ANNUAL REPORT 2015
Texas Conservation Plan for the Dunes Sagebrush Lizard

March 1, 2016

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ACRONYMS

CCAA:	Candidate Conservation Agreement with Assurances
CI:	Certificate of Inclusion
CPA:	Texas Comptroller of Public Accounts
CRA System:	Conservation Recovery Award System
DSL:	Dunes Sagebrush Lizard
EGESM:	Division of Economic Growth and Endangered Species Management
FWS:	U.S. Fish and Wildlife Service
HMUs:	Habitat Management Units
HPF:	Habitat Protection Fund
QTPC:	Qualified Third Party Contractor
TAMU Extension:	Texas A&M AgriLife Extension Service
TAMU Research:	Texas A&M AgriLife Research
TCP:	Texas Conservation Plan
THCF:	Texas Habitat Conservation Foundation

INTRODUCTION

The Texas Conservation Plan (TCP) for the Dunes Sagebrush Lizard (DSL) was implemented in 2012 to provide a conservation benefit to the DSL in west Texas.[1] This small lizard is a habitat specialist found in shinnery oak dune complexes in southeastern New Mexico and West Texas. Public or private entities conducting activities within the area of the Plan may voluntarily choose to participate in the TCP to avoid, minimize, or offset impacts to DSL habitat that may occur as a result of their operations.

The United States Fish and Wildlife Service (FWS) approved the Plan in February 2012. The Texas Comptroller of Public Accounts (CPA) holds the permit for the implementation of the TCP. In November 2011, the CPA contracted with Texas A&M AgriLife Extension Service (TAMU Extension) to administer and implement the TCP and with Texas A&M AgriLife Research (TAMU Research) to conduct DSL research activities. In March 2012, TAMU Extension subcontracted the day-to-day responsibilities for the implementation of the TCP to a non-profit foundation in Midland, Texas, the Texas Habitat Conservation Foundation (THCF). TAMU Extension, TAMU Research, and the THCF are Qualified Third Party Contractors (QTPCs) for purposes of the TCP and performed their respective duties with the CPA oversight during 2015.

In 2015, the newly elected Comptroller created the Division of Economic Growth and Endangered Species Management (EGESM). The EGESM was tasked with, among other responsibilities, the oversight of the TCP. In February 2015, the CPA initiated a review to evaluate the management and implementation of the TCP to determine areas that warrant improvement. As a result of this review, the CPA implemented changes to program management and is moving forward with additional improvements in 2016.

As required in the TCP, this Annual Report describes year four (2015) of the TCP implementation including, but not limited to, enrollment activities, conservation activities, oversight and compliance monitoring activities, surface disturbing activities, and research activities that occurred throughout the year. The report also includes information on management changes put in place in 2015 and plans for additional changes in 2016.

This report is divided into three sections, *Section I. Administration, Section II. Research*, and *Section III. Overall Effectiveness of the TCP*.

[1] The complete TCP and related documents can be found at http://keepingtexasfirst.org/esa/tx_conservation.php. Definitions for key terms used in this report can be found in Appendix J of the TCP.

SECTION I. ADMINISTRATION

Implementation Activities

In 2015, the THCF was tasked with the day-to-day implementation of the TCP. These tasks include activities such as: developing and executing Certificates of Inclusions (CIs);[2] conducting regular communication, outreach and education with Participants, potential Participants and landowners; offering assistance to Participants implementing Conservation Measures; operating and monitoring the Conservation Recovery Award System (CRA System); compliance monitoring; and reporting duties. The performance of these tasks in 2015 is further described in this subsection.

Acreage Enrolled

The Permit Area/Likelihood of Occurrence Map in Figure 1-2 of the TCP[3] is used as the baseline for defining DSL Habitat[4] in the TCP. It facilitates the implementation of the TCP by categorizing the DSL Habitat by colors that represent the likelihood of DSL occurrence within that particular area. The areas of likely DSL occurrence in the map are referred to as "polygons."

Participant and species location information is confidential under Texas Government Code § 403.454. To maintain confidentiality of data obtained under the TCP, enrollment information is provided in acreage and further described in subdivided Habitat Management Units (HMUs). The HMUs are categorized using the color scheme illustrated in Figure 1 of this report to signify the Likelihood of Occurrence category. Table 1 is a breakdown of DSL Habitat acres enrolled by HMUs and the total enrolled buffer acreage for 2015.

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[2] "Under a CCAA, the Participant is only responsible for implementing and maintaining the Conservation Measures and/or land management actions that he or she agreed to in the Certificate of Inclusion (CI) … ." (TCP at 5.) Thus, the CI forms "the basis of enforcement of the Plan." (TCP at 9.) The FWS has described the process for preparing the CI under the TCP:

> The primary conservation measure limits impacts to high-quality habitat on enrolled areas. Participants will work with the permittee … to develop individual CIs through a process identified in Appendix F of the Texas Conservation Plan. This process involves a habitat impact assessment, discussion of conservation options under the Texas Conservation Plan, determination of mitigation needs, and the development of a property-specific management plan. This is agreed upon through signing of the CI. A participant is then responsible for proper implementation... .

77 Fed. Reg. 36,872, 36,885 (June 19, 2012). Appendix F of the TCP is entitled "Enrollment Process to Determine Mitigation Needs for Covered Activities."

[3] Figure 1-2 of the TCP is reproduced in this report as Figure 1.

[4] DSL Habitat means the "portions of Andrews, Cochran, Crane, Ector, Gaines, Ward, Winkler, and Yoakum Counties which have shinnery oak dune complexes likely to be occupied by or particularly suitable for DSL as demarcated on Figure 1-2 in the Plan. … For the purposes of this Plan, DSL Habitat includes all shinnery oak dune complexes in the identified counties that are likely to be occupied by DSL or have the potential for occupation by DSL. Further, all area within a 30m buffer of DSL Habitat is conservatively considered DSL Habitat in the Plan." (Appendix J of the TCP at 2.)

In 2015, fifteen Participants were actively enrolled in the TCP under CIs. Property enrollment by these Participants resulted in 228,543 gross acres, which include habitat, buffer, and adjacent property. Of the gross acreage enrolled, 108,684 acres is DSL Habitat. The 108,684 acres constitute 55 percent of the total DSL Habitat in the polygons and 50 percent of the total DSL Habitat and buffer.[5]

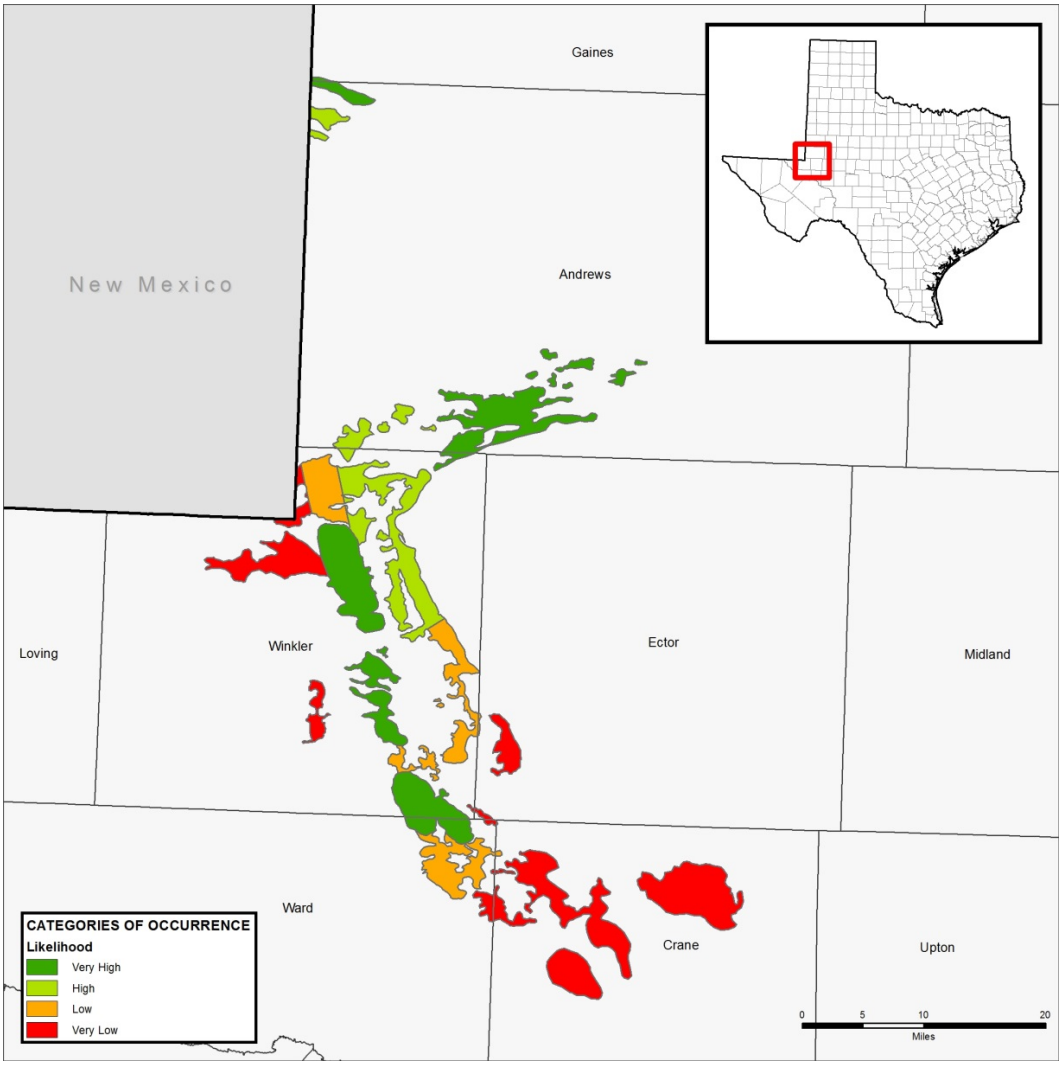

Figure 1. **Texas Conservation Plan Permit Area/Likelihood of Occurrence Map**. *The colors in the legend and corresponding map represent Likelihood of Occurrence Class; red is Very Low (0-25 percent probability of DSL occurrence), orange is Low (25-50 percent probability of DSL occurrence), light green is High (50-75 percent probability of DSL occurrence), and dark green is Very High (75-100 percent probability of DSL occurrence).*

The amount of enrolled acreage in the TCP increased from 108,314.58 in 2014 to 108,683.84 acres of DSL Habitat in 2015. The increase was due to changes in

[5] The total acreage within the polygons includes 197,604 acres. (TCP at 61.) With the buffer included, the total acreage was 217,365 acres. *Id.*

Participants' property interests in the Permit Area and two new Participants' enrolling in the TCP. In 2015, the THCF worked to identify new potential Participants and reached out to those entities to expand enrollment. These outreach efforts led to two pipeline companies committing to participate in the TCP. Outreach activities to further increase enrollment will continue in 2016.

Table 1. Enrolled DSL Habitat Acreage by Habitat Management Unit

Management Unit # 2	13,294.28
Management Unit # 7	7,318.18
Management Unit # 10	369.57
Management Unit # 16	12,673.88
Management Unit # 1	13,582.25
Management Unit # 12	3,644.78
Low (All)	**16,499.34**
Management Unit # 8	3,877.73
Management Unit # 13	9,378.50
Management Unit # 14	3,243.11
Very Low (All)	**41,301.56**
Management Unit # 3	15,518.40
Management Unit # 4	9,073.83
Management Unit # 5	6,250.68
Management Unit # 6	199.12
Management Unit # 9	7,035.06
Management Unit # 11	1,840.84
Management Unit # 15	1,383.64
Total DSL Habitat Enrolled	**108,683.84**
Buffer Acreage Enrolled	**28,816.00**
Gross Acreage Enrolled	**228,542.99**

Funding

As outlined in the TCP, fees and contributions deposited into the Habitat Protection Fund (HPF) (Texas Government Code § 403.452 (a)(4)) are to be used to implement the TCP and related Mitigation and Recovery Activities. Funds are deposited into HPF accounts (*i.e.*, Administration, Mitigation, or Recovery) based on the contribution type.[6] A quarterly reconciliation of all HPF account balances and transactions was performed in 2015 by TAMU Extension to ensure accuracy and verify that TCP program costs would be adequately covered. TAMU Extension reviewed enrollment fee information, mitigation/recovery project data, and other fee-related documentation from the THCF and compared against HPF account activities.

In 2015, deposits came from annual participation or enrollment fees, surface disturbance fees, and Recovery Awards paid by participants. Below details all deposits into the HPF in 2015.

- Administration: $700,408.76
- Surface Disturbance Fees: $283,500.00
- Recovery Award Purchases: $10,657.69
- Total deposits: $994,566.45

Expenditures totaled $937,330.06 in 2015. Administration expenditures for 2015 totaled $866,995.60, which reflects the reimbursement requests from TAMU Extension (including its subcontract with THCF) and TAMU Research that were paid in 2015. Recovery project expenses in 2015 totaled $65,938 for two projects (Project 004 and Project 005) including project verification by Texas Tech University.

Compliance and Oversight

TAMU Extension and the THCF continued to employ a variety of compliance monitoring and oversight methods to evaluate compliance with the TCP, in addition to ensuring Participants complied with the obligations in their respective CIs.

During 2015, the THCF continued compliance monitoring activities of enrolled acreage. These activities included regular communication with the Participants, education, site visits, driving tours, record reviews and verification, and Participant self-reporting.

Under the contract with TAMU Extension, THCF was also tasked with ensuring compliance with the Conservation Measures in the CIs. At the request of the CPA, TAMU Extension prepared a protocol (Appendix A) to review compliance with Conservation Measures in accordance with each Participant's CI. Results of these efforts are generally addressed below in the subsection *Review and Administrative Changes*.

[6] Two of the CIs require that all of the surface disturbance fees from each of those Participants be kept in separate accounts in the HPF. To avoid confusion, all of the funding is reported based on contribution type.

The THCF also utilized publicly available data to determine whether unreported surface disturbances had occurred on enrolled lands. Data from these sources were cross-checked against Participant information and THCF files.

- The Railroad Commission of Texas website was used to review drilling permits and quarterly H-8 loss reports (which document releases of petroleum or petroleum by-products).
- The University Lands website was used to review well information.
- Google Earth Pro was used to plot unknown wells to determine if they were located within DSL Habitat or buffer.

The THCF and TAMU Extension continued to use Geographical Information Systems (GIS) tools (LANDSAT 8 and RapidEye) to identify disturbances through Change Detection Analysis on a quarterly basis. Information about this analysis is fully presented in the 2014 Annual Report.

Additionally, Participants continued to report (due by February 1 of each year) their activities on enrolled acreage, using the FWS-approved standardized form.[7] This information was used to cross reference and verify the information collected by the QTPCs throughout the year.

In 2015, the CPA and QTPCs continue to conduct oversight of the activities in the TCP as described in past Annual Reports.

Ongoing Independent Project Verification

In 2015, Texas Tech University continued to perform ongoing third-party verification of the recovery projects implemented for the TCP. The scope of work included reviewing calculations associated with the CRA System, determining if TCP procedures are applied and followed, and determining if the projects are appropriate for the intended purposes of the utilized funds.

Three completed Recovery projects (Projects 001, 003, and 004) were reviewed and verified in 2015. One ongoing Recovery Activity project (Project 005) was given an initial review in 2014 prior to the project start.

The CPA has not renewed the contract for this verification for 2016. The CPA is determining how best to verify this information and will implement appropriate measures in 2016.

[7] *See* Appendix C of the 2014 Annual Report Texas Conservation Plan for Dunes Sagebrush Lizard at http://Keepingtexas first.org/pdf/2014AnnualReport.pdf

THCF File Audit

In August 2015, the CPA directed TAMU Extension to perform a complete file audit of THCF to ensure proper documentation of TCP implementation. The focus of the review was to determine if adequate documentation of transactions related to the implementation of the TCP are maintained and/or retained by the THCF. The intended goal of this audit was to review written, printed, recorded materials, and electronic records associated with the TCP. A final report of the audit was submitted to the CPA (Appendix B). The CPA is in the process of further assessing existing documentation of TCP implementation.

Conservation Activities

Mitigation and Recovery Activities

In 2015, Mitigation Activities were performed by a Participant, including removal and reclamation of 26 abandoned well pads and associated infrastructure to offset new and previous disturbances in buffer areas.[8] These projects were approved by the FWS and completed in 2015. All Mitigation Activities were implemented in areas of Very Low Likelihood of DSL Occurrence and generated 23.76 Mitigation Credits. These Activities were used to mitigate 12.8 acres of new and previous surface disturbance. After demonstrating that mitigation options were not available, the Participant purchased 9.16 Recovery Awards to offset an additional 5 acres of previous surface disturbance. Finally, at the end of the year, the Participant purchased an additional 4.11 Recovery Awards to offset 3 acres of surface disturbance related to wells that that had not been previously reported.

Appendix C provides detail on how surface disturbances were offset during the TCP. Beginning in 2013, there was a reliance on purchasing Recovery Awards instead of conducting mitigation activities to offset surface disturbances. These Recovery Awards were generated by recovery projects to remove mesquite (Projects 001, 002 and 004). The recovery projects largely involved removing mesquite from flats within the polygons detailed in Figure 1 rather than reclaiming and restoring abandoned well pads and infrastructure. In 2015, to be consistent with the TCP, the CPA focused on satisfying offset requirements through Mitigation Activities, when they were feasible. Currently the value of mesquite removal is being examined by TAMU Research. Further, the Science Advisory Committee is discussing this issue as part of the adaptive management process.

[8] Mitigation to offset surface disturbances can be implemented through the creation of Mitigation Credits by CPA through its QTPC or by the Participant. If mitigation options are not available, a Participant can use Recovery Awards in lieu of mitigation or Mitigation Credits. (TCP at 53.)

Recovery Awards

While the DSL is not a listed species and the FWS has not established a Recovery Plan, the TCP does include Recovery Awards that can be used to provide a net benefit to the recovery of the DSL.[9] To date, 1,990.2 Recovery Awards have been generated, 426.45 Recovery Awards have been purchased, and 568.65 Recovery Awards are available for sale. Of the remaining, 199.02 are held in permanent trust for recovery of the DSL and 796.08 will be made available after effectiveness monitoring demonstrates a positive impact to the DSL. Funds remaining in the Recovery Account will be used for future projects to generate more Recovery Awards.

2015 Recovery Projects to Generate Recovery Awards

Since it began in 2012, the TCP has contracted for the implementation of four recovery projects. The most recent project, Project 005, was the only one ongoing in 2015. It was selected, contracted, and started in 2014 with scheduled completion by spring 2016.

The project calls for the mechanical removal of invasive mesquite on 199.83 acres between two sections of established habitat in a Low Likelihood of DSL Occurrence area. According to the U.S. Department of Agriculture Natural Resources Conservation Service this land is the "Penwell-Dune Land Complex Hummocky" soil type. It had a canopy cover that exceeded 80 percent, according to an assessment by the THCF. By removing the trees and establishing a more native land cover, the project has the potential to serve as a corridor between the established habitats.

The project was divided into two phases to avoid DSL active periods and allow for monitoring before and after treatment. Part one of the project completed 151.85 acres of mesquite removal.

As shown in Table 2, Project 005 should generate 505.15 Recovery Awards after completion and verification.

Table 2. Recovery Award Project Summary for Project 005

Low Likelihood of Occurrence Habitat			
Location (meters)	**Value**	**Acres**	**Recovery Awards**
Habitat + 30	1.00	57.01	285.05
31 – 50	0.75	7.83	29.36
51 – 100	0.50	31.69	79.23
101 – 200	0.25	50.24	62.80
201 – 300	0.20	35.66	35.66
301 – 600	0.15	17.4	13.05
	TOTALS	**199.83**	**505.15**

[9] *See* TCP Appendix J at 5.

Level of Incidental Take

The DSL has not been listed, and no incidental take permit has been issued in conjunction with the TCP. Further, the FWS has found that it is not possible to quantify DSL "take." Thus, habitat loss is used as a surrogate for take of the species. Accordingly, surface disturbances that occur in DSL Habitat and buffer are reported monthly and annually to the FWS.[10]

Impacts in dunes and dune complexes are reported separately from the overall disturbance. (TCP at 34.) The TCP allows 21,257 acres of DSL Habitat loss (*i.e.*, disturbance) over the life of the Permit. (TCP at 58.) The surface disturbances that have occurred since the onset of the program are identified in Appendix C. A summary of this data is included in Table 3 below. The total of surface disturbances through 2015 is 293.71 acres.

Table 3. Total Surface Disturbance by Habitat Designation to Date

Habitat Type	Total Allowable Habitat Loss	Occupied, Suitable, or Dispersal Habitat within Polygon	Other Areas within Polygon	Buffer
Very High	6,916	21.20	86.02	60.62
High	3,429	0	0	0
Low	3,504	18	33.33	0
Very Low	7,408	8.26	63.50	2
Total	21,257	47.76	182.85	63.10

In 2015, surface disturbances impacted 127.9 acres of DSL Habitat and buffer, including 17.16 acres of actual habitat. Table 4 details those disturbances by habitat class and type.

[10] With respect to 13 of the 15 CIs, DSL Habitat is essentially defined as the areas in the polygons described in Figure 1 and the 30 meter buffer around the polygon. *See supra* at n. 4. Under two of the CIs, often referred to as the "Alternative CIs," the requirement to mitigate surface disturbances is limited to activities occurring between 30 and 200 meters of actual habitat, habitat that is unoccupied but contains structurally suitable habitat and dispersal habitat rather than the entire area within a polygon and a 30 meter buffer around the polygon. The different mitigation obligation in the two CIs resulted from the alternative CI containing an absolute prohibition against surface disturbances in actual habitat, meaning habitat that is unoccupied but contains structurally suitable habitat and dispersal habitat.

Table 4. Surface Disturbance in 2015 by Habitat Designation

Habitat Type	Total Allowable Habitat Loss	Occupied, Suitable, or Dispersal Habitat within Polygon	Other Areas within Polygon	Buffer
Very High	6,916	16.90	68.27	22.17
High	3,429	0	0	0
Low	3,504	0	6.70	0
Very Low	7,408	0.26	13.20	0
Total	21,257	17.16	88.17	22.17

Program Review and Administrative Changes

In February 2015, the CPA initiated a review of the TCP implementation process. During this review, issues were identified and addressed regarding the implementation of the TCP.

The CPA found the THCF had not in some cases promptly obtained Mitigation Credits as required by the relevant CI and some surface disturbances occurred prior to the mitigation plan being implemented. In a few instances, surface disturbances occurred prior to surface disturbance fees being paid or a plan of development being submitted to the THCF. These surface disturbances involved a total of 16.68 acres of non-occupied or suitable habitat within the polygons, and buffer.

In each instance, the CPA worked with the FWS to ensure the surface disturbance issues described above were properly mitigated or, in instances where mitigation opportunities were demonstrated not to exist, Recovery Awards were purchased. Further, the CPA is requiring the implementation of measures to ensure these issues do not occur again in the future, including the following.

- administrative and data management improvements;
- increased communication by QTPCs with Participants regarding future development plans and additional documentation relating to those plans;
- more efficient monitoring activities including more frequent and systematic driving surveys throughout enrolled property; and
- changing the management structure to give the CPA more direct control of TCP implementation.

Second, as part of its review, the CPA determined that documentation of the Participants' implementation of the Conservation Measures needed to be improved. To address this issue, the CPA directed measures be put in place to audit the implementation of the Conservation Measures. To respond promptly to this issue, TAMU Extension developed a check list that was used by the THCF in discussions with Participants regarding their implementation of the Conservation Measures. The information gathered through this process will be used to refine the oversight and documentation of Conservation Measures before the next audit of Conservation Measure implementation in spring 2016.

Third, the CPA determined the adaptive management component of the TCP was not effectively functional – a concern also voiced by the FWS. As the TCP recognizes, adaptive management is a "formal, structured approach to dealing with uncertainty in natural resources management, using the experience of management and the results of research as an on-going feedback loop for continuous improvement." (TCP at 33.) The adaptive management program had not been formalized or structured and the "experience of management" had not been vetted by an adaptive management-type process.

To address these issues, the CPA has reactivated and reconstituted the Science, Policy, and Steering advisory committees. The Science Committee began meeting in December 2015. Policy and Steering Committees were established in January 2016 and will begin meeting in March 2016. TAMU Research proposed questions for initial consideration in this process including (1) examination of the potential to translocate DSL to newly restored habitat; (2) the conservation value of road and mesquite removal; and (3) evaluation of recovery options that may not have any scientifically supported recovery value.

Finally, adequate documentation is lacking to support many of the conclusions reached in implementing the TCP and evaluating compliance with the respective CIs. In response, the CPA is developing an approved data management system and requiring the QTPC to document the basis for their decisions and ensure adequate documentation is available to evaluate compliance monitoring efforts.

Through this review process, the CPA determined the implementation process needed to be restructured. As a first step, the CPA requested the THCF place a person with regulatory compliance experience on site and give that person full authority to ensure that compliance is achieved on all issues and to assign the program management of the TCP implementation to that on-site person. To avoid duplication of efforts, TAMU Extension assigned its subcontract with THCF to the CPA and ended its direct involvement with the oversight of TCP implementation. TAMU Research remains responsible for conducting DSL related research and for the implementation of the Change Detection Program.

As requested, the THCF subcontracted with BIO-WEST, Inc., a QTPC, to handle program management responsibilities and implement a comprehensive regulatory

compliance program. Beginning on January 4, 2016, BIO-WEST placed a person with compliance management experience on site full time in Midland to handle these functions with additional support from BIO-WEST personnel in Round Rock, Texas.

As the CPA continued its review into 2016, its need to be more directly involved in the oversight of the program became increasingly apparent. Accordingly, in February 2016, the CPA ended the contract with the THCF and issued a Request for Proposals (RFP) for an 18-month contract to implement the TCP. The RFP emphasized the need for an on-site regulatory compliance person. At the same time, the CPA committed itself to more direct oversight of the program led by the Director of EGESM. To bridge the resulting gap until a contractor could be selected and put in place in early March, the CPA entered in to a short-term contract with BIO-WEST to assume on the ground management of the TCP. The new structure will allow CPA to have direct control of managing the TCP.

The review of TCP implementation by the CPA is ongoing, and it is possible additional issues may be identified. If any issues are found, the CPA will resolve them as it has done so far.

SECTION II. RESEARCH

The TCP provides funding for research activities to gain a better understanding of the effectiveness of the TCP conservation measures and the population biology and ecology of the DSL. On-going research activities under the TCP include annual survey and monitoring efforts to evaluate the status and trends of DSL occupancy and occurrence across different quality habitats through time. The goals of the survey and monitoring efforts are:

- To expand 2011-2012 survey efforts by adding survey sites that verify projected DSL occupancy in habitats not yet surveyed; and,
- To identify long-term survey sites that provide data on how patterns of occupancy of DSL populations vary through time.

In 2015, TAMU Research conducted research, including field studies, designed to answer questions related to DSL behavioral, population, and community ecology. The goals of the research were:

- To understand how landscape configuration and patterns of land use influence DSL movements and behavior;
- To quantify the dynamics of DSL populations at key study sites and assess the effects of roads and well pads and mesquite on lizard demography and immigration; and,
- To map suitable and potential habitat and identify critical areas for conservation, plan dispersal corridors, and classify threats to DSL persistence.

Over time, the information gathered from each of these studies can be integrated into a spatially explicit population model that evaluates how different land use scenarios relevant to the TCP may alter the probability of DSL persistence across shinnery oak sand-dune habitats in Texas.

Research activities conducted in 2015 will be completed and a final report prepared by May 2016. Additional information about the 2015 research activities including studies and surveys conducted, methods, results, and discussion are included in Appendix D.

Over the next four years, in addition to annual survey and monitoring efforts, TAMU Research will complete additional research tasks to further inform conservation efforts and evaluate the effectiveness of the TCP mitigation and recovery activities. These tasks further described in Appendix E include:

- Evaluation of translocation of DSL to unoccupied habitat in Texas;
- Effects of mesquite on DSL Habitat suitability and occupancy; and,
- Effects of road and well pad reclamation on DSL Habitat suitability.

These projects have been reviewed by the Science Advisory Committee and are expected to begin with the 2016 spring field season.

SECTION III. OVERALL EFFECTIVENESS OF THE TCP

The TCP is proving to be an effective contributor to the conservation of the DSL and its habitat.

First, surface disturbance of DSL Habitat has been shown to be substantially below the values established for the first three years of the TCP as triggers for reevaluating the effectiveness of the program. The TCP allows for a total of 21,257 acres of surface disturbance in DSL Habitat and buffer during the duration of the TCP. However, the TCP requires a review of the allowable habitat loss and possible changes to the TCP if the total surface disturbances during the initial three years of the program are within 75 percent of the values set out in in Table 8-2 of the TCP.

Table 5 describes the total allowable surface disturbance under the TCP, values in the first three years that would trigger the three-year review, and the surface disturbances that occurred during the first three years of the TCP.[11]

[11] Two of the CIs contain the following language "surface disturbance activities on Enrolled Lands will only contribute to the total amount of incidental take authorized of 21,257 acres by the TCP and Section K of the Enhancement of Survival Permit through buffer loss." Even though it is not required, we have elected to include the surface disturbances for these CIs in this three year review to show that the total amount of disturbances is far below the 75 percent threshold.

Table 5. Surface Disturbance for the First Three Years of TCP Implementation

Habitat Type	Total Allowable Surface Disturbance	Total Allowable Surface Disturbance - Three Year Review	Occupied, Suitable, or Dispersal Habitat within Polygon	Other Areas within Polygon	Buffer
Very High	6,916	707	16.50	59.95	52.35
High	3,429	350	0	0	0
Low	3,504	358	18.00	33.00	0
Very Low	7,408	758	8.26	62.03	2.00
Total	21,257	2,173	43.06	154.98	54.35

In the three years since approval of the TCP, a total of 252.39 acres were impacted of the 2,173 DSL Habitat acres allowed to be disturbed under Table 8-2 of the TCP. Thus, disturbance of DSL Habitat was substantially below the trigger values in the TCP for reevaluating the program.

Second, Participants have reduced potential disturbances to DSL Habitat through a combination of avoidance and minimization activities including:

- co-locating wells and other infrastructure on a single well pad;
- re-using previously abandoned well sites;
- using smaller drilling rigs;
- changing well pad dimensions to avoid DSL Habitat;
- utilizing horizontal drilling to go beneath DSL Habitat dune complexes; and
- routing pipelines around DSL Habitat or along existing infrastructure.

Third, four years of annual DSL surveys and other research conducted through the TCP is contributing valuable information regarding the DSL and its habitat as well as information essential to the ultimate development of effective conservation strategies for the species.

Finally, through its review, the CPA identified and made needed improvements in the program. Going forward, it is reasonable to expect the overall effectiveness of the TCP will remain positive.

The TCP continues to represent an innovative approach that protects species with minimal impact to private landowners. Strong participant relationships, ongoing research and continuing refinement in plan administration are improving the TCP's overall effectiveness, thus ensuring the preservation of the Dunes Sagebrush Lizard and its habitat.

APPENDICES

Appendix A Texas A&M AgriLife Extension Conservation Measures Monitoring Protocol

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Appendix C Summary of Surface Disturbances to Date

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APPENDIX A.

Texas A&M AgriLife Extension Conservation Measures Monitoring Protocol

Texas A&M AgriLife Extension Conservation Measures Monitoring Protocol

As described in the Texas Conservation Plan (TCP) for the Dunes Sagebrush Lizard (DSL) (Section 6), Participants of the program may perform Covered Activities (Section 6.1, TCP) as long as they are in compliance with the terms of their Certificates of Inclusion (CI) under the Candidate Conservation Agreement with Assurances (CCAA) or Certificate of Participation under the Habitat Conservation Plan. In order to meet conservation goals of the TCP, Conservation Measures (Section 8.6, TCP),which apply to DSL habitat and surrounding buffer zones, are a suite of strategies that can be used by Participants, as appropriate, under the CCAA. Specific Conservation Measures used by a Participant are determined on a case-by-case basis, as appropriate, as part of the CI process, and once case-by-case Conservation Measures are established in a CI; performance of those measures by the Participant are required in accordance with the terms of their CI.

The Texas Habitat Conservation Foundation (THCF) is responsible for ensuring overall compliance with the TCP and associated CI or CP for Participants. In collaboration with the Texas A&M AgriLife Extension Service (Extension), the following protocol will be utilized in order to verify knowledge (training) and compliance of Conservation Measures in accordance with each Participants' CI.

1. THCF will develop a Conservation Measures monitoring checklist for each Participant, unique to the Conservation Measures outlined in their CI (example of Oil and Gas and Agriculture checklists, Appendix A and B).
2. THCF will implement a bi-annual Conservation Measures monitoring schedule unique to each Participant. This monitoring schedule will be followed for the life of the Participants' enrollment in the TCP.
3. THCF will perform the scheduled bi-annual review either onsite or through desktop review (conference call).
    - During Participant reviews the THCF may need to administer training for new enrollees and new Participant employees or refresher training. Material for such training will be developed based on the Participants' needs and general CI requirements.
4. THCF will fill out the Conservation Measures monitoring checklists based on the Participants' responses and training administered (if applicable) during the review. Once completed, the THCF will have the Participant review and verify (sign) the checklist before sending a completed copy to Extension for review.
5. Extension will verify all Participant reviews are completed by the sixth month mark (June 30 and December 31) of each year.
6. THCF will further report all Conservation Measures activities as appropriate (e.g., monthly reports, annual report etc.)

Appendix A.

Conservation Measures – Compliance Monitoring Checklist

Texas Conservation Plan for the Dunes Sagebrush Lizard

Participant Number _____

The following checklist will aid in compliance monitoring of Conservation Measures outlined in each Participant's Certificate of Inclusion (CI). This report only applies to the quarter specified below.

Date: _____

Observer: _____

Reporting Period: _____
(1or 2)

Training Administered: _____
(Yes or No)

Monitoring Type: _____
(Onsite or Desktop)

By signing below, I certify that the following and attached information (if applicable) is true and correct to the best of my knowledge.

_____ _____
Observer Date

_____ _____
Participant Authorized Officer Date

Please read the following questions for each section carefully and respond accordingly.

EXAMPLE

Seismic and Land Surveying: *Notify THCF in advance of any seismic surveys.*

- Limit seismic surveying to areas outside of Dunes Sagebrush Lizard (DSL) Habitat or utilize walk in geophone (or other smaller seismic surveying equipment) where possible.
- When feasible in the reasonable judgment of the Participant, avoid DSL Habitat; if necessary, lay lines over DSL Habitat via foot, while seismic truck can be located 200 meters from lines.
- Consider seasonal periods of activity for impact level as appropriate and based on information from continued scientific research.

1. Was training administered about Seismic and Land Surveying Conservation Measures? *If "No", please describe.*

   □Yes □No

   _____

   _____

2. Were season restrictions observed by the Participant? *If "No", please describe.*

   □Yes □No

   _____

   _____

3. How many seismic surveys were conducted?

   _____

Comments on Seismic and Land Surveying:

_____

_____

_____

_____

□ Compliance documented (check if complete)

EXAMPLE

Construction: *All construction near or in areas of DSL Habitat as identified by the TCP, Figure 1, must be coordinated with the THCF.*

- Maximize use of existing developed areas and rights-of-ways for infrastructure supporting the development of the well (roads, power lines, pipelines, flowlines).
- When feasible in the reasonable judgment of the Participant, Well Sites should be developed outside of DSL Habitat.
- Minimize footprint for development, i.e., size of Well Site; centralized facilities; interim reclamation (reclaim portion of location after drilling and completion).
- When feasible, schedule temporary surface disturbance activities such as installation of lines during periods of seasonal DSL inactivity (i.e., October to March).
- Utilize directional drilling for avoidance of DSL Habitat, when practical.

1. Was training administered about Construction Conservation Measures? *If "No", please describe.*

   □Yes □No

   _____

   _____

2. Were existing developed areas and rights-of-ways for infrastructure utilized by the Participant? *If "Yes", please describe.*

   □Yes □No

   _____

   _____

3. Were all well developments outside of DSL habitat? *If "No", please describe.*

   □Yes □No

   _____

   _____

4. Was footprint minimization utilized? *If "Yes", please describe.*

   □Yes □No

   _____

   _____

EXAMPLE

5. Was inactive period utilized? *If "No", please describe.*

□Yes □No

_____

_____

6. Was direction drilling utilized? *If "Yes", please describe.*

□Yes □No

_____

_____

Comments on Construction:

_____

_____

_____

_____

□ Compliance documented (check if complete)

EXAMPLE

Drilling and Completion: *All drilling and completion activities near or in areas of DSL Habitat as identified by the TCP, Figure 1, must be coordinated with the THCF.*

- Control dust by actions such as vehicle speed limits not to exceed 25 miles per hour on unpaved roads (i.e., through signage and training) and/or water application to roads. Water used in road application will comply with state regulations.
- Restrict traffic to existing roads.
- Restrict, unnecessary off road vehicle access.
- Properly manage trash and human waste.

1. Was training administered about Drilling and Completion Conservation Measures? *If "No", please describe.*

   □Yes □No

   _____

   _____

2. Does the Participant have a policy in place to address vehicle speed limits? *If "Yes", please describe.*

   □Yes □No

   _____

   _____

3. Does the Participant have a policy in place to address restriction of traffic? *If "Yes", please describe.*

   □Yes □No

   _____

   _____

4. Does the Participant have a policy in place to address off road vehicle access? *If "Yes", please describe.*

   □Yes □No

   _____

   _____

EXAMPLE

5. Does the Participant have a policy in place to address waste management? *If "Yes", please describe.*

   □Yes □No

_____

_____

Comments on Drilling and Completion:

_____

_____

_____

_____

□ Compliance documented (check if complete)

EXAMPLE

Operations and Maintenance:

- Improve DSL Habitat through reclamation of abandoned locations in compliance with terms of any applicable lease or contractual agreement.
- Reduce footprint through management of abandoned wells, locations, roads and other infrastructure within the terms of any applicable lease or contractual agreement.
- Reclaim DSL Habitat with habitat appropriate native vegetation, using locally-sourced native seeds and vegetation in restoration efforts when possible.
- Relocation of infrastructure as development creates opportunity to reduce footprint within DSL Habitat.
- Avoid introduction of non-native vegetation. If an activity is identified that introduces new non-native vegetation, the activity or source will be controlled to manage or remove the invasive vegetation in accordance with landowner agreements.
- Remove invasive plants such as mesquite.
- Minimize spills through inspection, monitoring and maintenance programs.
- Avoid aerial sprayed application of approved herbicide for weed control (e.g., utilize pellets, hand applicators or manual removal).
- Minimize OHV activity in DSL Habitat.
- Use scada or remote well monitoring, where appropriate, to reduce traffic in and around DSL Habitat.
- When feasible in the reasonable judgment of the Participant, utilize closed loop drilling systems to reduce pit construction and heavy equipment activity.
- Where feasible in the reasonable judgment of the Participant, transfer hydrocarbon liquid product via pipeline rather than truck hauling.
- Train employees in spill response procedures.

1. Was training administered about Operations and Maintenance Conservation Measures? *If "No", please describe.*

   □Yes □No

   _____

   _____

EXAMPLE

2. Did the Participant reclaim any abandoned locations? *If "Yes", please describe.*

   □Yes □No

3. Did the Participant reduce footprint through management of abandoned wells, locations, roads and other infrastructure? *If "Yes", please describe.*

   □Yes □No

4. Did the Participant reclaim DSL Habitat with appropriate native vegetation? *If "Yes", please describe.*

   □Yes □No

5. Did the Participant reduce footprint through relocation of infrastructure (out of DSL Habitat)? *If "Yes", please describe.*

   □Yes □No

6. Did the Participant introduce and non-native vegetation, and if yes, what management is occurring to remove the non-native vegetation? *If "Yes", please describe.*

   □Yes □No

7. Did the Participant perform any invasive plant species (such as mesquite) removal? *If "Yes", please describe.*

   □Yes □No

EXAMPLE

8. Does the Participant have policies in place to address inspection, monitoring and maintenance programs which would help minimize spills? *If "Yes", please describe.*

   □Yes □No

9. Did the Participant utilize aerial spraying as a method for weed control? *If "Yes", please describe.*

   □Yes □No

10. Does the Participant have a policy to address OHV activity in DSL Habitat? *If "Yes", please describe.*

    □Yes □No

11. Did the Participant utilize scada or remote well monitoring in and around DSL Habitat? *If "Yes", please describe.*

    □Yes □No

12. Did the Participant utilize closed loop drilling systems in and around DSL Habitat? *If "Yes", please describe.*

    □Yes □No

13. Does the Participant utilize pipelines when transferring hydrocarbon liquid product? *If "Yes", please describe.*

    □Yes □No

EXAMPLE

14. Does the Participant have a policy to address employee spill response procedures? *If "Yes", please describe.*

□Yes □No

_____

_____

Comments on Operations and Maintenance:

_____

_____

_____

_____

□ Compliance documented (check if complete)

EXAMPLE

Appendix B.

Conservation Measures – Compliance Monitoring Checklist

Texas Conservation Plan for the Dunes Sagebrush Lizard

Participant Number _____

The following checklist will aid in compliance monitoring of Conservation Measures outlined in each Participant's Certificate of Inclusion (CI). This report only applies to the quarter specified below.

Date: _____

Observer: _____

Reporting Quarter: _____
(1or 2)

Training Administered: _____
(Yes or No)

Monitoring Type: _____
(Onsite or Desktop)

By signing below, I certify that the following and attached information (if applicable) is true and correct to the best of my knowledge.

_____ _____
Observer Date

_____ _____
Participant Authorized Officer Date

Please read the following questions for each section carefully and respond accordingly.

EXAMPLE

Brush Management:

- Brush management practices will include avoidance and minimization to limit adverse impacts to DSL Habitat loss.
- Herbicide application to dune/blow out complexes and surrounding buffer areas and dispersal corridors will be avoided. To minimize impacts, suppressed rates of approved herbicides will be applied to shinnery oak populations on adjacent flats outside dune habitat (Tebuthiuron specific measures are included under Section 8.6.3). A minimum of a 30.48 meter (100 foot) buffer will be utilized to reduce bleed over into DSL Habitat.
- Other management practices include control and/or elimination of mesquite, and other invasive and problematic herbaceous and woody species that would degrade or impair DSL Habitat.

1. Were brush management and/or invasive species control implemented? *If "Yes", please describe.*

   □Yes □No

_____

_____

2. Was herbicide application used in or near dune/blow out complexes and surrounding buffer areas? *If "Yes", please describe.*

   □Yes □No

_____

_____

Comments on Brush Management:

_____

_____

_____

_____

□ Compliance documented (check if complete)

EXAMPLE

Grazing:

- Grazing will be managed in accordance with NRCS Prescribed Grazing Standards, and will include proper stocking rates.
- Developing improved herbaceous plant community outside the DSL Habitat will reduce the need of domestic livestock to infringe into DSL Habitat to forage.

1. Is there a Grazing Plan in place? *If "No", please describe. If "Yes", review plan for appropriateness*

   □Yes □No

_____

_____

2. Is the Participant developing the herbaceous plant community outside of DSL Habitat? *If "Yes", please describe.*

   □Yes □No

_____

_____

Comments on Grazing:

_____

_____

_____

_____

□ Compliance documented (check if complete)

EXAMPLE

Building and Maintaining of Fences and Livestock Structures:

Control dust by actions such as vehicle speed limits not to exceed 25 miles per hour on unpaved roads (i.e., through signage and training) and/or water application to roads. Water used in road application will comply with state regulations.

- New fences and/or livestock structures will be constructed outside DSL Habitat when possible.
- Where avoidance is not an option, construction of new fences and livestock structures and maintenance of fences and livestock structures should be confined to the period during which the DSL is inactive, i.e., October – March.

1. Were new fences and/or livestock structures constructed in DSL Habitat? *If "Yes", please describe.*

   □Yes □No

_____

_____

2. If new fences and/or livestock structures were constructed and/or maintenance of fences and livestock structures took place in DSL Habitat, were DSL seasonal restricts observed? *If "No", please describe.*
   □Yes □No

_____

_____

Comments on Building and Maintaining of Fences and Livestock Structures:

_____

_____

_____

_____

□ Compliance documented (check if complete)

EXAMPLE

Water/Windmill:

- New water facilities and windmills will be constructed or placed outside of DSL Habitat when possible. This will reduce the possible usage of shinnery oak by domestic livestock in DSL Habitat.
- Water lines should avoid DSL Habitat and should use existing rights-of way when possible. When avoidance is not possible, activities should be confined to the period during which the DSL is inactive, i.e., October – March.

1. Were new water facilities and/or windmills constructed in DSL Habitat? *If "Yes", please describe.*

   □Yes □No

_____

_____

2. If new water facilities and/or windmills were constructed and/or maintenance of water facilities and/or windmills took place in DSL Habitat, were DSL seasonal restricts observed? *If "No", please describe.*

   □Yes □No

_____

_____

Comments on Water/Windmill:

_____

_____

_____

_____

□ Compliance documented (check if complete)

EXAMPLE

APPENDIX B.

Texas A&M AgriLife Extension File Audit

Texas Habitat Conservation Foundation
Document Audit

Alison Lund, Texas A&M AgriLife Extension Service

September 11, 2015

This is a basic document audit to account for files maintained by Jason Brooks, Executive Director of the Texas Habitat Conservation Foundation.

The Texas Habitat Conservation Foundation (THCF) is under subcontract with Texas A&M AgriLife Extension Service (TAMU Extension) to administer the day-to-day operations of the Texas Conservation Plan for the Dunes Sagebrush Lizard (TCP). The THCF is required by contractual obligations to retain certain records. "Records" refers to all THCF records (and can be used interchangeably with "documents"), including written, printed, and recorded materials, as well as electronic records (i.e., emails and documents saved electronically). As stated in the THCF Record Retention Policy (and subcontract with TAMU Extension):

> **Retention of Records**. THCF shall create, maintain and retain sufficient records to adequately document any and all transactions related to the implementation of the TCP at a level of detail satisfactory to Contractor. THCF shall retain fiscal records and supporting documentation for all expenditures related to this subcontract at its principal office adequate to ensure that claims for reimbursement are in accordance with applicable Comptroller and State of Texas requirements. THCF shall maintain all such documents and other records relating to this subcontract for a period of four (4) years after the date of submission of the final invoice or until a resolution of all billing questions raised by Contractor with respect to a particular transaction, whichever is later.
>
> **Access to Records**. THCF shall give the Auditor of the State of Texas, Comptroller, Contractor or any of their duly authorized representatives, during normal business hours, access to and the right to examine all books, accounts, records, reports, files, other papers, things or property belonging to or in use by THCF pertaining to this subcontract. Such rights to access shall continue as long as the records are retained by THCF. THCF shall cooperate with auditors and other authorized representatives of the Comptroller and the State of Texas and shall provide them with prompt access to all such property as requested by the Comptroller or the State of Texas. THCF's failure to comply with this Section VII shall constitute a material breach of this subcontract and shall authorize Contractor to immediately terminate this subcontract. THCF agrees to maintain such records in an accessible location.

On September 3-4, 2015 TAMU Extension reviewed all files maintained by THCF employee Jason Brooks. The following details Mr. Brooks' files maintained in relation to the TCP.

It is important to note the following:

- Some documents created at the beginning of the TCP have been modified and new documents have been added as that program has developed and requirements from the Permit Holder have changed.
- THCF related material such as bank statements, legal documents, financial records etc. are maintained by the THCF bookkeeper (see THCF Document Retention Policy). Mr. Brooks maintains all program specific files which involve implementation of the TCP and all Participant matters. THCF material was not reviewed during this audit.

Hard Copy Files

Mr. Brooks maintains all hard copy files in a locked, fireproof filing cabinet. The files are logically organized by category and include appropriate contents. Attachment A describes the hard copy files maintained.

Electronic Copy Files

Mr. Brooks maintains all electronic copy files on a password protected computer. He also maintains an external hard drive for backup. The files maintained on the computer mirror the hard copy files with the exception of early field notes which were not all scanned and saved to the computer (these notes are maintained in hard copy form). Through email, all relevant conversations relating to the TCP are saved in electronic folders in microsoft outlook and/or as a PDF in the electronic folders on the computer. Other documents such as Monthly Reports and spreadsheets are maintained electronically. Files with confidential Participant information are password protected.

Suggestions

Through this review, TAMU Extension has developed a few suggestions to improve the THCF file maintenance. The following suggestions have already been implemented by the THCF and are reflected in Attachment A.

1. Annual Meeting/Annual Report material- THCF had one folder with all contents included (from each year).

Suggestion: Create separate folders for each year.

2. Recovery Award Sale Material - THCF had deposit forms, invoices and check copies in separate folders.

Suggestion: Staple deposit forms, invoices and check copies together and mark Paid once complete to ensure Participant completion of purchase. Include in appropriate Participant file.

3. Enrollment Fee Material - THCF had deposit forms, invoices and check copies in separate folders.

Suggestion: Staple deposit forms, invoices and check copies together and mark Paid once complete to ensure Participant completion of fee payment.

4. Mitigation Project Material - THCF had well information, memos, and other related material in separate folders.

Suggestion: Staple all related information (for each well) together and mark Paid once complete to ensure Participant completion and payment for mitigation work.

5. Conservation Measures Monitoring- Did not exist

Suggestion: Once we begin new Conservation Measures Monitoring, create yearly folders to maintain documentation of Participant compliance.

6. Plans for Development- THCF maintained all staked sites in one folder, including both completed and non-completed sites.

Suggestion: Create separate folder for completed Surface Developments. Attach signed surface development plan to field notes, memo, verification and photos.

7. Texas Tech University Audit Communication- THCF did not have all communication by Texas Tech University for each Recovery Project printed.

Suggestion: Print all Texas Tech communication regarding projects and put in each project file.

Attachement A Document Audit- Hard Copy Files

File Name	Contents	Comments
Annual Meeting Material	Agenda Powerpoints Handout Material Yearly Report	Folder for each year of the program
Annual Participant Reports	Participant reports	Folder for each year of the program
Enrollment Invoices	Enrollment invoices Deposit slips Check copies	Folder for each year of the program
Enrollment Forms-Voided	Enrollment forms of people who ended up not signing up for the program	
CDA	Excel sheets from each review CDA Booklets	
[redacted]	Maps of proposed pipeline Correspondence about the water line developed in 2013	
Blank Forms	Includes various templates	
Driving Forms	Driving form for each trip	Folder for each year of the program
Recovery Projects	Project Description Correspondence with FWS Checklist Contract Exhibit A and B Photos (before and after) Field notes Ranking sheet (if applicable) Bid Sheet Texas Tech University audit material Project verification Project request for payment	Folder for each Recovery Project, including voided projects
Participant Files [redacted]	General Information Certificate of Inclusion Enrollment Form	

	Formal Correspondence Plans for Development Site Development Plans Well Number Fee Paid notice Field notes Mitigation 2015 Well information, pre-treatment Memo, includes credits generated Photos Verification Field notes Non-compliance Correspondence with FWS Material related to iresolution Email correspondence Surface Disturbance Fees Deposit slip Check copies Landfarm Email correspondence Letter of correspondence Photos Remediation Action Plan Associated material Recovery Award Invoice Deposit slip Check copy	
[redacted]	Certificate of Inclusion Enrollment Form Plans for Development (if applicable) Well Number Correspondence with THCF Ag Management Plans (for Ag Participants) Recovery Award Invoices (if applicable) Deposit slip Check copies	

APPENDIX C.

Summary of Surface Disturbances to Date

Summary of Surface Disturbances to Date							
Date	**Dune Complex Habitat Management Unit**	**Habitat Class**	**Surface Disturbance**			**Credits/Awards Purchased.**	**Comments**
			Occupied, Suitable, or Dispersal Habitat within Polygon	*Other Areas within Polygon*	*Buffer*		
Apr-12	16	Very High	0	3.00	0	**SDF paid. 6.25 Recovery Awards purchased.**	Participant operating under the alternate CI constructed a well pad in non-habitat within polygon after executing the CI. Disturbance has been reported to FWS and SDF has been paid.
Jul-12	16	Very High	2.80	4.00	6.90	**23.2 Recovery Awards purchased.**	Disturbances were created by a Participant under a standard CI. The Participant was using the wrong maps in their planning. Annual compliance monitoring by the THCF and Extension identified the disturbances. Participant has acquired the needed recovery awards from the surplus held in Trust by the THCF.
Jul-12	4	Very Low	0	2.45	0	**SDF paid. Mitigation Plan executed.**	Participant operating under alternate CI failed to notify THCF of disturbance. THCF identified the disturbance through records review and verified with Participant. Participant has submitted the SDF.
Jul-12	3	Very Low	4.50	4.90	0	**SDF paid. Mitigation Plan executed.**	Participant operating under alternate CI failed to notify THCF of disturbance. THCF identified the disturbance through records review and verified with Participant. Participant has submitted the surface disturbance fees and has completed 4.5 acres of remediation of plugged and abandoned sites in addition to SDF
Dec-12	16	Very High	1.50	0	0	**3.75 Recovery Awards purchased.**	Disturbances were created by a Participant under a standard CI. The Participant self-reported the disturbance to THCF and purchased the required Recovery Awards to offset the disturbance.
Feb-13	16	Very High	0	0	2.00	**SDF Paid. 2.45 Recovery Awards purchased.**	Participant operating under the alternate CI constructed a well pad in the buffer area. A plan of development and surface disturbance fee were submitted in accordance with the terms of their CI.
Mar-13	16	Very High	0	0	4.00	**SDF paid. 3.6 Recovery Awards purchased.**	Participant operating under the alternate CI constructed two well pads in the buffer area. A plan of development and SDF were submitted in accordance with the terms of their CI.

Jul-13	9	Very Low	2.50	0	0	**SDF paid. 2.5 Recovery Awards purchased.**	Disturbances were created by a Participant under a standard CI. The disturbance was actually a facility and not subject to the regulatory permitting process (the Participant's internal group that handles TCP coordination). Annual compliance monitoring by the THCF and Extension identified the disturbances. Participant has acquired the needed recovery awards from the surplus held in Trust by the THCF.
Jul-13	16	Very High	0	1.50	0	**SDF paid. 2.5 Recovery Awards purchased.**	Participant operating under the alternate CI constructed an extension of an existing well pad within the polygon but outside of habitat. A plan of development and surface disturbance fee were submitted in accordance with the terms of their CI.
Jul-13	16	Very High	0	0	2.00	**SDF paid. 5.0 Recovery Awards purchased.**	Participant operating under the alternate CI constructed a well pad in the buffer area. A plan of development and surface disturbance fee were submitted in accordance with the terms of their CI.
Dec-13	16	Very High	0	0	2.00	**SDF paid. 5.0 Recovery Awards purchased.**	Participant operating under the alternate CI constructed a well pad in the buffer area. A plan of development and SDF were submitted in accordance with the terms of their CI.
Dec-13	4	Very Low	0	0	2.00	**SDF not required.**	Participant operating under the alternate CI constructed a well pad in the buffer area. A plan of development was submitted and no SDF was required in accordance with the terms of their CI.
Jan-14	16	Very High	0	3.00	0	**SDF paid. 7.5 Recovery Awards purchased.**	Participant operating under the alternate CI constructed 2 well pads within the habitat polygon, outside of actual habitat. One pad totaled 2 acres and the other was one acre.
Feb-14	16	Very High	0	1.00	1.00	**SDF paid. 5.0 Recovery Awards purchased.**	Participant operating under the alternate CI constructed 1 well pad straddling the habitat polygon, with 1 acre inside the polygon but outside of actual habitat and one acre in the buffer. Four well pads were also built on previously disturbed sites, totaling 6.5 acres of avoidance.
Mar-14	16	Very High	0	2.00	2.00	**SDF paid. 5.0 Recovery Awards purchased.**	Participant operating under the alternate CI constructed 2 wells pads; one within the habitat polygon, outside of actual habitat and one in the buffer. Each pad was approximately 2 acres.

May-14	16	Very High	0	0	0.60	**0.4 Recovery Awards purchased.**	Participant operating under standard CI constructed a well outside of habitat with a small portion located within the 200 m buffer. Participant has acquired the needed recovery awards from the surplus held in Trust by the THCF.
Jun-14	13	Low	18.3	26.3	0	**61.54 Recovery Awards purchased.**	Participant operating under a standard CI constructed a pipeline which crossed an HMU of Low LOO. Participant has acquired the needed recovery awards from the surplus held in Trust by the THCF.
Jun-14	16	Very High	0	0	3.70	**SDF paid. 4.4 Recovery Awards purchased.**	Participant operating under the alternate CI expanded a facility in the buffer area.
Jun-14	4	Very Low	0	0.10	0	**SDF paid. 0.1 Recovery Awards purchased.**	Participant operating under the alternate CI created a temporary road for used during upgrades to an existing facility.
Jul-14	4	Very Low	1.00	34.75	0	**45.79 Recovery Awards purchased.**	Participant operating under a standard CI constructed a pipeline which crossed an HMU of Low LOO. Recovery Awards purchased were reflected in July 2014 Report
Aug-14	5	Very Low	0	8.10	0	**8.1 Recovery Awards purchased.**	Participant operating under a standard CI constructed a pipeline which crossed an HMU of Very Low LOO. Actual habitat was avoided through planning. Participant has acquired the needed recovery awards from the surplus held in Trust by the THCF.
Aug-14	16	Very High	0	0.25	2.75	**SDF paid. 4.5 Recovery Awards purchased.**	Participant operating under an alternate CI constructed a well pad to drill a horizontal well beneath the sand dune complex.
Aug-14	16	Very High	0	0	3.50	**SDF paid. 1.25 Recovery Awards purchased.**	Participant operating under an alternate CI constructed a well pad in the buffer to facilitate a traditional oil well and a salt water disposal well.
Aug-14	16	Very High	0	0	2.00	**SDF not required. 2.65 Recovery Awards purchased.**	Participant operating under the alternate CI constructed a well outside the habitat polygon, within the buffer, but beyond 200 meters from actual habitat.
Sep-14	16	Very High	0	0	3.00	**SDF paid. 0.95 Recovery Awards purchased.**	Participant operating under an alternate CI constructed a well pad to drill a horizontal well beneath the sand dune complex.
Oct-14	16	Very High	0	2.00	0	**5.0 Recovery Awards purchased.**	Participant operating under a standard CI constructed a well pad in non-habitat within polygon to drill a horizontal well beneath the sand dune complex.
Dec-14	16	Very High	0	1.00	2.00	**SDF paid. Disturbance offset with 6.6 Mitigation Credits.**	Participant operating under an alternate CI constructed a well pad to drill a horizontal well beneath the sand dune complex as well as a vertical well.

Dec-14	16	Very High	0	0	1.00	**SDF paid. 0.625 Recovery Awards purchased.**	Participant operating under an alternate CI extended an existing well pad to drill a horizontal well beneath the sand dune complex.
Jan-15	16	Very High	0	2.75	0	**SDF paid. Disturbance offset with 6.875 Mitigation Credits.**	Participant operating under an alternate CI built a facility to store and process product.
Jan-15	16	Very High	1.60	7.75	3.50	**26.92 Recovery Awards purchased.**	Participant operating under a standard CI constructed a pipeline which was colocated with an existing pipeline to the extent possible.
Mar-15	4	Very Low	0.26	11.73	0	**11.99 Recovery Awards purchased.**	Participant operating under a standard CI constructed a pipeline which was colocated with an existing pipeline and lease road to the extent possible. Recovery Awards were purchased and reported in January.
Apr-15	16	Very High	0	1.50	0	**SDF paid. Disturbance offset with 0.95 Mitigation Credits.**	Participant operating under the alternate CI constructed a well pad within the habitat polygon, outside of actual habitat.
Apr-15	16	Very High	3.50	0	1.40	**9.97 Recovery Awards purchased.**	Participant operating under a standard CI constructed a pipeline which directly crossed an area of habitat by the most direct route.
Apr-15	8	Low	0	6.70	0	**12.75 Recovery Awards purchased.**	Participant operating under a standard CI constructed a pipeline which avoided high quality habitat and colocated with an existing line through lower quality habitat.
May-15	16	Very High	0	2.50	0	**SDF paid. Disturbance offset with 6.25 Mitigation Credits.**	Participant operating under the alternate CI constructed a well pad within the habitat polygon, outside of actual habitat.
May-15	16	Very High	7.10	27.7	9.00	**97.1 Recovery Awards purchased.**	Participant operating under a standard CI constructed a pipeline which direct routes through habitat to existing storage facilities.
Jun-15	16	Very High	4.70	22.32	7.02	**60.33 Recovery Awards purchased.**	Participant operating under standard CI initiated pipeline construction extending through the habitat polygon and portions of actual habitat.
Jul-15	4	Very Low	0	0.79	0	**0.64 Recovery Awards purchased.**	Participant operating under a standard CI constructed a pipeline which direct routes through habitat polygon from existing pipeline to existing storage facilities.
Aug-15	3	Very Low	0	0.68	0	**SDF paid. Disturbance offset with 0.68 Mitigation Credits.**	Participant operating under the alternate CI constructed a well pad on an existing pad within the habitat polygon, outside of actual habitat. The 0.68 acres represents new disturbance only.

Aug-15	16	Very High	0	2.00	0	**SDF paid. Disturbance offset with 2.405 Mitigation Credits. 2.595 Recovery Awards purchased.**	Participant operating under the alternate CI constructed a well pad within the habitat polygon, outside of actual habitat.
Sep-15	16	Very High	0	0	0.50	**SDF paid. 0.31 Recovery Awards purchased.**	Participant operating under the alternate CI constructed a well pad outside of the habitat polygon but partially within the buffer.
Oct-15	16	Very High	0	1.75	0.75	**SDF paid. 6.25 Recovery Awards purchased.**	Participant operating under the alternate CI constructed a well pad within the habitat polygon, outside of actual habitat and extending into the buffer.
Jan-16	13	Low	0	0.33	0.48	**Pending**	Participant operating under a standard CI completed road construction linking 2 sections to provide access to 5 wells.
Jan-16	16	Very High	0	0.28	0.76	**SDF paid. 2.41 Recovery Awards purchased.**	Participant operating under alternative CI extended a portion of an existing well pad to accommodate additional operations.

APPENDIX D.

DSL Studies and Surveys Conducted and Analysis by Texas A&M AgriLife Research

DSL Studies and Surveys Conducted and Analysis by Texas A&M AgriLife Research

The TCP provides funding for research activities to gain a better understanding of the population biology and ecology of the DSL and impacts to its habitat. TAMU Research continues to conduct research activities outlined in the TCP (*Section 8.4*). The current research activities being performed are outlined in the Research Plan document and include field studies and impact assessments designed to answer questions related to DSL behavioral, population and community ecology. The data generated from these activities will be used to inform decisions about the development of measures needed to conserve the DSL. Specifically, the goals of these research activities are:

- To understand how landscape configuration and patterns of land use influence DSL movements and behavior;
- To quantify the dynamics of DSL populations at key study sites and assess the effects of roads and well pads and mesquite on lizard demography and immigration; and,
- To map suitable and potential habitat and identify critical areas for conservation, plan dispersal corridors, and classify threats to DSL persistence.

Over time, the information gathered from each of these studies can be integrated into a spatially-explicit population model that evaluates how different land use scenarios relevant to the TCP may alter the probability of DSL persistence across Shinnery Oak sand-dune habitats in Texas.

Research activities under the TCP also include annual survey and monitoring efforts to evaluate the status and trends of DSL occupancy and occurrence across different quality habitats through time. The goals of the survey and monitoring efforts are:

- To expand 2011-2012 survey efforts by adding survey sites that verify projected DSL occupancy in habitats not yet surveyed; and,
- To identify long-term survey sites that provide data on how patterns of occupancy of DSL populations vary through time.

Following the Adaptive Management process outlined in the TCP (TCP *Section 8.3*) and included in the FWS-approved Adaptive Management document[i], annual results from the monitoring and research tasks will be reviewed to determine if results should be incorporated into updates of the TCP and the Permit Area/Likelihood of Occurrence Map (Figure 1).

Methods

Study Design

The study design of this research program builds upon previous DSL research and the associated proven methodologies that have already provided insights into landscape-scale patterns of DSL distribution, population estimation, population genetics, habitat specificity and movements of gravid females, and the effects of oil and gas development on DSL detectability.[ii]

Surveys

Survey and monitoring efforts are designed to evaluate the status and trends of DSL occupancy at many sites through time. The DSL habitat occupancy surveys follow the methodology described in a 2011 report (Appendix E). This methodology is designed to increase the probability of detecting the DSL if it is present. This methodology has been used in surveys of the DSL in Texas and New Mexico since before 1997. The months of May-August are targeted for surveys, because these are the months of peak lizard activity in the Mescalero-Monahans Shinnery Oak dune ecosystem. During this period, lizards are establishing and defending territories, engaging in mate-seeking and nesting behaviors, and hatchlings are emerging.

During each survey, observers with extensive experience identifying DSLs in the field walked slowly through habitat searching for lizards. Observers did not walk a predetermined course; rather each observer carefully searched the area inspecting the habitat for all active lizards. When seen, lizards were identified to species and tabulated. Survey site locations and points where DSLs were observed were determined in the field with a hand-held Global Positioning System (GPS) unit (standard user precision only). Site locality data were recorded as decimal degrees using WGS84 as the GPS datum, but herein we report only site numbers to maintain compliance with landowner confidentiality agreements.

Behavior and Movement

We are analyzing DSL behavior and movements using the mark-recapture data collected from 4 years of trapping in the super-grids described below. Results from these additional behavior and movement analyses will be synthesized with findings from previous radio-telemetry studies on the species.

Population Dynamics

To quantify DSL demography in undisturbed and disturbed habitats, two pitfall trap super-grids were constructed for a mark-recapture study. One of these super-grids was constructed in undisturbed habitat and the other in disturbed habitat (Figure 2). Each

super-grid was designed with 36 sub-grids arranged in a 6 x 6 pattern with 50 meter spacing. Each sub-grid has nine pitfall traps arranged in a 3 x 3 pattern with 10 meter spacing. Thus, each super-grid contains a total of 324 pitfall traps (36 sub-grids x 9 traps each) that sample a 136,900 m^2 area (370 x 370 meter).

A pitfall trap consists of a five-gallon bucket, and plywood cover-board to provide shade (16”x16” painted piece of 3/8” plywood). A pitfall trap is created by burying the five-gallon bucket in the sand up to the rim, making sure not to fill the bucket with sand (Figure 3). When the super-grid is in operation, the buckets are open with the cover boards positioned 1-2 inches directly over the bucket opening. Lizards seeking refuge under the cover board move through this 1-2 inch gap and fall into the open bucket. The cover boards provide shade for trapped lizards waiting to be processed (i.e., waiting for TAMU Researcher to perform measurements and other necessary procedures before releasing). When the super-grid is not operational, buckets are sealed with tight-fitting plastic lids, covered with sand and covered with the boards.

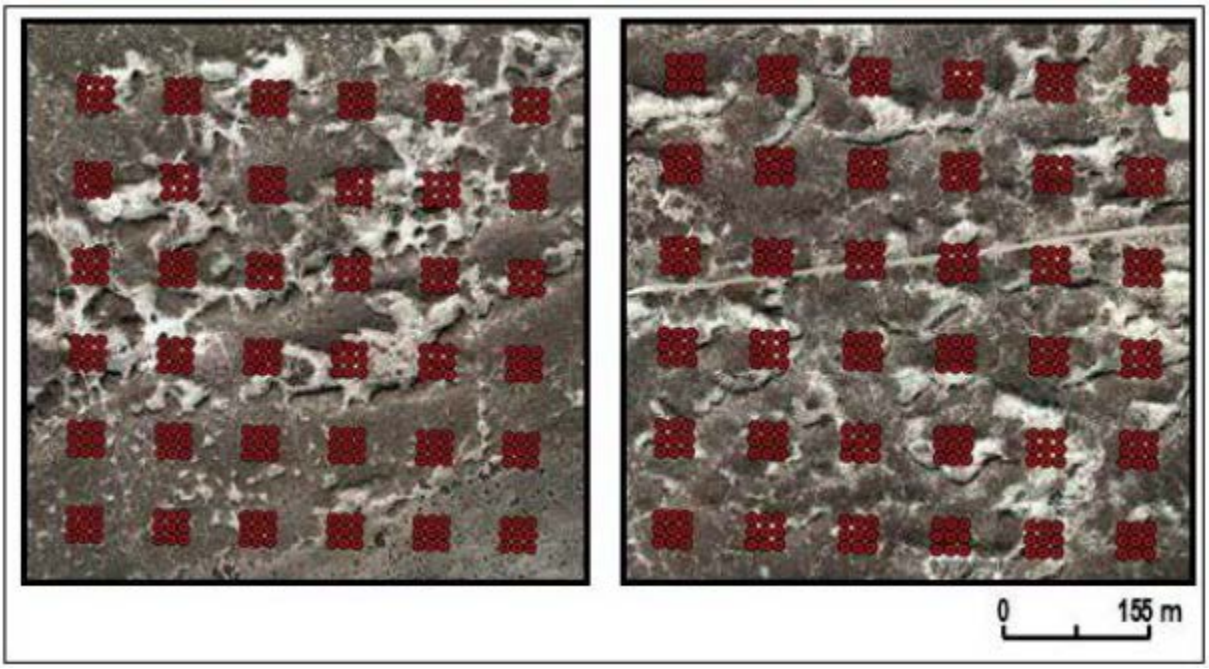

Figure 2. Mark-Recapture Super-grids. Super-grids constructed for mark-recapture study in undisturbed (left) and disturbed (right) habitats. Each red circle shows the location of a pitfall trap. See text for super-grid dimensions. Lighter shades depict blowouts embedded within the darker shaded shinnery oak sand dune landscape. The lightly shaded linear feature on the right is a road.

Figure 3. Pitfall Trap. Pitfall trap with cover board (upper left) and a female DSL left). Juvenile DSLs captured in pitfall trap (right).

Trapping sessions for each super-grid were eight days long in 2012 and six days long in 2013-2015. In 2012, most captures occurred in the first 6 days of trapping, dropping dramatically the last two days. Therefore, the trapping session was reduced, allowing more trapping sessions to occur each month. This adjustment to trapping methodology resulted in an increase in our trapping success rate for the DSL. On the first day of each trapping interval, all pitfall traps were opened, making the super-grid operational. Traps were checked every day, and lizards were processed on-site. On the final day of each trapping session, traps were checked, lizards were processed, and traps were closed. During processing, captured lizards were identified to species, given a unique mark (toe-clip) if not already marked (Figure 4), weighed, measured (e.g., length), and sex was determined. After recording the specific trap locality, the captured lizard was released.

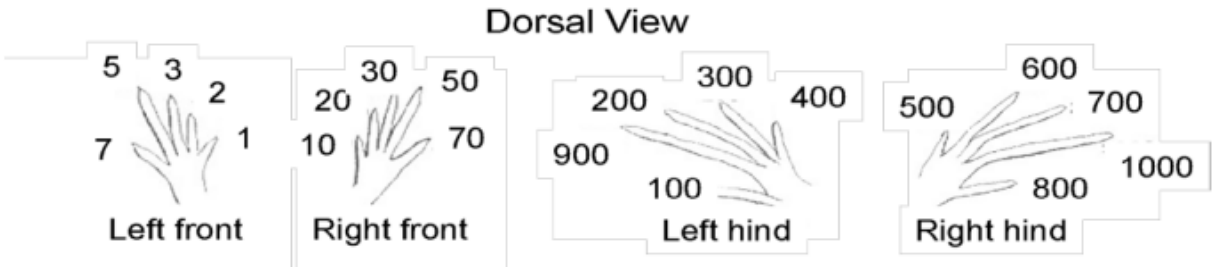

Figure 4. Marking Scheme for DSLs. Toes can be clipped in combination to provide unique numbered marks for up to 1,999 lizards.

Landscape Modeling of Habitat

While the current map depicting the TCP Permit Area/Likelihood of Occurrence

(Figure 1) reflects the best available knowledge of how occupied, suitable, and potential DSL habitat is arranged across the landscape, newer imagery is available for areas in Texas where the DSL exists. We are leading development of a refined range-wide analysis of suitable and potential DSL habitat that will continue to be effective at identifying areas where habitat conservation should be a priority under the TCP. Results of this analysis will guide updates to the current map, if needed, through the adaptive management process described in the TCP and the Adaptive Management document.

Persistence of DSL populations depends on the conservation of intact shinnery oak sand dunes, which are characterized by rugose topography and open patches of wind-blown sand, stabilized by shinnery oak. The focal variables used in our landscape model of DSL habitat suitability include the distribution of sand and shinnery oak as well as terrain rugosity (i.e., roughness of the topography). We used both Remote Sensing (RS) and Geographic Information Systems processing methods to identify, characterize, and analyze these variables (Figure 5).

To identify the extent of the study area and the distribution of shinnery oak sand dunes in Texas, we used the soil type and parent material data from the Soil Survey Geographic Database (SSURGO 2.2, http://soils.usda.gov/survey/ geography/ssurgo/) and Surface geology from Geologic Atlas of Texas (GAT). The SSURGO database stores a variety of soil information collected by the National Cooperative Soil Survey (NCSS) dating back more than 100 years. It consists of both georeferenced spatial and tabular soil data. The spatial units are linked to attributes in the tabular data in the Map Unit Interpretations Record relational data base. The tabular attribute data contains estimates of physical and chemical soil properties, soil interpretations for each soil, and static and dynamic metadata. The digital raster format surface geology maps come from GAT, which was created by scanning and geo referencing the original University of Texas, Bureau of Economic Geology Geologic Atlas of Texas map sheets. GAT data provided subsurface geologic information for the entire state at the scale of 1:250,000.

We identified sand and shinnery oak land cover types in the study area using RS classification of the 1- meter resolution color infrared (false-color) National Agriculture Imagery Program (NAIP) imagery in 4- bands (Red, Green, Blue, and near infrared) from the rear of 2014 (Retrieved in January 2015; http://gis.apfo.usda.gov/arcgis/ services/). The NAIP program is administered by the United States Department of Agriculture's (USDA) Farm Service Agency (FSA). The aerial photography NAIP imagery meets the FSA standards and is used to support FSA farms and its environment conservation programs. Remote sensing classification of this imagery is the process of converting spectral information in remotely sensed images from satellite or aircraft into a finite set of land cover classes or themes. We used the Environment for Visualizing Images (ENVI) RS software application to process and analyze geospatial imagery. It is widely used by professionals and image analysts in the RS field.

The ENVI platform provides two RS imagery types of classification: Unsupervised and Supervised. Each type of classification can be made with a broad range of different classification methods. Unsupervised classification is an approach that examines unknown pixels and categorizes them into a number of classes based on spectral response patterns within an image. It is performed to classify land cover types in RS imagery without providing training data. Its basic rule is that pixels from the same land cover type should be close together in the spectral measurement space, while pixels from different land cover types should be relatively well separated in spectral space. Classes generated from unsupervised classification are referred to as spectral classes, because they are entirely based on image spectral information (pixel values). The supervised classification technique requires user pre-defined training classes and is used to cluster pixels into classes based on training data provided by the user. It has various classification algorithms including maximum likelihood, minimum distance, Mahalanobis distance, Spectral Angle Mapper (SAM), Parallelepiped, Binary Encoding, etc.

We first applied the unsupervised Iterative Self-Organizing Data Analysis Technique (ISODATA) and K-mean classification methods to determine the number of characteristics of the natural groupings of cells in NAIP imagery. We found that the NAIP imagery can be divided into five main classes, meaning the image classification results don't change much when specifying the numbers of classes more than five. The imagery classification classes included sand, shinnery oak, caliche (well pads and roads), mesquite, and grass land cover types.

Seven supervised classification methods were tested; these were Mahalanobis distance, maximum likelihood, minimum distance, parallelepiped, binary encoding, SAM, and spectral Information Divergence (SID). Regardless of methodology, the supervised classification enhanced the extraction of sand and shinnery oak compared to the unsupervised classification results. Overall, Mahalanobis distance classifiers produced the best results.

To calculate the terrain rugosity, we used the digital elevation map from National Elevation Database (NED) and the Shuttle Radar Topography Mission (SRTM) data as the source elevation data. The NED, developed by U.S. Geological Survey (USGS), is a seamless mosaic of best-available elevation data. We used the 10-meter NED data (2013 released version, retrieved from http://nationalmap.gov/elevation.html). The NED data worked well throughout most of the known DSL distribution in Texas. However, it was imprecise in several discrete areas of open sand dunes without vegetation. In these areas, we used SRTM data to calculate terrain rugosity. SRTM technology uses radar interferometry to generate terrain elevation information by comparing two radar signals that are taken at slightly different locations. Therefore, the accuracy of SRTM is not affected in the areas of open sand dunes without vegetation. We used the 30 meter

resolution SRTM data to calculate rugosity in those particular areas to compensate for the low accuracy of NED data.

The most commonly used terrain rugosity calculation tools are Benthic Terrain Modeler (BTM) and Arc-Chord Ratio (ACR). The BTM toolbox for ArcGIS contains a set of tools that allow users to calculate the terrain characteristics such as bathymetric position index (BPI), aspect, slope, and Terrain ruggedness (i.e., vector ruggedness measure, VRM) from a spatial input data set. VRM measures terrain rugosity using the vector analysis to quantify the dispersion of vectors orthogonal to the terrain surface in three-dimensional orientation within a specific grid cells window. By using the vector analysis in BTM toolbox, the variability in slope and aspect is effectively captured into a single measured value. The VRM values can be from 0 (no terrain variation at all) to 1 (complete terrain variation). However, the typical values for real world terrains usually range from 0 to around 0.4. The ACR rugosity index is calculated from the contoured area of the surface divided by the area of the surface orthogonally projected onto a plane of best fit (POBF), where the POBF is a function (interpolation) of the boundary data only. We tested both BTM and ACR rugosity calculation results and found BTM decoupled the slope and generated better output than the ACR.

By overlaying DSL localities onto these classification and rugosity results, we should be able to identify and quantify the geospatial attributes that best explain DSL presence. Then, we can estimate the likelihood of DSL occurrence throughout the species' range in Texas. We note the analysis will be predictive, and only on-the-ground field surveys can confirm actual DSL presence at a particular place and time. Results of this analysis will guide updates to the current map, if needed, through the adaptive management process described in the TCP and the Adaptive Management document.

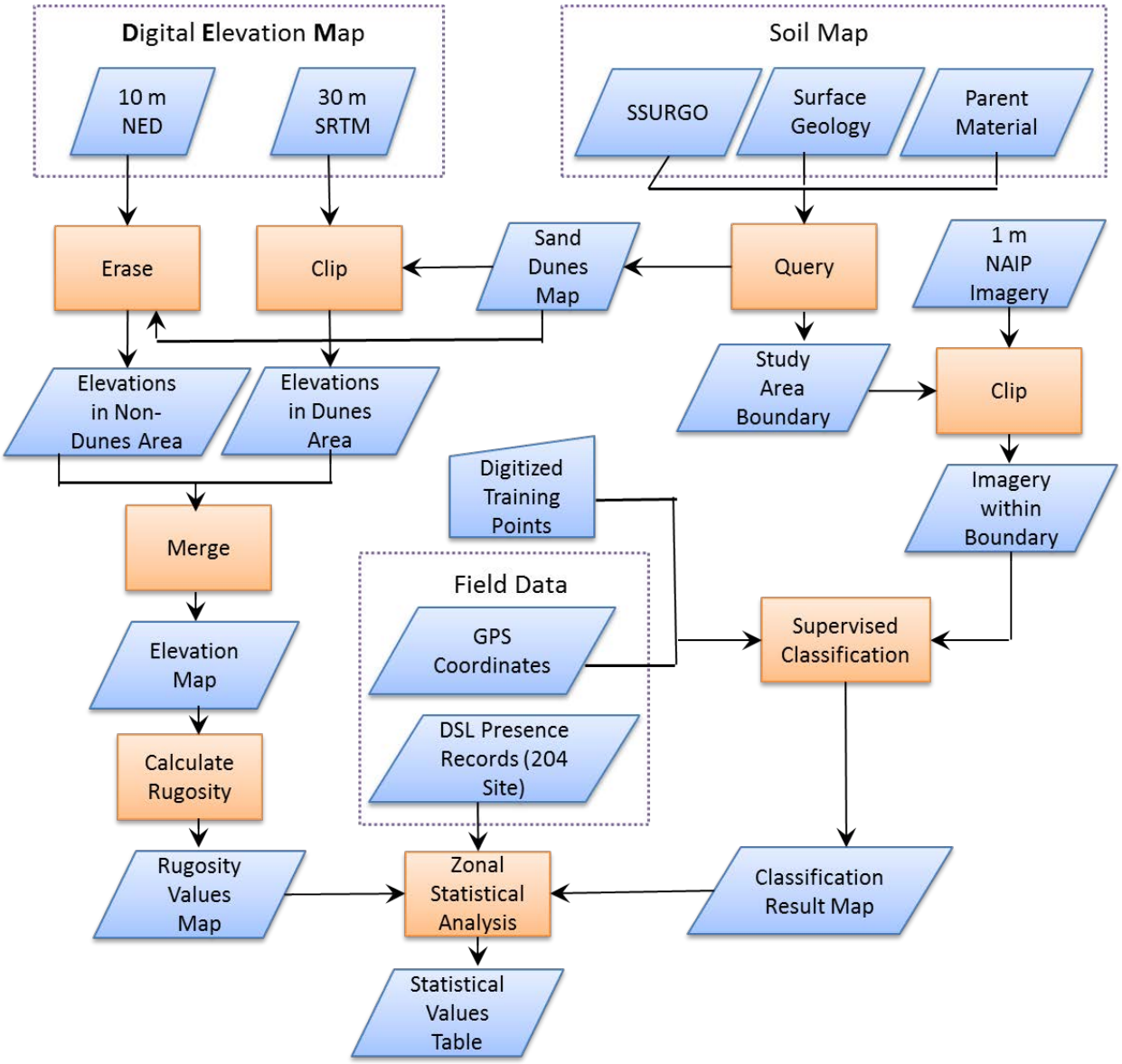

Figure 5. Workflow chart of remote sensing (RS) and geographic information system (GIS) processing.

Results, Discussion, Future Research

Surveys and Monitoring

In 2015, 144 DSL surveys were conducted in Andrews, Winkler, Ward, and Crane Counties. All surveys were carried out by four to five experienced observers between 8:32 AM and 12:55 PM (Table 5) during the morning activity period of the DSL.

Table 5. Surveys conducted for DSLs in 2015.

Site	Survey	Date	County	Start	End	Observers	Person Minutes	DSL Present
1	1	6/11/2015	Andrews	10:55	11:25	4	2:00	0
2	1	6/21/2015	Andrews	11:35	12:05	4	2:00	0
3	1	6/20/2015	Andrews	11:14	11:44	4	2:00	0
4	1	7/4/2015	Andrews	11:15	11:46	4	2:04	0
5	1	6/19/2015	Andrews	11:15	11:40	4	1:40	0
6	1	7/24/2015	Andrews	8:38	9:09	4	2:04	0
7	1	7/19/2015	Andrews	11:40	12:09	4	1:54	0
8	1	7/23/2015	Andrews	9:46	10:15	4	1:54	0
12	1	6/4/2015	Andrews	11:49	12:20	5	2:35	1
14	1	7/24/2015	Andrews	10:47	11:15	4	1:52	0
16	1	7/24/2015	Andrews	10:00	10:30	4	2:00	0
17	1	7/5/2015	Andrews	11:33	12:04	4	2:04	0
18	1	7/20/2015	Andrews	11:34	12:01	4	1:48	0
19	1	7/25/2015	Andrews	11:20	11:45	4	1:40	0
20	1	6/8/2015	Andrews	10:20	10:50	4	2:00	0
21	1	6/8/2015	Andrews	10:13	10:45	4	2:08	0
22	1	7/23/2015	Andrews	11:59	12:25	4	1:44	0
23	1	7/23/2015	Andrews	10:32	11:02	4	2:00	0
24	1	6/10/2015	Andrews	10:30	11:00	4	2:00	0
25	1	6/8/2015	Andrews	11:19	11:49	4	2:00	0
26	1	6/9/2015	Andrews	11:01	11:30	4	1:54	0
28	1	6/5/2015	Andrews	11:24	11:55	5	2:35	0
29	2	7/25/2015	Andrews	9:30	10:00	4	2:00	0
31	1	6/10/2015	Andrews	11:29	11:59	4	2:00	0
32	1	5/24/2015	Andrews	11:22	11:55	4	2:12	0
33	1	6/11/2015	Andrews	9:42	10:13	4	2:04	0

Site	Survey	Date	County	Start	End	Observers	Person Minutes	DSL Present
34	1	5/24/2015	Andrews	10:25	10:57	4	2:08	0
37	1	6/25/2015	Andrews	10:01	10:32	4	2:04	0
38	1	7/6/2015	Andrews	10:56	11:27	4	2:04	0
39	1	7/23/2015	Andrews	11:15	11:45	4	2:00	0
43	1	6/25/2015	Andrews	10:52	11:22	4	2:00	0
44	1	6/25/2015	Andrews	11:45	12:14	4	1:54	0
45	1	6/23/2015	Andrews	11:55	12:26	4	2:04	0
46	1	6/24/2015	Andrews	11:04	11:33	4	1:54	0
47	1	6/23/2015	Andrews	11:15	11:45	4	2:00	0
49	1	6/26/2015	Andrews	9:30	10:01	4	2:04	0
50	1	6/26/2015	Andrews	10:19	10:45	4	1:44	0
52	1	7/21/2015	Andrews	11:21	11:53	4	2:08	1
53	1	5/27/2015	Andrews	11:57	12:33	4	2:24	0
54	1	5/27/2015	Andrews	11:03	11:39	4	2:24	0
55	1	5/27/2015	Andrews	10:15	10:48	4	2:12	0
58	1	7/10/2015	Andrews	11:25	11:55	4	2:00	1
60	1	7/8/2015	Andrews	10:58	11:29	4	2:04	0
61	1	7/10/2015	Andrews	10:19	10:55	4	2:24	1
63	1	7/10/2015	Andrews	9:27	9:57	4	2:00	0
64	1	7/9/2015	Andrews	11:20	11:48	4	1:52	0
65	1	7/9/2015	Andrews	10:24	10:55	4	2:04	0
66	1	5/26/2015	Andrews	10:46	11:23	4	2:28	0
67	1	7/8/2015	Andrews	11:55	12:38	4	2:12	0
70	1	7/9/2015	Andrews	9:29	10:00	4	2:04	0
1	1	6/24/2015	Crane	11:13	11:46	4	2:12	0
1	2	7/23/2015	Crane	9:42	10:42	4	2:00	0
8	1	6/24/2015	Crane	10:08	10:43	4	2:20	0

Site	Survey	Date	County	Start	End	Observers	Person Minutes	DSL Present
8	2	7/23/2015	Crane	10:37	11:07	4	2:00	0
17	1	7/8/2015	Ward	10:38	11:07	4	1:54	0
20	1	7/8/2015	Ward	11:51	12:25	4	2:16	0
25	1	6/17/2015	Crane	11:09	11:39	4	2:00	0
25	2	8/3/2015	Crane	10:24	10:52	4	1:52	0
28	1	7/8/2015	Ward	9:42	10:12	4	2:00	0
34	1	7/19/2015	Crane	9:14	9:46	4	2:08	0
34	2	8/1/2015	Crane	8:59	9:28	4	1:54	0
59	1	6/5/2015	Crane	11:29	12:01	4	2:08	0
59	2	8/3/2015	Crane	9:25	9:55	4	2:00	0
71	1	7/5/2015	Ward	9:56	10:30	4	2:16	0
71	2	7/21/2015	Ward	8:52	9:23	4	2:04	0
74	1	6/17/2015	Crane	10:10	10:40	4	2:00	0
74	2	8/3/2015	Crane	11:13	11:43	4	2:00	0
79	1	6/5/2015	Crane	10:34	11:05	4	2:04	0
79	2	8/3/2015	Crane	8:36	9:05	4	1:54	0
84	1	6/9/2015	Crane	10:13	10:46	4	2:12	0
84	2	7/23/2015	Crane	8:45	9:16	4	2:04	0
87	1	6/9/2015	Crane	11:16	11:47	4	2:04	0
87	2	8/1/2015	Crane	9:55	10:25	4	2:00	0
102	1	5/26/2015	Ward	12:24	12:55	4	2:04	0
102	2	8/7/2015	Ward	9:16	9:45	4	1:54	0
105	1	6/7/2015	Crane	10:24	10:57	4	2:12	0
105	2	7/20/2015	Crane	9:00	9:30	4	2:00	0
106	1	6/7/2015	Crane	11:14	11:46	4	2:08	0
106	2	7/20/2015	Crane	9:50	10:20	4	2:00	0
109	1	7/19/2015	Crane	10:12	10:42	4	2:00	0

Site	Survey	Date	County	Start	End	Observers	Person Minutes	DSL Present
109	2	7/20/2015	Crane	10:38	11:11	4	2:12	0
110	1	6/20/2015	Crane	10:21	10:53	4	2:08	0
110	2	7/19/2015	Crane	11:03	11:34	4	2:04	0
117	1	6/20/2015	Crane	11:45	12:15	4	2:00	0
117	2	8/2/2015	Crane	9:35	10:05	4	2:00	0
120	1	6/21/2015	Crane	10:51	11:23	4	2:08	0
120	2	8/2/2015	Crane	8:32	9:03	4	2:04	0
147	1	6/20/2015	Crane	11:18	11:48	4	2:00	0
147	2	8/1/2015	Crane	10:52	11:20	4	1:52	0
163	1	6/4/2015	Crane	11:25	11:58	4	2:12	0
163	2	7/4/2015	Crane	9:58	10:28	4	2:00	0
175	1	6/4/2015	Crane	10:40	11:10	4	2:00	0
175	2	7/4/2015	Crane	9:10	9:40	4	2:00	0
182	1	6/19/2015	Ward	11:33	11:53	4	2:00	0
182	2	7/22/2015	Ward	11:28	11:58	4	2:00	0
188	1	7/2/2015	Ward	10:50	11:22	4	2:08	0
188	2	7/21/2015	Ward	9:53	10:23	4	2:00	0
201	2	8/8/2015	Ward	8:45	9:15	4	2:00	1
203	1	5/25/2015	Ward	10:07	10:36	4	1:54	0
203	2	8/7/2015	Ward	10:49	11:16	4	1:48	0
213	1	7/5/2015	Ward	11:04	11:37	4	2:12	0
213	2	7/21/2015	Ward	10:40	11:12	4	2:08	0
225	1	5/25/2015	Crane	11:20	11:50	4	2:00	0
225	2	8/7/2015	Crane	10:55	11:25	4	2:00	0
229	1	6/3/2015	Ward	10:18	10:53	4	2:20	0
229	2	7/22/2015	Ward	8:50	9:20	4	2:00	0
235	1	6/19/2015	Ward	10:40	11:12	4	2:08	0

Site	Survey	Date	County	Start	End	Observers	Person Minutes	DSL Present
235	2	7/22/2015	Ward	10:35	11:06	4	2:04	0
240	1	6/3/2015	Crane	10:24	10:55	4	2:04	0
240	2	8/2/2015	Crane	10:36	11:07	4	2:04	0
256	1	6/3/2015	Ward	11:26	11:58	4	2:08	0
256	2	7/22/2015	Ward	9:42	10:12	4	2:00	0
315	1	7/5/2015	Winkler	12:16	12:46	4	2:00	1
315	2	7/17/2015	Winkler	11:48	12:18	4	2:00	0
376	1	6/18/2015	Winkler	10:17	10:47	4	2:00	0
376	2	7/26/2015	Winkler	8:55	9:24	4	1:54	0
415	1	7/17/2015	Winkler	10:20	10:50	4	2:00	0
415	2	8/8/2015	Winkler	8:51	9:22	4	2:04	0
434	1	6/25/2015	Winkler	11:08	11:46	4	2:32	0
434	2	7/26/2015	Winkler	10:53	11:23	4	2:00	0
455	1	6/25/2015	Winkler	9:54	10:35	4	2:44	0
455	2	7/26/2015	Winkler	9:58	10:30	4	2:08	0
551	1	7/6/2015	Winkler	11:56	12:26	4	2:00	0
564	1	7/9/2015	Winkler	10:05	10:42	4	2:28	0
564	2	8/5/2015	Winkler	9:08	9:39	4	2:04	0
565	1	7/9/2015	Winkler	11:06	11:39	4	2:12	0
565	2	8/5/2015	Winkler	9:57	10:27	4	2:00	0
639	1	5/26/2015	Winkler	10:20	10:52	4	2:08	0
639	2	8/7/2015	Winkler	8:57	9:27	4	2:00	0
731	1	7/11/2015	Winkler	9:55	10:26	4	2:04	0
731	2	7/25/2015	Winkler	9:00	9:31	4	2:04	0
743	1	7/10/2015	Winkler	11:38	12:08	4	2:00	0
748	1	7/6/2015	Winkler	10:50	11:20	4	2:00	0
748	2	7/24/2015	Winkler	10:43	11:14	4	2:04	0

Site	Survey	Date	County	Start	End	Observers	Person Minutes	DSL Present
805	1	7/11/2015	Winkler	11:15	11:45	4	2:00	0
805	2	7/25/2015	Winkler	10:12	10:43	4	2:04	0
828	1	7/6/2015	Winkler	10:01	10:32	4	2:04	0
828	2	7/24/2015	Winkler	9:48	10:17	4	1:54	0
904	1	7/10/2015	Winkler	9:45	10:18	4	2:12	0
904	2	7/24/2015	Winkler	8:49	9:20	4	2:04	0
910	1	7/10/2015	Winkler	10:37	11:08	4	2:04	0
910	2	8/7/2015	Winkler	10:49	11:20	4	2:04	0
932	1	6/26/2015	Winkler	10:36	11:06	4	2:00	0
932	2	8/7/2015	Winkler	10:00	10:30	4	2:00	0

In 2015, DSLs were detected on six surveys at six different sites within areas of very high likelihood (dark green) on the TCP Permit Area/Likelihood of Occurrence Map (Figure 1). Four of these positive surveys were in Andrews County. At one survey site in Andrews County, the DSL was detected for the first time in 2015 following two negative surveys in 2014. At two other survey sites in Andrews County, the species was not detected in 2015 despite being detected on one of two surveys in 2014. At three sites in Andrews County, dunes sagebrush lizards were detected on surveys in 2014 and 2015. At two of those sites, the DSL has been detected with each visit (n=3), and twice at the remaining site. In Ward County, the DSL was detected at one site within 100m of a positive survey conducted in 2010. In Winkler County, it was detected at one site within 1km of a positive survey conducted in 2011. No dunes sagebrush lizards were detected in any surveys of Crane County.

These data indicate that detectability of the DSL is variable across the landscape, even in dark green areas where the estimated likelihood of DSL occurrence is very high. Alternatively, on many surveys, DSL was not detected, which could indicate that the likelihood of occurrence varies according to quality of habitat at a small scale within the established habitat classes identified in the TCP Permit Area/Likelihood of Occurrence Map (Figure 1). That is, even within the broad categories of likelihood of occurrence, there is variation in quality of habitat that influences the occurrence and number of dunes sagebrush lizards at a given location. To evaluate this hypothesis, TAMU Research will continue 1) landscape modeling of DSL habitat at fine spatial scales within established habitat classes, and 2) surveying and monitoring efforts to validate those habitat models.

During the entire 4-year study (2012-15), surveys resulted in a number of new

localities for the species in Texas, though some were geographically close to known localities.[iii] Also, all of the survey sites where the DSL was detected were located within the dark or light green areas on the TCP Permit Area/Likelihood of Occurrence Map, corresponding to areas of very high or high likelihood of occurrence (Figure 1). These new DSL localities validate our current perception of DSL habitat, corroborate the predicted likelihood of occurrence categories for these areas, and also imply that no changes to the TCP Permit Area/Likelihood of Occurrence Map (Figure 1) are needed at this time.

Population Dynamics

In 2012, trapping for mark-recapture studies took place on the two super-grids from May to September and again in November, yielding a total of 26,568 trap-days (41 days x 324 traps x 2 super-grids). In 2013, trapping sessions were carried out in February, April through September, and November, for a total of 33,048 trap-days (51 days x 324 traps x 2 super-grids). In 2014, the trapping sessions occurred in February, March through September, and November, for a total of 35,640 trap-days (55 days x 324 traps x 2 super-grids). In 2015, trapping sessions were carried out in February through August for a total of 30,456 trap-days (47 days x 324 traps x 2 super-grids). Over those four years combined (2012-15), trapping sessions amounted to 125,712 trap-days. A total of 12,814 lizards were captured, of which 1,539 were dunes sagebrush lizards. A total of 726 individual dunes sagebrush lizards have been captured: 549 on the east grid and 177 on the west grid. The other 813 captures were recaptures of some of these individuals.

To visualize trends in DSL activity and abundance, the capture data described above was adjusted by trapping effort to show mean daily captures by month for the six most common species of lizards observed in the mark-recapture study (Figure 6). Three additional species were captured so rarely that they were excluded from further analysis (*Aspidoscelis gularis*, $n = 1$; *Plestiodon obsoletus*, $n = 14$; *Holbrookia maculata* $n = 34$). The DSL (purple bars) had the third highest daily capture rate from May to September 2012, February 2013 to August 2013, May to August 2014, and May to July 2015 (excluding months in which traps were not operational). However, the DSL had the second highest daily capture rate in November 2012, September 2013 through April 2014, September and November 2014, and April and August 2015 (excluding months in which traps were not operational).

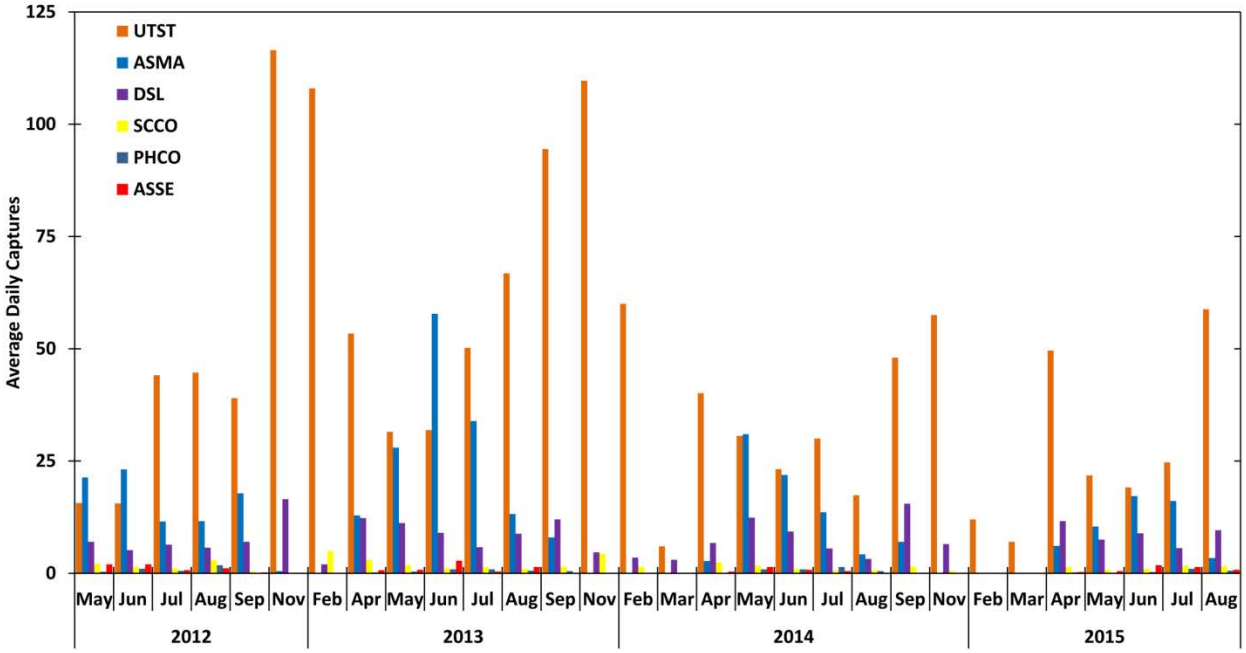

Figure 6. Average Daily Captures by Month for Six Species of Lizards from May 2012 to August 2015 (excluding months when no trapping occurred: October and December 2012; January, March, October and December 2013; January, October and December 2014; January 2015). *Species listed are Uta stansburiana (UTST), Aspidoscelis marmorata (ASMA), Sceloporus arenicolus (SCAR/DSL), S. consobrinus (SCCO), Phrynosoma cornutum (PHCO) and A. sexlineata (ASSE).*

When examining DSL capture rates alone (Figure7), capture rates were slightly higher in 2013 than 2012 and 2014 (8.2 ± 3.7, 8.0 ± 4.2, 7.3 ± 4.3captures/day, respectively). Capture rates for 2015 were lowest overall (6.4 ± 4.8), because the super-grids were disassembled in August at the end of the field study. Thus, there were no trapping sessions in September and November of 2015, which would have produced more captures.

DSL capture rates varied throughout the year, due to season, weather, and temperature. More lizards were active in the summer months compared to the winter months. This seasonality was extreme in 2015. No DSLs were captured in February and March of that year, but they were captured during those months in previous years (2013-2014). Capture rates also varied during the breeding season (spring to early fall) with an activity peak earlier in the spring (April and May) as the adults are active and another peak later in the season (August to November) as hatchlings emerge. This pattern appeared more subtle in 2015 likely due to the lack of trapping periods in September and November.

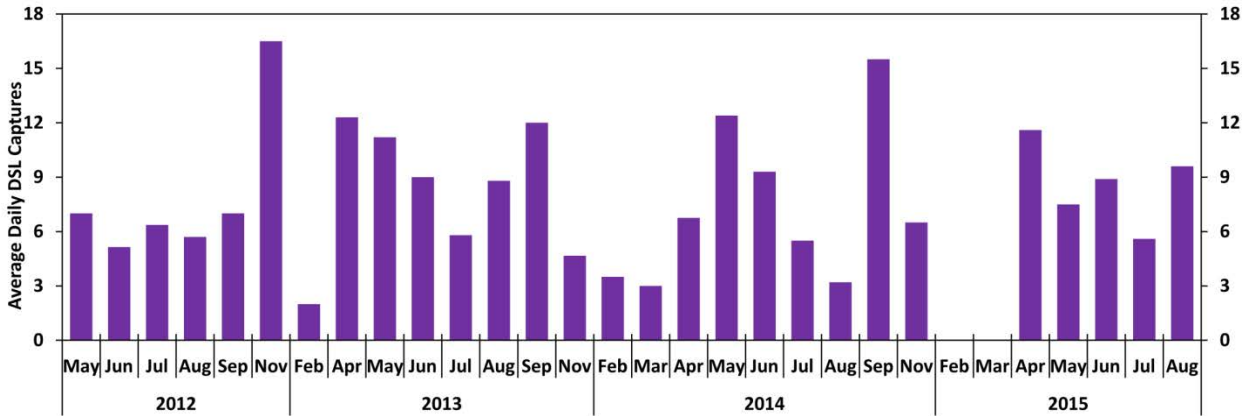

Figure 7. Average Daily Captures of dunes sagebrush lizards by Month from May 2012 to August 2015 (excluding months when no trapping occurred: October and December 2012; January, March, October and December 2013; January, October and December 2014; January 2015).

To visualize this seasonal change in demographic structure within the DSL population, the capture data was partitioned into adult male (blue bars), adult female (purple bars) and hatchling/juvenile (orange bars) categories (Figure 8). The stacked bars corresponding to adult males, adult females, and juveniles show the population cohorts progressing through the year. Across all years, captures early in the season generally consisted mostly of adults and a few juveniles from the previous breeding season that are still relatively small. By June, most of the juveniles have reached adult size. Hatchlings began to emerge in July and grew into juveniles in August and September. As a result, during these months DSL captures were comprised of mostly hatchling and juvenile life-stage lizards. In November, this trend decreased as the juveniles grew into adult life-stages. Overall, these seasonal trends in capture rate and DSL abundance match perfectly with the results of previous mark-recapture studies on the DSL throughout its range. [iv]

Captures of dunes sagebrush lizards on both super-grids tended to cluster around the larger blow-outs, with more open spaces and more vertical structure (Figure 9). Captures on the undisturbed super-grid are concentrated in the northern half of the super-grid, where a chain of dunes runs east-west (Figure 9a). When these total captures are broken down by adults (Figure 9b) and juveniles (Figure 9c), there is little difference between the capture locations of these different life stages. However, juveniles were found more often outside of higher quality habitat. For example, the majority of captures in the southeast corner of the undisturbed super-grid were juveniles. Juveniles and young adult male DSL were found at the edge of the habitat where dunes end and the vegetation consists of mesquite flats. Most of these individuals have been captured only once, but one individual was recaptured again, as an adult, back in the middle of rugose shinnery oak dune habitat. Juveniles were also found more often outside of blowouts.

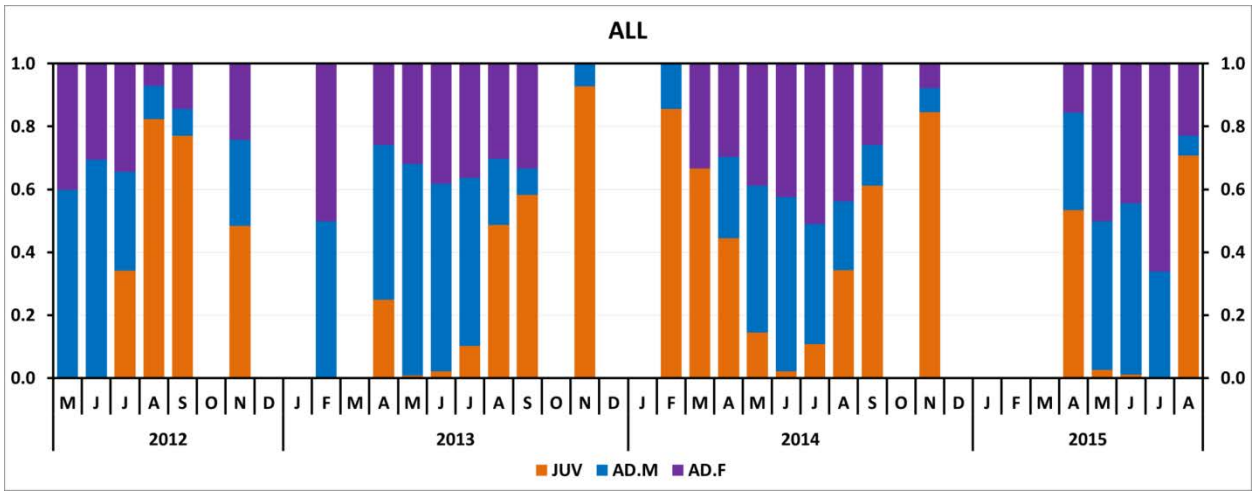

Figure 8. Proportion of Captures for Each Life Stage in the dunes sagebrush lizard by Month from May 2012 to August 2015 (excluding months when no trapping occurred: October and December 2012; January, March, October and December 2013, January, October and December 2014; January 2015). *Purple, blue and orange represent values for adult females, adult males and juveniles, respectively. Numbers at the bottom of each bar indicate the total number of captures for that month to which we were able to assign a life stage.*

On the disturbed super-grid, there were fewer captures of DSLs, and these captures were distributed sparsely throughout the super-grid (Figure 9d). On the disturbed super-grid, the dunes sagebrush lizards were still found in relatively large blowouts, but there were fewer individuals captured in each blowout. When looking at the differences between captures of adults (Figure 9e) and juveniles (Figure 9f), juveniles appear to be more widespread in their captures. Most adults were captured on the southern half of the disturbed super-grid, while juvenile captures were relatively more evenly dispersed throughout the super-grid. There is a caliche road through the middle of the grid, and while DSLs have been captured in traps immediately adjacent to the road, only three dunes sagebrush lizards have been captured on both sides of the road – one adult male captured initially north of the road and recaptured 3 weeks later south of the road, and two male juveniles, both captured initially south of the road and recaptured as adults 19 and 7 months later on the north side of the road.

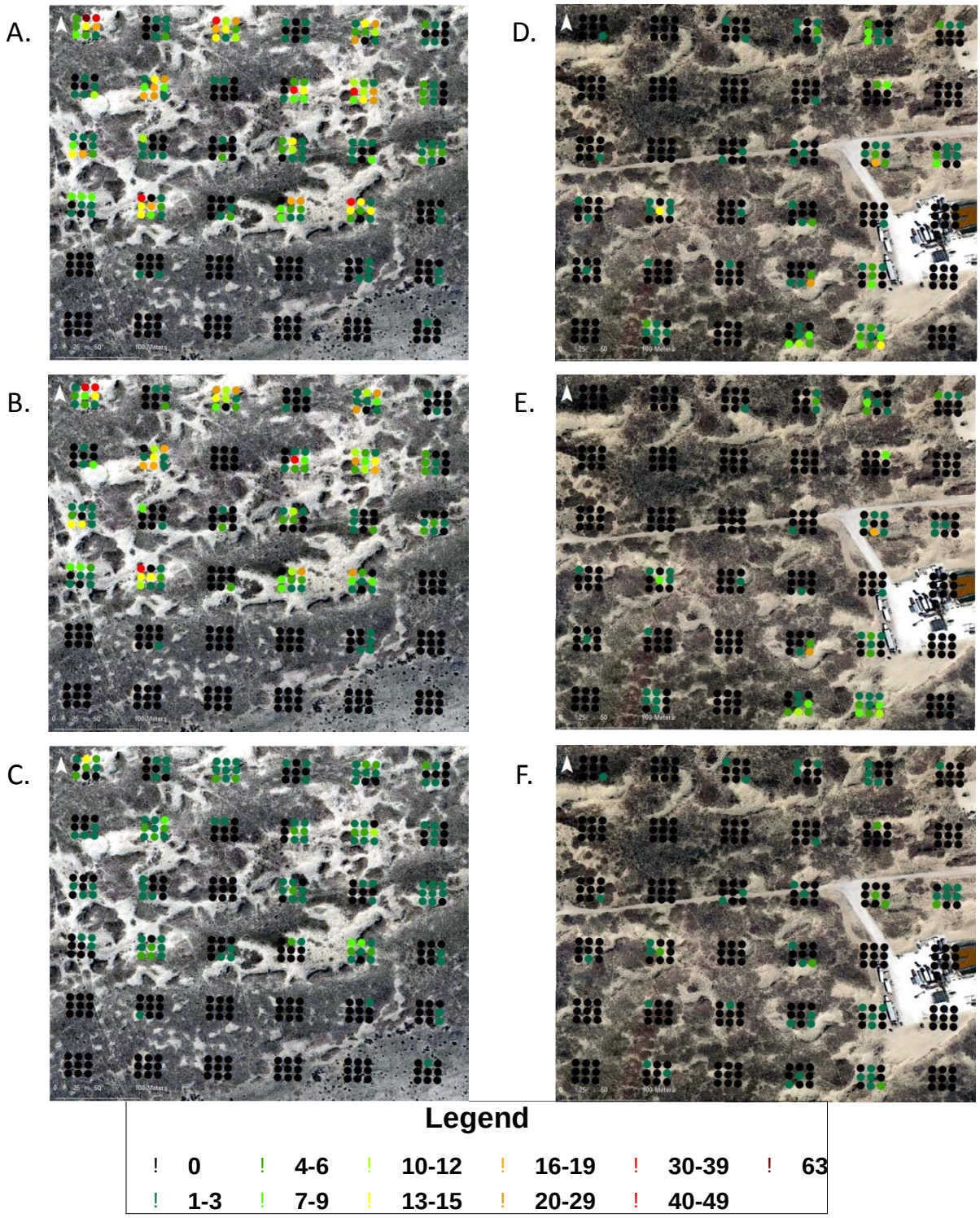

Figure 9. **Frequency of DSL Captures Overlaid on Trapping Locations at Each Super-grid**. *Panel A. All captures from undisturbed super-grid, Panel B. undisturbed super-grid adult captures, Panel C. undisturbed super-grid juvenile captures, Panel D. all disturbed super-grid captures, Panel E. disturbed super-grid adult captures, and Panel F. disturbed super-grid juvenile captures. Colored circles represent total numbers of captures at each trap.*

Research Integration

By design, this research program links fine-scale variation in habitat quality to individual movements and behaviors of DSLs, which determine the demographics of DSL populations. At larger scales, this research program links measures of habitat quantity, as well as quality, to occurrence across multiple sites in a region. Through current and continued research, information gathered from each of the studies in this research program will be integrated into a spatially-explicit population model that evaluates how different land use scenarios relevant to the TCP may alter the probability of DSL persistence across Shinnery Oak sand-dune habitats in Texas.

Habitat Update

The new DSL localities described in this report validate the predicted likelihood of occurrence for those survey areas. Additional survey and monitoring efforts are still required to further ground-truth portions of the TCP Permit Area/Likelihood of Occurrence Map (Figure 1) that have not been surveyed and to refine new habitat maps being generated. Based on these habitat updates, we believe the Adaptive Management process does not need to be deployed at this time, and no changes to the TCP Permit Area/Likelihood of Occurrence Map (Figure 1) are required at this time.

Species Update

With all four years of mark-recapture data assembled, population modeling, movement analyses, and microhabitat analyses in both disturbed and undisturbed DSL habitat are currently under-way. The trends and summary statistics presented here that begin to characterize this data set suggest no changes to the TCP Permit Area/Likelihood of Occurrence Map (Figure 1) are needed at this time. We will continue analyzing data gathered from this 4 year project and will determine if our new information warrants changes to the TCP in the final report.

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[i] Dunes Sagebrush Lizard Adaptive Management, www.keepingtexasfirst.org/tx_response/docs/DSL_Adaptive_Management.pdf.

[ii] Chan, L., and L.A. Fitzgerald, K. Zamudio. 2009. The scale of genetic differentiation in the Dunes Sagebrush Lizard (*Sceloporus arenicolus*), an endemic habitat specialist. Conservation Genetics 10:131-142.; Fitzgerald et al. 1997.; Fitzgerald et al. 2011.; Fitzgerald, L.A., M.W. Sears, C.W. Painter. 2005. Interdune dispersal of sand dune lizards (*Sceloporus arenicolus*) in the Mescalero Sands Ecosystem. New Mexico Department of Game and Fish. 13 pp.; Hibbitts, T.J., W.A. Ryberg, C.S. Adams, A.M. Fields, D. Lay, and M.E. Young. 2013. Microhabitat selection by a habitat specialist and a generalist in both fragmented and unfragmented landscapes. Herpetological Conservation and Biology 8(1) 104-113; Hill, M.T. and L.A. Fitzgerald. 2007. Radiotelemetry and population monitoring of sand dune lizards (*Sceloporus arenicolus*) during the nesting season. Share with Wildlife Report to New Mexico Department of Game and

Fish. 7 pp.; Laurencio et al. 2007.; Laurencio and Fitzgerald 2010.; Leavitt, D.J. 2012. Ecological consequences of landscape fragmentation on the lizard community in the Mescalero-Monahans shinnery sands. Ph.D. Dissertation. Texas A&M University, College Station, Texas.; Ryberg, W.A., M.T. Hill, D. Lay, and L.A. Fitzgerald. 2012. Observations on the reproductive and nesting ecology of the Dunes Sagebrush Lizard (*Sceloporus arenicolus*). Western North American Naturalist 72(4) 582-585.; Ryberg, W.A., M.T. Hill, C.W. Painter, and L.A. Fitzgerald. 2013. Landscape pattern determines neighborhood size and structure within a lizard population. PLoS One 8(2) e56856; Sias, D.S., and H.L. Snell. 1998. The sand dune lizard *Sceloporus arenicolus* and oil and gas development in southeastern New Mexico. Final report of field studies 1995-1997. New Mexico Department of Game and Fish. 27 pp.; Smolensky, N.L. and L.A. Fitzgerald. 2010. Distance sampling underestimates population densities of dune-dwelling lizards. Journal of Herpetology 44:372-381.; Smolensky, N.L. and L.A. Fitzgerald. 2011. Population variation in dune-dwelling lizards in response to patch size, patch quality, and oil and gas development. The Southwestern Naturalist 56:315-324.

[iii] Fitzgerald et al. 2011.

[iv] Walkup, D.K., D.J. Leavitt, W.A. Ryberg, and L.A. Fitzgerald. 2012. Results from 2009-2012: Effects of Landscape Fragmentation on the Mescalero Dune Landscape and Populations of the Dunes Sagebrush Lizard, *Sceloporus arenicolus*. Bureau of Land Management, Carlsbad Office. 45 pp.

APPENDIX E.

Texas A&M AgriLife Research Dunes Sagebrush Lizard Research Prospectus

Dunes Sagebrush Lizard Research Prospectus

Problem Statement—The overarching goal for conservation of the Dunes Sagebrush Lizard (DSL) is to sustain a broad pattern of habitat occupancy throughout the range of the species. There are numerous areas with suitable, but unoccupied habitat for the DSL. Establishment of the DSL in these areas with suitable habitat can only happen in the near term with assisted colonization via translocations. There are also numerous areas with suitable habitat that have been degraded by mesquite encroachment and fragmented by roads and well pads. Restoration of these habitats followed by successful establishment of DSL via translocations will sustain a broad pattern of habitat occupancy throughout the species' range and ensure the conservation of this species into the future.

To accomplish this conservation goal, Texas A&M University (TAMU), in collaboration with the U.S. Fish and Wildlife Service (FWS), Texas Habitat Conservation Foundation (THCF), and Texas Comptroller of Public Accounts (CPA), developed the following 5 research tasks:

- Task 1 – Translocation of Dunes Sagebrush Lizards to Unoccupied Habitat in Texas
- Task 2 – Effects of Mesquite on Dunes Sagebrush Lizard Habitat Suitability and Occupancy
- Task 3 – Effects of Road and Well Pad Reclamation on DSL Habitat Suitability
- Task 4 – Change Detection Analyses for Compliance Monitoring
- Task 5 – Completion of current research

Tasks 1-3 will also support continued annual survey and monitoring efforts to evaluate the status and trends of DSL occupancy and occurrence across different quality habitats through time.

Task 1 – Translocation of Dunes Sagebrush Lizards to Unoccupied Habitat in Texas

Research Approach—DSLs were known to occur at localities in Crane County, TX and elsewhere in the species' range, but have not been detected at those sites in more than a decade. A number of these sites represent opportunities for re-establishing populations. We propose a straightforward research project designed to translocate DSLs from relatively large, genetically similar, populations to historical sites where the species was known to occur and where habitat conditions have not perceptibly changed. We will use a soft-release strategy in a series of nearby enclosures in a translocation area. Soft-release involves keeping translocated individuals in temporary enclosures during an acclimation period. After the acclimation period, the enclosures are opened and individuals can disperse throughout the larger area of habitat. The soft-release strategy with enclosures is a proven technique that allows translocated individuals to become accustomed to new surroundings and encounter refugia in their new habitat.

Evaluation of Results—Translocation success will be monitored and evaluated over 4 years of trapping, including year 1, the translocation year (see Task 1 budget in Table 1). In the year following translocation (year 2), trapping will confirm the survival of founding individuals and quantify the number of hatchlings they produced. Trapping in subsequent years (3-4) will confirm the survival and reproduction of those hatchlings, and provide data used to determine the population growth rate. Long-term population viability will be estimated at the end of the four-year study.

Conservation Implications–The results from this research will help determine the feasibility of establishing populations of DSLs in unoccupied but otherwise suitable habitats. Information gathered from this translocation study will help create a standardized protocol for all future translocations in both restored habitats and unoccupied suitable habitats.

Task 2 – Effects of Mesquite on Dunes Sagebrush Lizard Habitat Suitability and Occupancy

Research Approach—In the last 3 years (2013-15), four mesquite removal experiments were initiated to study the effectiveness of this conservation practice for restoring degraded DSL habitats and populations. Habitat surveys before and after mesquite removal indicate that it is uncertain if habitat for the DSL will become suitable at these sites. Additionally, lizard surveys before and after mesquite removal indicate that DSL populations did not, and presently do not, occupy these sites, although occupied suitable habitats exist nearby. If suitable habitat were to regenerate at these sites, natural colonization by DSL populations would occur slowly. We propose to continue tracking changes in habitat suitability at these sites and to monitor their potential for DSL colonization. Given the expected slow rate of change at these sites, we propose research designed to characterize changes in habitat suitability and DSL occupancy based on historical patterns of mesquite encroachment.

We will use a chronosequence methodology to investigate the effect of mesquite on DSL habitat suitability and occupancy. A chronosequence is a sample of locations in DSL habitat that have been invaded by mesquite at different points in time. Some sites will have recent encroachment, and other sites will be decades old. Each site represents a different "stage" (e.g., early, late) in the encroachment process. Data on habitat and landscape condition across these sites will help document long-term changes in how habitat suitability for DSL changes as it is invaded by mesquite. The advantage of chronosequence methodology is results can be obtained in several years versus several decades.

In this proposed study, preliminary analyses indicate that historical mesquite encroachment into DSL habitats can be observed using Change Detection Analyses (CDA). These analyses will identify sites within DSL habitat that are in different "stages" of mesquite encroachment. By measuring physical habitat features known to be important for DSL persistence across encroachment sites at different stages, we can characterize the mechanism and estimate the speed with which mesquite degrades suitable habitats and disrupts DSL population dynamics.

Evaluation of Results—Changes in habitat suitability and DSL occupancy across the four mesquite removal sites will be monitored and evaluated over 4 years using standardized habitat suitability and lizard surveys (see Task 2 budget in Table 1). Changes in habitat suitability and DSL occupancy across the chronosequence of mesquite encroachment sites will also be quantified over 4 years using the same habitat and lizard survey methods. Baseline rates of mesquite encroachment into DSL habitats and natural rates of DSL habitat movement, creation and stabilization will be quantified. Comparisons of these rates, changes in the pattern and configuration of dunes, and other physical habitat features (e.g., sand grain composition, soil compaction) across the chronosequence mesquite sites and mesquite removal sites will help characterize effects of mesquite on DSL habitat suitability and occupancy. This Task also includes continued annual survey and monitoring efforts to evaluate the status and trends of DSL occupancy and occurrence across different quality habitats through time.

Conservation Implications–In the Texas Conservation Plan (TCP), mesquite removal has the largest recovery value, but the conservation value of this practice for enhancing DSL populations is uncertain. The results from this research will determine the efficacy of mesquite removal practices for DSL conservation and help evaluate their current recovery value. Additionally, information gathered from this study will help identify future mesquite removal sites and provide a standardized protocol for identifying restored suitable habitats that are acceptable for translocations.

Task 3 – Effects of Road and Well Pad Reclamation on Dunes Sagebrush Lizard Habitat Suitability

Research Approach—Several sites within unoccupied DSL habitat have been identified for road and

well pad reclamation. The suitability of these sites for future translocation studies is unknown. We propose research designed to evaluate the suitability of these sites for future translocation studies following road and well pad reclamation. We will use before-after and/or control-treatment comparisons of physical habitat features (e.g., sand grain composition, soil compaction) known to be important for DSL persistence to characterize changes in habitat suitability following road and well pad reclamation. Analysis of these data will allow us to determine if reclaimed sites have the characteristics of sand, topography, and vegetative cover that are known to predict the occurrence of DSL.

Evaluation of Results—Effects of road and well pad reclamation on DSL habitat suitability will be determined using standardized protocols for identifying restored suitable habitats. Assuming reclamation occurs in year 1, we anticipate three years of habitat surveys post-treatment (see Task 3 budget in Table 1). Sites considered acceptable for future translocations will be identified.

Conservation Implications–Research consistently points to the quality and connectivity of large contiguous areas of suitable habitat as the main factor affecting DSL persistence. Habitat fragmentation and degradation from oil and gas activities have been identified as a threat to suitable habitats and DSL populations range-wide. Restoration of these degraded habitats, and the future translocation of DSL populations to them, will help maintain a broad pattern of occupancy throughout the species' range.

Task 4 – Change Detection Analyses for Compliance Monitoring

Monitoring Approach—In accordance with the TCP and associated federal permit, we propose to continue compliance monitoring activities of enrolled acreage for four years (see Task 4 budget in Table 1). We will use Change Detection Analysis (CDA) methods described in the 2014 Annual Report to ensure that Participants comply with the obligations outlined in their respective Certificates of Inclusion. We will also collaborate with the Permit Holder, THCF, and FWS on necessary materials and documents related to the Change Detection Analysis.

Task 5 – Completion of current research

Research Approach—The field studies, impact assessments, annual surveys, and monitoring efforts have been completed for the current research project, but the data have not been analyzed and reports have not been prepared. Task 5 includes data analysis and report preparation for the current research project (see Task 5 budget in Table 1). The final report will be completed by May 31, 2016.

Specifically, the goals of the current research project are 1) to understand how landscape configuration and patterns of land use influence DSL movements and behavior, 2) to quantify the dynamics of DSL populations across sites and assess effects of human activities on lizard demography and immigration, and 3) to map suitable and potential habitat and identify critical areas for conservation, plan dispersal corridors, and classify threats to DSL persistence.

Research activities under the TCP also include annual survey and monitoring efforts to evaluate the status and trends of DSL occupancy and occurrence across different quality habitats through time. The goals of the survey and monitoring efforts are 1) to expand 2011-2012 survey efforts by adding survey sites that verify projected DSL occupancy in habitats not yet surveyed, and 2) to identify long-term survey sites that provide data on how DSL occupancy of suitable habitat varies through time.

Following the Adaptive Management process outlined in the TCP (TCP Section 8.3), final results from the monitoring and research tasks will be reviewed to determine if results should be incorporated into updates of the TCP and the Permit Area/Likelihood of Occurrence Map.