

TEXAS A&M UNIVERSITY-KINGSVILLE
CAESAR KLEBERG WILDLIFE RESEARCH INSTITUTE
SOUTH TEXAS NATIVES
KINGSVILLE, TEXAS

And

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
E. "KIKI" DE LA GARZA PLANT MATERIALS CENTER
KINGSVILLE, TEXAS

NOTICE OF RELEASE OF STN-176 GERMPLASM LITTLE BLUESTEM SELECTED
PLANT MATERIAL

Texas A&M University-Kingsville (TAMUK), Caesar Kleberg Wildlife Research Institute (CKWRI), *South Texas Natives* (STN), and the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), E. "Kika" de la Garza Plant Materials Center (PMC) announce the release of a selected plant material of little bluestem [*Schizachyrium scoparium* (Michx.) Nash var. *scoparium*] (USDA, NRCS 2013).

This release will be referred to as STN-176 Germplasm little bluestem, and is released as a selected plant material class of certified seed (natural track). STN-176 Germplasm was tested under the accession number 9086176. In a commercial blend, STN-176 in combination with STN-461 Germplasm little bluestem will be identified as Carrizo Blend little bluestem.

This alternative release procedure is justified because there are no existing commercial sources of little bluestem seed that have been tested or have known adaptation in the Rio Grande Plains, Gulf Coast Prairies and Marshes, or Coastal Sand Plain. Available commercial little bluestem seed originates from wild harvests of unevaluated populations, or originates from varieties developed from seed collected from native plants at distant locations such as OK Select Germplasm (Oklahoma origin), 'Cimmaron' (Oklahoma origin), or 'Pastura' (New Mexico origin) (USDA 2002). Prior to this release, and the release of STN-461 Germplasm little bluestem, none of the available sources of little bluestem seed met reasonable definitions of ecotypic seed desired by practitioners, or the specifications of the USDA NRCS Texas Range Planting Specifications (USDA 2007).

A. Proposed Variety Name and Temporary Designation:

STN-176 GERMPLASM LITTLE BLUESTEM

B. Family, kind, genus and species:

Family: Poaceae

Kind: little bluestem

Genus and species: *Schizachyrium scoparium* (Michx.) Nash var. *scoparium*

C. Origin and breeding history of the variety:

Collection Site Information:

Little bluestem accession 9086176 was collected December 20, 2001 from the U.S. Interstate Highway 37 right-of-way in Bexar County, Texas by Forrest Smith and Paula Maywald. Soil series of the collection site was Aluf sand. This site is classified as a Deep Sand 28-40 PZ ecological site.

Breeding History: Plants evaluated in initial evaluation plantings were grown from the original wild seed collection. Accession 9086176 was originally collected from several hundred wild plants growing in a large colony alongside Interstate Highway 37 and extending into nearby pastures. Advanced evaluations and seed increases were also started using the original seed collection. Later increases were made from seed harvested from seed production fields established by transplants grown from seed produced in isolation from other little bluestem accessions. Multiple harvests of the accession in the seed increase portion of the germplasm development were made in an effort to maintain the full spectrum of genetic diversity of the natural population. The minimum plant population used to increase this accession was 1,288 plants. No intentional selection of any kind was conducted within the accession in the development of this release.

D. Objective description of the variety

Description: Little bluestem exhibits considerable variation (Barkworth et al. 2007). In general, little bluestem is a perennial, caespitose or rhizomatous species (Shaw 2012). Shaw (2012) gives the following measurements: Culms to 2 m long, sheaths rounded or keeled, ligules 0.5-2 mm long, awns 2.5-17 mm long. Pedicillate spikelets are staminate or sterile, unawned or awned, with awns to 4 mm.

A number of varieties and sub-species of little bluestem are reported by various authorities. STN-176 Germplasm most closely matches the descriptions and range reported for *Schizachyrium scoparium* var. *scoparium* (Barkworth et al. 2007; Shaw 2012; USDA 2014). Botanical identification of the release was independently confirmed by examination of specimens by Dr. Stephen L. Hatch of the S.M. Tracy Herbarium at Texas A&M University, College Station, Texas.

Accession 9086176 is a medium-stature ecotype of little bluestem with lime green to yellowish-green coloration of leaves throughout much of the year, but turning blue green at maturity. Culms are typically 1.25-1.5 m at maturity when grown under ideal conditions. As is characteristic of the species in our observation, 5-10% of the plants grown from seed of the selected accession are divergent in a number of characteristics from the majority of the plants in the accession. We have made no attempt to select out this variability in order to maintain the natural makeup and diversity of the wild population.

Based on examination of herbarium collections and field observations, accession 9086176 is representative of the ecotype of little bluestem commonly found on sand, sandy loam, and loamy sand soils in the eastern Rio Grande Plains, Gulf Coast Prairies and Marshes, and Post Oak Savannah ecoregions of Texas.

Potential Uses: STN-176 Germplasm little bluestem is recommended for use in range seeding mixtures, upland wildlife plantings, roadside plantings, and conservation plantings on sand, loamy sand, and sandy loam soils in the Rio Grande Plains, Gulf Prairies and Marshes, and Post Oak Savannah ecoregions of Texas. Little bluestem is a dominant, late seral plant of sand, loamy sand, and sandy loam sites in these ecoregions. Little bluestem is a preferred nesting substrate for bobwhite quail, and was identified as the nesting substrate in 44 of 97 nests in one South Texas study (Arredondo et al. 2006). Everitt et al. (2011) states little bluestem is good forage for cattle, and provides excellent nesting cover for bobwhite quail and wild turkeys, and good fawning cover for white-tailed deer. Since little bluestem is slow to establish from seed, and the plants mature slowly, it is recommended that STN-176 Germplasm always be planted in mixtures with other native species, including adapted early successional grasses, forbs, and legumes naturally found in association with little bluestem.

E. Evidence

Method of Breeding and Selection:

Initial Evaluation

As part of an effort to collect, evaluate, and release adapted germplasms of a variety of plants native to South Texas for use in habitat restoration activities, seed collections from native populations of little bluestem were obtained from across the region from 2001-2009. Little bluestem collections from the South Texas region available in the USDA NRCS Plant Materials Program seed collections were also evaluated. In total, 95 populations of little bluestem originating from South Texas were evaluated. These populations represented a number of varieties and integrated morphological types of little bluestem, and the closely related species seacoast bluestem (*Schizachyrium littoralis*). Whenever possible, varietal identification of each accession following the best available local taxonomic reference (Hatch et al. 1999) was made. However, many populations we evaluated possessed plants of both seacoast and little bluestem, as well as intermediate plants having characteristics of more than one variety of little bluestem. Standards for evaluation included OK Select Germplasm little bluestem, 'Cimmaron' little bluestem, 'Pastura' little bluestem and a commercial selection marketed by Turner Seed Company, Breckenridge, Texas sold as "Native" little bluestem. None of the standards were particularly useful in the evaluations, as most had 100% mortality by the end of the 2nd growing season at the initial evaluation locations in South Texas. All standards were morphologically and phenologically distinct from the majority of the South Texas origin populations. Notable differences in morphology included smaller stature throughout the growing season and at maturity, and in phenology, earlier flowering and seed maturity dates. Previously, these types of little bluestem were characterized as botanical variety *frequens* (Gould 1965), thus they are distinct from the South Texas populations in appearance in most regards.

Initial evaluations resulting in the selection of STN-176 and STN-461 Germplasm little bluestems were conducted from 2001-2006 by personnel from the *South Texas Natives* Project of the Caesar Kleberg Wildlife Research Institute (STN) and the USDA NRCS E. "Kika" de la Garza Plant Materials Center (PMC). Three sites were used for initial evaluation, including the PMC near Kingsville, Texas; Rio Farms near Monte Alto, Texas; and Bladerunner Farms near Poteet, Texas. These sites are representative of the variations in soils and climate along a north to south gradient, each of the primary ecoregions within the natural distribution of little bluestem in the area of intended benefit from our work.

Based on evaluations at the PMC, Rio Farms, and Bladerunner Farms of 95 little bluestem accessions from 2001-2006, we chose 4 accessions for advanced evaluation. Field evaluations were based on a minimum of 2 replications of ten plants of each accession per location. Field characteristics were scored throughout the evaluation years and averaged by accession/site/year for selection purposes. Criteria evaluated included survival, disease resistance, foliage density and production, stage of development, seed production, and plant height. Whenever possible, seed was collected from the accessions planted at each evaluation site for tests of seed germination and comparative seed quality. Original seed collections were also screened for germination by the PMC in greenhouse plantings.

Initial selections were based primarily on field performance scores and plot observations at multiple sites, seed germination potential of original seed collections, collection origin, and remaining amount of original seed available for large scale increase and potential commercialization. Comparing seed quality (measured by seed germination) was difficult using seeds collected from the evaluation plots, and results were highly variable. This variability in results is likely due to high degree of dormant seed produced by little bluestem. Some accessions with good performance were identified in the initial field evaluation as seacoast bluestem, thus they were treated separately, and were not considered for the little bluestem release. Populations with plants of both seacoast and little bluestem were eliminated from consideration, as were populations with extreme variability that would have limited commercialization potential, or resulted in inadvertent selection in later seed production settings.

We attempted to select populations from each of the geographic areas in South Texas where little bluestem was collected from (naturally grows) that were represented in the evaluation. Selection decisions for advanced evaluation were based on the following initial evaluation observations:

- Accession 9086176-Bexar County was a clear selection based on: 1) original seed germination double that of any other wild collected South Texas accession, and germination similar to cultivars 'Pastura' and 'Cimarron'; and 2) it was the best performing accession in the Bladerunner Farms evaluation study, being scored superior to all other accessions in uniformity, disease resistance, foliage density; and was among the top 3 accessions in plant vigor and seed production scores.
- Accession 9064461-Zavala County was selected based on good performance in the Bladerunner Farms evaluation and outstanding performance in the Rio Farms evaluation. It was ranked equal to 9086176 for seed production potential at Bladerunner Farms, and

was consistently rated the best performing accession in the evaluation at Rio Farms over three years of evaluation.

- Accession 9090266-Goliad County was selected as the best performing accession amongst the collections originating from the Goliad/Refugio Prairie region of eastern South Texas. This accession had above average original seed germination, and exhibited good field performance at the PMC, Rio Farms, and Bladerunner Farms, although overall it was a weaker accession than 9064461 or 9086176 at all locations. Seed production potential was scored as average to slightly higher than average amongst the populations evaluated at most sites.
- Accession 9089229-Wilson County was selected as the best performing selection originating from the northeast portion of the evaluation region. Original seed collection germination was good, and the accession was scored highest in the evaluation for seed production potential at the Rio Farms evaluation site, and noted as the second best performing little bluestem accession overall at Rio Farms, behind accession 9064461.

Advanced Evaluation

Advanced evaluations were conducted beginning in 2006 at Rio Farms. Each seed increase field was established using transplants grown from the original seed from each selection in 2006 and subsequently increased to around 4,000 plants/accession using seed produced in 2006. These plantings were intensively managed to produce seed, including applications of irrigation, fertilizer, pesticides, and herbicides. All 4 isolated seed increase plots were on the same soil series, and were managed the same. Our major goal for the advanced evaluation was to determine if seed of the selections could be successfully grown in a setting similar to most commercial native seed operations, and to document the yield potential of each selection. We also carefully evaluated the uniformity of the accession in the initial generation, and subsequent generations to determine if shifts in plant population variation were occurring. Selected populations maintained generally high levels of within accession variation, but overall each population was relatively stable at this site with little apparent mortality. By year 4, differentiation of the original plants grown from the wild seed collections, and subsequent plants grown from harvests of the original plants was impossible.

Seed quality of each accession over a 6 year period under high input production varied tremendously, both by year and by accession in most years. Highest observed germination of the 4 selected accessions was 87% in accession 9064461 in 2007, followed by 75% in accession 9086176 also in 2007. Accession 9090266 produced excellent seed in 2007 (highest observed pure live seed (PLS) value in the evaluation), however the plants failed to produce any seed in 2008, and produced the poorest quality seed observed in the experiment (1.08% PLS) in 2009. Because of the variability in seed quality, production, and observed poor vigor of 9090266 in the seed increase planting, we removed this accession from the advanced evaluation in 2010.

We continued to manage and harvest the remaining 3 accessions through 2011. At the end of 2011, we analyzed the results of 6 years of seed quality data. Bulk seed yields amongst accessions were similar over the 6 years of harvests; however, seed quality did vary by accession

in all years. Across years, mean seed germination was highest in accession 9064461 (50%), followed by 9086176 (44%), and 9089229 (31%). Percent PLS was similar, ranging from 12-23% across accessions for the 6 years of harvests, however 9089229 averaged slightly higher inert matter % overall. The two years of highest observed germination (representing maximum potential of the accessions in our estimation) was 87% and 73% in 9064461; 59% and 44% in 9089229; and 75% and 72% in 9086176.

Throughout the advanced evaluation, accession 9089229 exhibited severe lodging problems at maturity in the seed production setting. Because of the lodging problems exhibited, indications of slightly lower seed quality, and its similarity in origin to 9086176, we chose to eliminate 9089229 from the evaluation at the end of 2011.

Following 2010 harvests, seed of accessions 9064461 and 9086176 were sent to commercial growers for further evaluation from 2011-2013. In 2011, accession 9064461 had 50% PLS when grown near Kenedy, TX, representing the highest observed seed quality in a harvest of this accession by >25% PLS. In 2012, accession 9086176 had 28% PLS in seed grown near San Antonio, and accession 9064461 had 28% PLS in seed grown near Kenedy, Texas. Both growers reported adequate yields for satisfactory commercial product at these levels of seed quality. As a result, we made the decision to develop releases of accession 9064461 and 9086176. Carrizo was chosen for the name of a blend of the two releases since each parent accessions originated from sandy soils representative of outcrops of Carrizo geologic formation.

We chose to release each accession individually, but name a specified blend of the two accessions to ensure success of consumer plantings across the South Texas region. Although little bluestem is a common plant on sandy soils in the region, populations vary distinctively by site. The two selected accessions are representative of the major variation in plant types found in the region. Since each accession will be produced in isolation in commercial production, and commercially produced seed will be blended after harvest, consumers on most all sites appropriate for this species will be planting some portion of their seed mix to adapted ecotypic material for their site. In cases where the exact ecotype of the plant needed for a site cannot be confirmed, the blend should allow for success nonetheless. Furthermore, since little bluestem is an outcrossing species, establishment of each pure strain will allow crossing of the accessions, potentially resulting in more fit offspring adapted for novel restoration sites.

By designating that commercial seed production of each component will occur in isolation, we can prevent such crosses between accessions from occurring in the seed production environment, and instead facilitate them on restoration sites, providing potential for adaptation for end users. In cases where the actual ecotype needed for a particular planting site is known, the individual components of Carrizo Blend will be available commercially as will either STN-461 Germplasm or STN-176 Germplasm.

Seed Increase

Seed increase plots are established at Rio Farms, near Monte Alto Texas, at Pogue Agri Partners (Kenedy, TX) and Douglass King Seed Company (San Antonio, TX). Seed of each of the accessions comprising Carrizo Blend little bluestem is grown in isolation from the other selected

accession, wild, or other cultivated materials of little bluestem. Seed quality of the 2 selections averaged 15% PLS for 9064461 over 7 years at Rio Farms, and 22% PLS over 7 years for 9086176. Highest PLS observed was 24% in 9064461, and 37% in 9086176. Potential bulk seed yields per acre have been measured at 268 lbs. per acre on 36" bedded rows with a plant population of 14,000 plants per acre (plants established using transplants spaced 1').

Seed Production, Harvest, and Cleaning

Seed production of STN-176 Germplasm little bluestem is best started from greenhouse grown transplants, planted on bedded rows. Seedlings are relatively slow growing, and when direct seeded, most plants will not reach maturity until the end of second growing season, whereas well-managed transplant stands will produce a marketable crop in the planting year. Specific seed lot characteristics such as percent dormant seed, percent active germination, and percent PLS should be carefully evaluated for both greenhouse transplant and direct seeding plantings. Seed with high dormancy will yield poor stands in both greenhouse and field plantings.

Seed production north of a line from approximately Del Rio to San Antonio to Victoria, TX is discouraged. Attempted production north of this line is likely to fail, as this accession typically does not flower until late October. Seed set and maturity are rarely complete before late November, thus seed does not fill and ripen before first frost in the northern two-thirds of Texas. Evaluation plantings of the selected accessions conducted in these areas have consistently failed to produce viable seed. Locations where poor performance has been observed include Knox City and Stephenville, TX.

Seed harvest is possible using a variety of methods and implements; however we have had excellent results using a Woodward Flail-Vac Seed Stripper (Ag-renewal, Inc., Weatherford, Oklahoma). Seed of little bluestem ripens indeterminately, and the Flail-Vac can collect the ripe seed crop without damaging or eliminating subsequent harvests as later flowering florets mature. As many as 5 harvests from October-December may be possible in some production years with a Flail-Vac. Multiple harvest dates are encouraged by producers insure maintenance of within-accession genetic diversity.

Seed is best cleaned by combinations of debearding, hammer milling, and screening. Large amounts of inert matter in cleaned seed are unavoidable due to the pubescence and hairs of the spikelets of this ecotype. This inert matter is generally impossible to remove, and influences the low PLS values associated with this selection. Seed morphology of 9086176 is distinctly different than many commercial sources of little bluestem because of longer spikelet length and increased pubescence.

G. Area of Adaptation

Based on origin

STN-176 Germplasm is likely to perform best on sand, sandy loam, and loamy sand soils in the Rio Grande Plains, Gulf Coast Prairies and Marshes, and southern portion of the Post Oak Savannah ecoregions of Texas. Use of STN-176 Germplasm in adjacent ecoregions is not

recommended, as other morphologically and phenotypically distinct ecotypes of little bluestem occur in these regions, and seed of these plants is generally available commercially. Furthermore, flowering dates of the accession in this germplasm make long-term successful reproduction of the plant unlikely north of a line from Del Rio to San Antonio to Victoria because of average first freeze dates.

Based on trial plantings and outside evaluations

A number of trial plantings and evaluations have been conducted from the accessions comprising Carrizo Blend little bluestem. Data from these evaluations indicate similar area of adaptation as indicated by origin and suggested limits on seed transfer (USDA 2007). In a 6-site, multi-species trial 2010-2013, accession 9086176 displayed good vegetative performance at Stephenville, Knox City, Uvalde, Kingsville, and Rio Farms. However, in comparison to available commercial sources of the plant also included in the study (e.g. OK Select Germplasm little bluestem, 'Pastura' little bluestem, and a selection from Turner Seed Company), STN-176 Germplasm was superior at just the Kingsville, Rio Farms, and to a lesser degree, Uvalde evaluation sites overall.

Trial plantings within the area of suggested adaptation have had sporadic success, and little bluestem appears to be relatively slow and difficult to establish from direct seeding in the South Texas region. Successful plantings have occurred on sandy soils with little competition from non-native species, whereas failed plantings have been on clay or tight surface textured soils. Establishment is generally not apparent until the second growing season after seeding.

G. Procedure for maintaining stock classes of seed

G0 seed of STN-176 Germplasm little bluestem will be maintained by *South Texas Natives*.

H. Description of how variety is to be constituted, etc.

Carrizo Blend little bluestem is a mechanical blend of 2 released accessions of little bluestem, STN-176 Germplasm and STN-461 Germplasm. For each accession in the Carrizo Blend, G0 seed will be made up of the individual accessions, grown in isolation from one another, and maintained by the breeder. G1 seed is harvested by isolated plantings of G0 seed by commercial seedsmen and G2 seed is harvested from plantings of G1 seed. Increase using G2 seed is prohibited. Carrizo Blend is a mixture of equal amounts of certified, G1 or G2 pure live seed (PLS) of accessions 9064461 and 9086176. Variance of +/- 15%, such that no accession makes up more than 65%, or less than 35%, of the blend is acceptable in seed marketed as Carrizo Blend. Each components of the release may be marketed individually as certified, selected native Texas germplasm seed, and sold as STN-461 Germplasm little bluestem or STN-176 Germplasm little bluestem.

I. Additional restrictions, etc.

G1 and G2 seed fields have a 7 year production limit, after which time, fields must be replanted from the appropriate seed generation (G0 or G1).

Will application be made to the Plant Variety Protection Office? YES _____ NO X

If yes will the application specify that the variety is to be sold by the variety name only as a class of certified seed? YES ___ NO ___

Ecological Considerations and Evaluation: An Environmental Evaluation of Plant Materials Releases was completed using guidelines established by NRCS, and the best available information for this species. Results of this evaluation determined that STN-176 Germplasm little bluestem was suitable for release based on the criterion contained in this document. This conclusion is mainly based on the fact that little bluestem is a naturally occurring species in Texas and planting it would not constitute an introduction of an exotic species into local ecosystems. Any negative impacts on other native plant species would likely be minimal to non-existent.

Conservation Use: STN-176 Germplasm little bluestem will provide a native plant species for rangeland plantings and wildlife habitat improvement.

Availability of Plant Materials: G0 seed will be maintained by the *South Texas Natives* Project of the Caesar Kleberg Wildlife Research Institute. G0 seed will be released to qualified growers under license agreement stipulating production requirements.

References:

- Arredondo, J.A., F. Hernandez, F.C. Bryant, R.L. Bingham, and R. Howard. 2006. Habitat-suitability bounds for nesting cover of northern bobwhites on semiarid rangelands. *Journal of Wildlife Management* 71(8): 2592-2598.
- Barkworth, M.E., L.K. Anderton, K.M. Capels, S. Long, and M.B. Piep. 2007. *Manual of Grasses for North America*. Utah State University Press. Logan, Utah.
- Everitt, J.H., D.L. Drawe, C.R. Little, and R.I. Lonard. 2011. *Grasses of South Texas*. Texas Tech University Press. Lubbock, Texas.
- Gould, F.W. 1975. *The Grasses of Texas*. Texas A&M University Press. College Station, Texas.
- Hatch, S.L., J.L. Schuster, and D.L. Drawe. 1999. *Grasses of the Texas Gulf Prairies and Marshes*. Texas A&M University Press. College Station, TX.
- Shaw, R.B. 2012. *Guide to Texas Grasses*. Texas A&M University Press. College Station, Texas.
- United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). 2002. Plant Fact Sheet little bluestem. USDA NRCS National Plant Materials Center. Beltsville, Maryland.

United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). 2007. Natural Resources Conservation Service conservation practice standard, Range Planting. Natural Resources Conservation Service. Temple, Texas.

United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). 2014. The PLANTS Database (<http://plants.usda.gov>, 30 April 2013). National Plant Data Texas, Greensboro, NC 27401-4901 USA.

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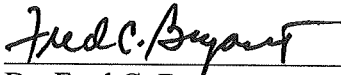
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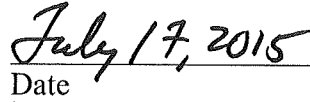
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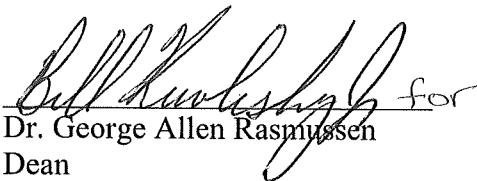
STN-176 GERMPLASM LITTLE BLUESTEM

Schizachyrium scoparium (Michx) Nash var. *scoparium*




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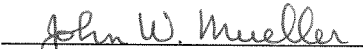

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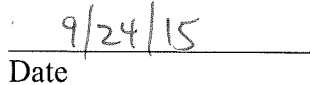
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Dick and Mary Lewis Kleberg College of
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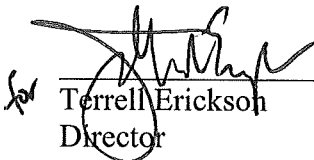

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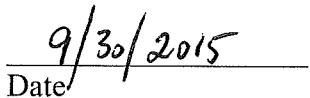


Salvador Salinas
Texas State Conservationist
United States Department of Agriculture
Natural Resources Conservation Service
Temple, TX


Date

 for

Terrell Erickson
Director
Ecological Sciences Division
United States Department of Agriculture
Natural Resources Conservation Service
Washington, D.C.


Date