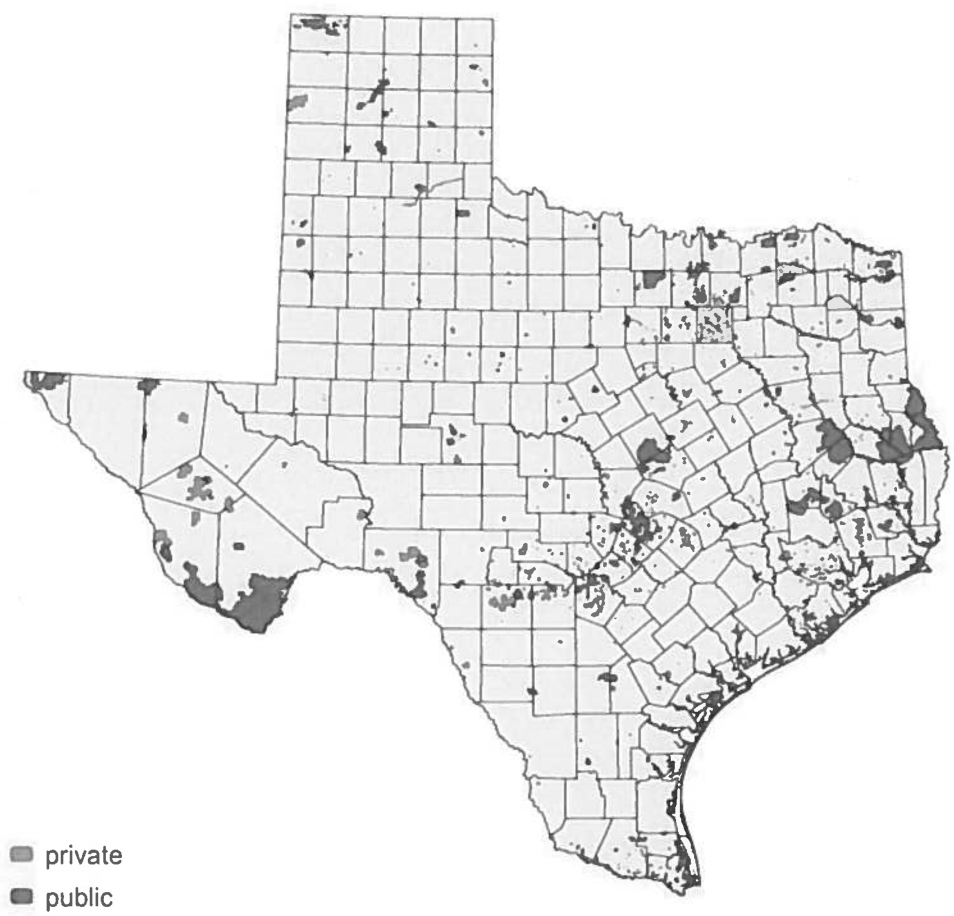


Figure 14. Distribution of formally protected land in Texas as reported in August 2015.

Table 1. Acreage and funding investment per agency on public and private lands in Texas (2010–2015).

Agency	Acreage	Expenditures
Federal[1]	4,184,356	$129,703,765
State	625,029	$4,624,469
Non-profit/Private	1,147,581	$11,932,498
Total	5,956,966	$146,260,732

[1] Federal estimate includes Conservation Reserve Program (administered by the Farm Service Agency) acreage (2,770,631 acres) and expenditures (minimum estimated as $95,721,519) from 1996–2015.

Grassland conservation activities occurred on 5,000–50,000 acres of public and private lands within ~50% of Texas counties and on >50,000 acres of public and private lands within ~10% of Texas counties (Figs. 15 and 16). In terms of funding, $100,000–$1,000,000 was invested in grassland conservation activities on public and private lands within ~45% of Texas counties and >$1,000,000 was invested on public and private lands within 15% of Texas counties (Figs. 17 and 18). In general, more acres were subject to grassland conservation activities and more funding was expended toward grassland conservation in the western portion of the state when compared to the eastern portion of the state (Figs. 15 and 17). This pattern is congruent with the distribution of grassland across the state of Texas and reflects the distribution of effort and funds from FSA and NRCS administered programs as well as species-specific conservation priorities. With some exceptions, urban areas received higher relative grassland conservation effort and funding when compared to rural counties in the surrounding region (Figs. 15 and 17). We also examined gross funding per acre (calculated as the number of acres invested in grassland conservation efforts divided by the number of dollars invested in grassland conservation efforts per county) as an indicator of the economic costs associated with grassland conservation efforts, specifically acquisition and rentals. As expected, the economic costs for grassland conservation are higher near urban areas (e.g., San Antonio, Dallas, Houston), which reflects trends in land market values for those portions of the state (Figs. 19 and 20; Texas Land Trends 2014). Conversely, estimates of funds per acre suggest that the economic costs of grassland conservation efforts are lower in less developed areas where larger tracts of contiguous grassland vegetation needed by most grassland dependent species are more likely to occur (Figs. 19 and 20; Texas Land Trends 2014).

We examined how grassland conservation efforts aligned with potential pipit habitat at the county scale. Using the remotely-sensed map created for Objective #1 (Fig. 7), we identified counties with >50% of their total area designated as having potential pipit habitat. One hundred and ten counties (hereafter "pipit counties") fit this criterion. To be clear, these counties do not represent the full extent of potential pipit habitat identified during our mapping process in Objective #1. Nor should our county-scale delineation be interpreted to represent the relative importance of specific counties to long-term pipit persistence (e.g., there many sites along the Texas coast with long-term records of pipit detections that were not identified in our county-scale analyses). Rather, our pipit counties represent the areas within the state with the largest contiguous grasslands that may support pipits during the wintering season in Texas.

Grassland conservation activities occurred on 5,000–50,000 acres of public and private lands within ~70% of the identified pipit counties and on >50,000 acres of public and private lands within 5% of the identified pipit counties (Figs. 15 and 16). In terms of funding, $100,000–$1,000,000 was invested in grassland conservation activities on public and private lands within ~70% of identified pipit counties and >$1,000,000 was invested on public and private lands within ~15% of identified pipit counties (Figs. 17 and 18). In general, more acres were subject to grassland conservation activities and more funding was expended toward grassland conservation in the northwestern and southern pipit counties when compared to other pipit counties (Figs. 15 and 17). This pattern reflects the distribution of effort and funds from FSA and NRCS administered programs and site-specific conservation priorities. With some exceptions, urban areas received higher relative grassland conservation effort and funding when compared to rural counties in the surrounding region (Figs. 15 and 17). Again, we examined gross funding per acre (calculated as the number of acres invested in grassland conservation efforts divided by the number of dollars invested in grassland conservation efforts per county) as an indicator of the economic costs associated with grassland conservation efforts within the pipit counties, specifically acquisitions and rentals. Economic costs for grassland conservation were higher for pipit counties near urban areas, which reflects trends in land market values for those portions of the state (Figs. 19 and 20; Texas Land Trends 2014). Conversely, estimates of funds per acre suggest that the economic costs of grassland conservation efforts are lower in less developed areas where larger tracts of contiguous grassland vegetation needed by most grassland dependent species are more likely to occur (Figs. 19 and 20; Texas Land Trends 2014).

Finally, we examined how funding per acre (i.e., economic costs for grassland conservation) aligned with pipit counties at highest risk of conversion as identified by our worst-case scenario for the 3rd time interval (i.e., 2062) in Objective #2 (Fig. 12). Of the 110 pipit counties, 15 were identified as having the highest risk of grassland conversion (Fig. 21). Most pipit counties at highest risk of conversion occurred in the western portion of the Panhandle or in urban areas of northern Texas where economic costs for conservation are high in comparison to other pipit counties (Fig. 21). Southern counties at highest risk of habitat conversion also occurred near urban areas where economic costs for grassland conservation are relatively high (Fig. 21).

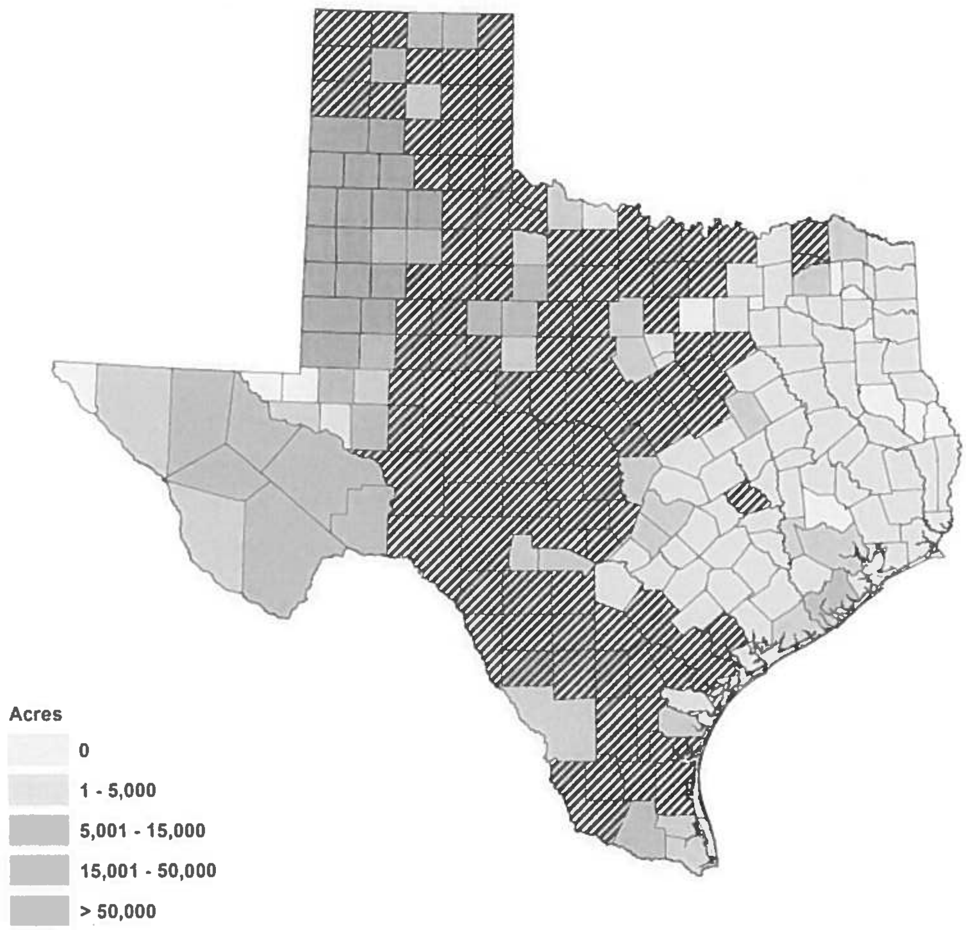


Figure 15. Gross acreage per county invested in grassland conservation efforts in Texas. Counties with >50% of their total area identified as potential Sprague's pipit habitat are represented by black hatching.

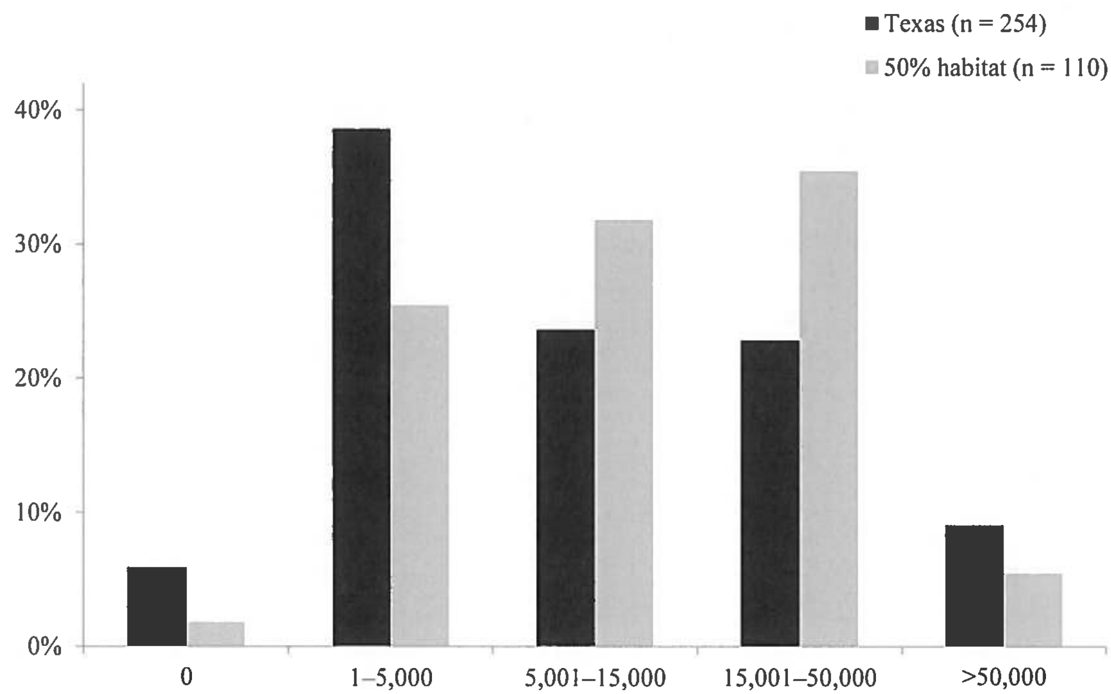


Figure 16. Percentage of Texas counties and percentage of Texas counties with >50% of their area identified as potential Sprague's pipit habitat per gross acreage category. Data corresponds to spatial representation in Figure 15.

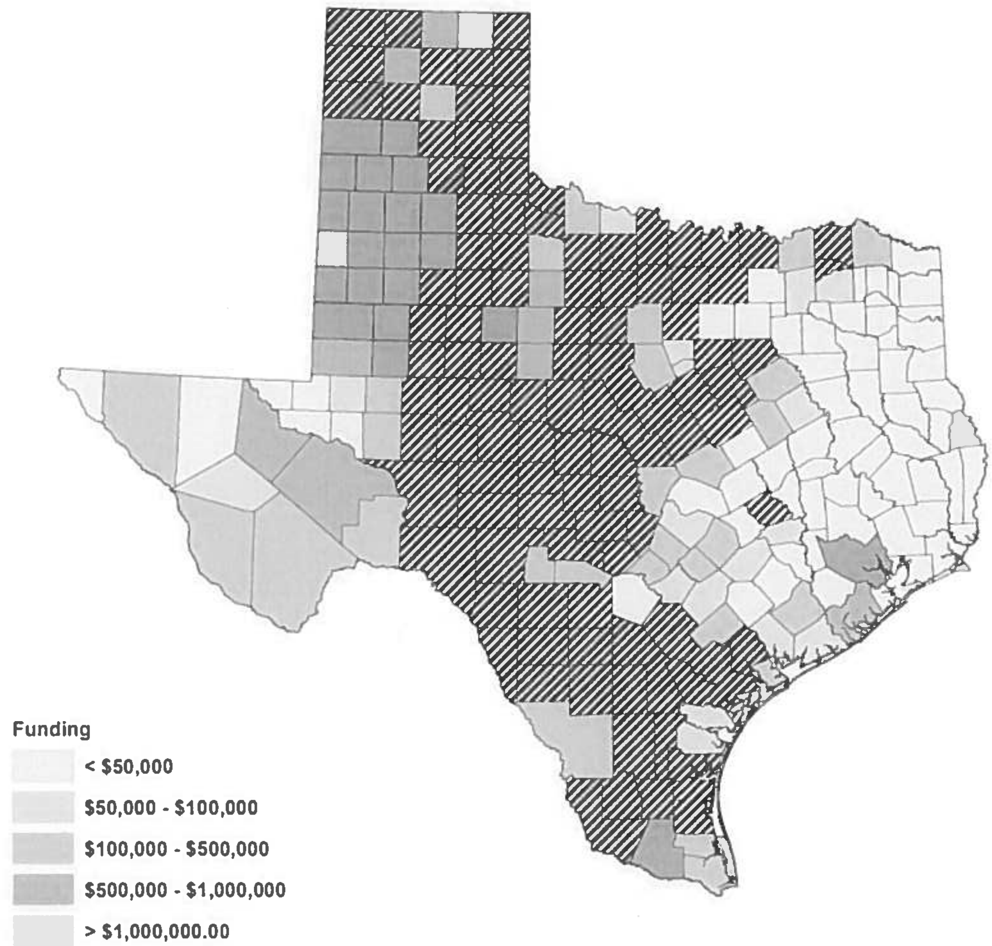


Figure 17. Gross funding per county invested in grassland conservation efforts in Texas. Counties with >50% of their total area identified as potential Sprague's pipit habitat are represented by black hatching.

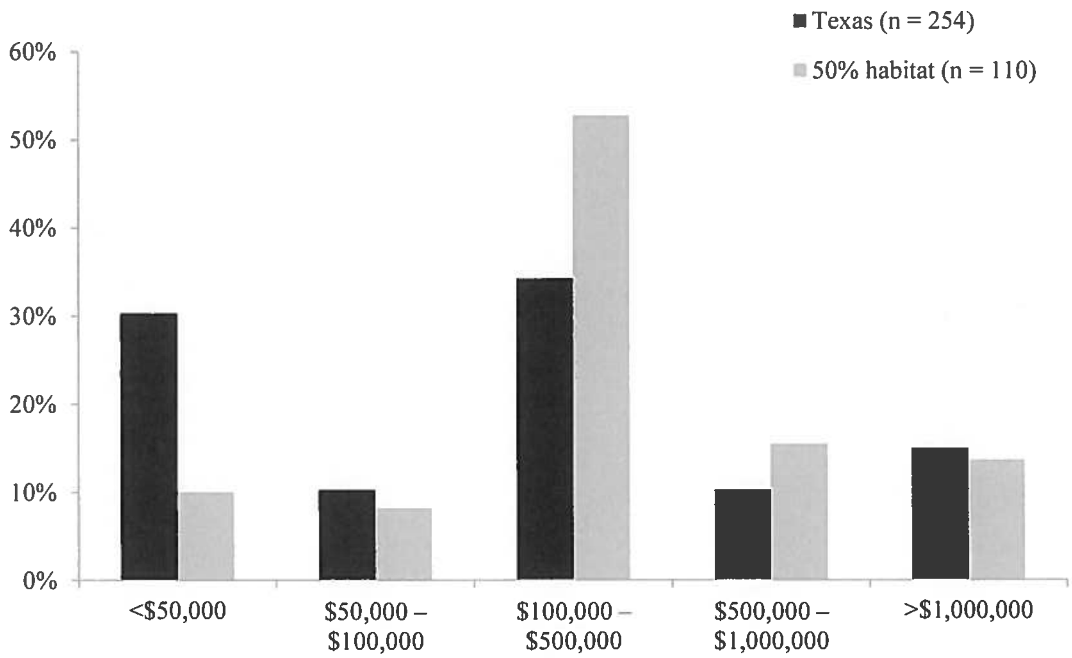


Figure 18. Percentage of Texas counties and percentage of Texas counties with >50% of their area identified as potential Sprague's pipit habitat per gross funding category. Data corresponds to spatial representation in Figure 17.

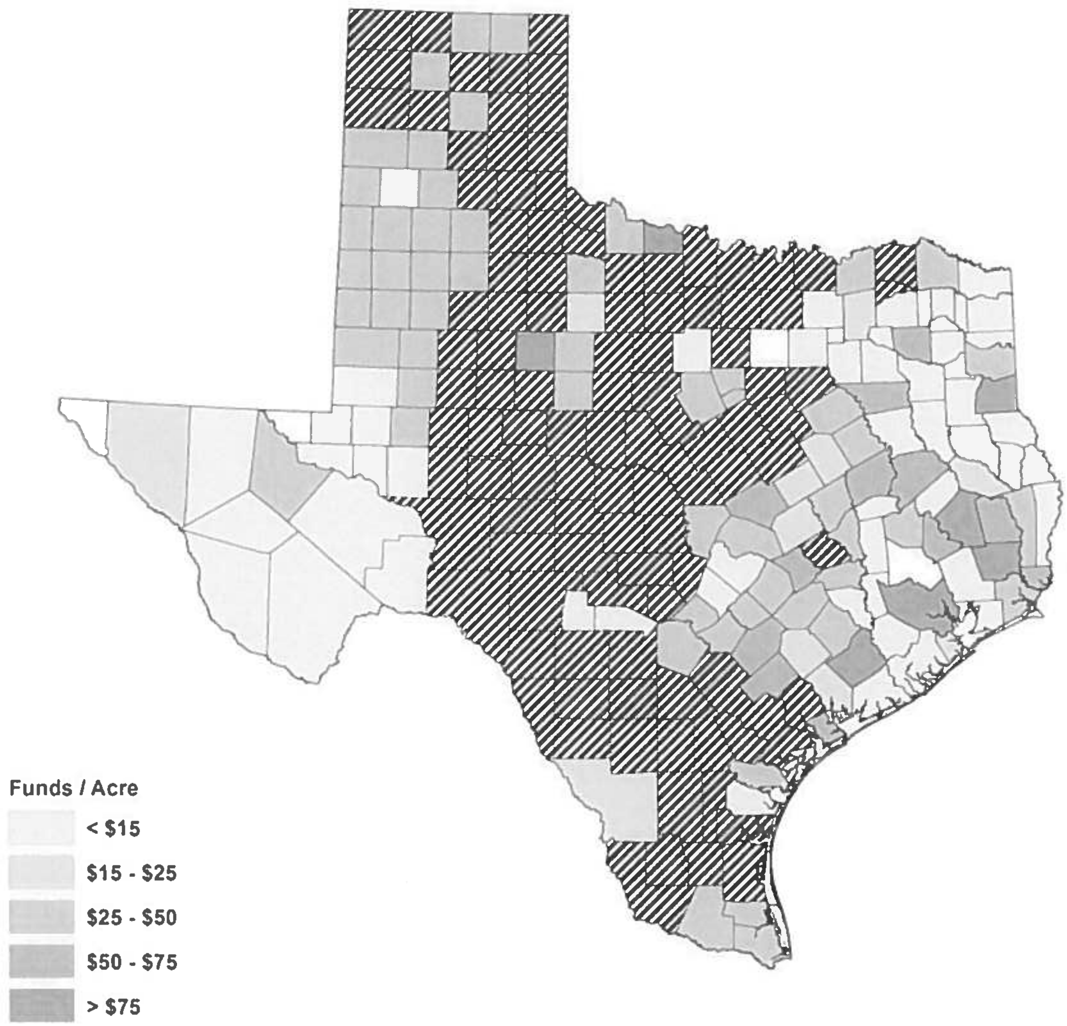


Figure 19. Gross funding per acre invested in grassland conservation efforts in Texas. Counties with >50% of their total area identified as potential Sprague's pipit habitat are represented by black hatching.

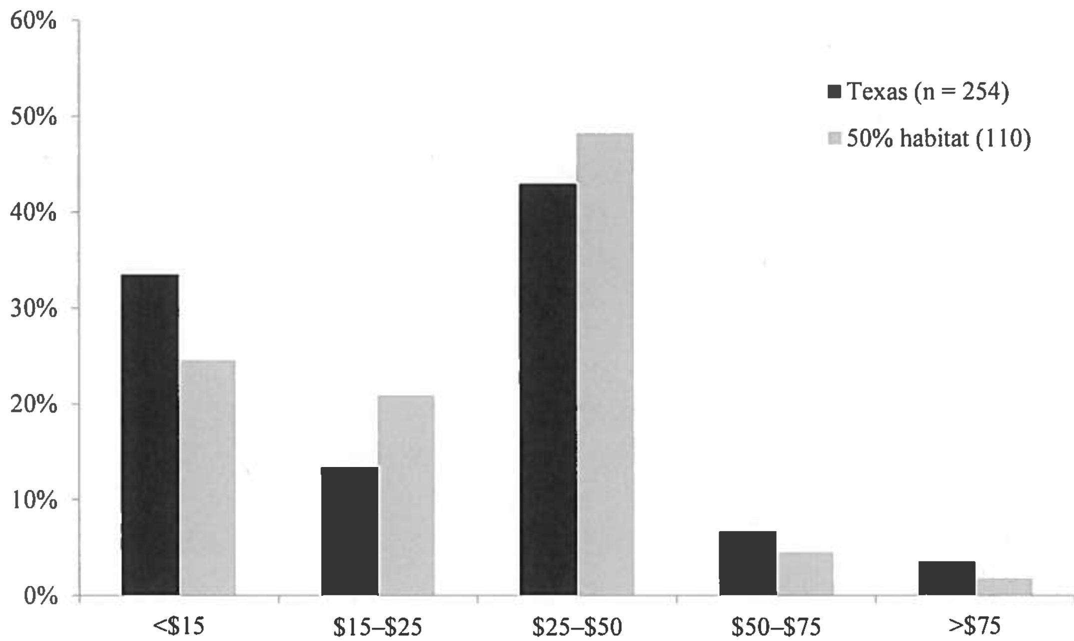


Figure 20. Percentage of Texas counties and percentage of Texas counties with >50% of their area identified as potential Sprague's pipit habitat per gross funding/acre category. Data corresponds to spatial representation in Figure 19.

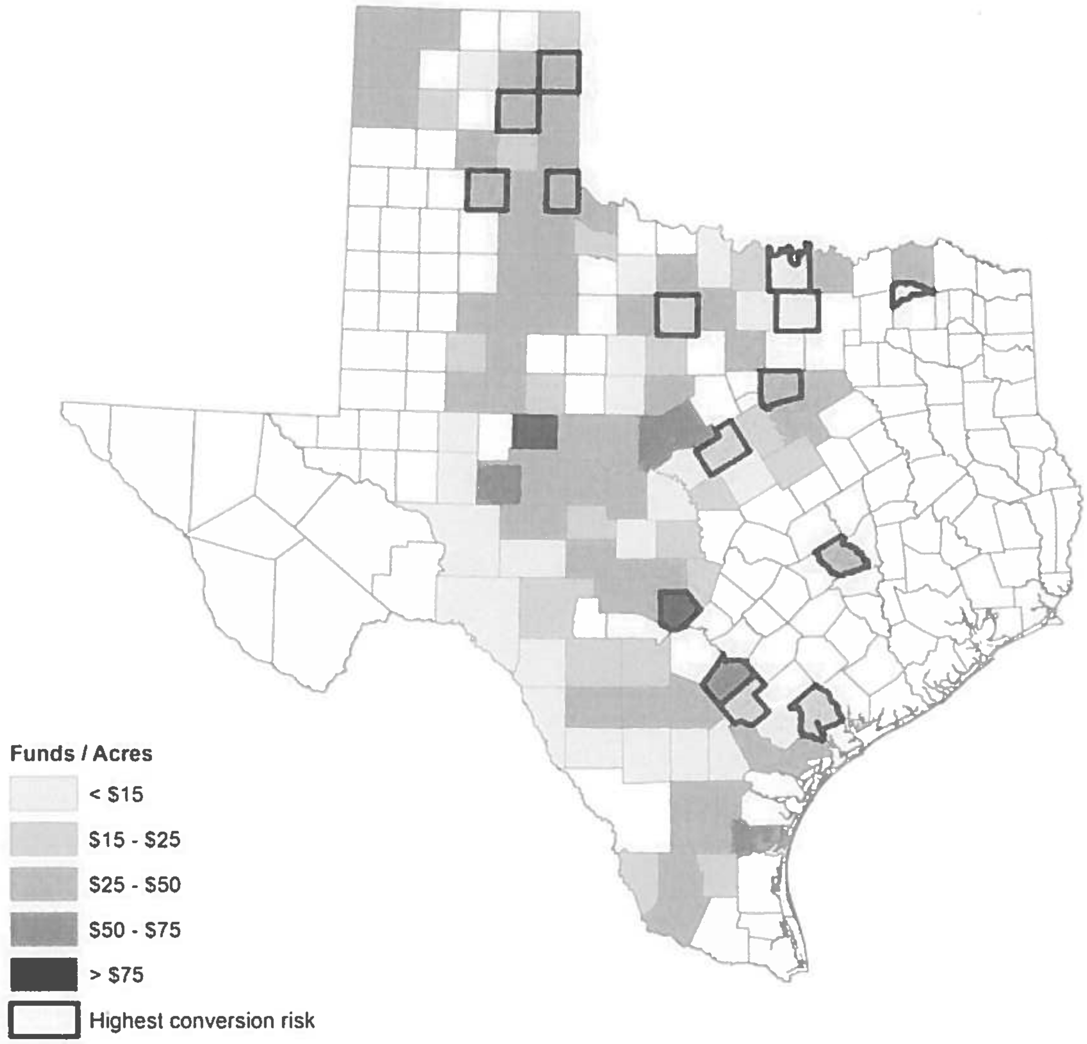


Figure 21. Gross funding per acre invested in grassland conservation efforts and areas with the highest conversion risk in relation to counties with >50% of their total area identified as potential pipit habitat in Texas.

The general patterns we found in relation to grassland conservation efforts and economic costs of grassland conservation across Texas and counties identified with >50% of their total area identified as potential pipit habitat are intuitive. However, as with all data sets, there are caveats and limitations associated with county-scale analyses. First, our identification of potential pipit habitat and subsequent pipit counties is based on remotely sensed imagery and non-randomly collected pipit data as described for Objective #1. This provided an inclusive, conservative estimate of potential wintering pipit habitat across the state based on the best available statewide data. However, other factors (e.g., grassland condition, grass height, patch size, management regime) likely influence the distribution of wintering pipit habitat in Texas. Ground-based data collected across the state could aid development of a predictive occupancy or abundance model for pipits, which would allow for a more accurate representation of how Texas' grassland conservation efforts align with pipit wintering habitat and areas at risk of habitat conversion.

Second, there is no organized or consistent reporting method used by all federal, state, private, and non-profit organizations. As such, there is a great deal of variation in acreage and expenditure estimates provided by the various agencies and programs, including annual versus cumulative estimates, specific location information, security of the funds (e.g., long-term vs short-term investments), overlapping claims, inflated estimates, and indistinguishable contributions towards grassland on properties with more than one managed vegetation type. We removed duplicate and unsubstantiated acreage and expenditure estimates from our data set, but acknowledge that there is a degree of uncertainty associated with the compilation process. In addition, there are organizations that are still compiling data for this section of our report, as well as missing data from entities that declined our request. Thus, we reiterate that our data for Objective #3 represents a minimum index of grassland conservation efforts, not exact values. Additional time and effort to resolve some of these confounding factors could aid more accurate and precise determination of grassland conservation effort per county.

Most importantly, while we have identified general trends, responses of pipits to grassland conservation efforts in Texas are unknown. We are also unable to account for grassland management activities on private lands that are not enrolled in formal programs. USFWS suggests that most protected pipit wintering habitat in the U.S. exists as large grassland tracts on public lands and on a small number of protected grassland areas in Mexico (Jones 2010). However, given that >90% of land in Texas is privately owned and that large contiguous grassland tracts of grassland do still remain, unreported grassland management activities on private lands may benefit Sprague's pipit, but cannot be accurately accounted for at the statewide scale. Maintaining existing grassland in light of increasing property fragmentation as identified in the most recent Texas Land Trends report (2014) is essential to maintenance of pipit habitat on their wintering grounds in Texas.

Conservation decisions rarely include spatially-explicit, data-driven identification of areas where current management efforts are sufficient and risks are relatively high, or a comprehensive evaluation of the economic costs necessary to implement region-specific activities. This is, in part, because historic data are difficult to find. In addition, there is no standardized organization or reporting methodology and there are privacy issues that must be addressed and accounted for during the data compilation process. Regardless, prioritization and economic costs implicitly drives the distribution of effort and effectiveness of our conservation actions. From a strategic planning standpoint, our results from Objective #3 should be used as a baseline to increase the efficacy of grassland conservation efforts that benefit the pipit and other grassland associated species and should highlight the utility of developing a formal tracking system that would aid USFWS and state agencies during the decision making process. This effort to integrate ecological, lands trends, and economic analyses into conservation planning could further benefit from an additive evaluation of conservation effectiveness, as dollars and effort may not reflect the true value of our conservation measures.

CONCLUSIONS

Because we highlighted limitations and conclusions throughout, we provide a summary of management implications here:

- Our model represents a data-driven delineation of potential pipit habitat across the state of Texas given the available geographically distributed observations. However, statewide field studies that account for detection probability under a probabilistic sampling design are necessary to identify the realized niche of the pipit and, thus, produce a more accurate model of pipit wintering habitat in Texas.

- Stabilizing population trend data from the breeding grounds and our working lands conversion scenarios suggest that habitat conversion on the wintering grounds may not be having an immediate or widespread negative effect on pipits outside of urban settings. However, land fragmentation in rural areas could influence pipits and other grassland associated species with large minimum patch size requirements. Effective conservation of grasslands and grassland-associated species like the Sprague's pipit will require efforts on rural private lands, which are experiencing increased rates of ownership fragmentation in Texas.

- Grassland conservation efforts in Texas are supported by 13 federal programs, 10 state programs, 33 non-profit and private organizations, and 5 multiagency programs. Information obtained from federal, state, private, and non-profit agencies and programs indicate that there are ~6.7 million acres of formally protected land in the state of Texas. Eighty-five percent (~5.7 million acres) of the formally protected land is located on public property and 15% (~990,000 acres) of formally protected land is located on private property. In recent years, federal, state, private, and non-profit agencies and programs have invested ~$146 million in grassland conservation efforts on ~6 million acres of public and private land.

- With some exceptions, urban areas received higher relative grassland conservation effort and funding when compared to rural counties in the surrounding region. Economic costs for grassland conservation were higher for pipit counties near urban areas, which reflects trends in land market values for those portions of the state.

- There is no organized or consistent reporting method for conservation efforts used by all federal, state, private, and non-profit organizations. As such, there is a great deal of variation in acreage and expenditure estimates provided by the various agencies and programs. Results from Objective #3 should be used as a baseline to increase the efficacy of grassland conservation efforts that benefit the pipit and other grassland associated species, but should also highlight the utility of developing a formal tracking system that would aid USFWS and state agencies during the decision making process.

- Given that >90% of land in Texas is privately owned and that large contiguous grassland tracts of grassland do still remain, unreported grassland management activities on private lands may benefit Sprague's pipit and other grassland species, but cannot be accurately accounted for at the statewide scale. Incentives must be developed to encourage private landowners to implement and report conservation activities.

- The conservation outlook for species that inhabit short and mixed grass prairie is more optimistic than for species inhabiting tallgrass prairie, as mixed grass prairie and short grass prairie have retained a larger proportion of their historic extent (Samson and Knopf 1994, Samson et al. 2004). However, a comprehensive grassland management strategy for the state of Texas must include large-scale grassland conservation on rural lands and a retroactive evaluation of prioritized species' responses to management activities.

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Appendix A. Summary of programs that provide grassland conservation support in Texas.

Federal

1. Agricultural Conservation Easement Program

NRCS program that provides landowners with the financial and technical assistance needed to conserve and restore agricultural land. Land is enrolled in the program through Agriculture Land Easements or Wetland Reserve Easements. http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/acep/

2. Candidate Conservation Program

Encourages landowners to reduce or eliminate threats to a candidate species on their property through voluntary agreements with USFWS (Candidate Conservation Agreements and Candidate Conservation Agreements with Assurances). TPWD may help landowners develop conservation plans. http://www.fws.gov/endangered/what-we-do/cca.html

3. Conservation of Private Grazing Land

A technical assistance program administered by NRCS that helps landowners establish effective conservation practices on their grazing lands to address natural resource issues. This program does not providing funding or cost-share assistance. http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/technical/cpgl/

4. Conservation Reserve Enhancement Program (CREP)

USDA Farm Service Agency administered program that addresses local high-priority environmental problems and involves state and/or tribal governments. Texas does not currently participate in CREP. http://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-enhancement/index

5. Conservation Reserve Program (CRP)

USDA Farm Service Agency administered program that provides landowners with a financial incentive to establish conservation practices on their land that improve water quality, provide wildlife habitat, and/or reduce soil erosion. Landowners receive rental

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payments for acres enrolled in the program, and may receive cost-share assistance, sign-up incentive payments, and performance incentive payments. Acres and expenditures available from 1996–2014. http://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index

6. Conservation Stewardship Program

Financial assistance program administered by NRCS through which landowners receive annual payments for establishing new conservation practices, maintaining certain conservation practices, or implementing a resource-conserving crop rotation. http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/

7. Conservation Technical Assistance (CTA) Program

Technical assistance program through NRCS that is available to landowners, communities, local and state government entities and tribes that are looking to voluntarily conserve and protect natural resources and comply with environmental regulations. Does not provide financial assistance or cost-sharing. http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/technical/cta/

8. Environmental Quality Incentive Program (EQIP)

Financial and technical assistance program administered by NRCS that is available to agricultural producers. Assistance allows landowners to meet environmental regulations and address natural resource concerns through conservation practices. Practices to aid grassland conservation in Texas include brush management, prescribed grazing/burning, range planting, and upland wildlife habitat management. Acreage and expenditures available for 2015. http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/

9. Grassland Reserve Program

NRCS's GRP provided landowners with financial incentives to restrict development of grazing and pastureland, as well as some activities during the nesting season of certain grassland birds. Replaced by the Agricultural Conservation Easement Program in 2014. Acres and dollars available for 2013. http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/grassland/

10. Gulf of Mexico Initiative

NRCS program that provides financial and technical assistance for implementing conservation practices that improve water quality and protect wildlife habitat in the Gulf of Mexico region.
http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/home/?cid=stelprdb1046039

11. Lesser Prairie Chicken Initiative

NRCS program funded through EQIP that provides financial and technical assistance to landowners willing to plan and establish conservation practices on their property that benefit lesser-prairie chickens. Acres and dollars available for 2011 and 2014.
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/null/?cid=nrcsdev11_023912

12. Ogallala Aquifer Initiative

Addresses water quality and conservation issues in the region overlaying the Ogallala Aquifer. Landowners receive financial and technical assistance for establishing certain conservation practices. Funding is provided through NRCS's EQIP.
http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/initiatives/?cid=stelprdb1048809

13. Regional Conservation Partnership Program (RCPP)

Facilitates cooperation between agricultural producers and local partners (agricultural associations, co-ops, government entities, universities, etc.) to protect wildlife and natural resources at regional or watershed scales. Partners submit project proposals and, if funded, enter into a partnership agreement with NRCS that provides assistance to producers in the region that wish to establish and maintain conservation practices. $225 million is expected to be available and distributed across the U.S. in 2016.
http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/farmbill/rcpp/

14. Safe Harbor Agreements (SHA)

Under USFWS administered SHAs, landowners take specific actions to help federally listed species recover in exchange for assurances that they will not have to engage in additional or different management practices.
http://www.fws.gov/endangered/landowners/safe-harbor-agreements.html

State

1. Caesar Kleberg Wildlife Research Institute, Texas A&M University, Kingsville

Research focused on wildlife conservation and management in South Texas. Northern bobwhite quail research is one of the Institute's priorities. http://www.ckwri.tamuk.edu/

2. Grassland Restoration Incentive Program (GRIP)

Established in 2014, GRIP in a TPWD administered program that provides financial incentives for landowners to conduct grassland restoration treatments on their property. These treatments are a combination of prescribed burning, prescribed grazing, brush management, and native grass reseeding. Treatment area and landowner reimbursements to date are available from 2014 and 2015.

3. Lady Bird Johnson Wildflower Center

The Lady Bird Johnson Wildflower Center (279 acres) has been an Organized Research Unit of the University of Texas at Austin since 2006. The center's mission is to protect and restore healthy landscapes through research, leadership, and education. www.wildflower.org

4. Lewisville Lake Environmental Learning Area (LLELA)

LLELA is a 2000-acre property managed by researchers at the University of North Texas and a group of dedicated volunteers. There are ongoing prairie restoration projects on the property and volunteers manage a native plant nursery on site. https://llela.unt.edu/

5. Pastures for Upland Birds (PUB)

TPWD's Pastures for Upland Birds Program provides financial and technical assistance to Texas landowners for projects that restore native grassland vegetation on land previously dominated by introduced grasses. Treatment area and expenditures are available to date. https://tpwd.texas.gov/landwater/land/habitats/post_oak/upland_game/pub/

6. Private Lands and Habitat Program

A technical assistance program offered by TPWD through which staff biologists help interested landowners develop a wildlife management plan to improve habitat quality and manage wildlife species on their property. https://tpwd.texas.gov/landwater/land/private/description/

7. Project Prairie Birds

A 5-year citizen science program intended to help researchers understand the wintering distribution and habitat preferences of grassland birds so that this information could be incorporated into conservation and land management plans. Interested public conducted avian surveys following the methods provided by the project developers. http://tpwd.texas.gov/huntwild/wild/birding/project_prairie_birds

8. Texas Native Seeds, Caesar Kleberg Wildlife Research Institute, Texas A&M University, Kingsville

The goal of this project is to establish native seeds sources that can be purchased and used for restoration projects in Texas. This involves collecting native seeds from several populations, planting seeds at various locations and evaluating the characteristics of the plants, providing seeds from the plants with desired characteristics to commercial seedsmen for large-scale production. http://www.ckwri.tamuk.edu/research-programs/texas-native-seeds/

9. TPWD Game Bird Enhancement and Wildlife Research Grants

TPWD grants administered by TPWD for restoring, managing, or conserving habitats required by bobwhite quail or migratory game birds. Acreage and expenditures are available for 2014 and 2015. https://tpwd.texas.gov/business/grants/wildlife/game-bird/

10. TPWD Landowner Incentive Program (LIP)

Provides financial incentives for landowners to restore or enhance wildlife habitat on their properties. Landowners must submit project proposals to TPWD and receive compensation upon completion of the project (up to 75% of project cost). Most money is provided by USFWS. Organizations funded include Wildlife Habitat Federation, Houston Quail Coalition, Bambert Seed, University of North Texas, National Wild Turkey Federation, Northeast Texas Quail Habitat Initiative, LBJ National Grassland, Abilene Christian University, The Nature Conservency, Welder Wildlife Foundation, Texas A&M Kingsville, Texas Tech University, Western Navarro

Bobwhite Initiative, and Grazing Lands Conservation Initiative. Acreage, cooperator costs, and LIP expenditures for projects benefiting grasslands are available from 2008–present. http://tpwd.texas.gov/landwater/land/private/lip/

Non-profit/Private Organizations

1. American Bird Conservancy

The American Bird Conservancy supports conservation projects involving birds and their associated habitats in the Americas and works to bring individuals and organizations interested in bird conservation together. www.abcbirds.org

2. Armand Bayou Nature Center

A 645-acre nature center located in the Houston area that is dedicated to preserving the habitats found within the boundaries of the nature center and educating the public on the importance of habitat preservation. www.abnc.org

3. Audubon Texas

Chapter members and partner organizations work to identify, conserve, and restore important bird habitats, manage bird populations, and educate students at their Audubon Centers in Texas. tx.audubon.org

4. Botanical Research Institute of Texas

BRIT scientists are involved in plant research and conservation projects across the globe. The facility in Fort Worth houses a large herbarium, offers several educational programs for the public, and has living roof and native prairie demonstrations.

5. Connemara Conservancy

Connemara Conservancy is a land trust that protects land in North Texas through ownership, conservation easements, and conservation developments. Current acreage and annual expenditures are available. connemaraconservancy.org

6. Hill Country Conservancy

Hill Country Conservancy is a land trust that uses conservation easements to preserve land in a natural state in order to protect water quality in Barton Springs Edwards Aquifer. Acreage estimates are available to date. www.hillcountryconservancy.org

7. Katy Prairie Conservancy

Katy Prairie Conservancy is a land trust with the goal of protecting 30,000-50,000 acres of the historic limits of the Katy Prairie near the Gulf Coast. They are also involved in restoring tallgrass prairie on protected properties and offer educational classes and recreational activities in some protected areas. www.katyprairie.org

8. National Fish and Wildlife Foundation (NFWF)

NFWF funds conservation-related projects throughout the United States. Grant money comes from federal and corporate partners, legal settlement money, and private donations. Acres and expenditures are available through 2012. www.nfwf.org

9. National Wild Turkey Federation

The Save the Habitat. Save the Hunt Initiative goals are to conserve or restore upland habitat to benefit wild turkeys, open additional land for hunting wild turkeys, and increase the number of hunters. NWTF's goal is to conserve/enhance 47,000 ha of wildlife habitat by the end of 2016. See TPWD funding for more information. www.nwft.org

10. Native Prairie Association of Texas (NPAT)

NPAT is a land trust involved in protecting native grasslands through conservation easements and property ownership. This organization is also involved in education and restoring native grasslands on public and private land, in addition to their own properties. Acreage estimates are available to date. Expenditures are available for some projects. ww.texasprairie.org

11. The Nature Conservancy (TNC)

TNC owns and manages 16,787 acres of grassland preserves in Texas and is a partner in the Goliad-Refugio Prairie Project (private lands initiative to restore coastal prairie). TNC works with landowners, USFWS, TPWD, NRCS, Coastal Prairie Conservation Initiative, and Grazing Lands Conservation Initiative on this project. Acreage information is available to date. http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/texas/

Prescribed Burn Associations - Promote the use of prescribed burning to protect the natural habitat by assisting members plan and implement prescribed burns on their properties.

12. Coastal Bend Prescribed Burn Association – serves 12 counties. www.prescribedburn.org

13. Edwards Plateau Prescribed Burning Association (EPPBA) - serves 17 counties. pbatexas.org/association/EPPBA

14. Hill Country Prescribed Burning Association, Inc.

15. North Central Texas Prescribed Burn Association (NCTPBA) – serves 10 counties. www.nctpba.org

16. Northeast Texas Prescribed Fire Initiative – serves nine counties. https://sites.google.com/site/netxpfi

17. South Central Texas Prescribed Burn Association – serves eight counties. www.sctpba.org

18. South Texas Prescribed Burn Association – serves 12 counties. pbatexas.org/association/STPBA

19. Southern Rolling Plains Prescribed Burn Association – serves 21 counties. www.sctpba.org

20. Texas Panhandle Prescribed Burn Association (TPPBA) – serves 26 counties. www.ranches.org/tppba.htm

21. Trans Pecos Prescribed Burn Association – serves nine counties. pbatexas.org/association/SRPPBA

22. Post Oak Quail Group

The Post Oak Quail Group is a co-op formed by a group of neighboring ranchers interested in restoring native savannah habitats on their ranchland to benefit quail populations.

23. Rolling Plains Quail Research Ranch

Research and demonstration facility dedicated to bobwhite and scaled quail management. Research is focused on understanding factors involved in quail declines and effective methods to improve quail habitat and numbers. Acreage and expenditures area available from 2012–2015. www.quailresearch.org

24. Quail Coalition

Members of the 13 chapters across the state raise money for quail research and are involved in projects to improve quail habitat. Funded organizations include The Rolling Plains Quail Research Ranch, Caesar Kleberg Wildlife Research Institute, The Quail-Tech Alliance, and the Wildlife Habitat Federations. Annual expenditures are available. qualcoalition.org

25. Quail Forever

A national organization (with several Texas chapters) that works to improve or create habitat for game bird species so there are populations large enough to allow hunting. Acreage and expenditures are available to date for some counties. quailforever.org

26. SPIRIT of Conservation Migratory Bird Program

A grant program administered by NFWF with funding and support provided by ConocoPhillips and USFWS. Funding supports projects that conserve critical bird habitats and/or aid in the development of conservation practices in areas where ConocoPhillips has a presence. Acres and expenditures are available to date. http://www.nfwf.org/spirit/Pages/home.aspx#.VeRsXvlVikq

27. Texas Land Conservancy

A land trust working to create a network of protected areas throughout Texas through ownership and conservation easements. They also restore native habitats and allow public access on some properties. Acreage and expenditure estimates are available for 2014. www.texaslandconservancy.org

28. Texas Master Naturalist

Program consists of well-trained volunteers that assist with environmental education, outreach, and service projects within their communities. There are currently 46 chapters across the state. Acreage estimates are available for some counties. txmn.org

29. Texas Rice Industry Coalition for the Environment

Organization works with rice farmers to improve their land for rice farming while enhancing habitat for birds and conducts grassland restoration on public lands. Acreage and expenditures are available to date. texasricefarming.org/TRIC/index.html

30. Western Navarro Bobwhite Recovery Initiative

Educates and assists private landowners in restoring and/or managing their land to provide habitat for quail and other grassland species. Members have access to specialized equipment and native plant seeds. See TPWD funding for more information. navarroquail.org

31. Wildlife Habitat Federation

Offers the technical guidance, personnel, supplies, and equipment necessary to preserve and re-establish upland bird habitat and have contributed to conservation efforts on ~40,000 acres. In addition, the organization helps those interested in restoration find technical assistance. See TPWD funding for more information. www.whf-texas.org

32. Wildlife Management Associations

WMAs are private landowner groups formed to improve wildlife habitats and associated wildlife populations. WMAs provide opportunities for landowners to work with and learn from wildlife and other natural resource professionals through programs and field day facilitated by TPWD and others. http://tpwd.texas.gov/landwater/land/associations/

Multi-agency Programs

1. Coastal Prairie Conservation Initiative

Allows landowners to receive financial assistance for projects that restore coastal prairie on their land in an effort to create larger and more continuous blocks of coastal prairie. Resources are provided by USFWS, Grazing Lands Conservation Initiative, Texas Nature Conservency, NRCS, TPWD, and others. Over 70,000 acres of privately owned land are enrolled in the program under Safe Habor Agreements for Attwater's Prairie Chicken management.

2. Coastal Prairie Partnership (CPP)

CPP is composed of private landowners, non-profits, and local, state, and federal government agencies working to support coastal prairie conservation and restoration in Texas and Louisiana. prairiepartner.org.

3. Great Plains Landscape Conservation Cooperative

One of several regional conservation partnerships between government agencies, universities, and interested public and private organizations. The Great Plains LCC identifies priorities for research and helps disseminate information regarding natural resource management and conservation to partners in the region. www.greatplainslcc.org

4. Gulf Coast Landscape Conservation Cooperative

One of several regional conservation partnerships between government agencies, universities, and interested public and private organizations. The Gulf Coast LCC has developed a science strategy that identifies focal species and their associated habitats, and helps partners coordinate research efforts and communicate results. www.gulfcoastprairielcc.org

5. Playa Lakes Joint Venture

Playa Lakes Joint Venture is a regional partnership of federal and state wildlife agencies, conservation groups, and private industry dedicating to conserving bird habitat through the western Great Plains (CO, KS, NE, NM, OK, TX). This Joint Venture provides science-based planning tools, decision support tools and outreach to help habitat managers and focuses most conservation efforts on grasslands and playas. pljv.org

Cary Dupuy

Subject: FYI: Interagency Task Force on Economic Growth and Endangered Species Meeting, March 9, 2015

Dear Working Group Members:

We wanted to let you know that the Comptroller's office will be hosting a meeting of the Interagency Task Force on Economic Growth and Endangered Species on March 9, 2015 at __________, in Room 1-111 of the Travis Building.

Travis Building Address: 1701 Congress Ave, Austin, TX 78701

In addition, the following dates are being considered for the next meeting of the Freshwater Mussel working group _______ & ______. As soon as we have a confirmed date we will be sending out information about the meeting.

JODEE BRUCE
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